Implementation report

Party	**Viet Nam**
Period covered in this report	2018-2020
Department or agency preparing this report	Viet Nam CITES Management Authority
Contributing departments, agencies and organizations	Institute of Ecology and Biological Resources, Viet Nam CITES Scientific Authority

GOAL 1 ENSURE COMPLIANCE WITH AND IMPLEMENTATION AND ENFORCEMENT OF THE CONVENTION

Objective 1.1 Parties comply with their obligations under the Convention through appropriate policies, legislation and procedures.
All Aichi Targets relevant to CITES, particularly Aichi Target 2, Target 6, Target 9, Target 12, Target 17 and Target 18.

Indicator 1.1.1: The number of Parties that are in category 1 under the national legislation project.

1.1.1a	Have any CITES relevant policies or legislation been developed during the period covered in this report? Yes ☒ No ☐ If 'Yes', have you shared information with the Secretariat? Yes ☒ No ☐Not Applicable ☐ If 'No', please provide details to the Secretariat with this report:
1.1.1b	Does your legislation or legislative process allow easy amendment of your national law(s) to reflect changes in the CITES Appendices (e.g. to meet the 90 day implementation guidelines)?Yes ☒ No ☐ If 'No', please provide details of the constraints faced:

Objective 1.2 Parties have in place administrative procedures that are transparent, practical, coherent and user-friendly, and reduce unnecessary administrative burdens.
Aichi Target 3.

Indicator 1.2.1: The number of Parties that have adopted standard transparent procedures for the timely issuance of permits in accordance with Article VI of the Convention.

		Yes	No	No information
1.2.1a	Do you have standard operating procedures for application for and issuance of permits?	☒	☐	☐
	Are the procedures publicly available?	☒	☐	☐
1.2.1b	Do you have: Electronic data management and a paper-based permit issuance system?	☐	☒	☐

	Electronic permit information exchange between Management Authorities of some countries If 'Yes', please list countries	☐	☒	☐
	Electronic permit information exchange to Management Authorities of all countries?	☐	☒	☐
	Electronic permit data exchange between Management Authorities and customs?	☐	☒	☐
	Electronic permit used to cross border with electronic validation by customs?	☐	☒	☐
	If 'Yes' to any of the above, please provide information on challenges faced or issues overcome:			
	If 'No', do you have any plans to move towards e-permitting[1]?	☒	☐	☐
	If you are planning to move towards e-permitting, please explain what might help you to do so: CITES Secretariat and USAID would help us.			

Indicator 1.2.2: The number of Parties making use of the simplified procedures provided for in Resolution Conf. 12.3 (Rev. CoP16).

1.2.2a	Has your country developed simplified procedures for any of the following?			
		Tick all applicable		
		Yes	No	No information
	Where biological samples of the type and size specified in Annex 4 of Resolution Conf. 12.3 (Rev. CoP16) are urgently required.	☐	☒	☐
	For the issuance of pre-Convention certificates or equivalent documents in accordance with Article VII, paragraph 2.	☐	☒	☐
	For the issuance of certificates of captive breeding or artificial propagation in accordance with Article VII, paragraph 5.	☐	☒	☐
	For the issuance of export permits or re-export certificates in accordance with Article IV for specimens referred to in Article VII, paragraph 4.	☐	☒	☐
	Are there other cases judged by a Management Authority to merit the use of simplified procedures? If 'Yes', please provide details:	☐	☒	☐

[1] *e-permitting refers to the electronic (paperless) management of the permit business process, including permit application, Management Authority – Scientific Authority consultations, permit issuance, notification to customs and reporting.*

Objective 1.3 Implementation of the Convention at the national level is consistent with decisions adopted by the Conference of the Parties.
All Aichi targets relevant to CITES, particularly Target 9, Target 14 and Target 18.

Indicator 1.3.1: The number of Parties that have implemented relevant reporting under Resolutions and Decisions of the Conference of the Parties and/or Standing Committee recommendations.

1.3.1a	Has your country responded to all relevant special reporting requirements that are active during the period covered in this report, including those in the Resolutions and Decisions of the Conference of the Parties, Standing Committee recommendations, and Notifications issued by the Secretariat (see [link to location on the CITES website where the reporting requirements are listed])? Responses provided to ALL relevant reporting requirements ☒ Responses provided to SOME of the relevant reporting requirements ☐ Responses provided to NONE of the relevant reporting requirements ☐ No special reporting requirements applicable ☐
1.3.1b	Were any difficulties encountered during the period covered in this report in implementing specific Resolutions or Decisions adopted by the Conference of the Parties? Yes ☒ No ☐ If 'Yes', please provide details of which Resolution(s) or Decision(s), and, for each, what difficulties were / are being encountered? Resolution Conf 9.14 and Resolutioon Conf 10.10 The inventory and reporting of confiscated ivory and rhino specimens storage included in CITES Appendix I must comply with Vietnam's law on public property management: The Ministry of Finance reports which must be approved by the Prime Minister, so the reporting time can not meet the deadline according to the regulation. Besides it, there is no guidance for implementation of these two Resolutions. The fee of inventory is very expensive.

Objective 1.4 The Appendices correctly reflect the conservation needs of species.
Aichi Target 1, Target12, Target 14 and Target 19.

1.4.1: The number and proportion of species that have been found to meet the criteria contained in Resolution Conf. 9.24 or its successors. This includes both the periodic review and amendment proposals.

1.4.1a	Have you undertaken any reviews of whether species would benefit from listing on the CITES Appendices? Yes ☒ No ☐ If 'Yes', please provide a summary here, or a link to the report of the work (or a copy of that report to the Secretariat if the work is not available online): Species have been protected from illegal exploitation and illegal trade by national law/regulations (Decree No. 64/2019/ND-CP, Decree No. 06/2019/ND-CP). Conservation programs have been undertaken for several species (*Cnemaspis psychedelica*, *Shinisaurus crocodilurus*, *Goniurosaurus spp.*, *Tylototriton spp.*, *Paramesotriton spp.*) (see attached publications)

	Rescue programs have been conducted for pangolins, bears, and turtles in some rescue centers and national parks.

Objective 1.5 Best available scientific information is the basis for non-detriment findings. Aichi Target 2, Target 4, Target 5, Target 6, Target 7, Target 9, Target 12 and Target 14.

Indicator 1.5.1: The number of surveys, studies or other analyses undertaken by exporting countries based on the sources of information cited in Resolution Conf. 16.7 on Non-detriment findings related to:

a)the population status of Appendix-II species;
b)the trends and impact of trade upon Appendix-II species; and
c)the status of and trend in naturally-occurring Appendix I species and the impact of any recovery plans.

1.5.1a	Have any surveys, studies or other analyses been undertaken <u>in your country</u> in relation to:	Yes	No	Not Applicable	If Yes, How many?
	- the population status of Appendix II species?	☒	☐	☐	☐8
	- the trends and impact of trade on Appendix II species?	☒	☐	☐	☐2
	- the status of and trend in naturally-occurring Appendix I species?	☒	☐	☐	☐2
	- the impact of any recovery plans on Appendix I species?	☒	☐	☐	☐2
	Have the surveys, studies or analyses integrated relevant knowledge and expertise of local and indigenous communities?	☒	☐	☐	☐

If there are such studies that you are willing to share, please provide:

Species name (scientific)	A brief summary of the results of the survey, study or other analysis (e.g. population status, decline / stable / increase, off-take levels etc), or provide links to published reference material.
Cibotium barometz	In Viet Nam, this plant is distributed unevenly throughout the mountainous provinces in the North and some high mountainous areas in the South. The population size is decreasing due to habitat loss and overharvesting. For sustainable use, a strict export quota for *Cibotium barometz* of 200 tones per year for five (5) years from 2019 should be set.

	Cyathea spp.	In Vietnam, *Cyathea gigantea* and *Cyathea contaminans* are scattered around at least 19 mountainous provinces. Population size is decreasing because of habitat loss and harvesting. For sustainable use, a strict export quota for *tree fern- Cyathea* of 30 tones per year for five (5) years from 2019 should be set.
	Cnemaspis psychedelica	*Cnemaspis psychedelica* is distributed in the southern Viet Nam. The known wild population of the species was estimated to comprise approximately 500 mature individuals. The extremely restricted habitats, together with a low reproduction rate, make the species especially vulnerable to external stressors and limit its capacity to recover from threats such as harvesting. As a result, the protection needs of *C. psychedelica* have received attention from all around the world. *Cnemaspis psychedelica* is listed in CITES Appendix I and Group IB, Decree *No.06/2019/ND-CP*
	Shinisarus crocodilurus	In Vietnam, wild *S. crocodilurus* populations suffered dramatic declines with an estimate of fewer than 150 adult individuals remaining. The distribution range of the Crocodile lizard is restricted to fragmented sites in northern Vietnam, where suitable habitats are small, isolated and steadily shrinking. *S. crocodilurus* is lecithotrophic viviparous (ovoviviparous) usually giving birth once a year to two to 12 living juveniles within the water. In natural habitats *S. crocodilurus* reaches maturity relatively late at c. 3– 4 years of age. population estimates from are alarmingly low. It is uplisted from Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) to Appendix I and also listed in Group IB, Decree No.06/2019/ND-CP.
	Goniurosaurus catbanensis	The insular Cat Ba Tiger Gecko (*Goniurosaurus catbaensis*) was discovered on Cat Ba Island in Cat Hai District, Hai Phong City, northeastern Vietnam, where it was assumed to be endemic. The insular Cat Ba Tiger Gecko was found to be vulnerable to anthropogenic disturbances, and of high demand in pet markets as well as on Internet platforms. In addition to poaching, habitat destruction for touristic purposes has dramatically increased the pressure on the wild *G. catbaensis* population. It is listed in CITES Appendix II.
1.5.1b	How are the results of such surveys, studies or other analyses used in making non-detriment findings (NDFs)? Please tick all that apply	

	Revised harvest or export quotas ☒ Banning export ☐ Stricter domestic measures ☒ Changed management of the species ☐ Discussion with Management Authorities ☒ Discussion with other stakeholders? ☒ Other (please provide a short summary):
1.5.1c	Do you have specific conservation measures or recovery plans for naturally occurring Appendix-I listed species? Yes ☒ No ☐ Not Applicable ☐ No information ☐ If 'Yes', please provide a brief summary, including, if possible, an evaluation of their impact: - Urgent action plan for Asian elephant conservation for period 2013-2020, - In-situ and Ex-situ conservation programs for *Cnemaspis psychedelica* in southern Vietnam, *Shinisarus crocodilurus*, *Goniurosaurus* spp., and *Tylototriton* spp. in northern Vietnam. - Urgent action plan for primates conservation to 2025, vision to 2030. - Action plan for marine turtle conservation in period of 2015-2025. (See Annex 4)
1.5.1d	Have you published any non-detriment findings that can be shared? Yes ☒ No ☐ If 'Yes', please provide links or examples to the Secretariat within this report: See attached reports.
1.5.1e	Which of the following (A to F of paragraph a) x) of Resolution Conf. 16.7) do you use in making non-detriment findings? Yes / No A. relevant scientific literature concerning species biology, life history, distribution and population trends. ☒ / ☐ B. details of any ecological risk assessments conducted. ☒ / ☐ C. scientific surveys conducted at harvest locations and at sites protected from harvest and other impacts. ☒ / ☐ D. relevant knowledge and expertise of local and indigenous communities. ☒ / ☐ E. consultations with relevant local, regional and international experts. ☒ / ☐ F. national and international trade information such as that available via the CITES trade database maintained by UNEP World Conservation Monitoring Centre (UNEP-WCMC), publications on trade, local knowledge on trade and investigations of sales at markets or through the Internet for example. ☒ / ☐

Indicator 1.5.2: The number of Parties that have adopted standard procedures for making non-detriment findings.

1.5.2a		Yes	No	No information
	Do you have standard procedures for making non-detriment findings in line with Resolution Conf. 16.7?	☒	☐	☐
	If 'Yes', please briefly describe your procedures for making non-detriment findings, or attach as an annex to this report, or provide a link to where the information can be found on the internet: Please see the attached report.			
1.5.2b	When establishing non-detriment findings, have any of the following guidance been used?		Please tick all that apply	
		Virtual College	☐	
		IUCN Checklist	☒	
		Resolution Conf. 16.7	☒	
		2008 NDF workshop	☒	
		Species specific guidance	☐	
		Other	☐	
	If 'Other' or 'Species specific guidance', please specify details:			
1.5.2c	How often do you review and/or change your non-detriment findings?	Case by case	☒	
		Annually	☐	
		Every two years	☐	
		Less frequently	☐	
		A mix of the above	☐	
	Please describe the circumstances under which non-detriment findings would be changed: Vietnam does not allow the exploitation and trade species on CITES Appendix I from the wild. For species listed in CITES Appendix II originating from the wild, exploitation can only be conducted when the exploitation does not negatively affect the existence of the species in the wild arccording to CITES Scientific Authority.			

Indicator 1.5.3: The number and proportion of annual export quotas based on population surveys.

1.5.3a	Do you set annual export quotas?	Yes	☒
		No	☐

	If 'Yes', do you set quotas based on population survey, or by other means? Please specify, for each species, how quotas are set: Species Name (scientific) *Cibotium barometz* *Cyathea* spp.	Population Survey? ☒ ☒	Other, please specify
1.5.3b	Have annual export quotas been set at levels which will ensure sustainable production and consumption? If 'Yes', please describe how this fits into your non-detriment finding process: This export quotas show the limited quantity of each species and make the suitable conditions for production and consumption.	Yes No	☒ ☐

Objective 1.6 Parties cooperate in managing shared wildlife resources.
Aichi Target 4, Target 5, Target 6, Target 7, Target 10, Target 12 and Target 19.

Indicator 1.6.1: The number of bilateral and multilateral agreements that specifically provide for co-management of shared CITES listed species by range States.

1.6.1a	Is your country a signatory to any bilateral and/or multilateral agreements for co-management of shared species? Yes ☐ No ☒ If 'Yes', please provide brief details, including the names of the agreements, and which other countries are involved:

Indicator 1.6.2: The number of cooperative management plans, including recovery plans, in place for shared populations of CITES-listed species.

1.6.2a	Do you have any cooperative management plans, including recovery plans, in place for shared populations of CITES-listed species? Yes ☒ No ☐ If 'Yes', please list the species for which these plans are in place and provide a link or reference to a published plan for each species. Species Name (scientific) Link or reference to a published plan *Tylototriton vietnamensis* See Annex 4

Indicator 1.6.3: The number of workshops and other capacity-building activities that bring range States together to address the conservation and management needs of shared, CITES listed, species.

1.6.3a	Have the CITES authorities *received or benefited* from any of the following capacity-building activities provided by external sources?						
	Please tick boxes to indicate which target group and which activity. Target group	Oral or written advice/guidance	Technical assistance	Financial assistance	Training	Other (specify)	What were the external sources[1]?
	Staff of Management Authority	☒	☒	☒	☒	☐	
	Staff of Scientific Authority	☒	☒	☒	☒	☐	Cologne Zoo, USAID, TRACE Wildlife Forensics Network, WWF, WCS, UNODC
	Staff of enforcement authorities	☒	☒	☒	☒	☐	USAID, HSI, WWF (Training courses)
	Traders	☐	☐	☐	☐	☐	
	NGOs	☐	☐	☐	☐	☐	
	Public	☐	☐	☐	☐	☐	
	Other (please specify):	☐	☐	☐	☐	☐	
1.6.3b	Have the CITES authorities been the *providers* of any of the following capacity-building activities to other range States?						
	Please tick boxes to indicate which target group and which activity. Target group	Oral or written advice/guidance	Technical assistance	Financial assistance	Training	Other (specify)	Details
	Staff of Management Authority	☐	☐	☐	☐	☐	
	Staff of Scientific Authority	☒	☒	☐	☒	☐	Providing wildlife forensic services; Capacity building for customs officers, policemen, border guards, students; providing technical advice for provincial management authorities and enforcement authorities in Lao and Cambodia.
	Staff of enforcement authorities	☐	☐	☐	☐	☐	
	Traders	☐	☐	☐	☐	☐	

	NGOs	☐	☐	☐	☐	☐	
	Public	☐	☐	☐	☐	☐	
	Other Parties/International meetings	☐	☐	☐	☐	☐	
	Other (please specify)	☐	☐	☐	☐	☐	

1.6.3c	In what ways do you collaborate with other CITES Parties?						
		Never	Rarely	Sometimes	Very Often	Always	Further detail / examples
	Information exchange	☐	☐	☐	☐	☒	
	Monitoring / survey	☐	☐	☐	☐	☐	
	Habitat management	☐	☐	☐	☐	☒	Collaboration with Lao in Phong Nha National Park, and with Cambodia in Yok Don National Park.
	Species management	☐	☐	☐	☐	☒	
	Law enforcement	☐	☐	☐	☐	☒	
	Capacity building	☐	☐	☐	☐	☒	
	Other (please provide details)						

Objective 1.7 Parties are enforcing the Convention to reduce illegal wildlife trade.
Aichi Target 4, Target 5, Target 6, Target 7, Target 9, Target 10, Target 12 and Target 19.

Indicator 1.7.1: The number of Parties that have, are covered by, or engaged with:
–an international enforcement strategy and/or action plan;
–formal international cooperation, such as an international enforcement network;
–a national enforcement strategy and/or action plan; and
–formal national interagency cooperation, such as a national interagency enforcement committee.

1.7.1a	Do you have, are you engaged in, or covered by:	Yes	No	No Information
	– an international enforcement strategy and/or action plan?	☐	☐	☐
	– formal international cooperation, such as an international enforcement network?	☒	☐	☐
	– a national enforcement strategy and/or action plan?	☒	☐	☐

[1] *Please provide the names of Parties, and any non-Parties, involved.*

	– formal national interagency cooperation, such as a national interagency enforcement committee?	☒	☐	☐

If 'Yes' to any of the above, please specify the level of engagement and provide additional details:

ASEAN Working Group on CITES and widlife: This network was established by uniting the ASEAN Network for Wildlife and Fauna Protection (ASEAN WEN) and the ASEAN Group of Experts on CITES (AEG-CITES) comprising representatives from CITES agencies, Customs, Environmental Police, Forest Protection, Border Guard to hold annual meetings to discuss and evaluate the control situation of wildlife and plant trade and to come to an agreement on priority solutions for CITES enforcement and species protection. wildlife in Southeast Asia.

Viet Nam Wildlife Enforcement Network: The interdisciplinary steering committee of law enforcement agencies on wildlife trade enforcement is chaired by the Deputy Minister of Agriculture and Rural Development. CITES members are Forest Protection, and Environment, Customs, Border Protection, Market Management, Fisheries, Veterinary Medicine, Procuracy, Courts. The Steering Committee meetings are hold twice a year to come an agreement on the work plan and the priority solutions to effectively control the wildlife and wildlife trade and transportation.

Indicator 1.7.2: The number of Parties with a process or mechanism for reviewing their enforcement strategies, and the activities taken to implement their strategies.

1.7.2a	Do you have a process or mechanism for reviewing your enforcement strategy(ies) and the activities taken to implement your strategy(ies)?	Yes No, but review is under consideration No No information	☐ ☐ ☒ ☐
	If 'Yes', what do you do? If 'Yes' or 'No, but review is under consideration', which tools do you find of value?		
1.7.2b	Have you used the International Consortium on Combating Wildlife Crime (ICCWC) Wildlife and Forest Crime Analytic Toolkit, or equivalent tools?	Yes No, but toolkit use is under consideration No No information	☐ ☐ ☒ ☐
	If 'Yes', please provide feedback on the parts of the toolkit used and how useful the toolkit or equivalent tools have been. Please specify improvements that could be made: If 'No', please provide feedback on why not or what is needed to make the toolkit or equivalent tools useful to you The Toolkit is not suitable with the actual situation in the crime approach and assessment by authorities in Viet Nam.		

Indicator 1.7.3: The number of Parties that have criminal (penal) law and procedures, capacity to use forensic technology, and capacity to use specialized investigation techniques, for investigating, prosecuting, and penalizing CITES offences..

1.7.3a	Do you have law and procedures in place for investigating, prosecuting, and penalizing CITES offences as a crime? If 'Yes', please provide the title of the legislation and a summary of the penalties available: Criminal Code 2015 (amended in 2017) Criminal Procedure Code 2015 Summary: If offences violate wildlife regulations, they are punished by up to fithteen years imprisonment.	Yes ☒ No ☐ No information ☐
1.7.3b	Are criminal offences such as poaching and wildlife trafficking recognized as serious crime[1] in your country?	Yes ☒ No ☐ No information ☐
	If 'Yes', please explain what criteria must be met for poaching or wildlife trafficking offences to be treated as serious crimes: Arcticle 234 and Arcticle 244 of Criminal Code. Wildlife crimes are recognized as serious in Viet Nam. If offences violate wildlife regulations, they are punished by up to fithteen years imprisonment.	
1.7.3c	Do you have capacity to use forensic technology[2] to support the investigation of CITES offences?	Yes ☒ No ☐ No information ☐
	If 'Yes', please provide a brief summary of any samples from CITES-listed species that were collected and submitted to an appropriate forensic analysis facility (located in your country and/or another country) during the period covered in this report: - Conducting wildlife forensics at the Institute of Ecology and Biological Resources in Hanoi using morphological characters and molecular techniques. - Sending DNA samples of Rhino horns to RHODIS in South Africa If 'Yes', and your country has an appropriate forensic analysis facility for CITES-listed species, please indicate which species it applies to: Rhino, Tigers, Pangolins, Elephant (*Loxodonta africana*, *Elephas maximus*), Marine turtles, Turtles (*Cuora* spp., *Heosemys* spp.), Bears, Primates, birds and snakes.	
1.7.3d	Did your authorities participate in or initiate any multi-disciplinary[3] law enforcement operation(s) targeting CITES-listed species during the period covered in this report?	Yes ☒ No ☐ No information ☐
	If 'Yes', please provide a brief summary, including any lessons learned which might be helpful for other Parties: Various arrested cases have been successfully carried out by relevant agencies, such as the arrest of 9.1 tons of ivory at Danang port in 2019, and importing of rhino horn cases at Noi Bai and Tan Son Nhat airports. Lessons learned: Inter-agency cooperation in CITES implementation is extremely important in which each agency has its own role with its own strengths and should be	

[1] *The United Nations Convention against Transnational Organized Crime defines serious crime as conduct constituting an offence punishable by imprisonment for at least four years or a more serious penalty.*

[2] *Capacity to use forensic technology means the ability to collect, handle and submit samples from crime scenes involving CITES-listed species to an appropriate forensic analysis facility, located either in your country or in another country(ies).*

[3] *A multi-disciplinary law enforcement operation is one that involves officers from all relevant enforcement disciplines as appropriate, for example officers from Police, Customs and the wildlife regulatory authority. It could be either sub-national, national or international in scope.*

	promoted as a whole with the coordinating role of CITES MA.				
1.7.3e	Do you have a standard operating procedure among relevant agencies for submitting information related to CITES offences to INTERPOL and/or the World Customs Organization?			Yes ☒ No ☐ No information ☐	
1.7.3f	Do you have legislative provisions for any of the following that can be applied to the investigation, prosecution and/or sentencing of CITES offences as appropriate?	Yes	No	No information	If yes, how many times was this used during the period covered by this report?
	General crime[1]	☒	☐	☐	0
	Predicate offences[2]	☒	☐	☐	0
	Asset forfeiture[3]	☒	☐	☐	0
	Corruption[4]	☒	☐	☐	1
	International cooperation in criminal matters[5]	☒	☐	☐	
	Organized crime[6]	☒	☐	☐	1
	Specialized investigation techniques[7]	☐	☐	☐	
	For all violations of CITES Appendices I and II (ivory, rhino horn, lizard, marine turtle ...), Vietnam put on trial with the highest sentence of 12 years in imprisonment and VND 660 million. Courts at all levels have tried 100 cases and considered as serious crime.				
1.7.3g	Do you have institutional capacity to implement the legislative provisions listed in question 1.7.3f against CITES offences?			Yes ☐ No ☐ No information ☐	
	If 'No', please provide a brief summary of your major capacity-building needs:				

Indicator 1.7.4: The number of Parties using risk assessment and intelligence to combat illegal trade in CITES-listed species.

1 *General crime laws relate to offences such as fraud, conspiracy, possession of weapons, and other matters as set out in the national criminal code.*

2 Article 2, paragraph (h) of the United Nations Convention against Transnational Organized Crime defines a predicate offence is an offence whose proceeds may become the subject of any of the money-laundering offences established under the Convention.

3 *Asset forfeiture is the seizure and confiscation of assets obtained from criminal activities to ensure that criminals do not benefit from the proceeds of their crimes.*

4 *Provisions against corruption include national laws to implement the United Nations Convention against Corruption covering offences such as bribery of officials, embezzlement or misappropriation of public funds, trading in influence and abuse of functions by public officials.*

5 *International cooperation in criminal matters includes legislation through which a formal request for mutual legal assistance and/or extradition of a person for criminal prosecution can be forwarded to another country.*

6 *Article 2, paragraph (a) of the United Nations Convention against Transnational Organized Crime defines an organized criminal group as a structured group of three or more persons, existing for a period of time and acting in concert with the aim of committing one or more serious crimes or offences established in accordance with the Convention, in order to obtain, directly or indirectly, a financial or other material benefit.*

7 *Specialized investigation techniques are techniques that are deployed against serious and/or organized crime when conventional law enforcement techniques fail to adequately address the activities of crime groups. Examples include controlled deliveries and covert operations.*

1.7.4a	Do you use risk assessment to target CITES enforcement effort?	Always Very often Sometimes Rarely Never No information	☐ ☒ ☐ ☐ ☐ ☐
1.7.4b	Do you have capacity to analyse information gathered on illegal trade in CITES-listed species?	Yes No No information	☒ ☐ ☐
1.7.4c	Do you use criminal intelligence[1] to inform investigations into illegal trade in CITES-listed species?	Always Very often Sometimes Rarely Never No information	☐ ☐ ☒ ☐ ☐ ☐
1.74d	Have you implemented any supply-side activities to address illegal trade in CITES-listed species during the period covered in this report?	Yes No, but activities are under development No No information	☒ ☐ ☐ ☐
1.7.4e	Have you implemented any demand-side activities to address illegal trade in CITES-listed species during the period covered in this report?	Yes No, but activities are under development No No information	☒ ☐ ☐ ☐

[1] *Criminal intelligence is information that is compiled, analyzed and disseminated in an effort to anticipate, prevent and/or monitor criminal activity. Examples include information on potential suspects held in a secure database and inferences about the methods, capabilities and intentions of specific criminal networks or individuals that are used to support effective law enforcement action.*

Indicator 1.7.5:The number of administrative measures, criminal prosecutions and other court actions for CITES-related offences.

During the period covered in this report:		Yes	No	No Information
1.7.5a	Have any administrative measures (e.g. fines, bans, suspensions) been imposed for CITES-related offences?	☒	☐	☐
	If 'Yes', please indicate how many and for what types of offences. If available, please attach details: Decree No. 35/2019/ND-CP providing for penalties for administrative violations against regulations on forestry (see attached file) Decree No. 42/2019/ND-CP providing for penalties for administrative violations agaisnt regulations on fisheries. (see attached file)			
1.7.5b	Have there been any criminal prosecutions of CITES-related offences?	☒	☐	☐
	If 'Yes', how many and for what types of offences? If available, please attach details: Please see Annex 1.			
1.7.5c	Have there been any other court actions against CITES-related offences?	☒	☐	☐
	If 'Yes', what were the offences involved and what were the results? Please attach details: Please see Annex 1.			
1.7.5d	How were any confiscated specimens disposed of?			Tick all that apply
	–Return to country of export			☒
	–Public zoos or botanical gardens			☒
	–Designated rescue centres			☒
	–Approved private facilities			☐
	–Euthanasia			☒
	–Other (please specify): Research agencies/University/Zoological Museum			☒
	Have you encountered any challenges in disposing of confiscated specimens? The illegal specimens should be identified to origin and there are difficulties in information exchange between Parties. Most of parties did not reply to the request of Viet Nam CITES Management Authority on the origin of illegal specimens. It is difficult to find suitable facilities and funding for specimen storage. Lack of finance resource and rescue technique. Lack of rescue center for aquatic species.			
	Do you have good practice that you would like to share with other Parties?			

Objective 1.8 Parties and the Secretariat have adequate capacity-building programmes in place. Aichi Target 1, Target 12 and Target 19.

Indicator 1.8.1: The number of Parties with national and regional training programmes and information resources in place to implement CITES including the making of non-detriment findings, issuance of permits and enforcement.

1.8.1a	Do you have information resources or training in place to support:	Yes	No
	The making of non-detriment findings?	☒	☐
	Permit officers?	☒	☐
	Enforcement officers?	☒	☐
1.8.1b	Is the CITES Virtual College used as part of your capacity building work?	Yes	☒
		No	☐
		No information	☐
	What improvements could be made in using the Virtual College for capacity building?		
	Viet Nam would like to propose CITES Secretariat provide copyrighted software for Parties to CITES.		
1.8.1c	Is the ICCWC Wildlife and Forest Crime Toolkit used in the development of capacity-building programmes, or does it form part of the curriculum of such programmes?	Yes	☐
		No	☒
		No information	☐
	What improvements could be made in using the ICCWC. Toolkit for capacity building?		

GOAL 2 SECURE THE NECESSARY FINANCIAL RESOURCES AND MEANS FOR THE OPERATION AND IMPLEMENTATION OF THE CONVENTION

Objective 2.1 Financial resources are sufficient to ensure operation of the Convention.

Information to be provided through records held by the Secretariat on financial management of the Convention.

Objective 2.2 Sufficient resources are secured at the national and international levels to ensure compliance with and implementation and enforcement of the Convention. Aichi Target 1, Target 2, Target 3, Target 12, Target 19 and Target 20.

Indicator 2.2.1: The number of Parties with dedicated staff and funding for Management Authorities, Scientific Authorities and wildlife trade enforcement agencies.

2.2.1a	Do you have an approved service standard(s)[1] for your Management Authority(ies)?	Yes	☒
		No	☐
	If 'No', please go to Question 2.2.1d.		
	If 'Yes', for which services are there standards, and what are those standards?		

[1] *For example, a time frame in which you are required to provide a response on a decision to issue or not issue a permit, certificate, or re-export certificate.*

	The CITES MA of Vietnam shall grant the export permit within 8 working days from the day on which the satisfactory application is received The CITES management authority of Vietnam shall grant the import permit within 8-20 working days from the day on which the satisfactory application is received.		
	If 'Yes', do you have performance targets for these standards[1]?	Yes No	☒ ☐
	If 'Yes', what are your performance targets?	90%	
	Do you publish your performance against service standard targets?	Yes No	☐ ☒
	If possible, please provide your performance against service standards during the period covered in this report:		
	If you did not meet your performance targets then was this shortfall a result of:	Yes	No
	–availability of funding?	☒	☐
	–number of staff?	☒	☐
	–a shortage of skills?	☐	☐
	If 'Yes' to a shortage of skills, which skills do you need more of?		
2.2.1b	Do you have an approved service standard(s)[47] for your Scientific Authority(ies)?	Yes No	☒ ☐
	If 'No', please go to Question 2.2.1d.		
	If 'Yes', for which services are there standards, and what are those standards?		
	Issuing CITES certificates, wildlife forensics		
	If 'Yes', do you have performance targets for these standards[48]?	Yes No	☐ ☐
	If 'Yes', what are your performance targets?		
	If possible, please provide your performance against service standards during the period covered in this report:		
	If you did not meet your performance targets then was this shortfall a result of:	Yes	No
	–availability of funding?	☒	☐
	–number of staff?	☒	☐
	–a shortage of skills?	☒	☐
	If 'Yes' to a shortage of skills, which skills do you need more of?		
	DNA analysis: origin checking		
2.2.1c	Do you have an approved service standard(s)[47] for your enforcement authority(ies)?	Yes No	☐ ☒
	If 'No', please go to Question 2.2.1d.		

[1] *For example, 85% of all decisions will take place within the service standard.*

	If 'Yes', for which services are there standards, and what are those standards? If 'Yes', do you have performance targets for these standards[48]? Yes ☐ No ☐ If 'Yes', what are your performance targets? If possible, please provide your performance against service standards during the period covered in this report: If you did not meet your performance targets then was this shortfall a result of: Yes / No –availability of funding? ☐ ☐ –number of staff? ☐ ☐ –a shortage of skills? ☐ ☐ If 'Yes' to a shortage of skills, which skills do you need more of?
2.2.1d	Please only complete this question if your answered 'No' to the first part of question 2.2.1a, 2.2.1b, or 2.2.1c, relating to the existence of approved service standards for your authorities: Do you have sufficient of the following for your authorities to function effectively?

	Management Authority(ies)	Scientific Authority(ies)	Enforcement Authority(ies)
Funding ?	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒
Staff?	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒
Skills?	Yes ☒ No ☐	Yes ☒ No ☐	Yes ☐ No ☒

Indicator 2.2.2: The number of Parties that have undertaken one or more of the following activities:
–changed the budget for activities;
–hired more staff;
–developed implementation tools;
–purchased technical equipment for implementation, monitoring or enforcement.

2.2.2a	Have any of the following activities been undertaken during the period covered in this report to enhance the effectiveness of CITES implementation at the national level?	Tick if applicable
	Hiring of more staff	☒
	Development of implementation tools	☐
	Purchase of technical equipment for implementation, monitoring or enforcement	☒
	Other (please specify):	

2.2.2b	During the period covered in this report, was the budget for your:	Increased	Stable	Decreased
	Management Authority(ies)	☐	☒	☐
	Scientific Authority(ies)	☐	☒	☐
	Enforcement authorities	☐	☒	☐
2.2.2c	Have you been able to use international development funding assistance to increase the level of implementation of your	Yes	No	Not applicable
	Management Authority(ies)?	☒	☐	☐
	Scientific Authority(ies)?	☒	☐	☐
	Enforcement authorities?	☒	☐	☐

2.2.2d	What is the respective level of priority for enhancing the effectiveness of CITES implementation at the national level through the following activities?				
	Activity	High	Medium	Low	Not a Priority
	Hiring of more staff	☐	☒	☐	☐
	Development of implementation tools	☒	☐	☐	☐
	Purchase of new technical equipment for implementation, monitoring or enforcement	☒	☐	☐	☐
	e-permitting	☐	☒	☐	☐
	Other (please specify):	☐	☐	☐	☐

2.2.2e	Do you have a operational system (e.g. electronic database) for managing	Yes	Under development	No
	Species information	☐	☒	☐
	Trade information	☐	☒	☐
	Non-detriment findings	☐	☒	☐

Indicator 2.2.3: The number of Parties raising funds for CITES implementation through user fees or other mechanisms.

2.2.3a	Does the Management Authority charge fees for:	Tick all that are applicable
	– Administrative procedures	☐
	– Issuance of CITES documents (e.g. for import, exports, re-export, or introduction from the sea)	☐
	– Shipment clearance (e.g. for the import, export, re-export, or introduction from the sea of CITES-listed species)	☐
	– Licensing or registration of operations that produce CITES species	☐
	– Harvesting of CITES-listed species	☐
	– Use of CITES-listed species	☐
	–Assignment of quotas for CITES-listed species	☐
	–Other (please specify):	☐

2.2.3b	Is a fee schedule publicly available? Yes ☐ No ☒ If 'Yes', please provide an internet link, or a copy of the schedule to the Secretariat:
2.2.3c	Have revenues from fees been used for the implementation of CITES or wildlife conservation? Entirely ☐ Partly ☐ Not at all ☒ Not relevant ☐
2.2.3d	Yes / No Do you raise funds for CITES management through charging user fees? ☐ / ☒ Do your fees recover the full economic cost of issuing permits? ☐ / ☒ Do you have case studies on charging or using fees? ☐ / ☒ If 'Yes' to any of the above, please provide brief details: Do you use innovative financial mechanisms to raise funds for CITES implementation? ☐ / ☒ If 'Yes', please provide brief details:

Indicator 2.2.4: The number of Parties using incentive measures as part of their implementation of the Convention.

2.2.4a	Do you use incentive measures[1] such as those described in CoP14 Doc 14.32 to implement the Convention? Yes / No Due diligence ☐ / ☒ Compensatory mechanisms ☐ / ☒ Certification ☐ / ☒ Communal property rights ☐ / ☒ Auctioning of quotas ☐ / ☒ Cost recovery or environmental charges ☐ / ☒ Enforcement incentives ☐ / ☒ If 'Yes' to any of the above, or if you use other measures, please provide a summary or link to further information:
2.2.4b	Have incentives harmful to biodiversity been eliminated? Not at all ☐ Very little ☐ Somewhat ☐ Completely ☒

[1] *Defined as 'Social and economic incentives that promote and regulate sustainable management of and responsible trade in, wild flora and flora and promote effective enforcement of the Convention'. The intent of such measures is not to promote wildlife trade as such, but rather to ensure that any wildlife trade undertaken is conducted in a sustainable manner.*

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Objective 2.3 Sufficient resources are secured at the national and international levels to implement capacity-building programmes.
Aichi Target 12, Target 19 and Target 20.

Indicator 2.3.1: The number of capacity building activities mandated by Resolutions and Decisions that are fully funded.

2.3.1a	How many training and capacity building activities[1] have you run during the period covered in this report?	Without assistance from the Secretariat	Conducted or assisted by the Secretariat
	None	☐	☐
	1	☐	☒
	2-5	☐	☐
	6-10	☐	☐
	11-20	☐	☐
	More than 20	☒	☐
	Please list the Resolutions or Decisions involved: Resolution Conf 17.8, Resolution Conf 17.10, Resolution 17.12, Resolution Conf 12.5, Resolution Conf 10.10, Resolution Conf 9.14, Resolution Conf 14.7		
2.3.1b	What sorts of capacity building activities have taken place? Training courses on CITES regulation and identification of common trade in wildlife.		
2.3.1c	What capacity building needs do you have?		

Please tick all boxes which apply to indicate which target group and which activity.	Oral or written advice/guidance	Technical assistance	Financial assistance	Training	Other (specify)	Details
Target group						
Staff of Management Authority	☒	☒	☒	☒	☐	
Staff of Scientific Authority	☒	☒	☒	☒	☐	
Staff of enforcement authorities	☒	☒	☒	☒	☐	
Traders / other user groups	☐	☐	☐	☐	☐	
NGOs	☒	☐	☐	☐	☐	
Public	☐	☐	☐	☐	☐	
Other (please specify)	☐	☐	☐	☐	☐	

GOAL 3 CONTRIBUTE TO SIGNIFICANTLY REDUCING THE RATE OF BIODIVERSITY LOSS AND TO ACHIEVING RELEVANT GLOBALLY-AGREED GOALS AND TARGETS BY ENSURING THAT CITES AND OTHER MULTILATERAL INSTRUMENTS AND PROCESSES ARE COHERENT AND MUTUALLY SUPPORTIVE

[1] *An activity might be a single day training e.g. for a group of staff from the Management Authority, or a longer course / project undertaken by an individual.*

Objective 3.1 Cooperation between CITES and international financial mechanisms and other related institutions is enhanced in order to support CITES-related conservation and sustainable development projects, without diminishing funding for currently prioritized activities.
Aichi Target 2 and Target 20.

Indicator 3.1.1: The number of Parties funded by international financial mechanisms and other related institutions to develop activities that include CITES-related conservation and sustainable development elements.

3.1.1a	Has funding from international financial mechanisms and other related institutions been used to develop activities that include CITES-related conservation and sustainable development elements?	Yes No Not applicable No information	☒ ☐ ☐ ☐
	If 'Yes', please provide brief details: Foreign funds often support for: (i) conservation in national parks and protected areas (ii) training and management capacity building for rangers, fisheries, police, customs, border guards, market management (iii) implementation of demand reduction campaigns for the use of wildlife.		
3.1.1b	During the period covered in this report, has funding for your country from international funding mechanisms and other related institutions:	Increased Remained stable Decreased	☐ ☒ ☐

Indicator 3.1.2: The number of countries and institutions that have provided additional funding from CITES Authorities to another country or activity for conservation and sustainable development projects in order to further the objectives of the Convention.

3.1.2a	Have you provided technical or financial assistance to another country or countries in relation to CITES?						Yes ☐ No ☒ No information ☐		
	If 'Yes', please tick boxes to indicate type of assistance provided Country(ies)	Species Management[1]	Habitat Management[2]	Sustainable use	Law Enforcement	Livelihoods	Other (specify)	Details (provide more information in an Appendix if necessary)	
		☐	☐	☐	☐	☐	☐		
		☐	☐	☐	☐	☐	☐		
		☐	☐	☐	☐	☐	☐		
		☐	☐	☐	☐	☐	☐		
		☐	☐	☐	☐	☐	☐		
		☐	☐	☐	☐	☐	☐		
		☐	☐	☐	☐	☐	☐		

Objective 3.2 Awareness of the role and purpose of CITES is increased globally.
Aichi Target 1, Target 4, Target 12 and Target 18.

Indicator 3.2.1: The number of Parties that have been involved in CITES awareness raising activities to bring about better awareness by the wider public and relevant user groups of the Convention requirements.

3.2.1a	Have CITES authorities been involved in any of the following activities to bring about better awareness of the Convention's requirements by the wider public and relevant user groups?	Wider public	Relevant User Groups
	–Press conferences	☒	☐
	–Press releases	☒	☐
	–Newspaper articles, brochures, leaflets	☒	☒
	–Television appearances	☒	☐
	–Radio appearances	☐	☐
	–Presentations	☒	☒
	–Public consultations / meetings	☐	☐
	–Market surveys	☒	☒
	–Displays	☐	☐
	–Information at border crossing points	☐	☐

[1] *Use species conservation column for work directly related to species – e.g. population surveys, education programmes, conflict resolution, etc.*

[2] *Use habitat conservation column for work that will indirectly support species conservation – e.g. habitat management, development of policy frameworks for how land is managed, etc.*

	–Telephone hotline	☐	☐
	–Website(s) – if so please provide link(s)	☒	☐
	–Other (specify):	☐	☐
	Please attach copies of any items or describe examples:		

Indicator 3.2.2: The number of visits to the CITES website.

3.2.2a	How regularly do your Authorities consult the CITES website?					
	Please tick boxes to indicate the most frequent usage (decide on an average amongst staff if necessary). Target group	Daily	Weekly	Monthly	Less frequently	Not known
	Staff of Management Authority	☐	☒	☐	☐	☐
	Staff of Scientific Authority	☐	☐	☒	☐	☐
	Staff of enforcement authorities	☐	☐	☐	☒	☐
3.2.2b	What has been your experience with using the CITES website?					
					Excellent	☐
					Good	☒
					Average	☐
					Poor	☐
					Very Poor	☐
					No information	☐
	Any further comments on the CITES Website? (e.g. useful aspects, any difficulties encountered, which authorities find which functions/tools most useful, what is missing, etc):					

Indicator 3.2.3:The number of Parties with web pages on CITES and its requirements.
A question relating to this indicator is within question 3.2.1a.

Objective 3.3 Cooperation with relevant international environmental, trade and development organizations is enhanced.

Indicator 3.3.1 The number of Parties which report that they have achieved synergies in their implementation of CITES, other biodiversity-related conventions and other relevant multilateral environmental, trade and development agreements.

3.3.1a	Have measures been taken to achieve coordination and reduce duplication of activities between the national CITES authorities and national focal points for other multilateral environmental agreements (e.g. the other biodiversity-related	Yes No No information	☒ ☐ ☐

	conventions: CBD, CMS, ITPGR, Ramsar, WHC)[1] to which your country is party? If 'Yes', please give a brief description: The major multilateral environmental agreements (MEAs) are dealt with by the meeting of Viet Nam – WEN. Viet Nam CITES MA and Biodiversity Conservation Agency (national focal points for the CBD, Ramsar).

Indicator 3.3.2: The number of biodiversity conservation or sustainable use projects, trade and development goals, or scientific and technical programmes that integrate CITES requirements.

3.3.2a	How many international projects which integrate CITES issues has your country contributed towards? No		
3.3.2b	In addition to 3.2.2a, how many national level projects has your country implemented which integrate CITES issues? - USAID saving species project. - Conservation, Sustainable Use of Forest Biodiversity and Ecosystem Services (GIZ-Bio) project		
3.3.2c	Have there been any efforts at a national scale for your CITES Management or Scientific Authorities to collaborate with:	Yes	No
	Agencies for development?	☒	☐
	Agencies for trade?	☐	☐
	Provincial, state or territorial authorities?	☒	☐
	Local authorities or communities?	☒	☐
	Indigenous or local peoples?	☐	☐
	Trade or other private sector associations?	☐	☐
	NGOs?	☒	☐
	Other (please specify)	☐	☐
3.3.2d	Are CITES requirements integrated into?	Yes	No
	National and local development strategies?	☒	☐
	National and local poverty reduction strategies?	☒	☐
	Planning processes?	☒	☐
	National accounting?	☐	☐

[1] *CBD = Convention on Biological Diversity; CMS = Convention on the Conservation of Migratory Species of Wild Animals, ITPGR = International Treaty on Plant Genetic Resources for Food and Agriculture, Ramsar = The Convention on Wetlands of International Importance, WHC = World Heritage Convention.*

Indicator 3.3.3: The number of Parties cooperating / collaborating with intergovernmental and non-governmental organizations to participate in and/or fund CITES workshops and other training and capacity-building activities.

3.3.3a	Has funding been provided or received to facilitate CITES workshops, training or other capacity building activities to / from:	Tick if applicable	Which organizations?
	Inter-governmental organizations?	☒	UNODC, USAID
	Non-governmental organizations?	☒	TRACE Wildlife Forensics Network, WWF, WCS

Objective 3.4 The contribution of CITES to the relevant Millennium Development Goals, the sustainable development goals set at WSSD, the *Strategic Plan for Biodiversity 2011-2020* and the relevant *Aichi Biodiversity Targets*, and the relevant outcomes of the United Nations Conference on Sustainable Development is strengthened by ensuring that international trade in wild fauna and flora is conducted at sustainable levels.

This objective may also be assessed by a variety of means beyond the reporting format, including action taken to implement many of the CITES resolutions and decisions.
Aichi Target 1, Target 2, Target 3, Target 4, Target 5, Target 6, Target 7, Target 12, Target 14, Target 17, Target 18 and Target 19.

Indicator 3.4.1: The conservation status of species listed on the CITES Appendices has stabilized or improved.

3.4.1a	Do you have data which shows that the conservation status of naturally occurring species in your country listed on the CITES Appendices has stabilized or improved?	Yes	No	Not Applicable
	Appendix I	☒	☐	☐
	Appendix II	☒	☐	☐
	Appendix III	☐	☐	☐
	If there are such studies that you are willing to share, please provide:			
	Species name (scientific)	Link to the data, or a brief summary		
	Cnemaspis psychedelica	See attachments		
	Goniurosaurus catbaensis	See attachment		
	Shinisaurus crocodilurus	See attachment		
3.4.1b	Do you have examples of specific examples of success stories or emerging problems with any CITES listed species?	Yes☒ No☐ No information☐		

	If 'Yes', please provide details: Conservation programs for *Cnemapis psychedelica, Goniurosaurus catbaensis, Shinisaurus crocodilurus* in Vietnam

Indicator 3.4.2: The number of Parties incorporating CITES into their National Biodiversity Strategy and Action Plan (NBSAP).

3.4.2a	Has CITES been incorporated into your country's National Biodiversity Strategy and Action Plan (NBSAP)?	Yes No No information	☒ ☐ ☐
3.4.2b	Have you been able to obtain funds from the Global Environment Facility (GEF) or other sources to support CITES aspects of NBSAP implementation?	Yes No No information	☐ ☒ ☐

Objective 3.5 Parties and the Secretariat cooperate with other relevant international organizations and agreements dealing with natural resources, as appropriate, in order to achieve a coherent and collaborative approach to species which can be endangered by unsustainable trade, including those which are commercially exploited.

Aichi Target 2, Target 4, Target 5, Target 6, Target 7, Target 10, Target 12, Target 14 and Target 19.

Indicator 3.5.1: The number of cooperative actions taken under established bilateral or multilateral agreements to prevent species from being unsustainably exploited through international trade.

3.5.1a	Has your country taken action under established bilateral or multilateral agreements other than CITES to prevent species from being unsustainably exploited through international trade? If 'Yes', please provide details: • A Memorandum of Understanding between Viet Nam and the Czech Republic, for the period 2017-2022, focuses on strengthening cooperation in the fight against illegal wildlife trade, and particularly trade in rhinos, elephants, and tigers; • An agreement between Viet Nam's CITES Management Authority and China's CITES Management Authority on strengthening the implementation of CITES was in effect during 2015-2020. The agreement focused on information sharing, public awareness raising, and capacity building and training on an equal basis, ensuring mutual benefits and a spirit of partnership building and long-term cooperation; • A Memorandum of Understanding on wildlife and biodiversity conservation and protection between Viet Nam and South Africa was in effect during 2012-2017. The agreement focused on enhancing cooperation in biodiversity management, conservation and protection, and law enforcement and compliance with CITES; • A Memorandum of Understanding between Viet Nam and Indonesia that was in effect during 2010-2015 focused on strengthening cooperation in combating trade in timber and wildlife, particularly tigers; • A Memorandum of Understanding between Vietnam Forest Protection Department and Lao PDR Department of Forestry Inspection that was effect during 2012-2017 in forest protection, illegal transportation of timber, forest products and wildlife.	Yes No No information	☒ ☐ ☐

Indicator 3.5.2: The number of times other relevant international organizations and agreements dealing with natural resources are consulted on issues relevant to species subject to unsustainable trade.

3.5.2a	Average number of times per year that international organizations or agreements have been consulted by CITES Authorities	Once	2-5 times	6-20 times	More than 20 times	No consultation	Optional comment about which organizations and issues consulted on
	Management Authority(ies)	☐	☒	☐	☐	☐	
	Scientific Authority(ies)	☐	☒	☐	☐	☐	Species identification, population assessment, listing species in the IUCN Red List.
	Enforcement Authority(ies)	☐	☒	☐	☐	☐	

General feedback

Please provide any additional comments you would like to make, including comments on this format.

Item		
Copy of full text of CITES-relevant legislation if changed Web link(s)	Enclosed Not available Previously provided	☒ ☐ ☐
Please list any materials annexed to the report, e.g. fee schedules, awareness raising materials, etc: Decree No.06/2019/ND-CP on management of endangered, rare and precious species of forest fauna and flora and observation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora Mannual for enforcement agencies to combat illegal wildlife trade (Annex 2). Handbook for Pharmacists (Annex 3).		
Have any constraints to implementation of the Convention arisen in your country requiring attention or assistance? If 'Yes', please describe the constraint and the type of attention or assistance that is required.	Yes No No Information	☐ ☒ ☐
Are there examples of good practice you would like to share with other Parties? If 'Yes' please provide details / links:	Yes No No Information	☐ ☒ ☐
How could this report format be improved?		

Thank you for completing the report. Please remember to include relevant attachments referred to in the report when it is submitted to the Secretariat.

Annex 1 - Offence for wildlife crime in period of 2018-2020

No.	Subject name	Location of seizure	Target species	Sentence date	Sentence term (imprisonment and fine)
1	Tran Tuan Anh	Nam Dinh	10 *Aonyx cinereus* individuals	31/1/2019	11 years and 6 months
2	Tran Van Nghi	Ha Nam	32 *Ophiophagus hannah* individuals	N/A	11 years
3	Tran Thi Tuyen	Ha Nam	32 *Ophiophagus hannah* individuals	N/A	7 years and 6 months
4	Pham Ba Kim	Quang Ninh	145 *Manis javanica* individuals, 7 kg *Manis javanica* scales, 71.4 Elephant skin	21/11/2019	13 years
5	Nguyen Van Quy	Quang Ninh	145 *Manis javanica* individuals, 7 kg *Manis javanica* scales, 71.4 Elephant skin	21/11/2019	7 years
6	Nguyen Duc Khanh	Quang Ninh	145 *Manis javanica* individuals, 7 kg *Manis javanica* scales, 71.4 Elephant skin	21/11/2019	6 years
7	Le Trung Kien	Quang Ninh	145 *Manis javanica* individuals, 7 kg *Manis javanica* scales, 71.4 Elephant skin	21/11/2019	5 years and 6 months
8	Hoang Van Hung	Quang Ninh	145 *Manis javanica* individuals, 7 kg *Manis javanica* scales, 71.4 Elephant skin	21/11/2019	6 years
9	Nguyen Dinh Thien	Quang Ninh	145 *Manis javanica* individuals, 7 kg *Manis javanica* scales, 71.4 Elephant skin	21/11/2019	5 years
10	Nguyen Van Nam	Quang Ninh	145 *Manis javanica* individuals, 7 kg *Manis javanica* scales, 71.4 Elephant skin	21/11/2019	5 years
11	Dinh Cong Son	Quang Ninh	145 *Manis javanica* individuals, 7 kg *Manis javanica* scales, 71.4 Elephant skin	21/11/2019	5 years
12	Tran Van Dan	Quang Ninh	145 *Manis javanica* individuals, 7 kg *Manis javanica* scales, 71.4 Elephant skin	21/11/2019	5 years
13	Le Van Yeu	Quang Ninh	145 *Manis javanica* individuals, 7 kg *Manis javanica* scales, 71.4 Elephant skin	21/11/2019	5 years
14	Nguyen Ngoc Manh	Quang Ninh	145 *Manis javanica* individuals, 7 kg *Manis javanica* scales, 71.4 Elephant skin	21/11/2019	8 years 2 months and 24 days

15	Nguyen Van Cuong	Ha Noi	12 Template *Chelonia mydas* and 2 *Eretmochelys imbricata* individuals	N/A	10 years
16	Nguyen Tien Duong	Ha Noi	12 Template *Chelonia mydas* and 2 *Eretmochelys imbricata* individuals	N/A	8 years and 6 months
17	Cao Xuan Lai	Dien Bien	27 *Platysternon megacephalum* individuals	N/A	10 years
18	Hoang Dinh Quan	Quang Ninh	5 frozen *Panthera tigris* individuals, 42 kg of *Panthera tigris* spicemens, 50 kg of pangolin scales, and other wildlife spicemens	N/A	10 years
19	Lo Van Duc	Ha Noi	5 frozen *Panthera tigris* individuals	N/A	6 years
20	Le Thi Phuong Hoa	Ha Noi	6 frozen *Panthera tigris* individuals	N/A	5 years
21	Nguyen Huu Tien	Ha Noi	92 kg of worked ivory items	N/A	6 years
22	Nguyen Van Hop	Ha Noi	39 *Ophiophagus* individuals	N/A	5 years and 6 months
23	Do Van Thanh	Ha Noi	8 frozen *Manis javanica* individuals, and 4 legs of *Helarctos malayanus*	N/A	10 years and 9 months
24	Melvin Van Zyl	Ha Noi	14.6 kg of Rhino horn	N/A	10 years
25	Nguyen Xuan The	Ha Noi	181 kg of Ivory	N/A	10 years
26	Le Chi Thuan	Ha Noi	688.5 kg of Ivory (114 pieces) and 228.5 kg of worked ivory items	N/A	10 years
27	Leu Xuan Lam	Ha Noi	119 kg of worked ivory items	N/A	10 years
28	Pham Ngọc Hoa	Thanh Hoa	24 *Manis javanica* individuals and 46 *Platysternon megacephalum* individulas	N/A	8 years
29	Nguyen Van Manh	Thanh Hoa	74 Pangolin individuals	N/A	7 years 6 months
30	Vo Xuan Duc	Ho Chi Minh city	7.26 kg of Rhino horn (12 pieces)	28/11/2018	7 years

31	Dinh Thi Nhuong	Ha Noi	688.5 kg of Ivory (114 pieces) and 228.5 kg of worked ivory items	N/A	6 years
32	Nong Van Ky	Cao Bang	51 kg of Ivory	08/10/2019	6 years
33	Nong Van Thanh	Cao Bang	51 kg of Ivory	08/10/2019	5 years 6 months
34	Vo Sy Ha	Ninh Binh	41 *Manis javanica* individuals	23/6/2019	5 years
35	Nguyen Van Sau	Ninh Binh	41 *Manis javanica* individuals	23/6/2019	6 years
36	Ho Minh Duc	Nghe An	7 *Manis javanica* individuals	10/11/2019	5 years
37	Bui Duc Hung	Nghe An	7 Manis javanica individuals	10/11/2019	5 years
38	Nguyen Ba Thin	Thanh Hoa	7 *Manis javanica* individuals	10/11/2019	5 years
39	Nguyen Duc Hop	Ha Tinh	1 *Manis javanica* individual, 7 *Cuora bourreti* individuals, 4 *Platysternon megacephalum* individuals	10/10/2019	3 years
40	Le Duy Dung	Ha Noi	82 kg of Ivory	N/A	3 years + VND 50 million
41	Le The Cuong	Ha Noi	6 statues of Ivory	N/A	2 years
42	Huynh Van Thang	Ha Noi	6 statues of Ivory	N/A	1 years 6 months
43	Nguyen Van Hien	Vinh Phuc	9.94 kg of Ivory	N/A	1 years 6 months
44	Nguyen Van Thao	Tay Ninh	1 *Manis javanica* individual and 1 *Paradoxurus hermaphroditus* individual	N/A	1 year
45	Zhang Lin Rong	Lang Son	100 kg of Pangolin scales	10/03/2018	4 years
46	Nguyen Thi Thuy	Nghe An	11 *Manis pentadactyla* individuals	N/A	5 years
47	Pham Van Tuan	Kien Giang	14 *Eretmochelys imbricata* individuals	N/A	5 years and 3 months

48	Vo Thi Xuan	Kien Giang	12 *Lepidochelys olivacea* and 2 *Eretmochelys imbricata* individuals	11/09/2018	5 years
49	Tran Xuan Mau	Kien Giang	12 *Lepidochelys olivacea* individuals	24/11/2018	5 years
50	Bui Van Mien	Hoa Binh	3 *Catopuma temminckii* invidividuals	06/08/2018	4 years
51	Pham Van Son	Quang Binh	379 kg of *Heosemys annandalii*	N/A	3 years
52	Nong Van Hoan	Dong Nai	1 *Pygathrix nemaeus nigripes*, 1 Tragulidae, 1 *Macaca nemestrina*, and 1 Viverridae individuals	N/A	3 years
53	Pham van Hiep	Quang Ninh	1 *Panthera tigris* skin, and 6 bone pieces of *Ursus thibetanus*	N/A	2 years and 6 months
54	Tran Thi Cuc	Kien Giang	1 *Lepidochelys olivacea* and 1 *Eretmochelys imbricata* individuals	16/12/2019	2 years
55	Khuat Van Lieu	Lang Son	1 *Manis javanica* individual	N/A	1 years 6 months
56	Nguyen Gia Chinh	Bac Ninh	2 frozen *Panthera tigris* individuals	N/A	1 years 6 months
57	Nguyen Thanh Loi	Buon Me Thuot	10.8 kg of ivory	N/A	1 years 6 months
58	Duong Thi Mai Sinh	Quang Ninh	31.8 kg of Pangolin scales	N/A	1 years 3 months
59	Pham Duc Hoa	Ha Noi	1 *Panthera tigris* individual	N/A	1 year 6 months
60	Dam Ich Binh	Ha Noi	1 bottle alcohol with a *Manis javanica* individual and 1 bottle alchohol with an *Ophiophagus hannah* individual	N/A	1 year 2 months
61	Nguyen Duc Tinh	Ha Noi	334g of Rhino horn	N/A	1 year
62	Pham Thi Vy	Ha Noi	A bottle alcohol with an *Ursus thibetanus* individual	N/A	1 year
63	Nguyen Van Ky	Ha Noi	1 *Panthera tigris*	N/A	9 months

64	Phan Van Doan	Ha Noi	1 *Panthera tigris*	N/A	9 months
65	Nguyen Xuan Hung	Ha Noi	1 *Panthera tigris*	N/A	9 months
66	Huynh Thanh Long	Kien Giang	1 Chelonioidea	N/A	6 months
67	Nguyen Thi Thu Thuy	Ha Tinh	5 *Manis javanica* individuals	N/A	5 years
68	Ma Van Tay	Dong Nai	1 *Pygathrix nemaeus nigripes* individual, 1 Tragulidae individual, 1 *Macaca nemestrina* indivudual, and 1 Viverridae individual	N/A	5 years
69	Nguyen Van Dan	Hanoi	1 *Panthera tigris*	N/A	1 year
70	Nguyen Duc Thanh	Thanh Hoa	2 pieces of bear pawn (*Ursus thibetanus*)	1/2/2020	3 years
71	Nguyen Van Toan	Ha Tinh	an individual of *Ursus thibetanus*	1/5/2020	1 year
72	Nguyen Dinh Hong	Hung Yen	116 *Manis javanica* individuals	16/7/2020	16 years
73	Nguyen Van Nam	Hanoi	204 kg of ivory	16/7/2020	10 years
74	Duong Van Phong	Hanoi	204 kg of ivory	16/7/2020	10 years
75	Nguyen Van Hung	Hanoi	204 kg of ivory	16/7/2020	11 years
76	Tran Quy	Ca Mau	114 *Manis javanica* individuals and 300 kg of Manis javanica scale	15/5/2020	13 years and VND 100 million
77	Nguyen Hai Nam	Ca Mau	115 *Manis javanica* individuals and 300 kg of *Manis javanica* scale	15/5/2020	12 years and VND 50 million
78	Nguyen Viet Linh	Ca Mau	115 *Manis javanica* individuals and 300 kg of *Manis javanica* scale	15/5/2020	10 years
79	Vu van Luc	Thai Nguyen	02 *Ursus thibetanus* individuals, and 07 *Cuora galbinifrons* individuals	16/1/2020	30 months
80	Pham Thi Thuan	Quang Nam	13 *Ophiophagus hannah* individuals, 8 *Varanus bengalensis* individuals, and 300 Testudines individuals	12/5/2020	5 years and VND 60 million

81	Nguyen Thi Huong	Ha Tinh	215 *Manis javanica* individuals	15/1/2020	8 year and VND 70 million
82	Vo Van Tam	Ha Tinh	215 *Manis javanica* individuals	15/1/2020	2 years, 9 months and VND 60 million
83	Tran Thi Thanh Tam	Ha Tinh	215 *Manis javanica* individuals	15/1/2020	2 years, 6 months and VND 50 million
84	Dinh Thi Anh	Ha Tinh	215 *Manis javanica* individuals	15/1/2020	2 years, 6 months and VND 50 million
85	Dau Xuan Hung	Ha Tinh	215 *Manis javanica* individuals	15/1/2020	2 years
86	Nguyen Thi Chien	Ha Tinh	215 *Manis javanica* individuals	15/1/2020	2 years
87	Nguyen Thi Quyen	Ha Tinh	215 *Manis javanica* individuals	15/1/2020	2 years
88	Nguyen Thi Chinh	Ha Tinh	215 *Manis javanica* individuals	15/1/2020	2 years
89	Nguyen Huu Chien	Ha Tinh	215 *Manis javanica* individuals	15/1/2020	2 years
90	Nguyen Anh Sao	Ha Tinh	215 *Manis javanica* individuals	15/1/2020	2 years
91	Nguyen Cong Dan	Ha Tinh	215 *Manis javanica* individuals	15/1/2020	2 years
92	Nguyen Van Ba	Bac Kan	6 *Manis javanica* individuals	24/6/2020	5 years
93	Nguyen Van Pho	Ha Noi	Rhino horn	1/6/2020	5 years
94	Nguyen Van Nam	Ha Noi	200 kg of ivory (pieces)	16/7/2020	11 years
95	Duong Van Phong	Ha Noi	201 kg of ivory (pieces)	16/7/2020	11 years
96	Nguyen Van Hung	Ha Noi	202 kg of ivory (pieces)	16/7/2020	10 years
97	Chu Van Thi	Dak Nong	01 *Manis javanica* individual	20/2/2020	VND 315 million
98	Hoang Thi Huong	Ha Noi	207.3 kg of ivory	17/1/2020	10 years
99	Pham Quyet	Ha Noi	207.3 kg of ivory	17/1/2020	12 years
100	Tran Thi Tu Anh	Ha Noi	207.3 kg of ivory	17/1/2020	12 years

101	Nguyen Van Thanh	Lam Dong	2 *Varanus nebulosus* inviduals	22/9/2020	VND 300 million
102	Phan Trong Duc	Nghe An	09 *Manis javanica* individuals	12/10/2020	10 years
103	Le Trung Hau	Quang Ninh	02 *Cuora galbinifrons* and 03 *Platysternon megacephalum* individuals	25/9/2020	1 year
104	Nguyen Anh Duong	Ho Chi Minh city	6.1 kg of Rhino horn (12 pieces)	20/11/2020	6 years
105	Do Thanh Son	Can Tho	28.2495 kg of Rhino horn (11 pieces)	29/12/2020	12 years 6 months and VND 100 million
106	Nguyen Mau Chien	Ha Noi	Rhino horn	15/9/2020	23 months
107	Nguyen Thi Khuyen	Ha Noi	Pawn bear (04 pieces)	21/12/2020	12 months

SỔ TAY

KIỂM SOÁT HẢI QUAN ĐỐI VỚI ĐỘNG VẬT HOANG DÃ VÀ CÁC SẢN PHẨM TỪ ĐỘNG VẬT HOANG DÃ

(Ban hành kèm theo Quyết định số 361/QĐ-TCHQ ngày 26 tháng 02 năm 2020)

(Tài liệu lưu hành nội bộ trong ngành Hải quan)

Hà Nội, tháng 02/2020

USAID
TỪ NHÂN DÂN MỸ

CHUYÊN KHẢO
VỀ PHƯƠNG PHÁP ĐIỀU TRA TỘI PHẠM VỀ MÔI TRƯỜNG

USAID
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SỔ TAY
HƯỚNG DẪN XỬ LÝ VI PHẠM PHÁP LUẬT TRONG LĨNH VỰC LÂM NGHIỆP

SỔ TAY HƯỚNG DẪN

QUY TRÌNH THU THẬP MẪU CỦA CƠ QUAN CHỨC NĂNG TRONG CÁC VỤ BẮT GIỮ ĐỘNG VẬT HOANG DÃ



Tác giả: Lê Đức Minh (Trưởng nhóm)

Phạm Quý Ty

Nguyễn Ngọc Tuấn

HÀ NỘI, 2019

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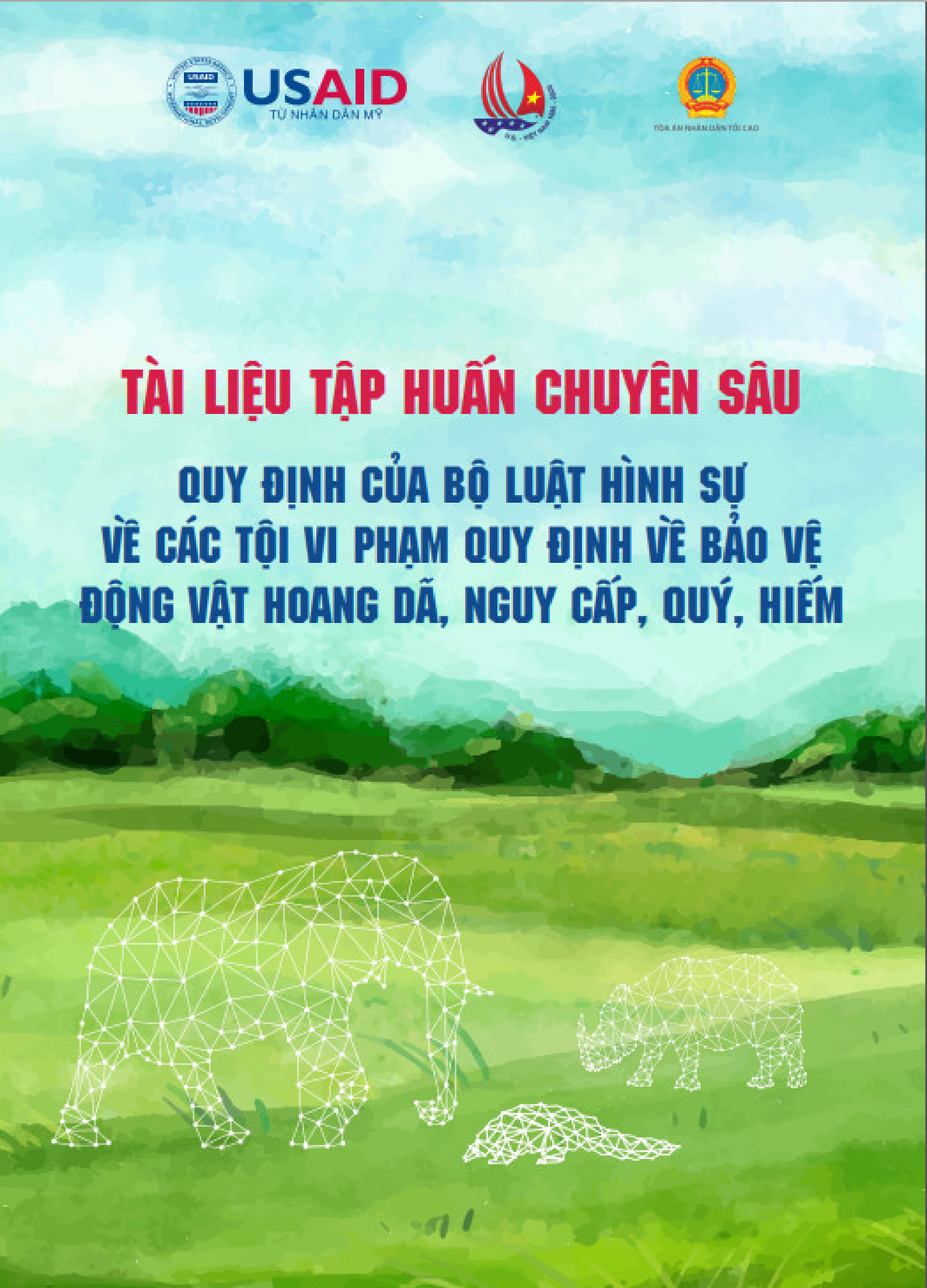
TÒA ÁN NHÂN DÂN TỐI CAO

TÀI LIỆU TẬP HUẤN CHUYÊN SÂU

QUY ĐỊNH CỦA BỘ LUẬT HÌNH SỰ VỀ CÁC TỘI VI PHẠM QUY ĐỊNH VỀ BẢO VỆ ĐỘNG VẬT HOANG DÃ, NGUY CẤP, QUÝ, HIẾM



SỔ TAY

HỎI ĐÁP VỀ NGHỊ ĐỊNH 06/2019/NĐ-CP

ngày 22/1/2019 của Chính phủ
về quản lý thực vật rừng, động vật rừng
nguy cấp, quý, hiếm và thực thi CITES

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TRƯỜNG ĐẠI HỌC KIỂM SÁT HÀ NỘI

SỔ TAY HƯỚNG DẪN
KIỂM SÁT VIÊN THỰC HÀNH QUYỀN CÔNG TỐ VÀ KIỂM SÁT VIỆC GIẢI QUYẾT CÁC VỤ ÁN LIÊN QUAN ĐẾN ĐỘNG VẬT HOANG DÃ

Năm 2020

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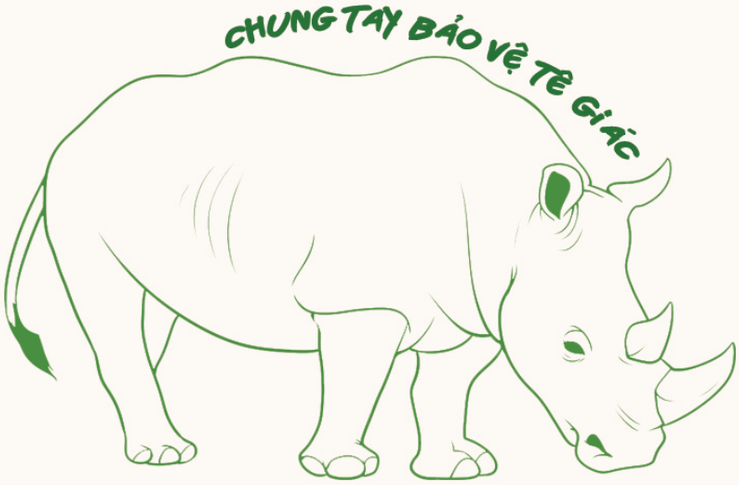
NHỮNG CÂY THUỐC, VỊ THUỐC có tác dụng thay thế SỪNG TÊ GIÁC



TÀI LIỆU LƯU HÀNH NỘI BỘ

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NHỮNG CÂY THUỐC, VỊ THUỐC có tác dụng thay thế VẢY TÊ TÊ

TÀI LIỆU LƯU HÀNH NỘI BỘ

Nature Conservation 31: 1–16 (2018)
doi: 10.3897/natureconservation.31.28145
http://natureconservation.pensoft.net

RESEARCH ARTICLE

A peer-reviewed open-access journal
Nature Conservation
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Microhabitat selection and communal nesting in the insular Psychedelic Rock Gecko, *Cnemaspis psychedelica*, in Southern Vietnam with updated information on trade

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Academic editor: *Franco Andreone* | Received 3 July 2018 | Accepted 8 October 2018 | Published 29 November 2018

http://zoobank.org/1B2B22A3-3173-456E-B15F-82B1A33F9023

Citation: Ngo HN, Nguyen TQ, Nguyen TV, van Schingen M, Ziegler T (2018) Microhabitat selection and communal nesting in the insular Psychedelic Rock Gecko, *Cnemaspis psychedelica*, in Southern Vietnam with updated information on trade. Nature Conservation 31: 1–16. https://doi.org/10.3897/natureconservation.31.28145

Abstract

The Psychedelic Rock Gecko, *Cnemaspis psychedelica*, was described in 2010 and certainly belongs to the most spectacular gecko discoveries worldwide. The species is endemic to two small offshore islands in Rach Gia Bay. Its striking colour pattern makes the species highly attractive for the international pet market. The existent *Cnemaspis* population is negatively affected by habitat degradation and predation by introduced macaques. We herein provide the first characterisation of microhabitat selection of this species, including seasonal variation on Hon Khoai and Hon Tuong islands, Ca Mau Province, Vietnam. We found that characteristics of the selected microhabitat, such as substrate type, temperature and canopy cover slightly differed between the wet and dry seasons. We also demonstrated age-related differences in the selection of perch heights. Communal nesting was, for the first time, reported for *C. psychedelica*, as well as natural predation by a snake species (*Lycodon capucinus*). In addition, we documented ongoing habitat destruc-

tion on Hon Khoai Island and recorded illegal trade of live Psychedelic Rock Geckos for the first time on local pet markets in both northern and southern Vietnam. Our findings highlight the need for improved conservation measures in order to reduce anthropogenic impacts on wild populations of *C. psychedelica*.

Keywords
Microhabitat requirements, seasonal variation, communal nesting, natural predators, illegal trade, conservation

Introduction

The old world gecko genus *Cnemaspis* Strauch is considered as one of the most species-rich paleotropical gekkonid genera, encompassing more than 100 species with a widespread distribution throughout tropical Africa, South Asia and Southeast Asia (Smith 1935, Wickramasinghe and Munindradasa 2007, Ganesh et al. 2011, Uetz and Hošek 2017, Vidanapathirana et al. 2014, Srinivasulu et al. 2015). To date, six species of *Cnemaspis* have been recorded from Vietnam, namely *C. aurantiacopes*, *C. boulengeri*, *C. caudanivea*, *C. nuicamensis*, *C. tucdupensis* and *C. psychedelica*. Two of these from Vietnam are endemic to islands (Grismer and Ngo 2007, Grismer et al. 2010). One of them is the insular Psychedelic Rock Gecko, *Cnemaspis psychedelica*, which was only described from isolated Hon Khoai Island, Ca Mau Province, Southern Vietnam in 2010 (Grismer et al. 2010). More recently *C. psychedelica* was also recorded on a further offshore island, namely Hon Tuong isle, which only covers a small area of ca. 300 m^2 (Ngo et al. 2016). Still, the species is assumed to be endemic to islands of Rach Gia Bay, southern Vietnam.

The known wild population of the species was estimated to comprise approximately 500 mature individuals (Ngo et al. 2016). Although the wild population of *C. psychedelica* appears to be relatively stable and actively reproducing, it is currently suffering from increasing habitat degradation on the small Hon Khoai Island (Ngo et al. 2016). Particularly, those granite formations, which represent essential microhabitat sites for *C. psychedelica* are frequently blasted by dynamite in order to flatten several areas on the island for construction of roads or artificial ponds (Ngo et al. 2016). Additionally, poaching for the international pet trade has already been recorded shortly after description of the species. *C. psychedelica* has been observed in European reptile fairs and on the online markets for prices of up to 3,000 EUR/pair (Auliya et al. 2016, Ngo et al. 2016). In addition, the introduction of invasive Long-tailed Macaques (*Macaca fascicularis*) on Hon Khoai Island poses another potential threat to *C. psychedelica,* as macaques were observed to feed on geckos and theirs eggs (Grismer et al. 2010, Ngo et al. 2016). The extremely restricted habitats, together with a low reproduction rate, make the species especially vulnerable to external stressors and limit its capacity to recover from threats such as harvesting. As a result, the protection needs of *C. psychedelica* have received attention from all around the world. Based on a first population and risk assessment, the species has recently been classified as "Endangered" on the IUCN Red List of Threatened species (Nguyen et al. 2016) and was subsequently listed in Appendix I of the Convention

on International Trade in Endangered Species of Wild Fauna and Flora (CITES 2016). Furthermore, immediate conservation measures have been initiated including the establishment of an in-country *ex situ* assurance population for *C. psychedelica* (Ziegler et al. 2016). However, detailed information about microhabitat requirements of the species, which are essential for both adequate habitat protection measures and to successfully implement conservation breeding programmes, are still lacking.

The study provides detailed data on microhabitat selection of *C. psychedelica* within its natural habitat. We examined differences in microhabitat selections of lizards between the wet and dry seasons, as well as variations in habitat use amongst age classes. Furthermore, we provide new information about egg deposition behaviour, natural predation and ongoing habitat destruction on Hon Khoai Island, as well as new evidence for local trade in *Cnemaspis psychedelica*, highlighting the need for immediate measures to protect the remaining populations.

Methods

Field surveys

Study sites were selected based on known occurrences of *C. psychedelica* on Hon Khoai and on Hon Tuong islands, Ca Mau Province, southern Vietnam, according to previous surveys (Grismer et al. 2010, Ziegler et al. 2016). The region is characterised by a monsoon sub-equatorial climate with constant annual temperatures, but with distinct climatic difference between a dry and a wet period with heavy rains (Fig. 1) (General Statistics Office of Vietnam 2016).

Field surveys were carried out during the wet season in November 2015 as well as during the beginning of the dry season in January 2016. Another short survey on Hon Khoai Island took place in January 2017. We mainly conducted night excursions after sunset between 19:00 h and 24:00 h. In order to determine the sex of the geckos and for taking measurements, individuals were captured by hand and subsequently released at the same spot in the morning or afternoon of the next day between 10:00 h and 17:00 h. While releasing geckos, further sighted individuals were also recorded, measured and released. Each gecko was measured with a digital slide-caliper to the nearest 0.1 mm. Abbreviations are as follows: snout-vent length (SVL), measured from tip of snout to anterior margin of cloaca; tail length (TL), measured from posterior of cloaca to tip of tail in geckos (Grismer et al. 2010).

In order to investigate the biodiversity of Hon Khoai Island, we carried out respective field surveys in January 2016. During these surveys, a few amphibians and reptiles were also collected and subsequently deposited in the collection of the Institute of Ecology and Biological Resource (IEBR), Hanoi, Vietnam. Stomach contents of collected snakes were analysed after dissection in order to identify whether they might represent natural predators of *C. psychedelica*.

Year	Months	Temp. (°C)	Prec. (mm)
2015	11	28	272.4
	12	27.8	48.6
2016	1	27.9	0.2
	2	27.3	2.1
	3	28	0
	4	30.1	4
	5	29.9	161.4
	6	28.3	230.8
	7	28.3	432.2
	8	28.4	271.9
	9	27.6	345
	10	27	501.1
	11	27.9	183.6
	12	27.1	171.8

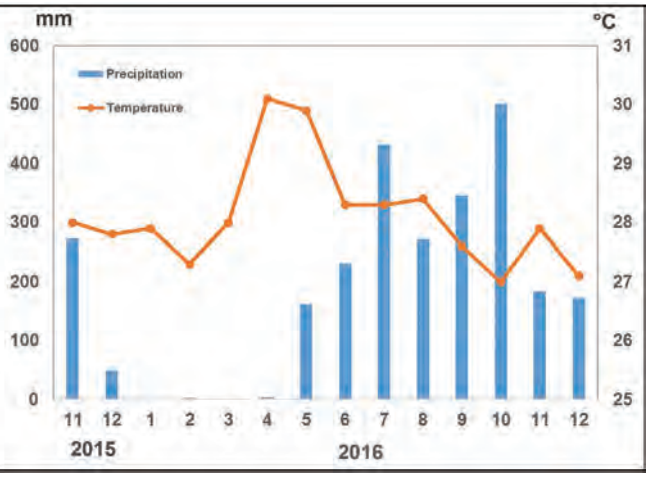

Figure 1. Mean annual air temperatures (°C) and monthly precipitation (mm) in 2015 and 2016 in Ca Mau Province, Vietnam (source: https://www.gso.gov.vn/default.aspx?tabid=713, accessed on 05 July 2018).

Microhabitat assessment

Microhabitat parameters were recorded for each sighted individual, including substrate type (classified as cliff, rock, branch, leaves, forest floor), perch height [in m] (vertical distance between captured animal and ground), percentage of vegetation or rock coverage above animal, position (resting outside, under a rock or within a crevice), substrate surface condition (dry or wet), activity (resting, feeding, foraging), air temperature [°C], substrate temperature [°C], animal's body surface temperature [°C] and relative air humidity [%]. Air temperature and relative air humidity were measured with a digital thermo-hygrometer at a vertical height from the ground up to 2m height at each microsite (TFA Dostmann/Wertheim Kat.Nr.30.5015), while substrate and body surface temperatures of animals were determined with an infrared thermometer (Measupro IRT20).

To identify intraspecific differences in microhabitat selection of *C. psychedelica*, individuals were classified into different age classes according to Ngo et al. (2016) based on snout-vent lengths (SVL): SVL < 58 mm = juvenile and SVL ≥ 58 mm = adult.

Chi-square tests and t-tests with $P \leq 0.05$ were performed to determine significant differences in selected microhabitat parameters with categorical and continuous variables, respectively, between wet and dry season and amongst age classes. Statistical analyses were applied with the programme SPSS Version 16.0 (SPSS Inc., Chicago).

Threat assessment

To obtain an overview on the availability of and evidence for trade in *Cnemaspis psychedelica* in Vietnam, we visited several local pet markets (one in Ca Mau Province where the species occurs, one in Dong Nai Province, one in Ho Chi Minh City and one in Ha Noi City) and further investigated different internet platforms, reptile Facebook pages and

Forums. We also interviewed three local dealers offering the lizard online and two local keepers in March 2018, in order to obtain information on origins, commercial prices and networks of illegal trade in this species. Additionally, we conducted field surveys at previous survey sites located on Hon Khoai Island, Ca Mau Province in January 2017 to evaluate anthropogenic threats. Nearly 10 road workers on Hon Khoai Island were interviewed to determine the local use of the species. Names of interviewees were kept anonymous to ensure data privacy rights and internet links were not disclosed to prevent misuse.

Results

Microhabitat characterisation

A total of 569 sightings took place (156 during the wet season and 413 during the dry season) including both subpopulations from Hon Khoai and Hon Tuong islands, respectively. *Cnemaspis psychedelica* was found to be active in the surroundings of granite basements within thick forest coverage, dominated by semi-deciduous forest vegetation. Mean air temperatures were with 29.1 ± 0.75 °C (26.0–31.5 °C, n = 569) slightly higher than average substrate temperatures of 26.6 ± 1.07 °C (20.0–31.7 °C, n = 567). Regarding seasons, substrate temperatures were with 26.9 ± 0.77 °C (25.2–31.7 °C, n = 411) slightly higher during the dry season than temperatures during the wet season (26.1 ± 1.48 °C, 20.0–29.6 °C, n = 156) (t-Test, t = 6.23, df = 187.8, P < 0.001) (see Fig. 2C, Table 1). Generally, temperatures remained relatively constant throughout the year without high fluctuations (Fig. 1). In contrast, relative humidity at microsites was with 86.2 ± 6.1% (71–100%, n = 156), distinctly higher during the wet season compared to 73.3 ± 2.56% (65–80%, n = 413) during the dry season (t-Test, t = 25.4, df = 175.9, P < 0.001) (see Table 1).

Table 1. Environmental parameters characterising the microhabitat of *Cnemaspis psychedelica*.

Parameters	Wet season (Nov)	Dry season (Jan)	T-test
Canopy cover [%]	0–100 (79.6±30.5) (n=156)	0–100 (91.2±20.1) (n=413)	F=2.3; P=0.0004<0.05
Height [m]	0.01–3 (0.75 ±0.39) (n=156)	0.01–2.8 (0.7±0.33) (n=413)	F= 1.17; P-value= 0.22>0.05.
Elevation [m]	1–81 (32.0±19.9) (n=158)	3–79 (35.6±17.8) (n=407)	
Ambient Temp. [°C]	26–31.5 (28.5±0.9) (n=158)	23.8–30.3 (29.3±0.4) (n=413)	
Substrate Temp. [°C]	20–29.6 (26.1±1.5) (n=156)	25.2–31.7 (26.9±0.8) (n=411)	F=2.6; P-value=0.0001<0.05
Relative air Humidity [%]	71–100 (86.2±6.2) (n=158)	65–80 (73.3±2.6) (n=413)	
Monthly Precipitation (mm) (GSOV. 2016) (access 05 July 2018)	272.4	0.2	
Mean monthly Temp. [°C] (GSOV. 2016) (access 05 July 2018)	28.0	27.9	

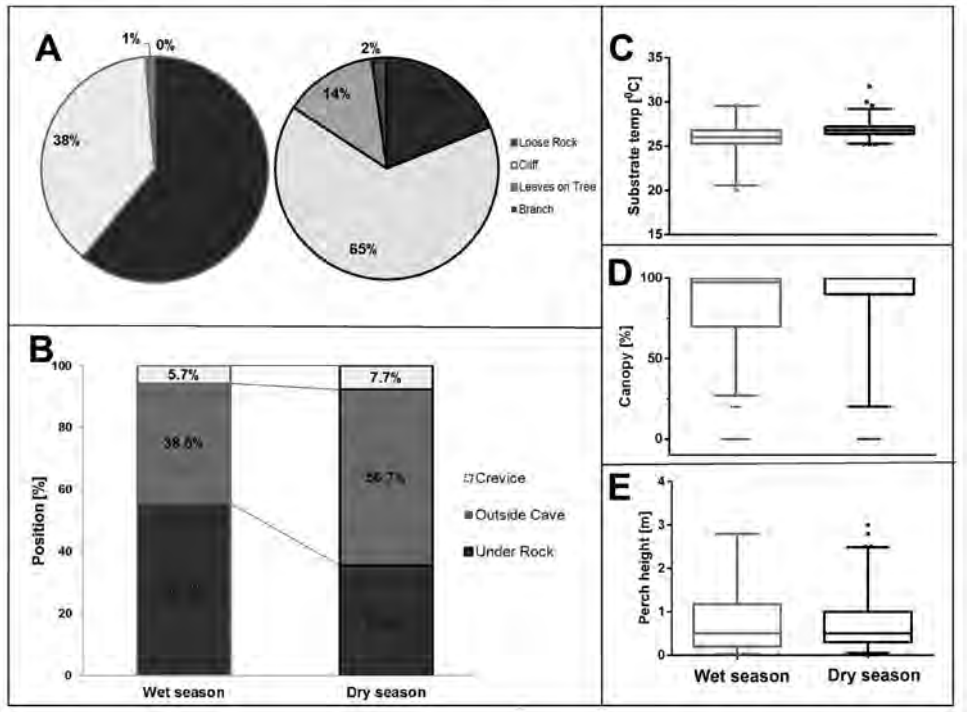

Figure 2. Microhabitat selection of *Cnemaspis psychedelica* **A** Substrate selection **B** Microsite selection **C** Box plots of substrate temperature **D** Box plots of canopy coverage **E** Box plots of perch height.

Microhabitat use

The Psychedelic Rock Gecko was found active during both the wet and dry seasons. Regarding daily activity pattern, *C. psychedelica* was observed active during any sighting between 10:00 h to 24:00 h. The vast majority of lizards were found in the shade, even if a patch of direct sunlight was in close proximity.

During the wet season, *C. psychedelica* was mainly found on loose granite rocks, followed by cliff and leaves on trees (61%, 38%, 1%, n = 413, respectively, see Fig. 2A), but never on branches or on the forest floor. During the dry season, the main selected substrate types were cliffs, followed by loose granite rocks, leaves on trees and branches (65%, 19%, 14%, 2%, n = 156, respectively, Chi^2 = 36.4, df = 3; P < 0.001, see Fig. 3A–D). We mainly encountered lizards resting under rock formations during the wet season, while animals frequently resided outside of caves or rock shelters during the dry season (outside of caves: 38.5% during the wet season vs. 56.7% during the dry season, respectively, see Fig. 2B, Chi^2 = 19.1, df = 2, P < 0.001). We further observed *C. psychedelica* at mean heights of 0.71 ± 0.6 m (0.01–3 m, n = 569) (see Table 1). There was no difference in the height selections of lizards between wet and dry season (t-Test, t = 0.86, df = 567, P > 0.05) (see Fig. 2E). While animals tended to reside under a mean canopy coverage of 79.6 ± 30.5% (n = 156) during the wet season, a higher percentage

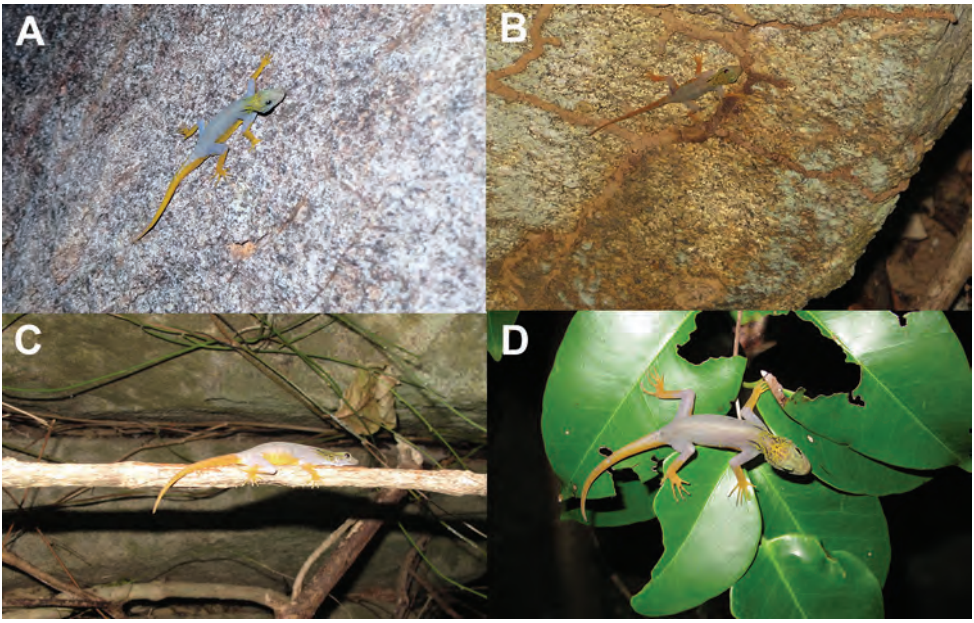

Figure 3. A–D Selected substrates of *Cnemaspis psychedelica* on Hon Khoai Island.

of canopy cover of 91.2 ± 20.1% (n = 413) above the animals was recorded during the dry season (t-Test, t = 4.4, df = 208, P < 0.001) (see Fig. 2D, Table 1). We observed that the majority (about 75.9%, n = 432) of lizards were resting during surveys, whereas only about one quarter of individuals (n = 137) were found actively foraging.

We found adult specimens at mean heights of 0.76 m (n = 419), while juveniles commonly resided at lower heights of 0.61 m (n = 149) (t = 2.9, df = 296.4, P = 0.004). Both age classes preferred to occupy granite rock formations (60.8%, 74.2%, respectively), while another high percentage of adults resided on cliffs (29% vs. 9%, respectively) and a lower percentage of adults occupied branches (7.8%, 16.8%, respectively).

Oviposition

Egg depositions of *Cnemaspis psychedelica* happened on flat surfaces of cliff walls, without direct sunlight. Egg deposition sites were located under high vegetation coverage during both seasons (see Fig. 4A). We did not find any eggs attached to branches or leaves. Newly laid eggs were bright and clear white in colouration, then changed to pinkish (early development of embryos) and then to a slightly grey colour (with developed embryos). Eggs were almost round in shape, except for the flattened side attached to the substrate. Clutches of *C. psychedelica* consistently comprised two eggs. Clutches of different individuals of *C. psychedelica* were commonly deposited in close proximity to each other, forming clusters. Furthermore, new clutches were frequently found to be deposited on top of remains of eggshells from previous clutches. We measured the min-

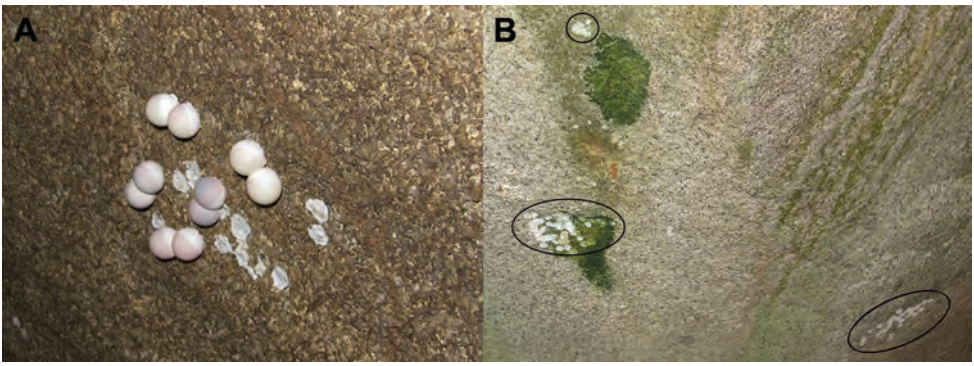

Figure 4. A Communal nesting in *Cnemaspis psychedelica* **B** Clumped distribution of clutches.

imum distance amongst different clusters as about 25 cm. Furthermore, the maximum observed number of unhatched eggs within a cluster was 10 eggs/5 pairs (see Fig. 4A, B). The clusters were generally deposited at heights ranging from 0.3 to 3.5 m above the ground. We frequently found several adult individuals in close proximity to the aggregation of clusters. Solitary clusters comprising only two eggs were usually observed higher than 2.5 m above the ground and were scarcely attended by adult individuals.

Natural predation

An ingested adult female of *C. psychedelica* (IEBR. 4141: SVL = 68.64 mm, TL = 74.8 mm) has been found within a preserved and subsequently dissected Common Wolf Snake (*Lycodon capucinus*, IEBR. 4211: SVL = 471.4 mm, TL = 95.11 mm) (Fig. 5A). The gecko was ingested with the head first and accounted for 30.4% of the snake's SVL.

Threats

During the survey in January 2017, the optimal habitats of *C. psychedelica* on Hon Khoai Island were found to have experienced further degradation due to expanding road construction and the building of further artificial ponds (see Fig. 6A, B). In particular, destruction with dynamite has entirely removed the natural habitat of *C. psychedelica* at one survey site and further extended to other survey areas.

Trade in living *C. psychedelica* has been recorded by our team in local pet shops from northern Vietnam (Ha Noi City) and southern Vietnam (namely, Ca Mau Province where the species is distributed, further in Dong Nai Province and Ho Chi Minh City), as well as online in Vietnamese Reptile Forums, Zalo Online and Facebook. During our visit to two pet shops, one in Ca Mau Province and one in Dong Nai Province in March 2018, we observed 20 and only one remaining *C. psychedelica*,

Figure 5. A Adult female Psychedelic Rock Gecko found as a prey item in the stomach of a Common Wolf Snake (*Lycodon capucinus*) **B** Wild-caught individual of *Cnemaspis psychedelica* offered for sale in a pet shop in Dong Nai Province, Southern Vietnam **C, D** Preserved reptile species in alcohol, used for traditional medicine on Hon Khoai Island.

respectively, which were kept in small boxes (Fig. 5B). A large number of animals had already been previously exported. Local dealers confirmed that *C. psychedelica* have been caught from the wild for sale since 2015. According to interviews with local dealers, 15 to 70 specimens from Vietnam have been frequently offered for sale and export to Thailand and Indonesia (for USD 100–300 per individual) and afterwards smuggled to Russia and Europe for USD 700 per individual, while prices achieved in the local trade were comparably lower (USD 20–40 per animal). According to one private keeper in Ho Chi Minh City, *C. psychedelica* have been offered for USD 450 per pair from another local pet shop in Ho Chi Minh City since 2016. In March 2018, he had 15 breeding specimens for sale for USD 200 per individual and several eggshells were observed in his terrarium. Regarding international trade, at least 23 specimens

Figure 6. A Forest degradation caused by building new roads **B** New artificial pond on Hon Khoai Island.

of *C. psychedelica* were found being offered for sale online (such as on Facebook) in Europe between September 2017 and March 2018 (Altherr et al. pers. comm.).

During the survey in January 2017, we found some reptile species such as *Cnemaspis psychedelica, Cyrtodactylus leegrismeri, Draco maculatus, Hemidactylus frenatus, Gehyra mutilata, Gekko gecko* and *Ahaetulla prasina* soaked together in rice wine and used for traditional medicine by road workers on Hon Khoai Island (Figs. 5C and D). According to interviews with road workers, *C. psychedelica* individuals have been kept as pets in their terrariums at home since 2015.

Discussion

Microhabitat

We found that selected microhabitat characteristics such as substrate type, temperature and canopy cover slightly differed between the wet and dry seasons. Our data showed that the species is more frequently found under granite rock formations during the wet season, probably to avoid heavy rains (10 of 11 survey days). During the dry season, geckos were observed in remarkable numbers outside of caves or rock formations. The species was found strongly associated with granitic rock formations and cliffs during all life stages. While *C. psychedelica* has never been found on the forest floor and only scarcely within the vegetation, clutches were also unexceptionally deposited on rock formations at heights of at least 0.3 m above the ground. We assume that vertical cliffs might provide shelter from ground-dwelling predators.

Furthermore, animals were found at spots which were more densely covered with canopy during the dry season than during the wet season, which could be their behaviour to avoid direct sun exposure. Accordingly, fewer animals were found along transects with only slight vegetation coverage during the wet than during the dry season. These findings suggest the dependence of *C. psychedelica* on the availability of shaded habitats. Egg depositions were also exclusively found on cliffs, which are facing away from the sun.

Our study revealed that the body surface temperature of *C. psychedelica* was positively correlated with the substrate temperature ($r_s = 0.51$, $P < 0.001$, $n = 567$). Thus,

as in other ectotherms, basic physiological functions of *C. psychedelica*, such as locomotion, growth and reproduction are determined by the environmental temperature. Since tropical lizards are considered to have narrow temperature optima and only few options for behavioural and physiological compensation, they are assumed to be, in particular, vulnerable to extinction by climate warming (Deutsch et al. 2008; Doody and Moore 2010; Huey et al. 2009; Vié et al. 2009).

Communal nesting and spatial distribution

We frequently observed aggregated oviposition sites and the placement of fresh eggs on top of or close to previous oviposition sites. Communal nesting is defined as "non-incidental deposition of eggs at a shared nest cavity by two or more co-specifics" (Espinoza and Lobo 1996). Such communal oviposition has been described in numerous lizard species including other *Cnemaspis* species (e.g. Kalaimani 2015; Lima et al. 2011; Magnusson and Lima 1984; Vitt 1986; Soares de Oliveira et al. 2015; Somaweera 2009; Srinivasulu and Srinivasulu 2013a, b; Werner 2002) and is assumed to offer potential benefits such as protection, predator-satiation and metabolic heating (Gurgel de Sousa and Freire 2010, Sönmez 2018). Mateo and Cuadrado (2012) experimentally proved that hatching success was significantly higher in communal than in solitary clutches of the gecko *Ptyodactylus oudrii* and significantly decreased when adult lizards were excluded from the oviposition site. Accordingly, we also observed high densities of *C. psychedelica* specimens of different ages and sexes, accumulated in close vicinity to communal oviposition sites following the principle of clumped distribution. The maximum observed density was 23 individuals, including 18 adults (9 males), per 4 m^2. The clumped presence of individuals, independent of age and sex in close proximity to clutches, has also been observed by Mateo and Cuadrado (2012), assuming a high population density and restricted availability of suitable oviposition sites to trigger communal nesting.

With a closer look on the spatial distribution of *C. psychedelica*, we found age related differences in perch heights, namely juveniles occurring at significantly lower heights than adults. Similar habitat divergences between juveniles and adult individuals have also been reported for Cat Ba Tiger Geckos and Crocodile Lizards in Vietnam (Ngo et al. in press, van Schingen et al. 2015) and gekkonids from New Caledonia (Snyder et al. 2010). Van Schingen et al. (2015) suggested that climbing might be a trade-off in lizards between saving energy costs and the reduction of interactions with competitors and predators. However, this hypothesis needs to be tested in future studies. Furthermore, adult specimens were usually found at similar heights to the closest communal clusters, which might indicate some kind of parental care behaviour.

Predation

Reptiles, including lizards are commonly prey of other vertebrates, such as mammals and reptiles (Whiles and Grubaugh 1993). The first case of a snake as a predator of

Cnemaspis psychedelica, as herein reported, is thus nothing extraordinary (e.g. Herman 2017, Nogueira et al. 2013, Vrcibradic and Eisfeld 2016, Whitaker and Captain 2004). However, Long-tailed Macaques (*Macaca fascicularis*) as predators, as reported by Grismer et al. (2010), is a worrying fact, as this species was introduced and thus does not belong to the normal ecosystem of Hon Khoai Island. The artificially enhanced predation probably impacts the population dynamics of *C. psychedelica*.

Anthropogenic threats and implications for conservation

Lizards with limited geographic distributions, such as *Cnemaspis psychedelica,* may be extremely vulnerable to local habitat loss or alteration (Sodhi and Ehrlich 2010). The limited availability of habitats for the species, namely only two offshore islands in the Rach Gia Bay, Vietnam, makes the species particularly vulnerable to habitat destruction. The optimal microhabitats of *C. psychedelica* on Hon Khoai Island were found to have experienced ongoing degradation due to expanding infrastructure. If the present trend continues, not only *C. psychedelica*, but also other species and yet undescribed or just recently discovered diversity on the island (Nguyen et al. 2018), will become potentially threatened by extinction. Furthermore, these constructions will probably further facilitate hunters to illegally approach Hon Khoai Island. *C. psychedelica* has already been observed on international markets, but detailed information about illegal traffic networks has been lacking (Altherr 2014; Auliya et al. 2016, Ngo et al. 2016). New evidence from interviews with local reptile dealers indicates that they paid local fishermen and visited Hon Khoai Island as tourists to collect live specimens of *C. psychedelica* without any permits. Live specimens of *C. psychedelica* have been frequently offered for sale in southern and northern Vietnam and are mainly smuggled to Thailand as a middle country and then exported to be sold in Russia and Europe for relatively high prices. However, the number of smuggled animals has allegedly declined to fewer than a total of 20 individuals per deal which might be an effect of the improved control of trade in the species due to the recent inclusion in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) as well as promulgating strict decrees that have restricted harvest and reduced the stress from over-exploiting of a number of lizard species (Sodhi and Ehrlich 2010). However, traders still continue to harvest wild individuals and the species is still found to be offered in local and European markets probably due to high demands and commercial value. Our findings indicate that there are currently no legal commercial harvests and trade in the species in Vietnam, implying that wild specimens entering the international trade have been illegally harvested. We highly recommend that the Vietnamese authorities more strictly control the illegal collection of *C. psychedelica* in the natural habitat. Furthermore, wildlife law enforcement along key border regions should be highly improved to alleviate the illegal exploitation and trade, not only in wild *C. psychedelica*, but also in other taxa.

Acknowledgements

We thank the directorates of the Forest Protection Department of Ca Mau Province for their strong cooperation, the support of field work and issuing relevant permits. We are grateful to T.Q. Le, T.H. Tran, P.H. Dang (IEBR, Hanoi), H.V. Le and B.T. Nguyen (FPD of Ca Mau Province), K.V. Nguyen from Wildlife at Risk (WAR, HCM City) and M.T. Nguyen, T.T. Nguyen (VNMN, Hanoi) for their support and assistance in the field. We thank Sandra Altherr (Munich) for sharing unpublished information with us. Thanks also to Emanuele Scanarini, Ulrich Schepp, Rudolf von May and Franco Andreone for the reviews of previous manuscript versions. Field works on Hon Khoai were supported by Cologne Zoo, the Rufford Foundation (Grant No. 18631-2), the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the Deutsche Gesellschaft für Herpetologie und Terrarienkunde (DGHT) - Zoologische Gesellschaft für Arten- und Populationsschutz e.V (ZGAP) (Project code: 3.*Cnemaspis psychedelica*.VNM.2016.DGHT-4703). This research was partially supported by the national project entitled "Study on the biodiversity of offshore limestone islands in Vietnam: Proposed solutions and models for conservation and sustainable development (Code: KC09.11/16-20)". Cologne Zoo is partner of the World Association of Zoos and Aquariums (WAZA): Conservation projects 07011, 07012 (Herpetodiversity Research, Amphibian and Reptilian Breeding and Rescue Station).

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Building of a Conservation Breeding Facility for the Psychedelic Rock Gecko (*Cnemaspis psychedelica*) in Southern Vietnam

Aufbau einer Erhaltungszuchtanlage für den Psychedelischen Felsengecko (*Cnemaspis psychedelica*) in Südvietnam

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Received 24 February 2016

Abstract

Vietnam belongs to the global hotspots of biodiversity, and new vertebrate species have been regularly discovered from this country. Lizards and in particular geckos are among the groups with the highest discovery rates. One of the most beautiful geckos recently discovered from Vietnam is the Psychedelic Rock Gecko (*Cnemaspis psychedelica*), an endemic species of Hon Khoai Island, a small island with a total area of only 8 km^2 in Ca Mau Province, southern Vietnam. Although Hon Khoai is protected through the Ca Mau Biosphere Reserve, and collecting and exporting of the wild fauna and flora for commercial purpose is prohibited, the beautiful geckos made their way to the international pet trade. But the species is not only threatened by illegal collecting for the pet trade, but also by macaques introduced on this island. To act against this alarming development, Wildlife at Risk (WAR), the Institute of Ecology and Biological Resources (IEBR) and Cologne Zoo decided to cooperate in building up a gecko house as basis for the establishment of a reserve population, which could become the beginning of a potential conservation breeding program for *C. psychedelica*. The gecko house was planned in May 2014 and finished in November 2014 in WAR's Hon Me Station in

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Kien Giang Province, southern Vietnam. It has a movable rain cover with sunblind and contains ten large terraria consisting of aluminium, metal gauze and glass. Terrarium furniture mainly consists of cemented rock walls, plants, and natural soil with leaves. The gecko house also has a double door system to prevent accidently escaped geckos from breaking out. The exterior of the gecko house is covered by a large water proof poster which points both in English and Vietnamese languages to the threats to the Psychedelic Rock Gecko and the background of the conservation project. First small gecko breeding groups were transferred from Hon Khoai Island to the Hon Me Station in March 2015, with relevant permits provided by the respective authorities. Furthermore we report about our first experiences with the keeping and breeding of *C. psychedelica*, and document colour pattern change during juvenile development.

Keywords: Gekkonidae; *Cnemaspis psychedelica*; Facility building; Husbandry; Conservation breeding; Vietnam

Introduction

Vietnam belongs to the global hot spots of biodiversity, and new vertebrate species have been regularly discovered from this country (e.g., Ziegler & Nguyen, 2010). Lizards and in particular geckos are among the groups with the highest discovery rates. For example, at the end of the past millennium, there were only four Bent-toed Geckos (genus *Cyrtodactylus*) known from Vietnam, but these days the number already has increased towards more than 35 species (Nguyen et al., 2015; Ziegler, 2015), and there is still no end of new descriptions in sight. But also among the Common Dwarf Geckos (*Hemiphyllodactylus*), Leaf-toed Geckos (*Dixonius*), True Geckos (*Gekko*) and Tiger Geckos (*Goniurosaurus*) diverse species descriptions from the Indochinese region have been published in the past decade (e.g., Botov et al., 2015; Luu et al., 2014; Ngo & Ziegler, 2009; Nguyen et al., 2014; Wang, Jin, Li, & Grismer, 2014). Also the Rock Gecko genus *Cnemaspis* is famous for numerous new discoveries from Southeast Asia during recent times, so that it is difficult meanwhile to keep track of the enormous *Cnemaspis* species diversity (e.g. Grismer et al., 2014). The species *Cnemaspis psychedelica* (Fig. 1) was recently described by Grismer, Ngo, and Grismer (2010) and certainly belongs to the most spectacular gecko discoveries in a world wide scale. This extremely gorgeous species is currently known only from Hon Khoai Island in Ca Mau Province, 18 km off the southern tip of the Ca Mau Peninsula in southern Vietnam. The species name refers to its bright, incongruous colouration and pattern. It is the most uniquely coloured rock gecko in that both sexes have bright orange forelimbs, forelegs, hands and feet, a bright orange tail, a dense yellow reticulum on the neck overlying thick black longitudinal lines, and a blue-gray to light purple trunk bearing yellow transverse bars on bright-orange flanks. The diurnal species lives on large granite boulders in the shade of the forest canopy. At night it usually is restricted to deeper areas of crevices and only rarely is seen outside the rock cracks. Reproduction takes place via eggs (usually two per female) which are deposited on the undersides of overhanging boulders (Grismer et al., 2010). As Hon Khoai Island is a very small island, with ca. 8 km^2 surface, the population size of *C. psychedelica* is rather small (Ngo, Nguyen, Nguyen, van Schingen, & Ziegler, submitted). A potential threat to the Psychedelic Rock Gecko (in Vietnamese

Fig. 1. The Psychedelic Rock Gecko (*Cnemaspis psychedelica*). Photo: T. Ziegler.

"Tac ke duoi vang") may be introduced Long-tailed Macaques, as they are known to feed on geckos and gecko eggs (Grismer et al., 2010). Although this island is protected through the Ca Mau Biosphere Reserve of southern Vietnam, and collecting and exporting of the wild fauna and flora is prohibited, the Psychedelic Rock Gecko recently appeared in the international pet trade and now is offered to hobbyists for high prices. Offers have been made, for example, from Russia, Spain, Czech and Germany – also for the international reptile market in Hamm (see www.terraristik.com). Since 2015, the species is also offered from the US (Auliya et al., in press). However, unregulated, illegal pet trade can severely harm the natural populations. An example is the Tiger Gecko species *Goniurosaurus luii* which immediately after its discovery has been extirpated at the type locality due to the commercial pet trade (Stuart, Rhodin, Grismer, & Hansel, 2006). Also the only recently discovered, alarmingly small population of the Crocodile Lizard (*Shinisaurus crocodilurus*) in Vietnam is seriously threatened by the pet trade (Van Schingen, Ha, et al., 2016; Van Schingen, Pham, et al., 2014; Van Schingen, Schepp, Pham, Nguyen, & Ziegler, 2015). Whilst the building up of a captive reserve population for the latter *Shinisaurus* population already has been started at the Melinh Station for Biodiversity of the Institute of Ecology and Biological Resources (IEBR), Hanoi (Van Schingen, Schepp, et al., 2015; Ziegler, 2015), there exist no comparable conservation measures for *C. psychedelica*. To prevent the Psychedelic Rock Gecko, which is regarded as endemic to Hon Khoai Island, from extirpation due to predation by introduced mammals and in particular over collecting for the animal trade (see also Bethge, 2014), Wildlife at Risk (WAR) together with the IEBR, Hanoi, and the Cologne Zoo in Germany have decided to develop a facility for the endemic species in WAR's Hon Me Rescue Station in southern Vietnam's Kien Giang Province, nearby the border with Cambodia to build up a reserve colony (see Ziegler, Rauhaus, Nguyen, & Nguyen, 2015). Herein we report in detail about the planning and building of the Psychedelic Rock Gecko facility and about our first husbandry and breeding experiences with this so far poorly known gecko species.

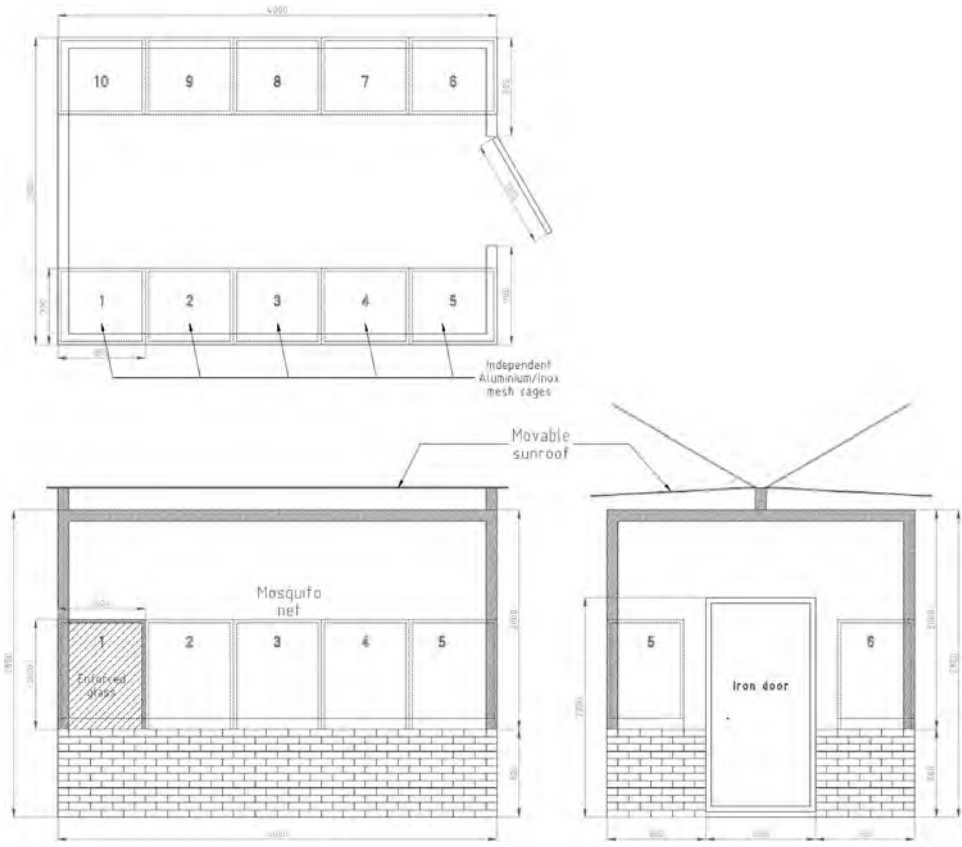

Fig. 2. The first plan of the gecko house; later, we decided to enlarge the entrance area to insert a double door system and to increase the dimensions of the gecko house towards 5 m × 3 m × 2.8 m (length (*L*) × width (*W*) × height (*H*)).

Planning and Building of the Gecko Facility

The planning, building and completion of the gecko facility took place within seven months, between May and November 2014. Our first plan of the gecko house is shown in Fig. 2. At that time, the dimensions were 4 m × 2.8 m × 2.8 m (length (*L*) × width (*W*) × height (*H*)). Later, we decided to enlarge the entrance area to insert a double door system to prevent accidently escaped geckos from breaking out. By adding the double door system, the dimensions of the gecko house were increased towards 5 m × 3 m (*L* × *W*). In parallel to the gecko house planning, the land selected for the building of the gecko house was prepared by clearing vegetation and removing rocks on a surface of about 5 m × 5 m. Subsequently the foundation was prepared by concrete. The building phases are visualized in Figs. 3–5. A drainage pipe was inserted in the right corner for leading rain water outside. To make sure that no gecko can escape from inside the house and no animals from outside can come in, the hole in the floor inside the house was covered by metal gauze (1 mm mesh

Fig. 3. Building phase 1: (A) This part of the Hon Me Station was selected for the building of the gecko house (phot. A. Rauhaus), (B) measuring and marking the cleared site, (C) starting with the fundament, (D) base plate and walls, (E) insertion of iron frames, (F) insertion of tables for the terraria. Photos: K.V. Nguyen.

aperture), the pipe ending on the outer side of the house can be closed by a valve and is only opened for cleaning purposes or during rain, also to prevent ants coming inside the house. The walls of the house consist of a base made by bricks and concrete and a top made by iron frames covered with metal gauze (1 mm mesh aperture). The concrete walls are 80 cm (measured from outside) or 50 cm high (measured from inside), respectively. The roof also consists of metal gauze (1 mm mesh aperture) on an iron frame. In addition, an oblique iron frame covered with wire mesh is attached on top of the roof as a base for

Fig. 4. Building phase 2: (A) Double door system, (B) development of the first terrarium, (C) bringing in of the terraria, (D) inside view of the gecko house with inserted terraria. Photos: K.V. Nguyen.

three separately rollable plastic sheets, both serving as rain cover and sun protection. The iron bars used for the frames measure 5 cm × 10 cm. Around the house a 15 cm high wall consisting of bricks and concrete was built in 20 cm distance towards the gecko house serving as a water canal (15 cm in width) for ant prevention. In front of the house, an area of 130 cm width was piled with stones as a visitor's platform. The double doors for keeper access to the house measure 104 cm × 248 cm × 6 cm ($W \times H \times$ thickness) and are installed in 110 cm distance from each other. Inside the gecko house contains each five terraria on

Fig. 5. Building phase 3: (A) Overall view of the gecko house with inserted terraria (phot. K. V. Nguyen), (B) building of the back walls (phot. T. Ziegler), (C) completed terrarium with geckos inside (phot. K. V. Nguyen), (D) inside view of the gecko house with most of the terraria being equipped and fans installed. Photos: T. Ziegler.

both sides, so altogether ten terraria. Terraria are placed on a 50 cm high and 70 cm wide metal table (iron frame thickness 3 cm) which is at the back side attached to the wall and on the front side based on four table-legs. First we planned and built a single, movable terrarium with the measurements 0.8 m × 0.7 m × 1.2 m ($L \times W \times H$), consisting of aluminium, metal gauze and glass. The frame consisted of 3.8 cm thick aluminium rods. Every ground board consisted of an aluminium plate and contained a drainage hole of 2.5 cm diameter, covered by metal gauze. Around the ground board there were 10 cm high aluminium walls for being able to insert soil in sufficient height (for digging in plants, etc.). The sides, the front side and the roof are entirely covered by metal gauze (1 mm mesh aperture). The lower half of the back side was built by a 5 mm thick glass panel, towards which the rock habitat could be cemented later. The upper half of the back side consisted of metal gauze (likewise 1 mm mesh aperture), so that sunlight/UV rays also can shine into the enclosure from the sides. The front side is movable via table-tracks on both sides, has a grip on the bottom and can be opened bottom-up and fixed by each two latches in 55 cm or 80 cm height, respectively, for having access to the terrarium for working/cleaning, etc. After that the remaining nine terraria were likewise built. All terraria of one side of the house are combinable as the dividing walls in between can be slid out with a metal grip, which is not in use so far but was planned for optional flexibility. The drainage holes in the terraria are

Fig. 6. Furnished terraria: (A) Terrarium (see Fig. 5C) at a later stage with more dense vegetation, providing for sufficient shadow and shelter, (B) this terrarium, which is directed towards the visitor's path, has a back side consisting of glass, so that visitors have the chance to see the geckos without entering the house. Photos: T. Ziegler.

attached to a PVC tube system which collects the water from the terraria and leads water to the drainage hole on the floor. Another PVC tube system is attached on top of the terraria and leads water from the freshwater access to a sprinkling/rain nozzle on each terrarium. The outermost left terrarium of the front of the gecko house, which is directed towards the visitor's path, had a back side consisting of glass, so that visitors have the chance to see the geckos through this glass panel from outside and without entering the house (Fig. 6). Before the ten enclosures were moved into the gecko house and installed on the side tables, the electricity (two LED lamps and two fans) and the water access were set up both from sources of power and water, in about 50–70 m distance. Finally, for creating the fitting terrarium interior we used microhabitat pictures from Hon Khoai Island; the habitat occupied by the geckos consisted of partly shaded, big stones surrounded by trees and other plants. Thus, as terrarium background we cemented rock walls, also including overhanging structures. The terrarium furniture furthermore consisted of branches, plants, natural soil, leaves and each a drinking vessel. Between the outermost left terrarium with its glass panel for visitor's insights and the entrance, the exterior of the gecko house was covered by a large water proof poster which points both in English and Vietnamese languages to the threats to *C. psychedelica* and the background of the conservation project (Figs. 7 and 8).

Fig. 7. The gecko house was finished in November 2014: on the top the manually adjustable rain and sun protection is visible; on the left there is the enclosure visible for visitors from outside, in the middle the weatherproof project banner, and on the right the double door system. Photo: A. Rauhaus.

After the finishing of the gecko facility and completing the terraria and their equipment, we conducted a comprehensive theoretical and practical keeper training in November 2014, comprising terraristics in general, husbandry of lizards, handling and sexing, as well as breeding of feeder insects, both for the staff of the Hon Me Rescue Station and for the staff of the close U Minh Thuong National Park.

Husbandry Conditions

First small gecko breeding groups were transferred from Hon Khoai Island to the Hon Me Station in March 2015, with relevant permits provided by the respective authorities. During the time on Hon Khoai Island we collected data concerning the microhabitat of the geckos and respective climatic conditions (temperature, humidity), to use this information for creating optimum terrarium conditions in the gecko house. Temperatures at Hon Khoai ranged from 28 to 32 °C, the humidity was from 64 to 79% (recorded data from 8 to 10 March 2015). On Hon Khoai Island we found the Psychedelic Rock Geckos to be active during the daytime and also in the evening, usually seen on big stones under the forest canopy, and resting at night on tree branches or in crevices and holes between stones, approximately between 0 and 1.5 m above the ground. During daytime geckos could be seen basking on stones in forested environment. In the Hon Me Station, geckos were split in groups consisting of couples or two or three individuals per terrarium. The geckos well tolerated the transfer from the island to the station. After the arrival of the geckos in the Hon Me Station, in April and May 2015, the climate was very dry, similar to the situation on Hon Khoai Island. After short adaptation of few days the geckos readily accepted provided food, consisting

Fig. 8. Self-made banner in front of the gecko house pointing to the threats to the Psychedelic Rock Gecko in English and Vietnamese language (layout: M. v. d. Ploeg, vdp-design; text, pictures, design and logo: T. Ziegler, T.Q. Nguyen, A. Rauhaus, K.V. Nguyen, T.M. Phung, R. Dieckmann).

of small insects. Food (mainly beetle larvae and crickets) generally is provided three times a week, and powdered with vitamin and mineral supplements. Feces samples were taken, which revealed some of the geckos being infected with nematodes (oxyurids, heterakids) and coccidians, which were treated with fenbendazole and toltrazuril. To provide optimum climatic conditions, fans can be switched on very hot, windless days for providing air movement, and for providing optimum humidity, terraria are sprayed with water by means of the irrigation system. Temperature and humidity is controlled by means of minimum-maximum thermometers, data loggers, and infrared thermometers. Terraria and geckos are checked several times every day (health condition of geckos, activity) and for activating sun/rain protection, if required.

First Breeding Successes

The first egg depositions occurred at the end of May 2015. Clutches consisted of two eggs which were attached to the terrarium surface (branches, walls) at elevated, rather dry and in part sunny sites. Eggs were nearly round, white, and measurements ranged between 1.2–1.4 mm × 1.0–1.2 mm. After some of the first clutches obviously were destroyed by the parents, eggs were covered by a gauze basket or taken out of the terrarium, if possible,

Fig. 9. First reproduction success in the gecko house: (A–B) Deposited eggs, (C) hatchling, (D) young gecko at the age of three days with food (fruit fly) and freshly deposited feces inside the rearing box. Photos: K.V. Nguyen.

and transferred to a plastic box with vermiculite. First juveniles hatched at the beginning of July 2015. The first hatchlings showed malformations such as a curled up tail in one case or dull eyes together with respiratory problems in another case and died rather fast after hatching. Subsequently we tried to improve the feeding by a wider variation of feeder insects together with increased mineral and vitamin supply, as at least the egg destruction behavior of the adults points to insufficient calcium supply. The first successful rearing happened at 4 December, resulting in a healthy juvenile which readily accepted fruit flies as food (Fig. 9). Juveniles at time are reared separated from the adults in small plastic terraria with soil as ground substrate and branches and leaves as climbing and hiding opportunities. In contrast to Grismer et al. (2010) who stated that all age classes have bright orange forelimbs, forelegs,

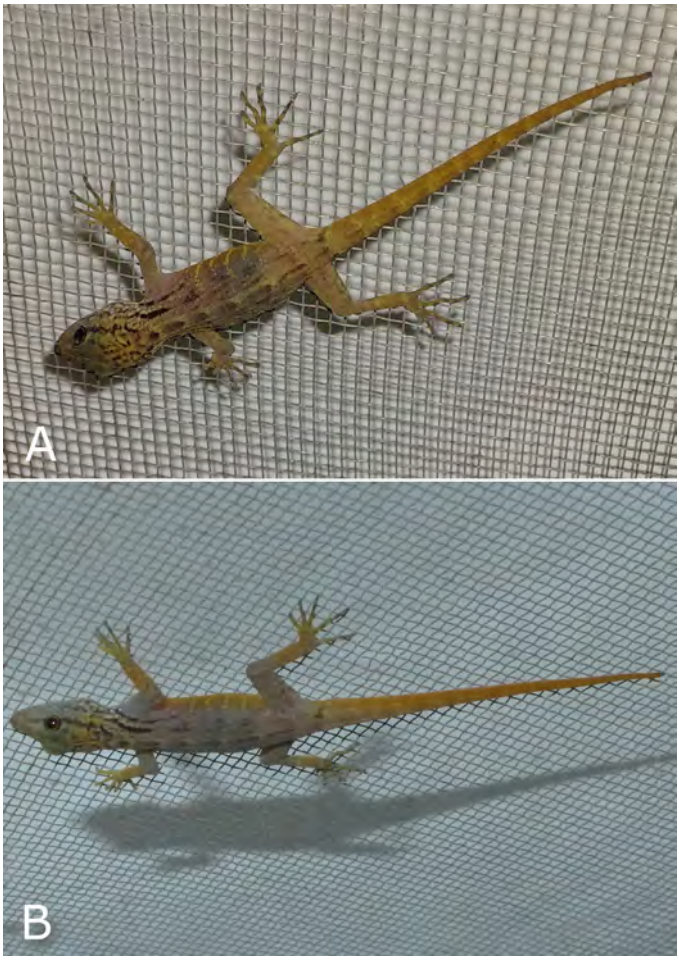

Fig. 10. The hatchling depicted in Fig. 9 at an age of: (A) 37 days (10 January 2016) and (B) 59 days (1 February 2016); the change towards the adult colour pattern in the second month of development is obvious. Photos: K.V. Nguyen.

Fig. 11. The hatchling depicted in Fig. 9 at an age of three months. Photo: T. Ziegler.

Fig. 12. After eight months of keeping, all adult Psychedelic Rock Geckos (*Cnemaspis psychedelica*) are doing well in the gecko house. Photo: T. Ziegler.

Fig. 13. Self-made poster to point to the threats and conservation needs of the Psychedelic Rock Gecko in English and Vietnamese language (layout, text and pictures by Thai Do and the authors).

hands and feet, a bright orange tail, a dense yellow reticulum on the neck overlying thick black longitudinal lines, and a blue-gray to light purple trunk bearing yellow transverse bars on bright-orange flanks, we observed colour pattern change from juvenile to adult colour pattern to take place in the second month after hatching (see Figs. 10 and 11).

Outlook

Our first experiences with the keeping and rearing of the Psychedelic Rock Gecko (*C. psychedelica*) showed up that adults do well in captivity (Fig. 12), when proper environmental and climatic conditions are provided (sufficient temperature, humidity and air circulation; suitable places for climbing and sun basking, but also cooler areas and hiding possibilities). For successful breeding diversified food and in particular sufficient mineral and vitamin supply seem to be crucial (Fig. 11). Whatsoever, we must collect further experiences with the long-term keeping and breeding of this gecko species, in particular as the facility in southern Vietnam is run by local staff which can only be advised and trained during one or two annual short visits of the reptile team of Cologne Zoo and otherwise can only be guided by e-mail communication. It would be desirable to establish a successful long term rock gecko keeping with subsequent F2 breeding. By doing so, after having initiated the buildup of this captive reserve colony, this could be the beginning of a conservation breeding programme, which could be extended to other institutions in the future. In parallel, conservation based in situ ecological research is conducted by our working group with support of

the Federal Ministry of Environment, Nature Conservation, Building and Nuclear Safety (BMUB) and the Rufford Foundation (Grant No. 18631-2) (Ngo et al., submitted) and an awareness campaign is currently being built up (see Fig. 13), which will be dealt with in detail elsewhere.

Acknowledgements

We thank the directorates of the Ca Mau Forest Protection Department and Hon Khoai Unit for issuing relevant permits. Many thanks to the staff of the Hon Me Station for the great support in building and running the gecko station. Thanks also to Theo Pagel and Christopher Landsberg (Cologne Zoo) for the ongoing support and co-funding of the gecko facility. Many thanks to Trung My Phung (Dong Nai) for sharing pictures and habitat information from Hon Khoai Island with us. We further thank Ruth Dieckmann (Cologne Zoo), and Marc van der Ploeg (vdp-design) for their help in creating the gecko house poster layout. Cologne Zoo is partner of the World Association of Zoos and Aquariums (WAZA): Conservation Project 07012 (Amphibian and Reptilian Breeding and Rescue Stations).

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Original language: English CoP19 Prop. XXX

CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

Nineteenth meeting of the Conference of the Parties
San José (Costa Rica) TBC 2022

CONSIDERATION OF PROPOSALS FOR AMENDMENT OF APPENDICES I AND II

A. Proposal

To list *Physignathus cocincinus* in CITES Appendix II, in accordance with Article II, Paragraph 2 (a) of the Convention satisfying criterions A and B, Annex 2(a) of Resolution Conf. 9.24 (Rev. CoP17). It is known, or can be inferred or projected, that the regulation of trade in the following species is necessary to avoid it becoming eligible for inclusion in Appendix I in the near future; and it is required to ensure that the harvest of specimens from the wild is not reducing the wild population to a level at which its survival might be threatened by continued harvesting or other influences.

B. Proponent

Party name*: [Viet Nam – to be confirmed] and the European Union.

C. Supporting statement

1. Taxonomy

1.1 Class: Reptilia

1.2 Order: Squamata

1.3 Family: Agamidae

1.4 Genus, species or subspecies, including author and year: *Physignathus cocincinus* Cuvier, 1829

No subspecies recognised.

1.5 Scientific synonyms:

Physignathus cocincinus Cuvier, 1829 was assigned with different names in literature: such as *Lophura cuvieri* by Gray 1831; *Istiurus cochinsinensis* by Cuvier 1837; *Istiurus physignathus* by Duméril & Bibron 1837; *Dilophyrus mentager* by Günther 1861; *Physignathus cochinchinensis* by Boulenger 1885; *Physignathus mentager* by Boulenger 1885; *Physignathus cocincinus caudicinctus* by Barbour 1912; *Physignathus cocincinus mentager* by Barbour 1912.

1.6 Common names:

English: Indo-Chinese Water Dragon, Asian Water Dragon, Green Water Dragon
Chinese: 长鬣蜥
Viet Namese: Rồng đất
German: Grüne Wasseragame

French: Dragon d'eau chinois, Dragon d'eau vert
Spanish: dragón de agua chino, dragón verde

1.7 Code numbers: NA

2. Overview

The Indo-Chinese Water Dragon, *Physignathus cocincinus* Cuvier, 1829 is widely distributed in Southeast Asia from southern China through Viet Nam, Laos, Cambodia to eastern Thailand (Das 2010; Nguyen et al. 2009). The semiaquatic species is associated to rocky streams in undisturbed evergreen lowland forests at elevations from 50 to 820 m a.s.l (Das 2010; Gewiss et al. 2020; Nguyen et al. 2018a; Ziegler 2002). Therefore, the actual area of occupancy (AOO) is assumed to be much smaller than the total extent of occurrence (EOO) (Nguyen et al. 2018a). The species was listed as Vulnerable (VU) by the IUCN (International Union for Conservation of Nature) Red List of Threatened Species in 2019 (Stuart et al. 2019). Additionally, *P. cocincinus* was nationally assessed as Endangered (EN) in the Red Lists of China and Thailand and listed in the Red Data Book of Viet Nam as Vulnerable (VU) (Dang et al. 2006; Jiang et al. 2016; Nabhitabhata & Chan-ard 2005). The species is a common target in both the domestic and international trade because of its attractive appearance, semi-aquatic lifestyle and relatively large size (for the local food consumption). Since water dragons are sedentary and very easy to collect, the harvest of wild specimens poses a serious threat to the survival of wild populations. In fact, more than 1.4 million live specimens of *P. cocincinus* were recorded to be imported into the EU and US during the period from 1999 to 2019, most of them originating from the wild populations in Viet Nam (Gewiss et al. 2020; UNEP-WCMC 2020; USFWS 2018). Besides the international and domestic pet trade, harvest of water dragons for consumptive use (mainly food consumption) was documented and identified as a significant threat in the past, but has not yet been quantified. Considering the international trade in addition to domestic trade volumes, the pressure from harvesting on wild populations is likely very high.

Recent studies on the population status of *P. cocincinus* in northern and central Viet Nam revealed that water dragons currently occur in these areas in low population densities, and population sizes were estimated to be overall very small (see Gewiss et a. 2020; Nguyen et al. 2018a). Due to the extremely high export numbers of about 70.000 individuals per year from Viet Nam during the last 20 years, and at the same time low population sizes of the species in this country, it is most likely that specimens in the international trade originate from other range states than Viet Nam as well. It can be assumed that trade will cause population declines, and even local extinctions if trade volumes remain at current levels. In addition to the trade in *P. cocincinus*, habitat degradation and fragmentation due to agriculture, industry and infrastructure development are considered a threat to the survival of the species in its natural distribution range. Therefore, this proposal seeks to list the Indo-Chinese Water Dragon, *Physignathus cocincinus* in CITES Appendix II in accordance with Article II, Paragraph 2 (a) of the Convention satisfying criterions A and B, Annex 2(a) of Resolution Conf. 9.24 (Rev. CoP17).

3. Species characteristics

3.1 Distribution

P. cocincinus is widely distributed in Southeast Asia from southern China through Viet Nam, Laos, Cambodia to eastern Thailand (Das 2010; Nguyen et al. 2009). Das (2010) indicated an occurrence of the species in Myanmar, which has not been confirmed in recent studies. Additionally, *P. cocincinus* has been introduced to Hong Kong (Mo 2019; To 2005), Taiwan (Lee et al. 2019), peninsular Malaysia (Grismer 2011; Grismer & Quah 2019) and Florida, USA (Ferriter et al. 2009).

In more detail, the Asian Water Dragon has been recorded from the following provinces in its natural range states:

China: Guangdong, Guangxi and Yunnan provinces (Das 2010; KFBG 2002; Nguyen et al. 2009)

Viet Nam: Lao Cai, Ha Giang, Cao Bang, Yen Bai, Bac Kan, Thai Nguyen, Lang Son, Vinh Phuc, Quang Ninh, Ninh Binh, Bac Giang, Hai Duong, Son La, Hoa Binh, Thanh Hoa – northern provinces, Nghe An, Ha Tinh, Quang Binh, Quang Tri, Thua Thien Hue, Da Nang, Quang Nam, Kon Tum, Gia Lai, Lam Dong – central provinces, Binh Phuoc, Dong Nai and Kieng Giang – southern provinces (Gewiss et al. 2020; Nguyen et al. 2009)

Laos: Vientiane, Sekong (Suzuki et al. 2015), Savannakhet, Champasak (Duckworth et al. 1999), Khammouane (Stuart 1998), Bolikhamsai (Manthey & Manthey 1998), Xieng Khouang provinces (ABP 2013)

Cambodia: Koh Kong, Pursat, Kampot, Kampong Speu provinces (Grismer et al. 2008, Stuart & Emmett 2006), Mondolkiri, Ratanakiri, Stung Treng provinces (Stuart et al. 2006)

Thailand: Sakon Nakhon, Sisaket Nakhon, Ratchasima Nakhon, Nayok, Ubon Ratchathani, Chanthaburi, Trat, Chon Buri, Sa Kaew, Rayong, Prachin Buri, Chachoengsao and Saraburi provinces (Hawkeswood & Sommung 2017; Hawkeswood et al. 2019; Nabhitabhata & Chan-ard 2005; Taylor 1963)

3.2 Habitat

P. cocincinus inhabits riparian areas along rocky streams in evergreen lowland forests mixed with deciduous and bamboo forests at elevations from 43 up to 820 m above the sea level (Gewiss et al. 2020; Nguyen et al. 2018a; Ziegler 2002). Undisturbed, natural areas are the preferred habitat, but water dragons can also be found in densely vegetated streams nearby villages and agricultural areas (Ziegler 2002) or urban areas where the species has been introduced (Chan et al. 2020; Mo 2019). The availability of woodlands with a dense canopy coverage next to streams appears to be a crucial criterion for the habitat selection of *P. cocincinus* (Chang et al. 2020). Animals were mainly observed to rest on hardwood, leaves, and vines-shrubs (Nguyen et al. 2017). Adult water dragons were usually recorded to occupy perches with heights over 3 m, while juveniles and sub-adults are resting at lower heights mostly below 2 m above the water surface (Nguyen et al. 2017). Due to its close association to freshwater habitats the area of occupancy (AOO) is considered to be much smaller than the total extent of occurrence (EOO) (IUCN 2012; Nguyen et al. 2018a). Regarding microhabitat conditions, a mean air temperature of 29.1 ± 2.8 ℃ and a relative humidity of 66.4 ± 5.8 % during the daytime, and 25.7 ± 1.8 ℃ and 78.6 ± 9.5 % at night was recorded in summer (Nguyen et al. 2017).

3.3 Biological characteristics

P. cocincinus is a semiaquatic and arboreal lizard inhabiting the riparian vegetation along freshwater streams (Werning 2010; Ziegler 2002). Water dragons are diurnal with a sedentary behaviour (Nguyen et al. 2018a). Nguyen (2018) reported a relatively small movement range of 4.7 ± 6.1 m for the species in natural habitats in central Viet Nam. Chan et al. (2020) reported an extensive use of nearby habitats next to streams with a mean home range of 1,793 ± 1,604 m^2 and a mean daily movement range of 5.13 ± 3.68 m in the wet season for an introduced *P. cocincinus* population in Hong Kong. During the active season, water dragons were recorded to be most abundant and active between ten and thirteen o'clock in Viet Nam (Nguyen et al. 2017). During night, animals are usually resting on branches above the water (Gewiss et al. 2020; Nguyen et al. 2017; Nguyen et al. 2018a). Being disturbed, animals show a distinct escape behaviour by jumping into the water or by running quickly, just bipedally on their hindlegs into the bushes (Chan et al. 2020; Das 2010; Manthey & Schuster 1992; Ziegler 2002). The species is known as an excellent swimmer and diver (Manthey & Schuster 1992; Werning 2010). Water dragons are oviparous and generally reach maturity with 6 to 12 months with a snout-vent-length (SVL) of about 150-170 mm (Werning 2010). In the wild, females regularly lay and bury about 5 – 16 eggs in sandy soil at the end of the dry season and the beginning of the rainy season (Das 2010; Ziegler 2002). In captivity, water dragons mate without specific induction and females can lay multiple clutches per year (Manthey & Schuster 1992; Werning 2010). The incubation period of eggs is 60 to 100 days (Das 2010; Manthey & Schuster 1992; Ziegler 2002). A case of facultative parthenogenesis has been documented recently (Miller et al. 2019). In captivity, *P. cocincinus* can reach an age of 15 to 25 years (Werning 2010). The species is omnivore, with the diet consisting mostly of invertebrates, but also including fish, small mammals, birds and reptiles, as well as a certain fraction of plants (Das 2010; Taylor 1963; Werning 2010; Ziegler 2002). Nguyen et al. (2018b) examined the stomach content of wild water dragons and documented different undetermined insect larvae, as well as parts of specimens from the groups Isoptera, Formicidae, Achatinidae, Orthoptera, Araneae, Lepidoptera, Coleoptera, other Hymenoptera and Lumbriculida as the most common prey organisms. The authors also reported only a very small proportion of vegetarian diet (Nguyen et al. 2018b), while Ziegler (2002) documented a vegetarian food portion of up to 1/3 in mature animals. Research on *P. cocincinus* as an invasive species in Taiwan documented the predation on agamid lizards (*Diploderma swinhonis* or *D. polygonata*), frogs (*Buergeria robusta*), snakes (*Calamaria pavimentata*), and mice (Ciou 2015 in Lee et al. 2019). In captivity, water dragons are known to feed also on mice, bovine heart, fish, dog and cat food, and vegetarian food such as sweet fruits (Manthey & Schuster 1992; Werning 2010).

3.4 Morphological characteristics

Asian Water dragons have a green to brownish-greyish body coloration, which serves as a camouflage within the natural habitat of the species. The scales of the mandibular and cheek regions are white, blueish or reddish to orange. Males have sometimes a yellowish, orange to white coloured axilla, gular or thoracic region (Manthey & Schuster 1992; Werning 2010; Ziegler 2002). The body and tail are laterally compressed, and water dragons have very strong extremities, whereby they are perfectly adapted to their arboreal lifestyle (Werning 2010). The shape of the snout varies between distribution areas. Adult lizards have continuous crests from the neck to the dorsum and separated crests at the front region of the tail. Crests develop with increasing age and are more pronounced in males (Werning 2010). The tail shows transversal dark bandings. In juveniles, the whole body has

some bright horizonal stripes along the flanks which fade with increasing age (Das 2010; Werning 2010). From the back of the eye to the ear opening extends a dark longitudinal band (Ziegler 2002). There is a distinct sexual dimorphism in adult animals. Males have an enlarged head and swollen cheeks (Das 2010). The general appearance of the females in comparison to the males is more diminutive (Manthey & Schuster 1992). *P. cocincinus* can reach a snout-vent-length (SVL) up to 250 mm and a total length including the tail up to 900 mm (Manthey & Schuster 1992; Smith 1935; Werning 2010). In general, male water dragons are larger (SVL 170 – 250 mm) than females (SVL 160 – 200 mm) (Manthey & Schuster 1992). Likewise, Ziegler (2002) reported a mean SVL of about 220 mm for males and about 140 mm for females in natural habitats in Viet Nam. The length of the tail averaged about 550 mm for males and 350 mm for females (Ziegler 2002). Males reach a weight of about 600 g and females of about 250 g (Werning 2010). Hatchlings have a SVL of 45 – 53 mm and a tail length of 86 – 100 mm (Manthey & Schuster 1992).

3.5 Role of the species in its ecosystem

According to its diet and movement pattern, *P. cocincinus* is considered as a "wide forager", hunting its prey actively (Nguyen 2018). While the diet of wild water dragons from Viet Nam has been reported to consist mainly of invertebrates such as insects, arachnids and earthworms (Nguyen et al. 2018b), the predation of other reptiles, amphibians, small mammals and fish has been also reported and described in literature (Ciou 2015 in Lee et al. 2019; Werning 2010, see also 3.3). Water dragons, especially males, are reported to be very territorial and aggressive towards conspecifics in captivity (Manthey & Schuster 1992; Werning 2010). In accordance with these observations, males were recorded to have no overlapping home ranges in natural habitats (Chan et al. 2020), while juveniles, subadults and adult females have been observed in close proximity to other individuals (van Schingen-Khan et al. pers. obs.). *P. cocincinus* occasionally co-occurs with other freshwater associated lizards such as *Shinisaurus crocodilurus*, *Sphenomorphus cryptotis* or *Acanthosaura* spp. (van Schingen-Khan et al. pers. obs). Snakes are considered as natural predators of *P. cocincinus* (Werning 2010).

4. Status and trends

4.1 Habitat trends

The habitat of *P. cocincinus*, the primary and secondary tropical forests in continental Southeast Asia are heavily affected by deforestation (e.g. Stibig et al. 2014). After decades of forest loss in Viet Nam, a forest transition took place starting in the late 1990s, resulting in a net forest increase in the 21st century (Meyfroidt & Lambin 2008). However, the increase in forest cover varied among regions. While some regions such as the northern mountain areas benefited from reforestation, other regions such as the Viet Namese central highlands still suffered forest losses (Cochard et a. 2017). Moreover, the increase in forest cover in Viet Nam was often due to plantations and secondary forests of poor quality providing no suitable habitat for most species, while the deforestation of natural forests is still ongoing (Asian Development Bank 2013; Cochard et al. 2017). In general, habitat degradation and fragmentation for agriculture, industrial plantations, infrastructure development and the exploitation of timber and non-forest timber products contribute to the loss of biodiversity in Viet Nam (MONRE 2014). Forest degradation for infrastructure development for tourism and religious sites and for industrial activities (timber logging, coal mining), as well as forest land conversion for cultivation have been reported from several natural habitats of *P. cocincinus* in northern Viet Nam (Gewiss et al. 2020; van Schingen et al. 2014). Road building and illegal timber logging affecting habitats were also documented in distribution sites in central Viet Nam (Nguyen et al. 2018a). In Lao PDR, there has been a decline in forest cover mainly due to timber logging, slash and burn shifting cultivation and conversion of forest lands for multiple purposes despite recent governmental efforts to decrease the forest loss (e.g. Kim & Alounsavath 2014; Koch 2017). Accordingly, extensive habitat loss was reported as a result of agriculture and development in Lao PDR and as well in Cambodia (T. Neang & B. Stuart pers. comm. 2017 in Stuart et al. 2019). In China, habitat loss was documented due to urban development, hydropower development and tourism (D.Q. Rao pers. comm. 2018 in Stuart et al. 2019). In general, habitat fragmentation is considered as a serious threat, due to the close association of the species to freshwater habitats and its sedentary behaviour lacking the ability to migrate long distances (Gewiss et al. 2020; Nguyen et al. 2018).

As a semiaquatic species, the impact of water pollution on *P. cocincinus* has to be considered but has not yet been studied (Gewiss et al. 2020).

As ectothermic animals, reptiles are considered to be particularly susceptible to climate change (e.g. Fitzgerald et al. 2018; Powers and Jetz 2019). In fact, studies on two sympatric lizards of *P. cocincinus* in northern Viet Nam, namely *Goniurosaurus lichtenfelderi* and *Shinisaurus crocodilurus*, predicted that their suitable habitats will decrease significantly under scenarios of climate change (Ngo et al. in press; van Schingen et al. 2016). Furthermore, climate change has been considered as the main cause of increasing the number of natural catastrophes in Southeast Asia, especially in Viet Nam in recent years. In October 2020, two storms and floods

took place in central Viet Nam, where natural populations of *P. cocincinus* were recorded in the past (Ngo pers. com.). Therefore, suitable habitats in the distribution range of *P. cocincinus* might be negatively affected by climate change in the future.

4.2 Population size

Detailed information on the population size of *P. cocincinus* is lacking for all range states except for Viet Nam.

In Viet Nam, two studies were recently carried out estimating the population size of *P. cocincinus* using capture-mark-recapture methods (Gewiss et al. 2020; Nguyen et al. 2018a). Nguyen et al. (2018a) conducted field surveys at 14 different sites located in three protected areas (Phong Dien Nature Reserve, Sao La NR, Bạch Ma National Park) in Thua Thien Hue Province, central Viet Nam in April and June 2016 and 2017. The species was absent at three of the surveyed sites. The authors estimated a total population size of 232 to 250 individuals at all remaining survey sites (Nguyen et al. 2018a). The mean population density was between 1.98 and 2.64 individuals per 100 m of surveyed stream (range of 0.8 to 6.6 ind./ 100 m depending on the survey site). Population densities were highest at lower elevations and decreased with higher elevations (Nguyen et al. 2018a). Moreover, Nguyen et al. (2018a) assessed the level of anthropogenic impact of harvest and habitat degradation for each locality, demonstrating lower population densities at stronger impacted sites. Gewiss et al. (2020) conducted field surveys at 15 different sites in northern Viet Nam, in Vinh Phuc Province, Ha Giang Province (Bac Me Nature Reserve), Quang Ninh Province (Dong Son-Ky Thuong Nature Reserve) and Bac Giang Province (Tay Yen Tu Nature Reserve), between 2014 to 2016. The authors failed to observe any water dragons at eight of the 15 surveyed sites. The total population was estimated to consist of 80 individuals at all remaining sites (Gewiss et al. 2020). Population densities were between 0.07 and 0.95 ind./ 100 m of streams inhabited by *P. cocincinus*, being significantly higher at a single, strongly protected and undisturbed survey site (0.83 and 0.95 ind./ 100 m) than at the remaining sites (mean of 0.25 ind./ 100 m) (Gewiss et al. 2020).

Although these two studies do not encompass all existing subpopulations of *P. cocincinus* in northern and central Viet Nam, they reveal that the species occurs in relatively low population densities with a small total population size. The authors of both studies emphasize the potential negative anthropogenic impact of harvest and habitat loss on wild populations (Gewiss et al. 2020; Nguyen et al. 2018a).

Self-sustaining and viable introduced populations have been reported from Hong Kong and Taiwan (Lee et al. 2019; Mo 2019). According to 54 citizen-reports, a total of 62 *P. cocincinus* specimens were observed across different locations of Hong Kong between 2004 and 2019 (Mo 2019). Intensive surveys to remove the species from its introduced habitats in Taiwan documented capturing about 880 water dragons between 2013 and 2017 (Lee et al. 2019).

4.3 Population structure

Nguyen et al. (2018a) reported large proportions of juveniles (60 % in April and 30 % in June) and subadults (18 % in April and 50 % in June) in the wild population from Thua Thien Hue Province, central Viet Nam. Only a minor proportion of the investigated subpopulations consisted of adults (21 % in April and 17 % June). Likewise, Gewiss et al. (2020) recorded subpopulations consisting mostly of juveniles (between 25 and 64 %) and subadults (between 18 and 41 %), while adults accounted only for max. 34 % of the population in northern Viet Nam. Nguyen et al. (2018a) indicated that adult lizards are the primary target of locals hunting for food consumption, explaining low percentages of mature water dragons. A low proportion of mating individuals may have a negative impact on the population development due to a loss of genetic diversity and reproductive capacity (Nguyen et al. 2018a).

The introduced water dragon population in Hong Kong consists mainly of adult males (47 %), followed by adult females (36 %) and juveniles (18 %) (Mo 2019).

4.4 Population trends

According to Stuart et al. (2019) the wild population is in decline, due to a decrease of habitat quality in parts of the distribution range (see also 4.1). There is evidence for an apparent decline of about 50 % in 18 years (corresponding to about three generations) at one side in Cambodia based on interviews with local hunters (T. Neang, unpublished data in Stuart et al. 2019). In Viet Nam, the species has been listed as Vulnerable in 2007 in the Viet Nam Red Book based on an estimated 20 % decline over 10 years across the country (Stuart et al. 2019). Field surveys in Viet Nam between 2014 and 2017 revealed that populations are extremely small and that mature individuals were not recorded at some sites (see 4.2 for more details). If harvest levels will remain at

present magnitudes, further population declines, and potential local extirpations are expected to occur in the near future.

4.5 Geographic trends

Since *P. cocincinus* is a habitat specialist which is adapted to unique freshwater habitats within evergreen forests, the actual area of occupancy (AOO) is considered to be much smaller than the total extent of occurrence (EOO) (Nguyen et al. 2018a). Previous observations have documented severe degradation and fragmentation of suitable habitats of the water dragon by direct anthropogenic activities (Gewiss et al. 2020; Nguyen et al. 2018a; van Schingen et al. 2014). Habitat fragmentation likely creates barriers that prevent genetic exchange and dispersal capability among populations of *P. cocincinus*. Comparable to other sympatric lizards, *P. cocincinus* is predicted to be affected negatively by climate change in the future (Ngo et al. in press; van Schingen et al. 2016), Due to the synergetic effects of habitat fragmentation and climate change, *P. cocincinus'* suitable distribution is predicted to considerably contract in the near future.

5. Threats

The species was listed as Vulnerable (VU) by the IUCN Red List of Threatened Species in 2019 (Stuart et al. 2019). Harvest of specimens for local food consumption and to supply the domestic and international pet trade poses a serious threat to the survival of wild populations of *P. cocincinus*. Besides, the use of the species in the traditional medicine (eggs soaked in rice wine) (Nguyen et al. 2018a; Annex I, Fig. 5D) and the trade in derivatives of this species (UNEP-WCMC 2020) have been reported. Harvest of wild water dragons for food consumption is a common issue and has been documented from local food markets and restaurants from nearly all range states except of Thailand (e.g. Duckworth et al. 1999; Lee et al. 2004; Nguyen et al. 2018a; Stuart et al. 2006; Ziegler 2002).

Due to their attractive appearance and interesting way of life, water dragons have been coveted objects in the national and especially the international pet trade for decades (Nguyen et al. 2018a; Werning 2010). According to the recorded trade numbers, overharvesting is considered the major threat to the survival of the species in the wild (Nguyen et al. 2018a; Stuart et al. 2019, see also 6.2 and 6.4). Although the species can be bred in captivity without any major difficulties, the harvest of wild specimen is still more convenient and cheaper, explaining why most internationally traded water dragons still originate from wild populations rather than from captive breeding facilities (Gewiss et al. 2020; Nguyen et al. 2018a; UNEP-WCMC 2020; USFWS LEMIS). According to Gewiss et al. (2020) and Nguyen et al. (2018a) the trade in *P. cocincinus* is assumed to be unsustainable and to have a negative impact on wild populations in Viet Nam.

In addition to harvest, habitat loss and degradation threatens wild populations of *P. cocincinus* throughout its distribution range (Stuart et al. 2019, see also chapter 4.1). Considering the level of deforestation and environmental pollution in Southeast Asia and the close association of water dragons to freshwater streams in densely vegetated evergreen forests, the impact of habitat loss has to be considered a serious threat (see also 4.1 for more details). The impact of habitat degradation on wild *P. cocincinus* populations through timber logging, cultivation, tourism and coal mining has been reported from Viet Nam (Gewiss et al. 2020; Nguyen et al. 2018a).

6. Utilization and trade

6.1 National utilization

In Viet Nam, the use of *P. cocincinus* in the traditional medicine seems to be negligible since there is only one record of water dragon eggs soaked in rice wine from Viet Nam (Nguyen et al. 2018a; Annex I, Fig. 5D). In contrast, the collection and sale of the species for food consumption at local food markets and restaurants is a well-documented issue in Viet Nam (Dang 2009; Gewiss et al. 2020; Nguyen & Bain 2006; Nguyen et al. 2018a; Ziegler 2002). The supply of the species at local food markets has been occasionally documented in southern Viet Nam (Dang 2009), as well as in central Viet Nam (Nguyen & Bain 2006; Ziegler 2002). An intensive study by Nguyen et al. (2018a) recorded the harvest of 1,000 kg of animals corresponding to more than 2,000 individuals of *P. cocincinus* by local hunters in Thua Thien Hue Province, central Viet Nam in 2016. Prices ranged from 250,000 Viet Nam Dong (about $12) per kg in remote localities to 450,000 Viet Nam Dong (about $20) per kg in restaurants in Hue City. In comparison, Nguyen & Bain (2006) documented the sale of water dragons for food and trade for prices between 50,000 and 70,000 Viet Nam Dong (about $2–3) per kg in central Viet Nam ten years before. Gewiss et al. (2020) reported the offer of *P. cocincinus* for food consumption throughout Viet Nam. In addition to the purpose of food consumption, water dragons are collected and offered as pets in local shops, at markets and on internet platforms in Viet Nam (Gewiss et al. 2020; Nguyen et al. 2018a; Annex I Fig. 5, 6, 7). As a rather popular pet, the lizards fetch prices ranging from 150,000 to 450,000 Viet Nam Dong (about

$7-20) per individual (Nguyen et al. 2018a). Gewiss et al. (2020) documented similar online prices ranging from 60,000 to 480,000 Viet Nam Dong ($3-21) per individual. The authors also reported large cities such as Ha Noi and Ho Chi Minh City as important destinations with a large number of dealers trading water dragons (Gewiss et al. 2020). Although the total extent of the use of *P. cocincinus* as food and pet in Viet Nam remains not quantified, the domestic trade is relatively well documented compared to the other range states.

In China, the species is reported to be popular in the domestic pet trade, as food and in the traditional medicine (Stuart et al. 2019). In southern China, *P. cocincinus* has been reported as common at local food markets in the provinces Guangdong and Guangxi (Lee et al. 2004; Li et al. 1996; Li & Li 1998). Wild caught water dragons were offered for an average price of 160 RMB¥ (about $24) per kg at food markets in Guangzhou (Lee et al. 2004).

In Lao PDR, the harvest and sale of adult water dragon as well as eggs have been documented at local food markets in the provinces Khammouane, Vientiane and Sekong (Duckworth et al. 1999; Kasper et al. 2020; Suzuki et al. 2015). Water dragons were frequently sold at local markets in the Lao – Viet Nam border area (Gewiss et al. 2020).

In Cambodia, the collection of the species by local hunters has been reported as well (Stuart et al. 2006).

6.2 Legal trade

The species is nationally traded in considerable numbers for local consumption and for the pet trade. The sale of the species at local markets is reported from Cambodia, Lao PDR, China and Viet Nam (see also chapter 6.1). In Viet Nam, domestic online adverts of the species are recorded frequently (see Annex I Fig. 7 and Table 1 for examples).

Besides domestic trade, large volumes of *P. cocincinus* are reported in the international pet trade, which is considered as major threat to wild populations. Import of the species to Europe from Thailand is documented by dealer lists at least since 1975 (see Annex I Fig. 8). That time, prices were between 75 and 95 DM (today about 38 and 49 €) per individual. Nowadays, *P. cocincinus* is assessed as Endangered (EN) in the Red List of Thailand (Nabhitabhata and Chan-ard 2005) and there are almost no more exports from Thailand (UNEP-WCMC 2020).

Official import data of *P. cocincinus* into the EU are available since the inclusion of the species in Annex D of the Council Regulation (EC) No. 338/97 in 2010. According to the UNEP-WCMC trade database, imports of 74,124 live individuals of *P. cocincinus* were recorded into the EU between 2010 and 2019 (mean of 7,412 ind. per year) (Annex I, Fig. 1; UNEP-WCMC 2020). Another 2,226 live individuals were recorded to be imported into Germany from Viet Nam in 2020 (BfN pers. comm.).

All animals, imported into the EU between 2010 and 2019, for which the purpose was documented were traded for commercial purposes (59.58 %). For the majority of imported individuals, the origin was documented as “unknown” (83.52 %) and only mentioned for less than 17 % of the individuals (7.29 % wild-sourced; 9.19 % captive bred) (Annex I, Fig. 2). In the EU, Germany has been the biggest importer (41.94 %) followed by the Netherlands (20.15 %), Great Britain (16.69 %) and Spain (16.62 %). Viet Nam was by far the major exporter to the EU with almost 67,000 exported individuals corresponding to 90 % of all traded live individuals (Annex I, Fig. 3). Nguyen et al. (2018a) argued that most exported individuals originate probably from the wild since there is no knowledge about any breeding facilities in Viet Nam being capable of producing such large quantities of water dragons for the pet trade. Additionally, the collection of wild animals is still more convenient and cheaper (Nguyen et al. 2018a), providing few incentives to breed the species. During a recent study by Altherr et al. (2020), a total of 53 online adverts was recorded for the species between September 2017 and September 2018 in Germany with prices between 20-125 € per individual. None of these adverts included a source code.

In 2020, wild caught *P. cocincinus* individuals were offered in Germany in various sizes (baby, small, medium, subadult). Prices usually range between 49 and 149 € per individual depending on the size. As “special offer”, wild caught lizards were offered for cheaper prices than captive bred specimens (see Annex I Fig. 9). While import levels into Germany remain rather high, few online adverts can be currently found in the country. In the past, specimens were regularly offered on various internet platforms, particularly on eBay Kleinanzeigen (Laurenz Gewiss pers. comm.). To improve animal welfare, the trade in live animals has recently been restricted by popular internet platforms such as Facebook and eBay Kleinanzeigen.

According to the USFWS Law Enforcement Management Information System (LEMIS), import numbers of *P. cocincinus* into the US were much higher than into the EU (Gewiss et al. 2020). A total number of more than 1.4 million live individuals have been imported between 1999 and April 2018 into the US (Annex I, Fig. 4). The number

of traded wild sourced water dragons declined in the past 10 years and reached a level of about 42,000 to 55,000 individuals per year. Between 2002 and 2011 an average of about 81,000 individuals were imported annually. The source of the imported water dragons was documented for 98 % of all imports. The majority, about 1,332,000 individuals (almost 95 %), were wild sourced, while almost 47,000 captive bred individuals were imported into the US, corresponding to less than 4 %. Just as it is the case for the EU, the majority (99.8 %) of the imported individuals originated from Viet Nam.

Due to very high export numbers from Viet Nam, it is likely that individuals also originate from other range states using Viet Nam only as transit hub (Gewiss et al. 2020).

6.3 Parts and derivatives in trade

The Asian Water Dragon is known to be internationally traded mainly as live individuals. However, imports of 1,608 skins, 406 small leather products and 277 other derivatives of *P. cocincinus* into the EU were recorded between 2010 and 2019 (UNEP-WCMC 2020). Domestically, meat or dead individuals are traded for consumption (see also 6.1).

6.4 Illegal trade

In Viet Nam, the collection of wild animals including *P. cocincinus* (non-CITES and the Viet Nam Governmental Decree 06/2019/ND-CP) is illegal, if wild animals are collected without respective permits within protected areas, such as national parks and nature reserves. However, it is very difficult for local rangers and other related authorities to identify the origin of specimens in trade and conduct penalties, as water dragon populations are located in both unprotected and protected areas (Gewiss et al. 2020; Nguyen et al. 2009).

6.5 Actual or potential trade impacts

According to extremely high export numbers of mostly wild caught animals, the international pet trade is considered to be unsustainable and to threaten wild populations of *P. cocincinus* at least in Viet Nam (Gewiss et al. 2020; Nguyen et al. 2018a). Gewiss et al. (2020) did not observe any water dragons at eight survey sites although the species was known to have been present at these localities in the past. Due to the high export numbers from Viet Nam, it is likely that individuals also originate from Lao PDR or other neighbouring/ range states implying wild populations in Viet Nam`s neighbouring states are being affected by the international pet trade as well (Gewiss et al. 2020). Although the species is internationally very common in husbandry and captive breeding in the species does not pose any difficulties with adequate housing conditions and, large parts of water dragons in trade are still sourced from the wild. Likewise, harvest for local consumption is considered to negatively affect wild populations. Even though cross-border trade between range states is less documented, the use of the species for food consumption likely also contributes to international trade between range states.

7. Legal instruments

7.1 National

P. cocincinus is listed as Endangered (EN) in the Red List of China (Jiang et al. 2016). According to the Law of the People's Republic of China on the Protection of Wildlife, anyone who intends to hunt or catch wildlife that is not under special state protection must obtain a hunting license and observe the hunting quota assigned. In nature reserves, the hunting and catching of wildlife and other activities, which are harmful to the survival of wildlife, are prohibited.

In Viet Nam, the species has not been included yet in any wildlife protection laws. However, the collection of wild specimens without governmental permits is strictly restricted within protected areas such as national parks and nature reserves in Viet Nam. Due to the listing of *P. cocincinus* as Vulnerable (VU) in the Red Data Book of Viet Nam (Dang et al. 2006) and in the IUCN Red List (Stuart et al. 2019), any advertising media activities for the species are strictly restricted in Viet Nam. Recently, the Viet Namese Prime Minister announced a plan together with Ministries of Agriculture and Rural development, and Information and Communications to control the online trade in wild animals with stricter national laws.

Furthermore*, P. cocincinus* is listed as Endangered (EN) in the Red List of Thailand (Nabhitabhata and Chan-ard 2005). The conservation status has not been evaluated yet by Cambodia and Lao PDR.

7.2 International

The species was included in Annex D of the EU Council Regulation (EC) No. 388/97 in 2010 to monitor trade volumes of trade into and from the EU.

8. Species management

8.1 Management measures

Several *Physignathus* populations occur inside protected areas. The hunting and collecting of the wildlife within these areas are strictly controlled and forbidden without govermental permits according to the Law in the Protection of Wildlife and the Regulations in the Nature Reserves of the People's Republic of China and the Socialist Republic of Viet Nam.

8.2 Population monitoring

First population estimates have been carried out in northern and central Viet Nam between 2014 and 2017 (Nguyen et al. 2018a; Gewiss et al. 2020), while long-term data on population dynamics are lacking.

8.3 Control measures

8.3.1 International

None.

8.3.2 Domestic

According to domestic legislation, the collection of *P. cocincinus* is restricted at least in protected areas in China and Viet Nam (see 7.1).

8.4 Captive breeding and artificial propagation

Dealer lists attest that *P. cocincinus* has been kept in Europe at least since 1975. First captive breeding has been recorded at least since centuries. In Europe, husbandry in 151 zoological institutions is reported according to zootierliste.de (accessed 09th February 2021). According to the ZIMS database, the husbandry of 268 animals is documented from 63 zoological institutions in Europe, 69 water dragons are documented 10 zoological institutions in Asia and 15 animals are documented from 11 zoological institutions in North America (accessed 08th February 2021).

The species is being kept by many hobbyists in Europe, America and Asia and captive breeding does not pose any difficulties with adequate housing conditions and proper nutrition (Manthey & Schuster 1992; Werning 2010). However, international trade still occurs mainly in wild sourced animals. Difficulties in keeping wild sourced specimens have been frequently reported. Due to their distinct escape behaviour, wild animals frequently get injuries while running into glass panes (e.g. Manthey & Schuster 1992; Werning 2010). It is considered that mortality rates in wild specimens during or after transport might be rather high (see 6.2). Nevertheless, imported wild caught water dragons are regularly offered in Europe, occasionally for cheaper prices than domestic captive bred individuals (see Annex I, Fig. 8). According to the UNEP-WCMC CITES trade database, captive bred water dragons have been imported into the EU between 2010 and 2019 from Viet Nam (in total almost 7,000 specimens), while there is no evidence for captive breeding facilities in Viet Nam which are actually able to provide such a large number of water dragons (Nguyen et al. 2018a).

8.5 Habitat conservation

Several *P. cocincinus* populations occur inside of protected areas. However, habitat destruction and fragmentation have been reported even within protected areas in Viet Nam, and population densities were observed to be relatively low (Gewiss et al. 2020; Nguyen et al. 2018a; van Schingen et al. 2016).

8.6 Safeguards

9. Information on similar species

The Eastern water dragon *Intellagama lesueurii*, formerly *Physignathus lesueurii*, is a water dragon species distributed in Australia. The genus *Physignathus* has been recovered as a paraphylum in phylogenetic studies (Amey et al. 2012, Hugall et al. 2008, Townsend et al. 2011), which resulted in the resurrection of the genus *Intellagama* (Gray 1845) by Amey et al. (2012). Despite a similar ecology both water dragon species, *Physignathus cocincinus* and *Intellagama lesueurii*, are clearly distinguishable from each other by morphologic characteristics.

10. Consultations

Internal information for SRG/ KOM: Viet Nam and Lao PDR were consulted bilaterally by the German SA, a reply is still pending, while the SA of Viet Nam confirmed the necessity to list the species in Appendix II.

11. Additional remarks

12. References

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Annex 1

To be completed

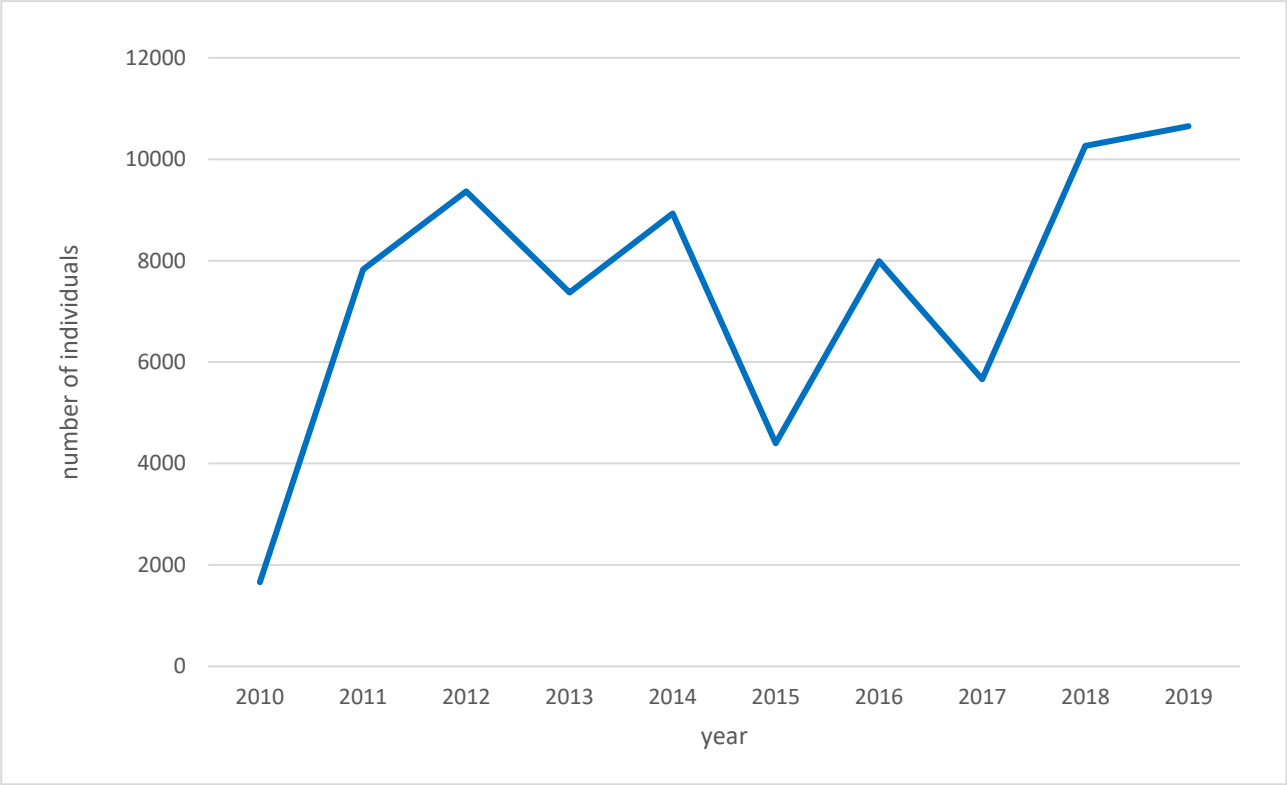


Figure 1. Number of *Physignathus cocincinus* live individuals imported into the EU between 2010 and 2019. Data obtained from the UNEP-WCMC CITES trade database (2020).

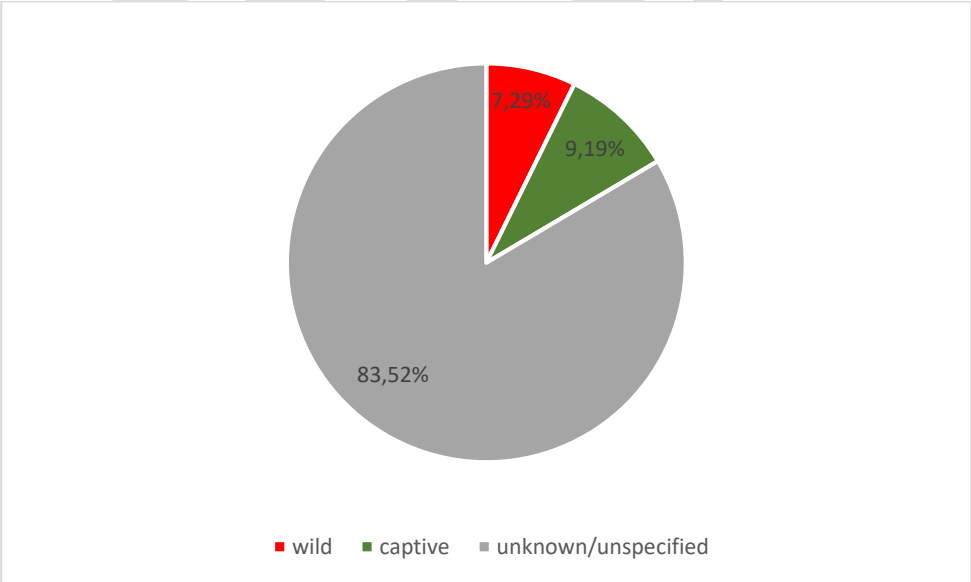


Figure 2. Source of live *Physignathus cocincinus* individuals imported into the EU between 2010 and 2019. Data obtained from the UNEP-WCMC CITES trade database (2020).

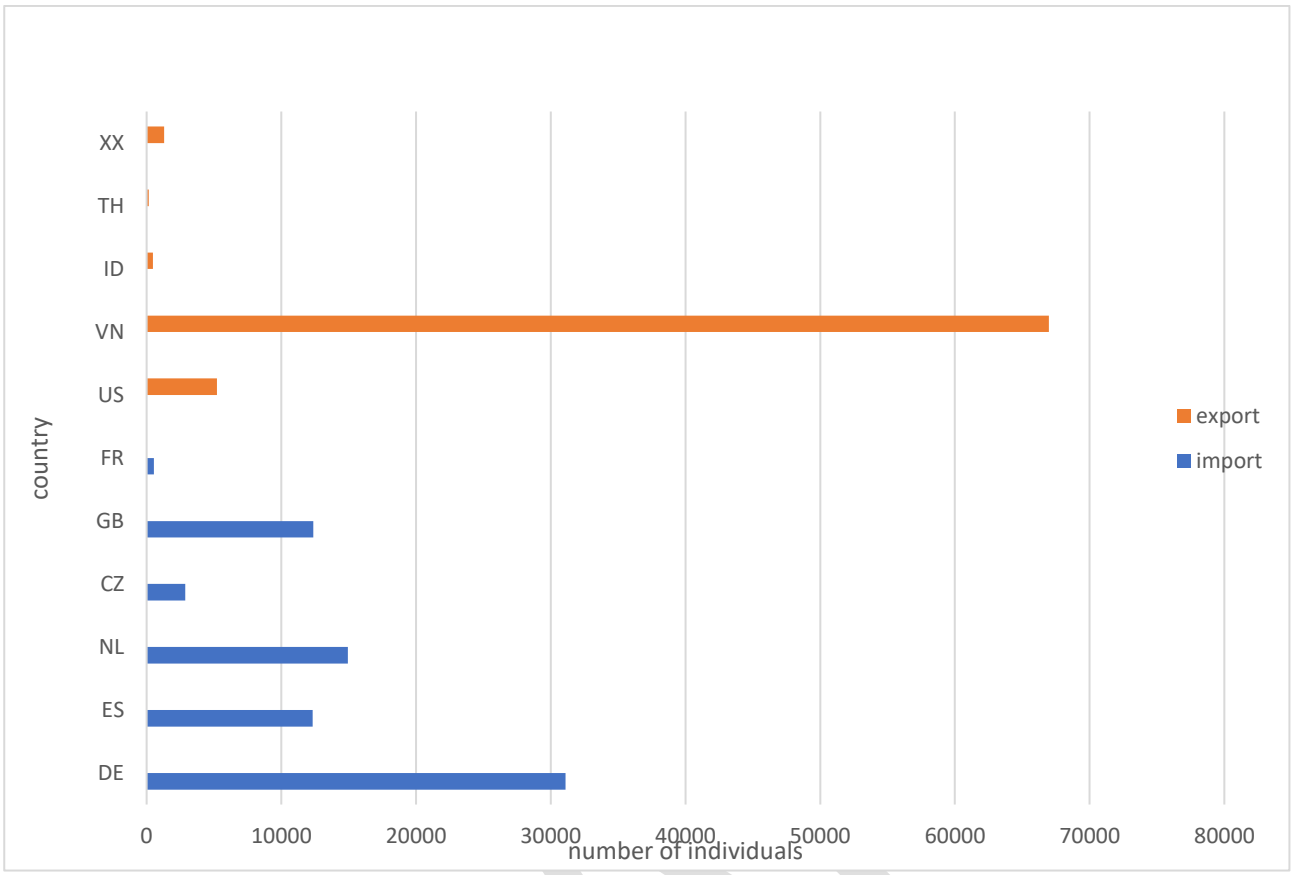


Figure 3. Numbers of live *Physignathus cocincinus* individuals imported into the EU between 2010 and 2019 per exporting/importing country. Data obtained from the UNEP-WCMC CITES trade database (2020).

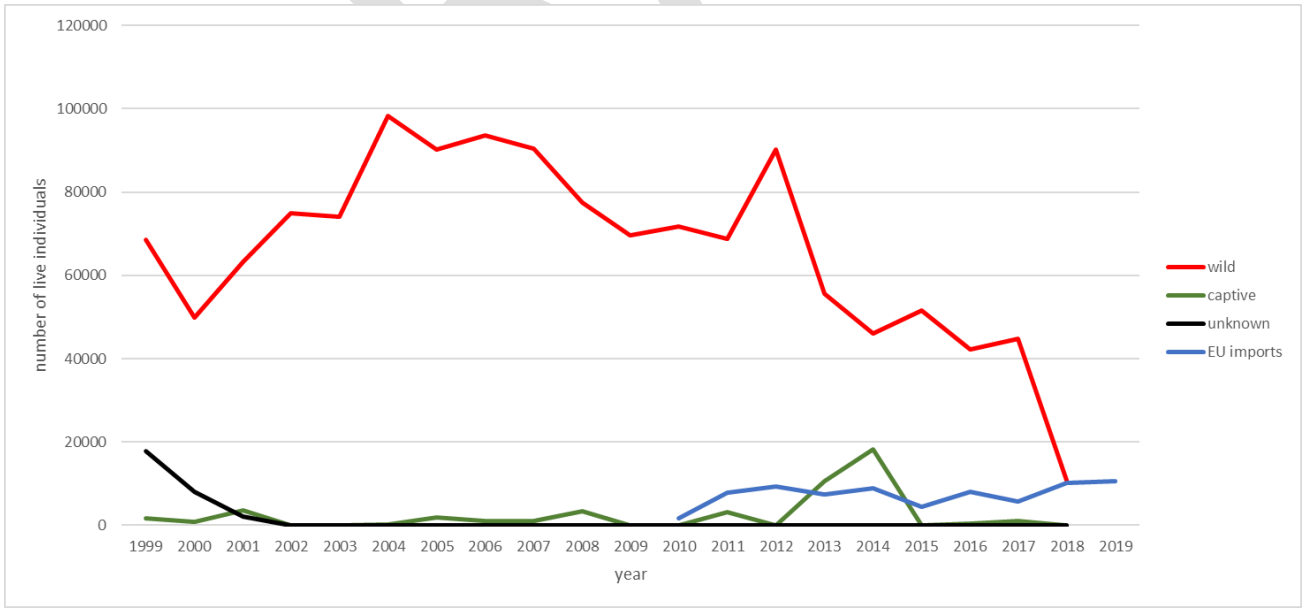


Figure 4. Number of *Physignathus cocincinus* live individuals imported into the US between 1999 and April 2018 and into the EU between 2010 and 2019. Data obtained from the UNEP-WCMC CITES trade database (2020) and the U.S. Fish & Wildlife Service (USFWS) LEMIS database (2018).

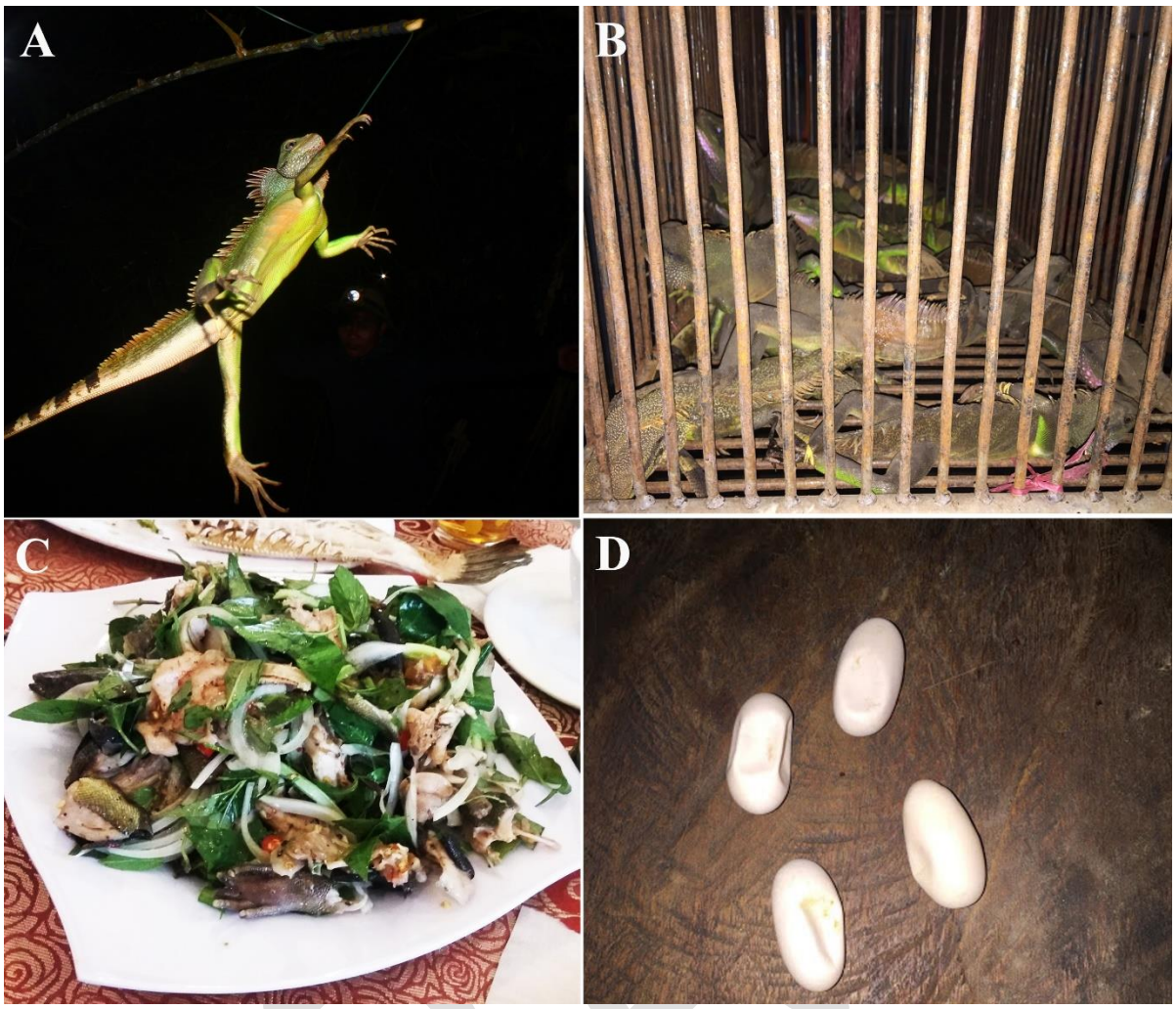


Figure 5. Examples for domestic threats to *Physignathus cocincinus* from Thua Thien Hue Province, central Viet Nam: A) Trapped individual in Nam Dong District B) Live individuals collected for food in Hue City C) Water dragons meat served as food in a restaurant in Hue City D) Eggs of the species preserved in alcohol in Nam Ding District (obtained from Nguyen et al. 2018a).

Figure 6. Collected live specimens of *Physignathus cocincinus* in Viet Nam.

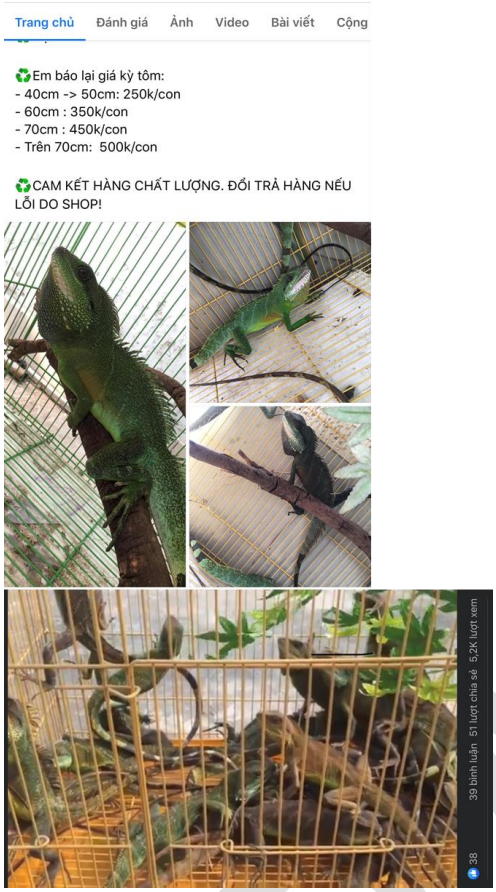
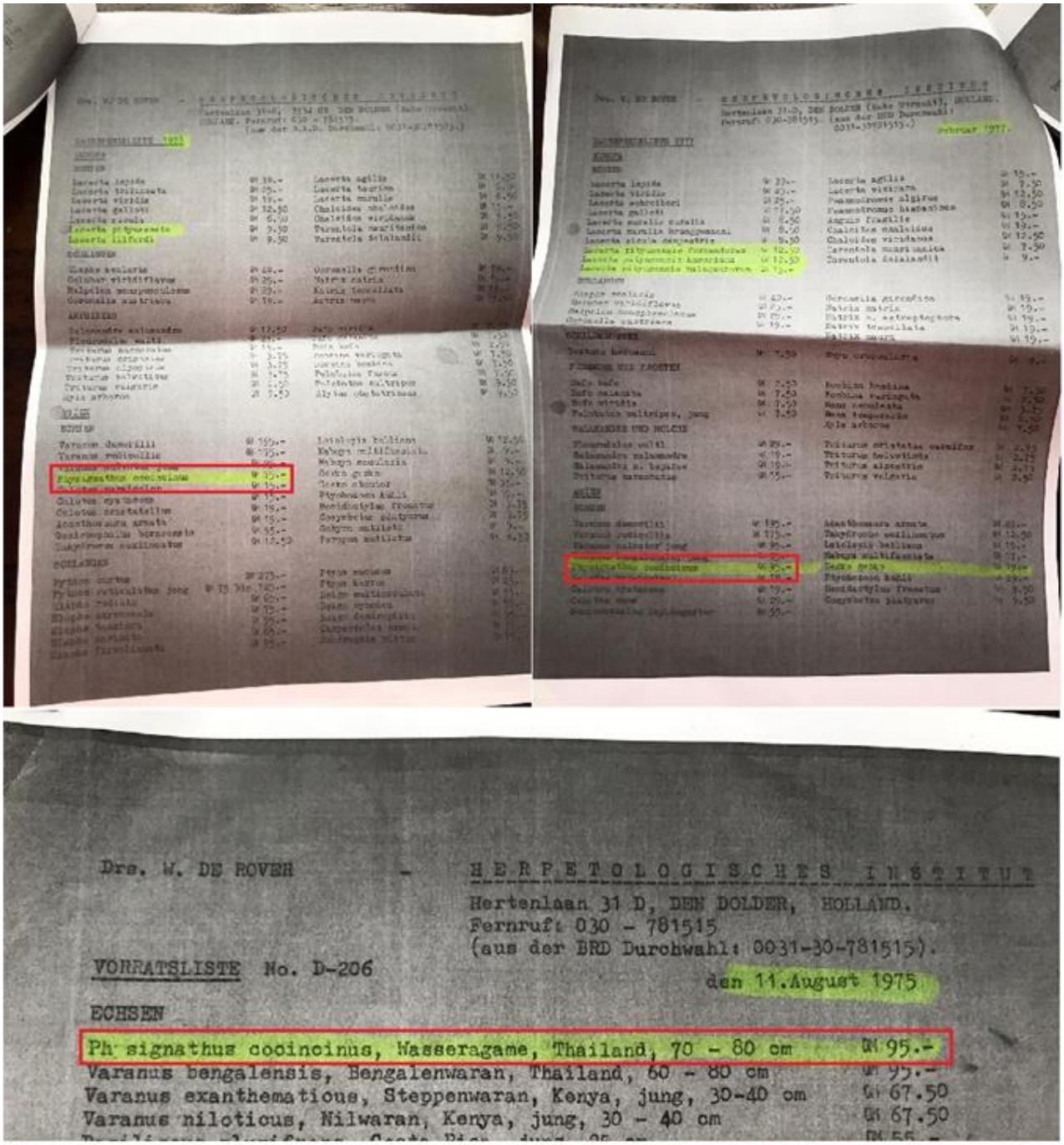


Figure 7. Examples for online advertisements of *Physignathus cocincinus* from Viet Nam.



Drs. W. DE ROVER – HERPETOLOGISCHES INSTITUT

Hertenlaan 31 D, DEN DOLDER, HOLLAND.
Fernruf: 030 - 781515
(aus der BRD Durchwahl: 0031-30-781515).

VORRATSLISTE No. D-206

den 11.August 1975

ECHSEN

Ph signathus cocincinus, Wasseragame, Thailand, 70 - 80 cm	DM 95.-
Varanus bengalensis, Bengalenwaran, Thailand, 60 - 80 cm	DM 95.-
Varanus exanthematicus, Steppenwaran, Kenya, jung, 30-40 cm	DM 67.50
Varanus niloticus, Nilwaran, Kenya, jung, 30 - 40 cm	DM 67.50

Figure 8. Dealer lists from 1975 and 1977 documenting the offer of *Physignathus cocincinus* from Thailand in Europe.

A

Agamen				
Bartagame NZ 12-15 cm	Pogona vitticeps	NZ	99,00	
Bartagame farbig DNZ klein	Pogona vitticeps	DNZ	149,00	
Bartagame farbig DNZ 15-20 cm	Pogona vitticeps	DNZ	169,00	Quarantäne bis 13.07.2020
Bartagame farbig EUNZ klein ca. 15 cm	Pogona vitticeps	EUNZ	149,00	
Zwergbartagame NZ klein	Pogona henrylawsoni	NZ	149,00	
Somalische Dornschwanzagame DNZ klein	Uromastyx princeps	DNZ	1999,00	
Schmetterlingsagame	Leiolepis belliana	WF	59,00	
Reeves Schmetterlingsagame	Leiolepis reevesii	WF	35,00	Sonderangebot
Hardun DNZ klein	Stellagama stellio picea	DNZ	179,00	Quarantäne bis 13.07.2020
Hardun DNZ mittel - groß	Stellagama stellio picea	DNZ	199,00	Quarantäne bis 13.07.2020
Wasseragame Baby	Physignatus cocincinus	WF	35,00	Sonderangebot
Wasseragame klein	Physignatus cocincinus	WF	79,00	
Wasseragame mittel	Physignatus cocincinus	WF	99,00	
Wasseragame subadult	Physignatus cocincinus	WF	149,00	
Vietnam-Nackenstachler	Acanthosaura capra	WF	69,00	
Natalia's Nackenstachler	Acanthosaura nataliae	WF	199,00	

B

Gestreifte Hausschlange White Line NZ klein	Lamprophis lineatus	EUNZ	149,00	
Indische Schmucknatter DNZ klein	Coelognathus (Elaphe) helena	DNZ	199,00	
Rauhe Grasnatter	Opheodrys aestivus	WF	129,00	
Westliche Waldfeilennatter DNZ Weibchen	Gonionotophis poensis	DNZ	699,00	
Hakennasennatter Albino Superconda het snow DNZ 20	Heterodon nasicus	DNZ	999,00	
Agamen				
Bartagame NZ 12-15 cm	Pogona vitticeps	DNZ	99,00	
Bartagame farbig DNZ klein	Pogona vitticeps	DNZ	149,00	
Bartagame farbig DNZ 15-20 cm	Pogona vitticeps	DNZ	169,00	
Zwergbartagame NZ klein	Pogona henrylawsoni	DNZ	149,00	
Somalische Dornschwanzagame DNZ klein	Uromastyx princeps	DNZ	1999,00	
Wasseragame Baby	Physignatus cocincinus	WF	35,00	Sonderangebot
Wasseragame klein	Physignatus cocincinus	WF	79,00	
Wasseragame mittel	Physignatus cocincinus	WF	99,00	
Wasseragame DNZ klein	Physignatus cochinchinus	DNZ	79,00	
Australische Wasseragame NZ klein	Physignatus leseurii	NZ	499,00	
Natalia's Nackenstachler	Acanthosaura nataliae	WF	199,00	
Leguane				

C

D

E

Bartagame farbig DNZ 15-20 cm	Pogona vitticeps	DNZ	169,00	
Bartagame farbig EUNZ klein ca. 15 cm	Pogona vitticeps	EUNZ	149,00	
Zwergbartagame NZ mittel	Pogona henrylawsoni	NZ	199,00	
Zwergbartagame NZ klein	Pogona henrylawsoni	DNZ	149,00	
Somalische Dornschwanzagame DNZ klein	Uromastyx princeps	DNZ	1999,00	
Wüstenagame Männchen	Trapelus mutabilis	WF	69,00	
Wasseragame Baby	Physignatus cocincinus	WF	49,00	
Wasseragame klein	Physignatus cocincinus	WF	49,00	Sonderangebot
Wasseragame mittel	Physignatus cocincinus	WF	99,00	
Wasseragame DNZ klein	Physignatus cochinchinus	DNZ	79,00	
Australische Wasseragame NZ klein	Physignatus leseurii	NZ	499,00	
Natalia's Nackenstachler	Acanthosaura nataliae	WF	199,00	
Grüne Segelechse s-m	Hydrosaurus weberi	WF	299,00	

Figure 9. Example for online adverts (special offer) of wild caught *Physignathus cocincinus* individuals in Germany from July (A), October (B and C) and November (D and E) 2020; WF = wild caught; NZ = bred/ born in captivity; DNZ = bred/ born in captivity in Germany.

Table 1. Domestic trade in *Physignathus cocincinus* in Viet Nam based on online investigations (obtained from Gewiss et al. 2020)

Areas	Provinces	Number of dealers	Number of shops and markets	Purposes	Prices (US$) per specimen
Northern Viet Nam	Ha Noi	5	5	Pet trade	3-16
	Hai Phong	1	1	Pet trade	3-11
	Ha Giang	1	0	Pet trade and food	US$14/ kg
	Nam Dinh	1	0	Pet trade	4-8
	Phu Tho	3	0	Pet trade	*
	Quang Ninh	1	0	Pet trade	*
	Yen Bai	1	0	Food	*
Central Viet Nam	Binh Dinh	2	0	Pet trade and food	4-18
	Da Nang	3	0	Pet trade	4-9
	Nha Trang	3	0	Pet trade	7-11
	Quang Nam	1	0	Food	*
Southern Viet Nam	Ba Ria - Vung Tau	1	0	Pet trade	*
	Binh Duong	1	0	Pet trade	10
	Binh Phuoc	1	0	Pet trade	14
	Dong Nai	2	1	Pet trade	3-20
	Gia Lai	1	0	Pet trade and food	7-22
	Ho Chi Minh	17	2	Pet trade and food	3-16 or US$ 6/ kg
	Unknown	6	0	Pet trade	6-18 or US$ 16 per pair

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DER ZOOLOGISCHE GARTEN

Genetic screening of captive crocodile lizards (*Shinisaurus crocodilurus*) in Europe

Genetische Identifizierung von in Menschenhand gehaltenen Krokodilschwanzechsen (*Shinisaurus crocodilurus*) in Europa

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Abstract

The endangered crocodile lizard (*Shinisaurus crocodilurus*) is a reptile species regularly kept in zoos and private collections across Europe, Japan, the United States and other countries. This species had long been thought to represent a single conservation unit, but a recent study show-

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ed that the population from Vietnam is morphologically, ecologically and genetically distinct from several populations from China. As such, the populations should be managed separately to avoid hybridization with other independently evolving natural populations. Until now, the identification of different populations remains challenging because of their subtle morphological differences. In this study, we undertook a genetic screening of crocodile lizard individuals from zoos and private holdings in Europe using mitochondrial DNA sequences. Our results based on phylogenetic and network analyses strongly support four different mitochondrial clades, one from Vietnam and three from China. Most screened individuals belonged to one mitochondrial clade from China, while a few others clustered in the Vietnamese clade. The low number of specimens from the Vietnamese population found in captivity might be explained by specimens from Vietnam arriving only recently in Europe through the international pet trade, or by the extremely small size of the Vietnamese population. Interestingly, our analyses identified a new mitochondrial clade of the crocodile lizard, which we suggest originates from China. We recommend that further investigation should be conducted to better understand the distinctiveness of the three lineages in China for future conservation actions. Our study illustrates the potential of molecular data for assigning crocodile lizards to distinct genetic clades. However, to determine genetic purity of individuals in captivity, other nuclear markers, such as microsatellites, should be employed.

Keywords: Sauria, Shinisauridae, *Shinisaurus, S. c. crocodilurus, S. c. vietnamensis*, conservation breeding management, genetic screening, zoo holdings, mitochondrial markers

Introduction

The crocodile lizard (*Shinisaurus crocodilurus*) is a frequently kept reptile species both in zoological gardens and by hobbyists. Originally only known from southern China, the species was subsequently discovered in Vietnam (Le & Ziegler, 2003). The latest integrative taxonomic study revealed Vietnamese representatives to be morphologically, ecologically, and genetically distinct from Chinese populations (van Schingen et al., 2016b). As a consequence, the importance of establishing separate conservation breeding programs for two different taxa from Vietnam and China to maintain their genetic integrity within ex situ facilities has been highlighted, in particular for the newly described subspecies from Vietnam (*Shinisaurus crocodilurus vietnamensis*) (see also Ziegler et al., 2016) due to its extremely low population estimates (van Schingen et al., 2014; 2016a).

Since the two subspecies are exposed to different ecological conditions and occur in different microhabitats in China and Vietnam (van Schingen et al., 2015a, 2016b), husbandry parameters have to be adjusted accordingly. A recent review of habitat use of Vietnamese crocodile lizards by Ziegler et al. (2019) provided recommendations for enhanced and adjusted husbandry conditions for both subspecies and proposed new husbandry models. However, accurate identification of the two subspecies without reliable information on their geographic origin remains difficult, as their morphological differences are subtle. So far, the identification of captive or confiscated animals without locality information has been extremely challenging.

Because Vietnamese crocodile lizards have increasingly been collected for the international pet trade during recent years (van Schingen et al., 2015; Auliya et al., 2016), it is crucial to identify the origin of ex situ individuals to maintain genetic integrity of the conservation units, and avoid hybridization between breeding populations that may potentially be recruited for future restocking/release programs. At time, it is not yet known whether Vietnamese crocodile lizards are already represented in captive stocks, both in private and zoo facilities in Europe. To

trace the origin of captive individuals in the region, we undertook a genetic screening of animals maintained in zoos and private collections in Europe using mitochondrial markers. This approach, if successfully applied, should also enable reliable taxonomic assignments of crocodile lizards in future confiscations.

Material & Methods

A total of 119 (swab or tissue) samples of crocodile lizards were received from private keepers and zoos in Europe. A fragment spanning various mitochondrial genes, including cytochrome b, partial ND6, and partial tRNA-Glu were amplified using primer 1 (5'-GCAATTGAATAAGCAAAAAC-CAC-3') and primer 2 (5'-TAGTTTATTAAAAATGCTAGTTTTGGG-3') developed by Huang et al. (2014). DNA of samples was extracted using proteinase K digestion (10 mg/ml concentration) followed by a standard salt-extraction protocol (Bruford et al., 1998). Extracted DNA from the fresh tissue or swab was amplified by Go Taq DNA Polymerase (Promega, USA). Tissue samples or oral cavity swabs from zoos and private holdings were included in the study. In addition to 11 sequences of *S. crocodilurus* from China, we also incorporated three previously sequenced samples from Quang Ninh and Bac Giang provinces, northern Vietnam, all available from GenBank. All samples of crocodile lizards are summarized in Table 1. Three taxa were used as outgroups based on their phylogenetic relationships with *Shinisaurus crocodilurus* (Li et al., 2012).

The PCR volume consisted of 12.7 µl (2.5 µl of buffer 5x, 0.5 µl dNTPs, 0.1 µl Go Taq, 8 µl of water, 0.3 µl of each primer at 10 pmol/ µl and 1 µl of DNA or higher depending on the quantity of DNA in the final extraction solution). The following temperature profile for PCR reactions was used: 95 °C for 5 min to activate the taq; with 35 cycles at 95 °C for 30s, 48 °C for 45s, 72 °C for 60s; and the final extension at 72 °C for 6 min. Successful amplifications were purified to eliminate PCR components using ExoSAPIT (ThermoFisher Scientific, Waltham, MA, USA) and sequenced on a 3130xl Genetic Analyser (Applied Bio-systems) using Big Dye v3.1 cycle sequencing chemistry.

Sequences generated in this study were checked by eye and trimmed for low-quality stretches. Heterozygote positions were identified, and errors corrected using Codon Code Aligner (v5.1.5, Codon Code Corporation) and were aligned in BioEdit v7.1.3 (Hall, 1999) with default settings. All newly generated sequences were submitted to GenBank (accession numbers MT507115-MT507213). Data were analyzed using maximum likelihood (ML) as implemented in IQtree (Minh et al., 2013), Bayesian inference (BI) as implemented in MrBayes 3.2.1 (Ronquist et al., 2012), and NeigborNet analysis as implemented in SplitsTree 4.14.2 (Huson & Bryant., 2006). For ML and BI analyses, the optimal model for nucleotide evolution was determined using jModeltest v2.1.4 (Guindon & Gascuel, 2003; Darriba et al., 2012). Support for the likelihood hypothesis was evaluated by 10,000 ultrafast bootstrap analysis. We regarded ultrafast bootstrap values of ≥ 95% as strong support and values of < 95% as weak support (Minh et al., 2013).

For BI and ML analyses, we used TPM2uf+G model as determined by jModeltest. For BI, two simultaneous analyses with four Markov chains (one cold and three heated) were run for 10 million generations with a random starting tree and trees were sampled every 1000 generations. Log-likelihood scores of sample points were plotted against generation time to determine stationarity of Markov chains. Trees generated before log-likelihood scores reached stationarity were discarded from the final analyses using the burn-in function. The cutoff point for the burn-in function was set to 38 in the Bayesian analysis, as –lnL scores reached stationarity after 38,000 generations in both runs. The posterior probability values for all clades in the final majority rule consensus tree were provided. Uncorrected pairwise divergences were calculated in PAUP*4.0b10 (Swofford, 2001).

Alternative intraspecific relationships were visualized with the NeighborNet algorithm (Bryant & Moulton, 2002) with the following settings: edge fitting as ordinary least squares, equal angle as chosen splits transformation, least squares to modify weights, and four maximum dimensions as the filtering option. The split graph generated showed a visual representation of conflicting signals in the data by presenting them as a series of parallel edges. The program computed the least squares fit (LSfit) between the pair-wise distances from the graph and the distances from the matrix. Internal node supports were estimated by 1,000 bootstrap pseudo-replicates (Felsenstein, 1985).

Tab. 1: GenBank accession numbers, and associated voucher specimens/tissue that were used in this study, wild (versus captive individuals) are marked in bold.

No.	Lab ID / Genbank Accession Nr.	Sample Nr.	Origin
1	Si 81 / MT507115	Duisburg, confiscated	Duisburg
2	Si 82 / MT507116	Duisburg, confiscated	Duisburg
3	Si 83 / MT507117	Cologne Zoo, old	Cologne
4	Si 84 / MT507118	0.0.1	Private 1
5	Si 85 / MT507119	RH1	Reherp Rotterdam
6	Si 86 / MT507120	RH2	Reherp Rotterdam
7	Si 87	RH3	Reherp Rotterdam
8	Si 90 / MT507121	MV2	Reherp Rotterdam
9	Si 91 / MT507122	MV3	Reherp Rotterdam
10	Si 92 / MT507123	MV4	Reherp Rotterdam
11	Si 93 / MT507124	MV5	Reherp Rotterdam
12	Si 94 / MT507125	MV6	Reherp Rotterdam
13	Si 95 / MT507126	MV7	Reherp Rotterdam
14	Si 96	MV8	Reherp Rotterdam
15	Si 97	R01339 0.1	Leipzig Zoo
16	Si 98 / MT507127	R01272 1.0	Leipzig Zoo
17	Si 99	R01338 0.1	Leipzig Zoo
18	Si 100 / MT507128	G01840	ZSL London
19	Si 101 / MT507129	G01843	ZSL London
20	Si 102 / MT507130	G01842	ZSL London
21	Si 103 / MT507131	G01841	ZSL London
22	Si 104 / MT507132	G01292	ZSL London
23	Si 105 / MT507133	G01293	ZSL London
24	Si 106	HdM1	Haus des Meeres Wien
25	Si 107 / MT507134	HdM2	Haus des Meeres Wien
26	Si 108 / MT507135	HdM3	Haus des Meeres Wien
27	Si 109 / MT507136	HdM4	Haus des Meeres Wien
28	Si 110 / MT507137	HdM5	Haus des Meeres Wien
29	Si 111 / MT507138	HdM6	Haus des Meeres Wien
30	Si 112 / MT507139	HdM7	Haus des Meeres Wien
31	Si 113 / MT507140	HdM8	Haus des Meeres Wien
32	Si 114 / MT507141	HdM9	Haus des Meeres Wien
33	Si 115 / MT507142	1,0	Vivarium Darmstadt
34	Si 116	1,0	Wilhelma Stuttgart
35	Si 117 / MT507143	0,1	Wilhelma Stuttgart
36	Si 118 / MT507144	Parijs 1	Reherp Rotterdam
37	Si 119	ZI5359	Blijdorp Rotterdam
38	Si 120 / MT507145	705531	Blijdorp Rotterdam
39	Si 121 / MT507146	ZI5348	Blijdorp Rotterdam

40	Si 122 / MT507147	ZI5349	Blijdorp Rotterdam
41	Si 123 / MT507148	ZI5359	Blijdorp Rotterdam
42	Si 124	ZI5350	Blijdorp Rotterdam
43	Si 125 / MT507149	704405	Blijdorp Rotterdam
44	Si 126 / MT507150	707183	Blijdorp Rotterdam
45	Si 127 / MT507151	704408	Blijdorp Rotterdam
46	Si 128 / MT507152	V1 967000009784260	Antwerp Zoo
47	Si 129 / MT507153	V2 967000009784225	Antwerp Zoo
48	Si 130 / MT507154	V3 967000009784289	Antwerp Zoo
49	Si 133 / MT507155	V4 967000009784282	Antwerp Zoo
50	Si 134 / MT507156	V5 967000009784269	Antwerp Zoo
51	Si 135 / MT507157	V6 967000009784271	Antwerp Zoo
52	Si 136 / MT507158	Quar 1	Antwerp Zoo
53	Si 137 / MT507159	Quar 2	Antwerp Zoo
54	Si 138 / MT507160	Quar 3	Antwerp Zoo
55	Si 139	Quar 4	Antwerp Zoo
56	Si 140 / MT507161	Quar 5	Antwerp Zoo
57	Si 144 / MT507162	Quar B1 Basel	Antwerp Zoo
58	Si 145 / MT507163	Quar B2 Basel	Antwerp Zoo
59	Si 146 / MT507164	Quar B3 Basel	Antwerp Zoo
60	Si 147 / MT507165	Quar B4 Basel	Antwerp Zoo
61	Si 148 / MT507166	Quar B5 Basel	Antwerp Zoo
62	Si 149 / MT507167	Quar B6 Basel	Antwerp Zoo
63	Si 150 / MT507168	Quar B7 Basel	Antwerp Zoo
64	Si 151 / MT507169	Quar B8 Basel	Antwerp Zoo
65	Si 152	1	Private 6
66	Si 153 / MT507170	2 (skin)	Private 6
67	Si 154 / MT507171	3 (skin)	Private 6
68	Si 155 / MT507172	4 (swab)	Private 6
69	Si 156 / MT507173	5 (swab)	Private 6
70	Si 157 / MT507174	6 (swab)	Private 6
71	Si 158	7	Private 6
72	Si 159	8	Private 6
73	Si 160 / MT507175	9,00 C S	Private 2
74	Si 161 / MT507176	132481	Bristol Zoo
75	Si 162 / MT507177	132482	Bristol Zoo
76	Si 163 / MT507178	132483	Bristol Zoo
77	Si 164 / MT507179	132484	Bristol Zoo
78	Si 165 / MT507180	132485	Bristol Zoo
79	Si 166 / MT507181	4 ZB 28 1,0	Private 3
80	Si 167 / MT507182	6 ZB 22 1,0	Private 3
81	Si 168 / MT507183	3 ZB 97 1,0	Private 3
82	Si 169 / MT507184	ZB 30 1 1,0	Private 3
83	Si 170	2 ZB 99	Private 3
84	Si 171 / MT507185	7 ZB 23 0,1	Private 3
85	Si 172 / MT507186	5 ZB 12 0,1	Private 3
86	Si 173 / MT507187	211049 local 10, female	Helsinki Zoo
87	Si 174 / MT507188	211050 local 10, male	Helsinki Zoo
88	Si 175 / MT507189	276095610109887	Private 4
89	Si 176 / MT507190	276095610147418	Private 4
90	Si 177 / MT507191	276095610147610	Private 4
91	Si 178 / MT507192	276095610146597	Private 4
92	Si 179 / MT507193	276095610147829	Private 4
93	Si 180 / MT507194	276095610148119	Private 4
94	Si 181 / MT507195	276095610148979	Private 4
95	Si 182	276095610149787	Private 4

96	Si 183 / MT507196	276095610150014	Private 4
97	Si 184 / MT507197	276095610150253	Private 4
98	Si 185	276095610150389	Private 4
99	Si 186	276095610150658	Private 4
100	Si 187	276095610154110	Private 4
101	Si 188 (1) / MT507198	Tier 1 (1), Nr.1	Aquazoo
102	Si 189 (1) / MT507199	Tier 2 (13), Nr.2	Aquazoo
103	Si 190 (1) / MT507200	Tier 420 (5)	Aquazoo
104	Si 191 (1) / MT507201	Tier 421A (7)	Aquazoo
105	Si 192 (1)	Tier 421B (9)	Aquazoo
106	Si 193 (1)	Tier 421C (11)	Aquazoo
107	Si 194 (1)	Tier 450 (3)	Haus des Meeres Wien
108	Si 195 / MT507202	MV3/Second screening	Wilhelma
109	Si 196 / MT507203	MV4/Second screening	Haus des Meeres Wien
110	S2 / MT507204	Second screening, dead. ind.	Reherp Rotterdam
111	MV1 / MT507205	Second screening, swab (red)	Cologne
112	MV2 / MT507206	Second screening, swab (yellow)	Cologne
113	MV6 / MT507207	Second screening, HdM3	Haus des Meeres Wien
114	MVTIS3221 / MT507208	CZ TZ 2019 third screening	Private 5
115	MVTIS3222 / MT507209	CZ TZ 2019 B 3 third screening	Reherp Rotterdam
116	MVTIS3223 / MT507210	CZ TZ 2019 5001 third screening	Reherp Rotterdam
117	MVTIS3224 / MT507211	CZ TZ 2019 5002 third screening	Reherp Rotterdam
118	MVTIS3225 / MT507212	CZ TZ 2019 third screening	Private 5
119	MVTIS3226 / MT507213	CZ TZ 2019 third screening	Private 5
120	**AB080274**	**GenBank, MtGenome**	**probably China**
121	**AY099995**	**GenBank**	**probably China**
122	**HQ008865**	**GenBank, MtGenome**	**probably China**
123	**KF928266**	**GenBank**	**haplotype1**
124	**KF928268**	**GenBank**	**haplotype3**
125	**KF928269**	**GenBank**	**haplotype4**
126	**KF928270**	**GenBank**	**haplotype5**
127	**KF928271**	**GenBank**	**haplotype6**
128	**KF928272**	**GenBank**	**haplotype7**
129	**KF928275**	**GenBank**	**haplotype10**
130	**KF928276**	**GenBank**	**haplotype11**
131	**KX430035**	**GenBank**	**HH_QN4 (Hai Ha, Quang Ninh)**
132	**KX430036**	**GenBank**	**TYT4 (Tay Yen Tu, Bac Giang)**
133	**KX430038**	**GenBank**	**DSKT2 (Dong Son-Ky Thuong, Quang Ninh)**

Results

In total, of the 119 Shinisaurus samples available for this study, 99 were successfully amplified and sequenced. Of these, 89 belonged to a known Chinese clade "China clade 1" (Fig. 3), one specimen was assigned to an unknown Chinese clade named "China new clade", and nine to the Vietnam clade (Fig. 4). The 20 samples remaining unamplified included Si 87, Si 96 (Reherp Rotterdam), Si 97, Si 99 (Leipzig Zoo), Si 106, Si 116 (Wilhelma), Si 119 (Blijdorp Rotterdam), Si 124 (Blijdorp Rotterdam), Si 139 (Antwerp Zoo), Si 152, Si 158, Si 159 (Private 6), Si 170 (Private 3), Si 182, Si 185, Si 186, Si 187 (Private 4), Si 192 (1), Si 193 (1) (Aquazoo), Si 194 (1) (Haus des Meeres Wien) (Table 2).

Our genetic analyses of 1368-character matrix clearly recovered at least four different mitochondrial lineages, in the following referred to as clades. All of these mitochondrial clades received a high statistical value from every analysis (ultrafast BP > 95%; PP > 95%) (Fig. 1 and 2). China clade 1 contained the majority of individuals currently

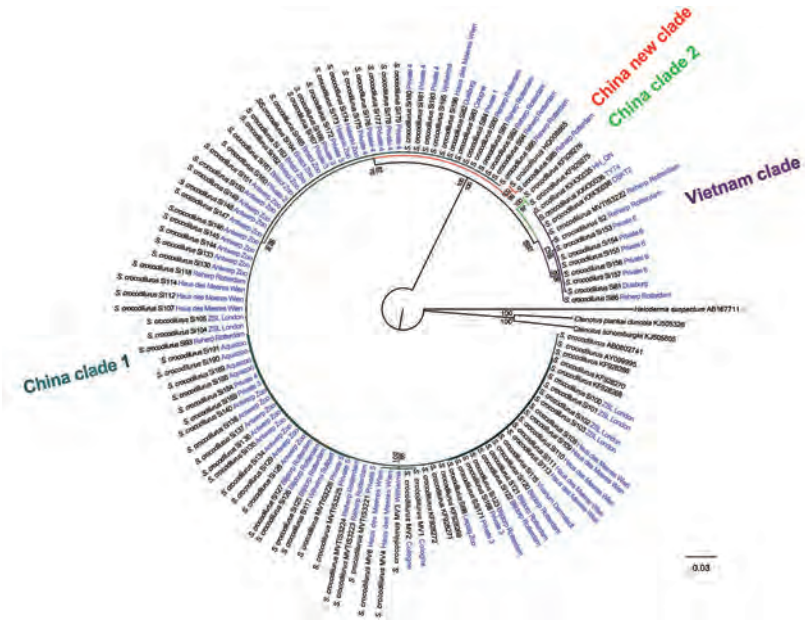

Fig. 1: Bayesian cladogram based on 117 DNA sequences of *Shinisaurus* (total alignment length 1368 nucleotides) of mitochondrial genes (cytochrome b, partial ND6, and partial tRNA-Glu for 100 newly sequenced specimens, plus 17 sequences retrieved from GenBank). The numbers above and below branches are Bayesian posterior probability and bootstrap values, respectively (both in percent).

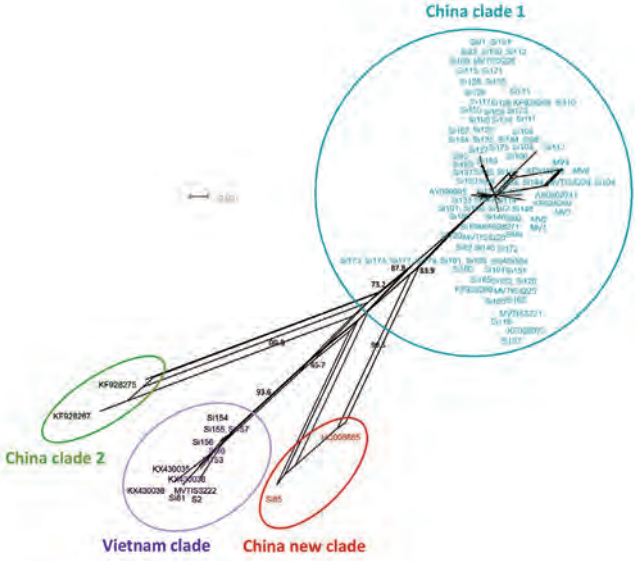

Fig. 2: Split tree calculated from 117 *Shinisaurus* DNA sequences (total alignment length 1368 nucleotides) of mitochondrial genes (cytochrome b, partial ND6, and partial tRNA-Glu). Numbers at nodes are bootstrap values in percent.

Fig. 3: A living individual (currently kept at Cologne Zoo) of the China clade 1 (MV 2), which contains the majority of individuals currently managed by zoos and private collectors in Europe. Photo: T. Ziegler.

Fig. 4: A living individual of the Vietnam clade currently kept at Cologne Zoo. Photo: T. Ziegler.

Fig. 5: A living individual of the new clade from China (Si 85), initially rescued by Reherp Foundation and currently kept at Cologne Zoo. Photo: T. Ziegler.

managed by zoos and private collectors in Europe (Fig. 3). China clade 2, which was represented by two samples retrieved from GenBank, did not seem to be represented by any individual in European facilities. Besides this second clade among the Chinese populations, as already shown in van Schingen et al. (2016), we identified a new mitochondrial clade. This group probably originated from China and therefore was named China new clade (Fig. 5), because the second sample assignable to this clade, without precise locality and with GenBank accession number HQ008865 (Table 2), was sequenced in China (Li et al., 2012).

Five living individuals deriving from the pet trade in Europe were assigned to the Vietnamese clade, including a confiscated individual temporarily housed at the Duisburg Zoo and four individuals (with multiple samples per individual taken for our analyses) from the pet trade (Fig. 4) currently being housed in the crocodile lizard facility at Cologne Zoo's terrarium section. Two further individuals assigned to the Vietnamese clade and likewise originating from the trade in Europe (also with multiple samples taken) died at the Reherp Foundation facility shortly after being rescued (Table 2). Pairwise genetic divergences based on the cytochrome b gene showed the highest values within China clade 1 (0.91%), and lowest within China clade 2. The new clade was 1.10% – 3.61% divergent from the other three (Table 3).

Tab. 2: Genetically identified *Shinisaurus crocodilurus* samples from China and Vietnam, assigned to the four mitochondrial clades. Bold accession numbers refer to sequences retrieved from GenBank.

China clade 1					China clade 2	China new clade	Vietnam clade
AB080274	Si98	Si122	Si149	Si178	**KF928275**	**HQ008865**	**KX430035**
AY099995	Si100	Si123	Si150	Si179	**KF928276**	Si85	**KX430036**
KF928266	Si101	Si125	Si151	Si180			**KX430038**
KF928268	Si102	Si126	Si160	Si183			S2
KF928269	Si103	Si127	Si161	Si184			Si81
KF928270	Si104	Si128	Si162	Si188(1)			Si86
KF928271	Si105	Si129	Si163	Si189(1)			Si153
KF928272	Si107	Si130	Si164	Si190a			Si154
MV1	Si108	Si133	Si165	Si191(1)			Si155
MV2	Si109	Si134	Si166	Si195			Si156
MV6	Si110	Si135	Si167	Si196			Si157
Si82	Si111	Si136	Si168	MVTIS3221			MVTIS3222
Si83	Si112	Si137	Si169	MVTIS3223			
Si84	Si113	Si138	Si171	MVTIS3224			
Si90	Si114	Si140	Si172	MVTIS3225			
Si91	Si115	Si144	Si 173	MVTIS3226			
Si92	Si117	Si145	Si174				
Si93	Si118	Si146	Si175				
Si94	Si120	Si147	Si176				
Si95	Si121	Si148	Si177				

Tab. 3: Percentages of uncorrected pairwise distance based on 1138 bp of cytochrome b between and within four clades of *Shinisaurus* identified by this study. Average distances within clades are italicized and shown in parentheses.

	China clade 1	China clade 2	China new clade	Vietnam clade
China clade 1	*(0.91)*			
China clade 2	2.20 – 3.26	*(0.19)*		
China new clade	1.10 – 2.60	2.83 – 3.61	*(0.41)*	
Vietnam clade	1.93 – 3.14	2.2 – 3.26	2.14 – 3.61	*(0.46)*

Discussion

The morphological differentiation between Chinese and Vietnamese crocodile lizards appears to be challenging. The head shape may help to distinguish between the two currently recognized subspecies (van Schingen et al., 2016a), while it remains unclear if morphological differences can be identified among other Chinese populations. Another potential approach might be determining isotopic signatures of individuals, which was successfully employed to differentiate between wild and captive crocodile lizards, the first case study of its kind for lizards (van Schingen et al., 2016b). Future studies could assess whether this method can be used to identify the geographic origin of Shinisaurus representatives. In principle, this approach appears promising because the populations in Vietnam and China occur in different microhabitats with distinct, separate trophic networks.

In this study, we show that genetic screening of animals using mitochondrial markers is a suitable technique to assign crocodile lizard individuals to conservation units. Of the 119 Shini-

saurus samples available for this study, 19 could not be successfully amplified and sequenced. It is likely that these samples were not collected correctly, or DNA was too degraded for successful amplification. Our analyses revealed that the majority of *Shinisaurus crocodilurus* kept in Europe, both in zoos and in private holdings, originated from one clade in China. It is surprising that none of the screened individuals came from China clade 2 and only one from China new clade. A better understanding of captive stocks in Europe might therefore require expansion of genetic screening among all zoos and private collections. In the future, screening of captive colonies in Japan, the United States, and other countries will help to better characterize movement of crocodile lizards from their native range and develop suitable management strategies for maintaining their genetic integrity.

The results of our study suggest that crocodile lizards from Vietnam have only arrived in Europe recently through the international pet trade, which could be due to the relatively recent discovery of the Vietnamese population (Le and Ziegler 2003) and the inclusion of the species in CITES in 1990. Relatively high numbers of crocodile lizards have been imported into Europe before the inclusion of the species in CITES, indicating that a high percentage of the current breeding stock in Europe may still originate from these first imports (CITES 1989; van Schingen et al. 2015b). The limited number of Vietnamese crocodile lizards occurring in Europe could also be due to the extreme small population size in the country (van Schingen et al. 2016a). Either way, given the rarity of Vietnamese representatives in captivity in Europe, there is a low probability for accidental crosses between the taxonomic and conservation units in captivity so far. Nonetheless, as only maternally inherited mitochondrial markers were employed in this study, it is not possible to determine putative hybrid individuals from the available samples. It is recommended that future studies employ both mitochondrial and nuclear markers, e.g., microsatellites, to provide more definite answers.

As discussed by van Schingen et al. (2016a), the geographic barrier separating the Vietnamese and Chinese subspecies is not yet known. At the time of writing, we assume that it coincides with the border between China and Vietnam; however, it cannot be ruled out that the Vietnamese subspecies also ranges into southern China. It is also likely that China harbors more than one form of crocodile lizards, which can only be resolved with more comprehensive morphological and molecular analyses of inter-population variation. In this respect, the herein uncovered new clade is of high interest. There is a high probability that it originates from China as a whole mitochondrial genome of this form was sequenced by Chinese researchers (Li et al., 2012).

A single living individual of this clade (sample Si 85), initially rescued by Reherp Foundation, is currently kept at the Cologne Zoo (Fig. 5). For the time being, we keep the living individual separately and treat it as an independent conservation unit within *Shinisaurus crocodilurus*. Different subclades known from China necessitate further integrative taxonomic analysis/revision of the nominate form using additional morphological, molecular, and ecological evidence.

Concerning the Chinese populations, Fellowes et al. (2002) stated that a multi-disciplinary conservation program for *Shinisaurus crocodilurus* is needed to ensure the survival of this unique species and that a study focusing on the phylogenetic relationships, distribution and status of the other recently discovered populations is required in order to design a comprehensive conservation action plan for this endangered lizard. If restocking/supplementing is needed, cooperation from zoos that breed the species in captivity should be sought. For example, *S. c. vietnamensis* is successfully bred at the Cologne Zoo, Germany, and offspring is available to be placed at other institutions interested in participating and extending the conservation breeding network in Europe as a measure for future repatriation. Conservation breeding is not only important due to habitat destruction and over-collection for pet trade but also because of disease outbreaks that can cause a high mortality rate as recently reported by Jiang et al. (2019). Given the rarity of the range restricted crocodile lizard in the wild, its specific lifestyle and habitat

requirements, as well as severe anthropogenic threats, it is an ideal flagship species for regional zoos and conservation institutions to establish well developed breeding programs based on individuals with known origin or genetically identified in advance, as shown in this study, to safeguard its future survival. Thereby, our research again underscores the IUCN's One Plan Approach, which aims to develop integrative strategies to combine in situ and ex situ measures with support from international experts for the purpose of species conservation.

Acknowledgements

We cordially thank the donators of tissue and swab samples. We also are grateful to Meike Kondermann for assistance with laboratory work. This research was funded by Vietnam's Ministry of Science and Technology (Program 562) and Cologne Zoo. Cologne Zoo is partner of the World Association of Zoos and Aquariums (WAZA): Conservation Projects 07011, 07012 (Herpetodiversity Research, Amphibian and Reptilian Breeding and Rescue Stations).

Zusammenfassung

Die stark bedrohte Krokodilschwanzechse (*Shinisaurus crocodilurus*) ist eine in Europa sowohl in Zoos als auch in Privathand häufig gehaltene Reptilienart. Ging man früher davon aus, dass es sich um ein einziges Taxon handelt, so haben aktuelle Studien gezeigt, dass sich die Populationen in China und Vietnam morphologisch, ökologisch und genetisch voneinander unterscheiden und demnach als unterschiedliche Einheiten betrachtet und entsprechend in separaten Erhaltungszuchtprogrammen gehalten werden sollten, um Hybridisierung in Menschenhand zu vermeiden. Die vietnamesische Form wird seither als eigene Unterart, *S. crocodilurus vietnamensis*, von den chinesischen Populationen (*S. c. crocodilurus*) abgegrenzt. Eine eindeutige Zuordnung zu einer der Unterarten ist bislang ohne Fundortinformationen, z. B. bei Tieren aus Beschlagnahmungen, nicht zufriedenstellend möglich, da die morphologischen Unterschiede zwischen den beiden Formen zu gering sind. In dieser Studie führen wir ein genetisches Screening anhand mitochondrialer DNA-Sequenzen von in Zoos und Privathand in Europa gehaltenen Krokodilschwanzechsen durch. Unsere auf phylogenetischen und Netzwerkanalysen basierenden Ergebnisse deuten darauf hin, dass es insgesamt vier verschiedene mitochondriale Kladen gibt, und zwar eine aus Vietnam und drei aus China. Der Großteil der von uns getesteten Tiere lässt sich einer der chinesischen Kladen zuordnen, einige wenige Individuen entstammen der vietnamesischen Klade. Die geringere Anzahl der aus Vietnam stammenden Tiere ist wahrscheinlich darauf zurückzuführen, dass Individuen aus Vietnam erst vor Kurzem über den Tierhandel nach Europa gelangt sind, während Tiere aus China bereits seit mehreren Jahrzehnten gehalten werden. Anhand unserer Analysen konnten wir weiterhin eine neue mitochondriale Klade der Krokodilschwanzechse identifizieren, die vermutlich aus China stammt. Es besteht Bedarf an weiterer Forschung, um die genaue Abgrenzung der verschiedenen Linien aus China zu untersuchen und zukünftige Schutzmaßnahmen effektiv durchführen zu können. Unsere Studie zeigt, dass mitochondriale Marker für die genetische Zuordnung von Krokodilschwanzechsen zu den verschiedenen Schutzeinheiten geeignet sind. Um allerdings die Reinerbigkeit gehaltener Tiere zu ermitteln und potenzielle Hybridisierungen auszuschließen, sollten weitere nukleare Marker, beispielsweise Mikrosatelliten, herangezogen werden.

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13(2) [General Section]: 1–13 (e183).

First record of the Cat Ba Tiger Gecko, *Goniurosaurus catbaensis*, from Ha Long Bay, Quang Ninh Province, Vietnam: microhabitat selection, potential distribution, and evidence of threats

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***Abstract.*—The Cat Ba Tiger Gecko (*Goniurosaurus catbaensis*) was described from Cat Ba Island, Hai Phong, northern Vietnam in 2008, while a presumed congener was recently spotted from another offshore island in the Ha Long Bay. During the field surveys reported here, new *Goniurosaurus* occurrences were discovered for the first time on small offshore islands in the Ha Long Bay, Quang Ninh Province. These were identified and confirmed as *G. catbaensis* based on morphological and molecular data. However, these newly found populations are very small and exposed to increasing anthropogenic pressures. Since knowledge about the species ecology remains poor, the first microhabitat characterization for *G. catbaensis* is provided herein, which is essential for conservation of the species as well as its natural habitats. Sex- and age-related differences in selection of perch height are herein presented. In addition, we present evidence for various anthropogenic threats such as regular trade in living tiger geckos (including *G. catbaensis*) on local markets in Hai Phong and Ho Chi Minh cities, Vietnam. These findings highlight the need for more stringent conservation measures to reduce human impacts on the extremely small, insular populations of the Cat Ba Tiger Gecko.**

Key words. Anthropogenic pressure, conservation, ecology, offshore islands, phylogram, trade

Citation: Ngo HN, Le TQ, Pham ML, Nguyen TQ, Le MD, van Schingen M, Ziegler T. 2019. First record of the Cat Ba Tiger Gecko, *Goniurosaurus catbaensis*, from Ha Long Bay, Quang Ninh Province, Vietnam: microhabitat selection, potential distribution, and evidence of threats. *Amphibian & Reptile Conservation* 13(2) [General Section]: 1–13 (e183).

Submitted: 18 July 2017; **Accepted:** 27 February 2019; **Published:** 2 September 2019

Introduction

The genus *Goniurosaurus* currently comprises 19 species with a disjunct distribution in southern East Asia. Most *Goniurosaurus* species are endemic with restricted distribution ranges (Chen et al. 2014; Grismer et al. 1994, 1999; Honda and Ota 2017; Seufer et al. 2005; Yang and Chan 2015; Zhou et al. 2018; Ziegler et al. 2008). Habitat degradation and overharvesting for the pet trade were identified as major threats to wild populations of tiger geckos (Yang and Chan 2015). At present, five species of *Goniurosaurus* are known from Vietnam, namely *G. araneus*, *G. catbaensis*, *G. huuliensis*, *G. lichtenfelderi*, and *G. luii* (Nguyen et al. 2009). Among these species, the insular Cat Ba Tiger Gecko (*Goniurosaurus catbaensis*) was discovered on Cat Ba Island in Cat Hai District, Hai Phong City, northeastern Vietnam, where it was assumed to be endemic (Ziegler et al. 2008). Preliminary population assessments of *G. catbaensis* revealed that its effective population size, defined as number of mature individuals, is much smaller than the suggested threshold values for minimal viable populations to maintain a stable population in the long term (Ngo et al. 2016; Nguyen et al. 2016, 2018; Reed et al. 2003; Traill et al. 2007).

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Fig. 1. New population. **(A)** Habitat of *Goniurosaurus catbaensis* on one offshore island in Ha Long Bay, Quang Ninh Province; **(B)** Microhabitat of *G. catbaensis* in Ha Long Bay; **(C)** Adult male; and **(D)** Adult female from Ha Long Bay. *Photos: H.N. Ngo.*

Even in undisturbed habitats, *G. catbaensis* occurs at low densities (Ngo et al. 2016; Nguyen et al. 2016, 2018).

The insular Cat Ba Tiger Gecko was found to be vulnerable to anthropogenic disturbances, and of high demand in pet markets as well as on Internet platforms (Ngo et al. 2016; Nguyen et al. 2018). In addition to poaching, habitat destruction for touristic purposes has dramatically increased the pressure on the wild *G. catbaensis* population. Consequently, the need for protection of the Cat Ba Tiger Gecko has received growing attention. Based on the first international population and trade investigations, this species has recently been listed in the IUCN Red List of Threatened Species as "Endangered" (Nguyen et al. 2016). The wild population is probably in peril due to its restricted distribution range, rising anthropogenic threats, and the lack of appropriate conservation measures. For the latter, detailed information on habitat requirements and the exact distribution of this species is essential, but such data are currently lacking. Ngo et al. (2016) recently suggested the potential occurrence of *G. catbaensis* on at least one more offshore island in Ha Long Bay.

To confirm this possibility, we investigated other small offshore islands in Ha Long Bay, Quang Ninh Province to locate populations of *G. catbaensis*, and predicted the overall availability of suitable habitats for the species in northeast Vietnam. In addition, the present study aimed to provide the first data on microhabitat selection of *G. catbaensis*. We assumed that differences in habitat use would occur between age classes and sexes, as they have been observed in other lizards (Snyder et al. 2010; van Schingen et al. 2015).

Materials and Methods

Study areas: Study sites were selected based on our previous surveys on Cat Ba Island, Hai Phong City, and on photo documentation which gave evidence for the possible occurrence of *Goniurosaurus* on a small island in Ha Long Bay, Quang Ninh Province (Ngo et al. 2016). Cat Ba Island and adjacent islands comprise isolated limestone karst formations, which provide diverse habitats for a unique flora and fauna (Clements et al. 2006). Cat Ba Archipelago was recognized as the "Cat Ba Archipelago Biosphere Reserve" (CBBR) by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 2004 due to its significant ecosystem and biodiversity values (CBBR Authority 2013). Ha Long Bay was also twice recognized (in 1994 and 2000) by UNESCO as a World Heritage Site for the outstanding universal value of its landscape, geology, and geomorphology (The Management Department of Ha Long Bay 2014). Both areas are among the most popular tourist destinations in Vietnam, and face challenges from rapid tourism development.

Field surveys: Field surveys were conducted on Cat Ba Island between June and August 2014, May 2015, and during a short time in June 2016, which fell in the non-hibernation season of *Goniurosaurus* (Grismer et

al. 1999; Ngo et al. 2016). Furthermore, six offshore islands in Ha Long Bay, situated in close proximity to Cat Ba Archipelago, were surveyed in July 2016. Night excursions were conducted between 7:30 and 11:30 PM, when the lizards were found to be active (Ngo et al. 2016; Ziegler et al. 2008). To measure morphological characters, the animals were captured by hand and subsequently released at the same spot after checking and taking measurements.

Ecological analyses: Microhabitat data were recorded for each sighted *G. catbaensis*, including substrate types (classified as cliff, rock, branch, sand, or forest floor), perch height (vertical distance between captured animal and ground, in cm), percentage of vegetation or cave coverage, position (resting outside or inside cave), substrate surface condition (dry or wet), and activity (resting, feeding, or foraging). Air temperature and relative humidity were measured with a digital thermo-hygrometer (TFA Dostmann/Wertheim Kat. Nr. 30.5015), and substrate temperature and body surface temperature of animals were measured with an infrared thermometer (Measupro IRT20).

To identify intraspecific differences in microhabitat selection by *G. catbaensis*, individuals were classified into different age classes according to their snout-vent lengths (SVL): SVL < 85 mm = juvenile, SVL ≥ 85 mm and < 105 mm = sub-adult, and SVL ≥ 105 mm = adult (Ngo et al. 2016). Adults were differentiated between the sexes, as well as between gravid and non-gravid individuals. Sex of specimens was determined by the presence of the large swollen hemipenal bulges in males, while non-swollen in females.

A *t*-test, with $\alpha = 0.05$, was performed to determine differences in microhabitat parameters between age classes and sexes. Statistical analyses were performed with the program PAST, Version 2.17c (Hammer et al. 2001).

Morphological analyses: Morphometric measurements of captured individuals were taken with a digital caliper to the nearest 0.1 mm. In addition, two voucher specimens of the newly discovered populations in Ha Long Bay were collected, euthanized with ethylacetate, preserved in 70% ethanol, and deposited in the collections of the Vietnam National Museum of Nature (VNMN), Hanoi, Vietnam (VNMN 05423, VNMN 05424). Morphological characters were taken according to Ngo et al. (2016), Orlov et al. (2008), Yang and Chan (2015), and Ziegler et al. (2008).

Abbreviations of measurements are as follows: snout vent length (SVL) from tip of snout to vent; tail length (TaL) from vent to tip of tail; distance between axilla and groin (AG) from posterior edge of forelimb insertion to anterior edge of hind limb insertion; forelimb length (FoL) from axilla to tip of longest finger; hindlimb length (HiL) from groin to tip of longest finger; snout to eye distance (SE) from tip of snout to anterior-most point of eye; eye to ear distance (EE) from posterior margin of eye to posterior margin of ear; orbital diameter (OD) greatest diameter of orbit; ear diameter (ED) longest dimension of ear; internarial distance (IND) as distance between nares; anterior eye distance (AED) as distance between anterior corners of eyelids; posterior eye distance (PED) as distance between posterior corners of eyelids; maximum head width (HW); maximum head height (HH); head length (HL) from tip of snout to posterior edge of occiput; pileus length (PL) from tip of snout to posterior scale of the head; and jaw length (JL).

Abbreviations of scalation are as follows: supralabials (SPL); infralabials (IFL); nasal scales surrounding nare (N); internasals (IN); gular scales bordering the internasals (PostIN); postmentals (PM); gular scales bordering the postmentals (GP); eyelid fringe scales or ciliaria (CIL); granular scales surrounding dorsal tubercles (GST); dorsal tubercle rows at midbody (DTR); paravertebral tubercles between limb insertions (TL); scales around midbody (MB); subdigital lamellae under the first finger (LF1) and the fourth finger (LF4); subdigital lamellae under the first toe (LT1) and the fourth toe (LT4); precloacal pores (PP); and postcloacal tubercles (PAT).

Molecular analyses: To confirm the taxonomic status of the newly collected *Goniurosaurus* from Ha Long Bay, Quang Ninh Province, a fragment of the mitochondrial 16S ribosomal gene was amplified, using the primer pair 16Sar and 16Sbr (Palumbi et al. 1991), for three samples (VNMN 05424 plus two small tissue samples from two released individuals, field numbers G8 and G12). Tissue samples were taken from the tail tips, which were disinfected before immediate release of the animals at the site of capture. DNA was extracted from tissue samples using the DNeasy blood and tissue kit, Qiagen (Redwood City, CA). The extracted DNA from the fresh tissue samples were amplified by PCR, with the PCR volume (21µl) consisting of 10 µl of mastermix (Fermentas, Canada), 5 µl of water, 2 µl of each primer at 10 pmol/µl, and 2 µl of DNA. The PCR conditions were: 95 °C for five minutes to activate the taq; with 40 cycles at 95 °C for 30s, 50 °C for 45s, 72 °C for 60s; and the final extension at 72 °C for six minutes (Ngo et al. 2016).

PCR products were subjected to electrophoresis through a 1% agarose gel (UltraPure™, Invitrogen). Gels were stained for 10 minutes in 1x TBE buffer at 2 pg/ml of ethidium-bromide, and visualized under UV light. Successful amplifications were purified to eliminate PCR components using GeneJET™ PCR Purifcation Kit (Fermentas, Canada). Purified PCR products were sent to 1st Base (Selangor, Malaysia) for sequencing. Sequences were edited using the program Geneious v.7.1.8 (Kearse et al. 2012). After sequences were aligned using Clustal X v2 (Thompson et al. 1997), data were analyzed by Bayesian inference as implemented in MrBayes v3.2 (Ronquist et al. 2012). Settings for these analyses followed Le et al. (2006), except that the number of generations in the Bayesian analysis was increased to 1×10^7. The optimal model for nucleotide evolution was set to GTR+I+G as selected by Modeltest v3.7 (Posada and Crandall 1998). The cutoff point for the burn-in function was set to 13 in the Bayesian analysis, as -lnL scores reached stationarity after 13,000 generations in both runs. Nodal support was evaluated using posterior probability in MrBayes v3.2. Uncorrected pairwise divergences were calculated in PAUP*4.0b10 (Swofford 2001).

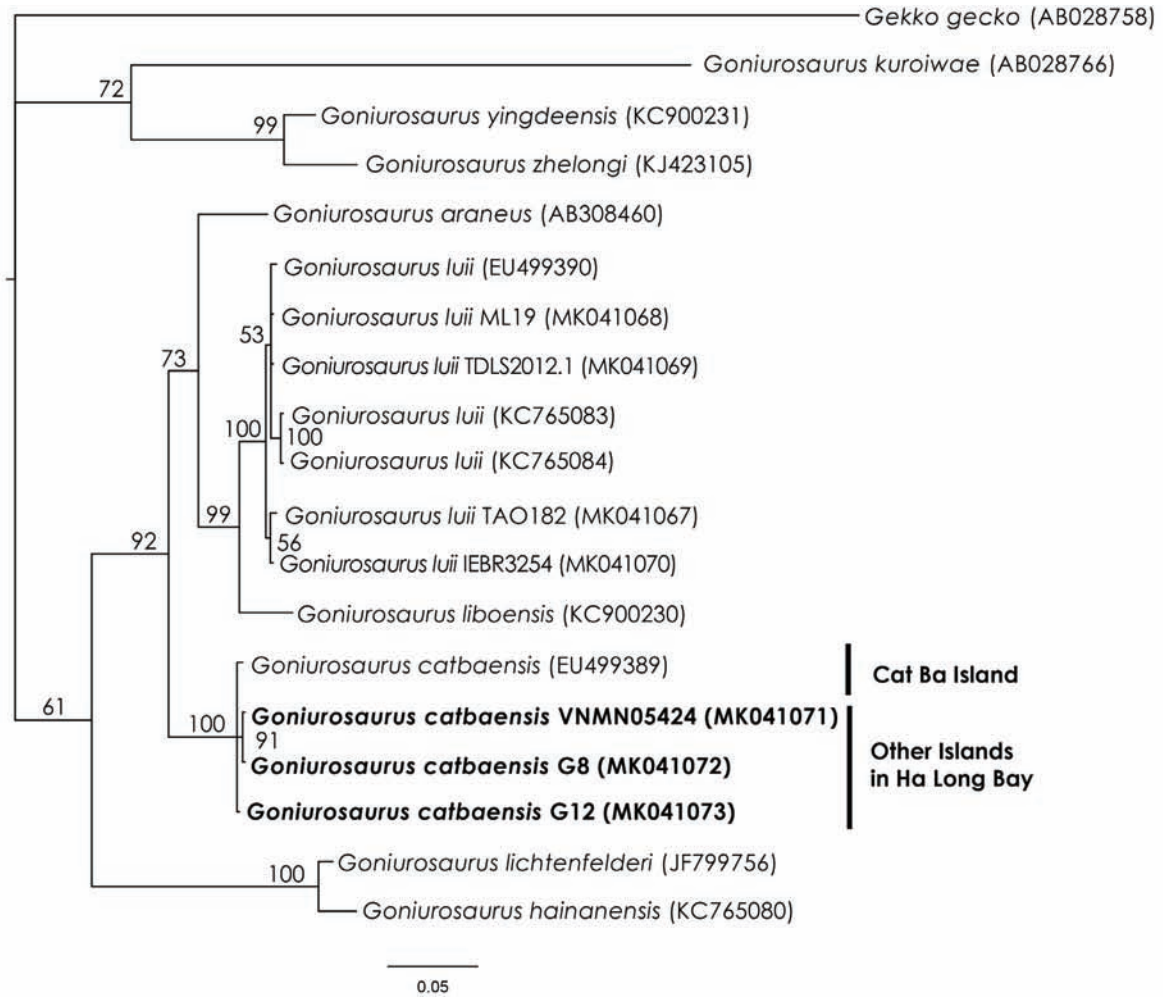

Fig. 2. Phylogram of *Goniurosaurus* based on the Bayesian analysis of a 16S ribosomal fragment. Numbers next to nodes are Bayesian posterior probabilities. Voucher numbers of new samples and GenBank accession numbers are placed after species names and in parentheses, respectively.

Species distribution models (SDMs): Based on occurrence records and a set of 19 environmental factors, the current overall availability of suitable habitats for *G. catbaensis* were predicted using the program Maxent Version 3.3.3.e (Beaumont et al. 2005; Phillips et al. 2006). Only the most distant occurrences of each site were included in the analyses to minimize effects of spatial autocorrelation and to ensure the independence of the records (Jennings and Veron 2011; Jennings et al. 2013). As a result, 11 records were filtered from a total of 60 localities of *G. catbaensis* on Cat Ba Island and Ha Long Bay. Nineteen bioclimatic variables that were obtained from the WorldClim global climate database (http://www.worldclim.org, accessed September 2016; Hijmans et al. 2005; Table 1) were used as environmental predictors.

Threat records: To get a first impression of trade in *Goniurosaurus* species in Vietnam, local pet markets were visited in Hai Phong and Ho Chi Minh cities, the two most important trade centers in the country, and different Internet platforms were investigated. Two local dealers from Ho Chi Minh City offering *Goniurosaurus* online were interviewed in September 2016, in order to trace the source of the traded *Goniurosaurus* species in Vietnam. Additionally, five fishermen from the Ha Long Bay were interviewed to identify caves used by tourism companies for night parties, and determine the general attitude and use of the species in Ha Long Bay. Those sites located within the World Heritage Site were subsequently surveyed in July 2016 to evaluate potential threats from tourism activities. The names of interviewees are kept anonymous to ensure data privacy rights and Internet links are not disclosed to prevent misuse. Accurate locality data, cave names, and prices are also not presented to prevent targeted poaching for the wildlife trade.

Results

New records of *Goniurosaurus catbaensis*: During the present study, new *Goniurosaurus* occurrences were discovered on four small offshore islands, including two tourism caves in Ha Long Bay, Quang Ninh Province. The distances between these islands ranged from 1.4 km to 13 km, while the shortest distance between Cat Ba Island and one surveyed island in Ha Long Bay was 1.2 km. A total of 14 individuals (eight males, four females, one juvenile, and one unsexed individual which was only photographed) were recorded on these islands, which

Table 1. Bioclimatic variables from environmental data (Source: http://www.worldclim.org, accessed September 2016).

No.	Bioclimatic variables from the WorldClim dataset
1	BIO1 = “Annual Mean Temperature”
2	BIO2 = “Mean Diurnal Range" (Mean of monthly [max temp - min temp])
3	BIO3 = "Isothermality" (P2/P7) (*100)
4	BIO4 = "Temperature Seasonality" (standard deviation *100)
5	BIO5 = "Max Temperature of Warmest Month"
6	BIO6 = "Min Temperature of Coldest Month"
7	BIO7 = "Temperature Annual Range" (P5–P6**)**
8	BIO8 = "Mean Temperature of Wettest Quarter"
9	BIO9 = "Mean Temperature of Driest Quarter"
10	BIO10 = "Mean Temperature of Warmest Quarter"
11	BIO11 = "Mean Temperature of Coldest Quarter"
12	BIO12 = "Annual Precipitation (year)"
13	BIO13 = "Precipitation of Wettest Month"
14	BIO14 = "Precipitation of Driest Month"
15	BIO15 = "Precipitation Seasonality" (Coefficient of Variation)
16	BIO16 = "Precipitation of Wettest Quarter"
17	BIO17 = "Precipitation of Driest Quarter"
18	BIO18 = "Precipitation of Warmest Quarter"
19	BIO19 = "Precipitation of Coldest Quarter"

ranged between 0.34 and 2.94 km^2 in size.

Molecular analysis using Bayesian inference of the obtained matrix containing 613 aligned characters showed that all samples from Cat Ba Island (n = 1) and from the most distant other islands in Ha Long Bay (n = 3) clustered in a single clade with strong statistical support (posterior probability = 100%, Fig. 2). Genetic analyses revealed that sequences of the new records from Ha Long Bay, Quang Ninh Province, were identical to each other and virtually the same (99% to 100%) as that of the holotype of *G. catbaensis* from Cat Ba Island (GenBank accession number: EU499389). The maximum genetic divergence between the samples is approximately 0.3%, whereas the lowest divergence between two species of this genus, i.e., *G. hainanensis* and *G. lichtenfelderi*, is approximately 2.3% (Table 2). These results confirmed the newly recorded *Goniurosaurus* populations in Ha Long Bay are conspecific with *G. catbaensis* from Cat Ba Island (Fig. 2).

In addition, the morphological characters of the newly recorded *G. catbaensis* from Ha Long Bay accorded well with the population from Cat Ba Island, except that three of six individuals from a single site in Ha Long Bay showed a postrostral (internasal) scale. This character is consistently lacking in individuals recorded so far from Cat Ba Island (Ziegler et al. 2008) [Fig. 3A, 3B; Table 3].

Microhabitat selection: A total of 61 sightings took place (13 from smaller islands in the Ha Long Bay, and 48 from Cat Ba Island). *Goniurosaurus catbaensis* was active in the surroundings of large limestone caves covered in part by primary forest vegetation and in the vicinity of primary shrub vegetation on limestone. Mean air temperatures were 28.1 ± 1.7 °C (21.5–31.3 °C, n =

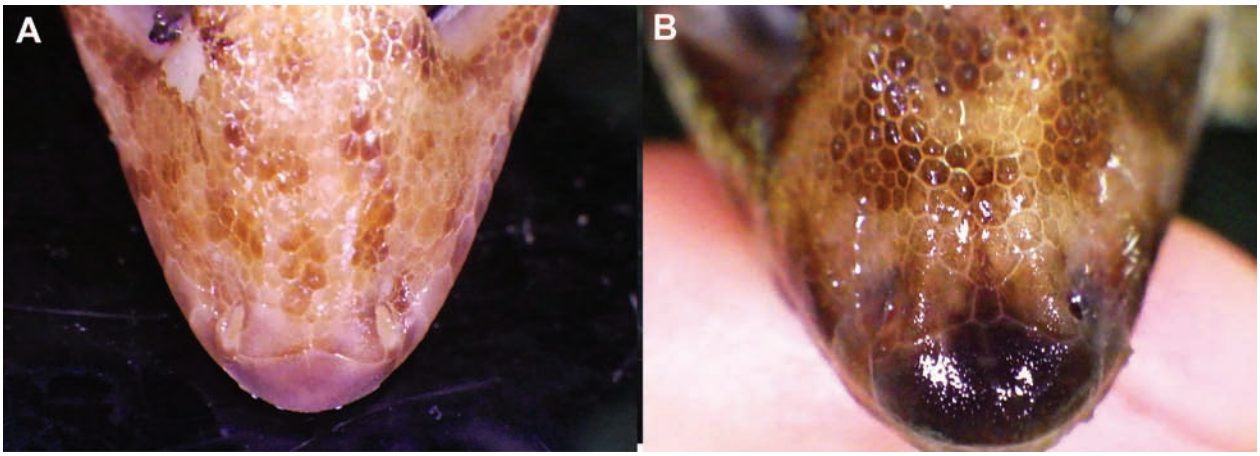

Fig. 3. Absence versus occasional presence of internasal scales of *Goniurosaurus catbaensis* from **(A)** Cat Ba Island and **(B)** Ha Long Bay. *Photos H.N. Ngo.*

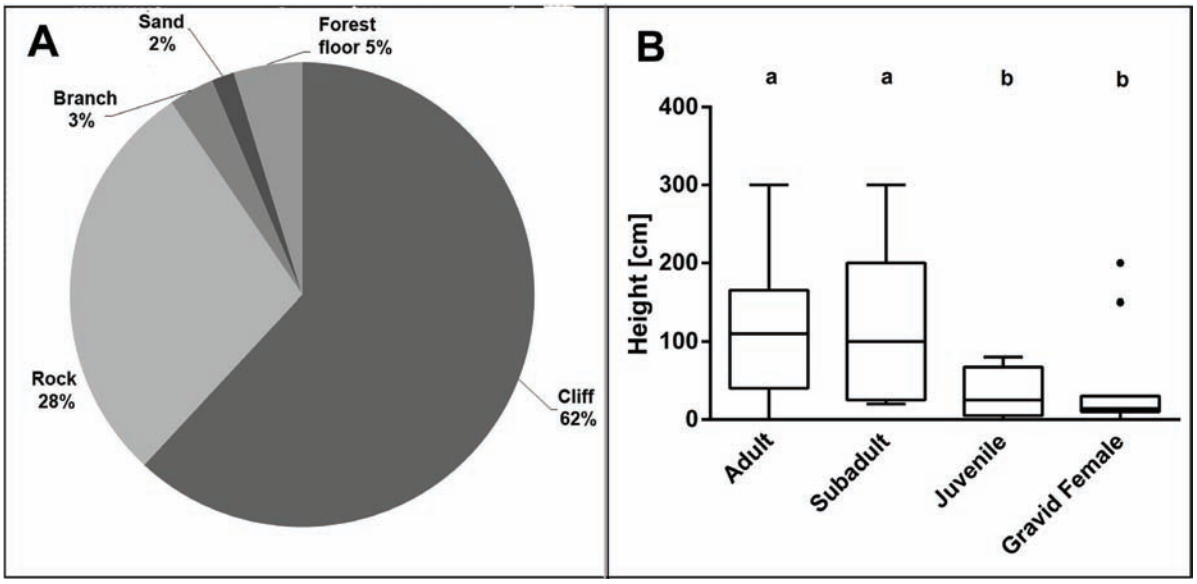

Fig. 4. (A) Substrate selection of *Goniurosaurus catbaensis*. **(B)** Box plots of perch heights of different age classes and sexes.

59) slightly higher than mean substrate temperatures of 26.02 ± 1.5 °C (22.2–28.2 °C, n = 28, Table 4). Recorded relative humidity at microsites ranged between 70–99% (mean 84.9 ± 6.99%, n = 52).

A vast majority of lizards was found on limestone cliffs (62%), followed by rocks (28%), while only a few specimens were found on the forest floor (5%), branches (3%), or sand (2%) [Fig. 4A]. A significantly lower number of lizards was encountered inside compared to outside of limestone caves (26.9% vs. 73.1%, respectively). *Goniurosaurus catbaensis* selected spots with a mean canopy coverage of 95.2 ± 9.6% (n = 63, Table 4). Adult specimens (non-gravid) were found at average heights of 1.15 m (n = 38), while juveniles and gravid females resided at significantly lower heights of 0.28 m (n = 4) and 0.41 m (n = 12), respectively (t = 2.82, df = 48, P < 0.05; t = 2.06, df = 40, P < 0.05, Fig. 4B). A majority (about 77.4%, n = 48) of lizards was resting during the surveys, while only a few individuals (n = 14) were found actively foraging.

Suitable habitats for *G. catbaensis* were predicted to encompass a majority of small islands belonging to Cat Ba Island and Ha Long Bay, and include a wider area on the coastal mainland of Quang Ninh Province, where no surveys have been conducted so far (Fig. 5).

Trade: Trade in living tiger geckos has been frequently recorded by our team in local pet markets from Hai Phong and Ho Chi Minh cities, as well as on Facebook since 2015. Interviews with two local traders in Ho Chi Minh City revealed that they pay for local villagers living within the species' distribution range to collect live tiger geckos during the non-hibernation season, confirming the wild (rather than captive-bred) source of traded animals. The dealers reportedly received individuals of three tiger gecko species, namely *G. huuliensis*, *G. luii*, and *G. catbaensis*, collected in April 2015. Among those, three individuals of *G. huuliensis* (one male and two females) were allegedly collected by a local hunter from Huu Lien Nature Reserve, Lang Son Province. Two local collectors from Cao Bang Province reportedly collected six individuals (three males and three females) of *G. luii* in northern Vietnam and another local hunter collected two couples of *G. catbaensis*. These 13 wild caught tiger geckos were transferred to pet markets in Ho Chi Minh City, southern Vietnam, in April 2015.

Human impacts on the habitat: Tourism activities in the region have dramatically increased in the past, and likely exerted enormous pressure on wild *G. catbaensis* populations. Events organized by tourism companies

Table 2. Uncorrected ("p") distance matrix showing percentage pairwise genetic divergence (16S) between members of *Goniurosaurus.*

Species name	1	2	3	4	5	6	7	8	9
1. *G. araneus*	–								
2. *G. catbaensis*	6.4–6.7	–							
3. *G. hainanensis*	13.7	12.4–12.8	–						
4. *G. kuroiwae*	20.4	19.5–19.8	19.3	–					
5. *G. liboensis*	6.3	6.6-6.8	12.8	21.9	–				
6. *G. lichtenfelderi*	12.9	11.2–11.6	2.3	18.8	13.3	–			
7. *G. luii*	5.6–6.2	6.2–7.1	12.2–12.9	20.0–20.4	3.4–3.8	11.5–13.5	–		
8. *G. yingdeensis*	14.8	13.4–13.5	15.2	18.8	13.0	15.2	13.3–13.5	–	
9. *G. zhelongi*	15.3	14.2–14.4	16.9	21.4	13.4	16.2	14.8–15.4	4.8	–

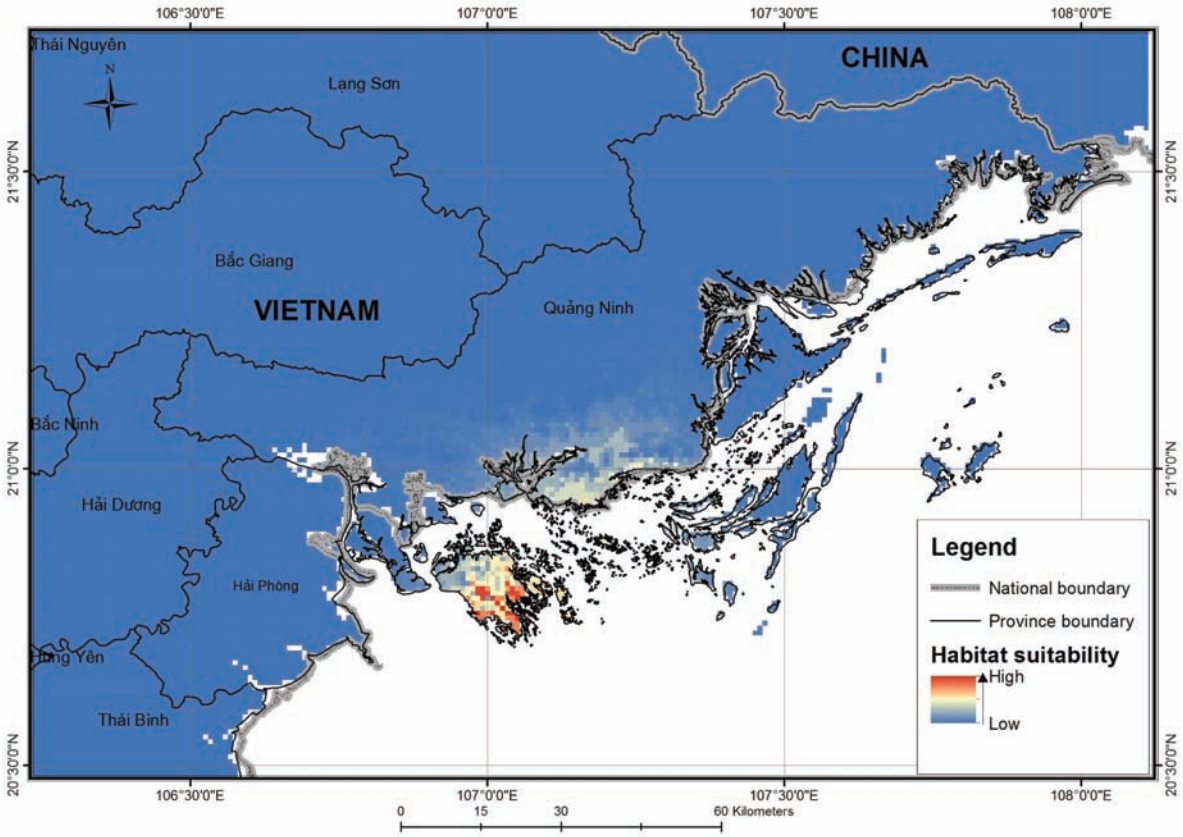

Fig. 5. Predicted habitat suitability for *Goniurosaurus catbaensis* in Vietnam.

regularly took place in at least two caves located within the UNESCO World Heritage Site. According to interviews with fishermen, daily excursions to the caves are scheduled to start at 7:30 PM and end around 11:00 PM. On these occasions, tourists dine in brightly lit caves before returning to their tour boats (Fig. 6B). As a consequence, wildlife is likely to be disturbed by the candle light, noisy sounds, and waste left by the tourists.

Discussion

New population records: Since its discovery in 2008, the Cat Ba Tiger Gecko was thought to be endemic to Cat Ba Island (Ziegler et al. 2008). These new records of *G.* cf. *catbaensis* on further offshore islands in Ha Long Bay confirmed for the first time the occurrence of the species outside its type locality. The newly recorded specimens showed an insignificant genetic divergence from the type series from Cat Ba Island and could be assigned to *G. catbaensis* (Table 2). Accordingly, the newly collected specimens from Ha Long Bay were also almost identical to the type series of *G. catbaensis* in morphology, except for the presence of a single internasal scale (which is absent in the type series from Cat Ba, see Ziegler et al. 2008) in a few individuals from a single site in Ha Long Bay. These findings indicated a slightly broader distribution range of the species than previously expected.

According to Li et al. (2010), the islands of Ha Long Bay and Cat Ba Archipelago were shaped by the erosion of limestone karst formations within the Gulf of Tonkin at the northern east coast of Vietnam after the coastal shelf region became inundated by marine waters about 13,000 years ago. Repeated falls (> 50 m) of the sea level during glaciations periodically connected various islands and the mainland, which allowed exchanges between island and mainland populations, as well as colonization and re-colonization between island and mainland populations (Li et al. 2010; Liang et al. 2018). Thus, past recurrent gene flow is assumed to have occurred between (sub)populations, which helped to maintain a classical island-mainland metapopulation—in accordance with the high genetic similarity between *G. catbaensis* (sub)populations from different islands with identical habitats (Hanski 1991; Harrison and Taylor 1997; Levins 1969). Orlov et al. (2008) confirmed that *G. lichtenfelderi* was found from both continental mainland and islands. On the other hand, Liang et al. (2018) suggested that *G. lichtenfelderi* diverged from *G. hainanensis* of Hainan Island to Vietnam (including both mainland and island populations), which might have occurred during the glacial periods with past dispersal events. The speciation in the diversification process of *Goniurosaurus* was probably promoted by the adaption to different microhabitats. Populations of *G. lichtenfelderi* were found on granite beds of valley streams, while the closely related *G. hainaensis* is found on igneous rocks and *G. catbaensis* occurs in karst forests (Orlov et al. 2008; Liang et al. 2018; Ziegler et al. 2008; Nguyen et al. 2018).

To avoid the misuse of distribution data for targeted harvesting of the species (e.g., Lindenmayer and Scheele

Table 3. Morphological characters of *Goniurosaurus* from Ha Long Bay, Quang Ninh Province, compared with *G. catbaensis* from Cat Ba Island, Hai Phong Province. Measurements are given in mm. Note: (*) n = 6; ([a]) n = 2.

Specimens	Ha Long Bay (current study, n = 13)	Cat Ba Island (current study, n = 48)	Cat Ba Island (Ziegler et al. 2008) [n = 4]
SVL	74.54–122.7 (111.2 ± 11.9)	69.2–130.4 (108.9 ± 12.6)	84.7–111.5 (102.4 ± 14.5)
TaL	10.1–97.6 (69.9 ± 27)	28.9–104.02 (78 ± 17.7)	52.5–101.5 (68.1 ± 27.6)
AG	33.9–60.2 (52.9 ± 6.5)	43.07–58.43 (48.4 ± 5.4)*	-
HL	21.3–33.8 (30.2 ± 2.9)	17.8–34.2 (29.8 ± 3.5)	23.1–30.6 (27.7 ± 4.1)
HW	14.4–24.56 (22.1 ± 2.5)	13.9–28.2 (21.9 ± 2.5)	16.2–21.6 (19.5 ± 2.9)
HH	7.1–14.9 (12.8 ± 1.9)	8.2–16.9 (12.4 ± 1.9)	10.1–14.3 (12.2 ± 2.0)
FoL	32.2–53.8 (50.4 ± 5.6)	29.7–54 (47.8 ± 4.7)	-
HiL	42–67.47 (60.1 ± 6.2)	36.2–65 (57.9 ± 5.99)	-
SE	8.7–13.4 (11.9 ± 1.1)	10.45–13.4 (12.1 ± 1.0)*	9.8–12.6 (11.5 ± 1.6)
EE	9.4–13.2 (10.8 ± 1.5)*	9.78–12.13 (11.1 ± 0.88)*	8.5–12.3 (10.6 ± 2.1)
OD	5.6–8.3 (7.5 ± 0.7)	6.1–8.95 (7.6 ± 1.1)*	-
ED	2.8–5.3 (4.01 ± 0.8)	2.8–4.3 (3.5 ± 0.5)*	-
IND	3.39–4.33 (3.9 ± 0.34)*	2.9–4.2 (3.7 ± 0.5)*	-
IOD	6.78–8.62 (7.98 ± 0.67)*	6.9–8.47 (7.5 ± 0.6)*	-
ION	11.8–15.03 (13.9 ± 1.23)*	11.9–15.1 (13.1 ± 1.3)*	-
JL	12.3–10.8 (18.1 ± 2.1)	15.5–19.5 (17.2 ± 1.4)*	-
PL	27.6–32.5 (29.9 ± 1.7)*	26.6–32.8 (29.2 ± 2.5)*	-
SVL:HL	3.5–3.8 (3.68 ± 0.1)	3.3–4.3 (3.7 ± 0.2)	3.61–3.67 (3.7 ± 0.05)
SVL:AG	1.9–2.3 (2.1 ± 0.1)	2.04–2.45 (2.3 ± 0.14)*	-
HL:HW	1.28–1.48 (1.37 ± 0.05)	1.1–1.5 (1.36 ± 0.09)	1.43–2.11 (1.6 ± 0.4)
HL:HH	2.3–3.01 (2.35 ± 1.6)	1.79–3.3 (2.4 ± 0.4)	2.29–2.43 (2.33 ± 0.07)
SE:EE	0.9–1.2 (1.1 ± 0.1)*	1.07–1.1 (1.09 ± 1.14)*	1.02–1.15 (1.09 ± 0.07)
SPL	9–10 (9.4 ± 0.5)*	8–11 (10.08 ± 1.1)*	8–9 (8.7 ± 0.5)
IFL	8–9 (9.75 ± 0.45)*	8–10 (8.8 ± 0.7)*	6–8 (7.8 ± 0.6)
N	5–6 (5.25 ± 0.5)[a]	6–8 (7 ± 0.47)*	5–6 (5.1 ± 0.4)
IN	0–1 (0.23 ± 0.4)	0	0
PostIN	0–2 (0.4 ± 0.77)	0	0
PM	2–3 (2.5 ± 0.7) [a]	2–3 (2.83 ± 0.41)*	2–3 (2.8 ± 0.5)
GP	7[a]	6–9 (7.8 ± 1.2)*	6–7 (7.22 ± 0.6)
CIL	45–49 (46.75 ± 1.7)[a]	41–56 (47.8 ± 4.4)*	52–55 (54.0 ± 1.1)
MB	104–109 (106.5 ± 3.5)[a]	102–109 (103.8 ± 3.8)*	112–127 (119.2 ± 7.6)
GST	9–12 (10.5 ± 1.3)[a]	9–14 (10.3 ± 1.6)*	8–11 (9.8 ± 1.6)
TL	35–37 (36 ± 1.4)[a]	27–34 (31.5 ± 3.0)*	33–34 (33.7 ± 0.6)
DTR	23[a]	19–25 (22.3 ± 1.97)*	23–25 (24.0 ± 1.2)
LF1	9–12 (10.25 ± 1.3)[a]	9–11 (10 ± 0.7)*	11–12 (11.75 ± 0.5)
LF4	18–19 (18.75 ± 0.5)[a]	19–20 (19.3 ± 0.5)*	18–19 (18.1 ± 0.5)
LT1	9–10 (9.75 ± 0.5)[a]	9–10 (9.91 ± 0.3)*	11–12 (11.4 ± 0.6)
LT4	24[a]	22–24 (23.4 ± 0.8)*	22–24 (23.4 ± 0.7)
PP	20–24 (22.5 ± 1.4)*	21*	5–21 (15.3 ± 2.5)
PAT	1–3 (2.25 ± 0.6)*	2–3 (2.5 ± 0.5)*	2–3 (2.8 ± 0.5)

2017; Stuart et al. 2006; Yang and Chan 2015), detailed locality information of the new records is being withheld. According to the SDMs *G. catbaensis* is predicted to occur on other, similar islands in the Gulf of Tonkin, but is still endemic to Ha Long Bay and Cat Ba Archipelago. According to Orlov et al. (2008) the type locality of *G. lichtenfelderi* is an offshore island in Bai Tu Long Archipelago, which is contiguous with Ha Long Bay

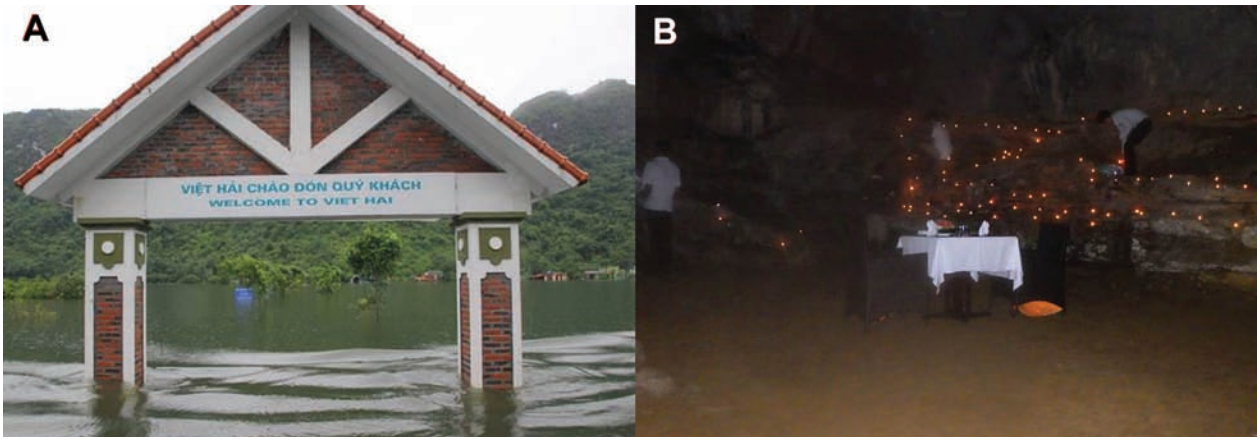

Fig. 6. Potential threats to *Goniurosaurus*. **(A)** Flooding of Viet Hai Commune in August 2015. **(B)** Tourist event in a cave within the UNESCO World Heritage Site on Ha Long Bay. *Photos H.N. Ngo*.

in the Gulf of Tonkin. However, extensive field surveys have failed to record any individual of *G. catbaensis*, occurring in syntopy with *G. lichtenfelderi* (Gawor et al. 2016; Nguyen et al. 2011; Orlov et al. 2008). The habitat of *G. lichtenfelderi* in Bai Tu Long was described as valleys of forest streams on granite rocks within mixed forests of bamboo and broad-leaved trees (Gawor et al. 2016; Nguyen et al. 2009; Nguyen et al. 2011; Orlov et al. 2008; Ziegler et al. 2008), while *G. catbaensis* was found only in limestone karst ecosystems present in Ha Long and Cat Ba archipelagos. Accordingly, our SDMs predicted the potential distribution of *G. catbaensis* to encompass Ha Long Bay and Cat Ba Archipelago, but excluding Bai Tu Long Archipelago (Fig. 5). However, the present SDMs also predicted the mainland area including limestone formations around Ha Long City to be suitable for *G. catbaensis*. Thus, it will be important to search for further occurrences at these predicted sites in order to determine the exact distribution boundaries, and to assess genetic diversity of potentially new populations.

Microhabitat selection: Both sex- and age-related perch selection were found in *G. catbaensis*, namely differences in perch heights. Specifically, juveniles and gravid females occurred at significantly lower heights than subadults and adults. Similar habitat divergences between juveniles and adult individuals have been reported for Crocodile Lizards in Vietnam (van Schingen et al. 2015), and gekkonids in New Caledonia (Snyder et al. 2010).

This study also revealed that the body surface temperature of *G. catbaensis* showed a highly positive correlation with the air temperature (r_s = 0.56; P < 0.05, n = 23) and substrate temperature (r_s = 0.66; P < 0.001, n = 26). Thus, as in other ectotherms, basic physiological functions of *G. catbaensis*, such as locomotion, growth, and reproduction are determined by the environmental temperature. Since tropical lizards are considered to have narrow temperature optima, and only few options for behavioral and physiological compensation, they are assumed to be especially vulnerable to extinction by climate warming (Deutsch et al. 2008; Doody and Moore 2010; Huey et al. 2009; Vié et al. 2009). In particular, body surface temperatures of *G. catbaensis* ranged from between 23.6 and 30.6 °C (mean = 27.2 ± 1.6 °C, n = 26) and were comparably higher than those of *G. kuroiwae* with average skin surface temperatures of 16.6 °C in the humid subtropical Oriental forest (Werner et al. 2005).

Potential threats and recommendations for conservation: Due to the restricted distribution range, low densities, and estimated global population being much lower than suggested threshold values for minimal viable populations, the Cat Ba Tiger Gecko is expected to be especially endangered to unsustainable for harvest (Ngo et al. 2016). Consequently, the species was recently assessed and ranked by the IUCN Red List of Threatened Species as "Endangered" (Nguyen et al. 2016). Other members of the genus *Goniurosaurus* from Vietnam have not been considered for inclusion on the IUCN Red List yet, as data on their population statuses are currently lacking. The findings reported here indicate that not only *G. catbaensis*, but also *G. huuliensis* and *G. luii*, are subject to intensive collection for local trade and provide concrete evidence for the wild source of the respective specimens. It is likely that the reported

Table 4. Environmental parameters characterizing the microhabitat selection of *Goniurosaurus catbaensis.*

Parameter	Number of sightings (n)	Min	Max	Mean ± SD
Canopy cover [%]	63	50	100	95.2 ± 9.6
Height [m]	54	0	3	0.97 ± 0.86
Elevation [m asl]	60	4	132	46.2 ± 32.9
Air Temperature [°C]	59	21.5	31.3	28.1 ± 1.7
Substrate Temperature [°C]	28	22.2	28.2	26.02 ± 1.5
Relative air Humidity [%]	52	70	99	84.9 ± 6.99

cases only reflect a small proportion of illegal harvesting activities. Since over-exploitation of local populations of range-restricted lizard species has been repeatedly found to rapidly cause extinction (e.g., Auliya et al. 2016; Stuart et al. 2006; Yang and Chang 2015), further research on the population status, distribution, ecology, and availability of suitable microhabitat sites is critically needed. The results of such studies may lead to the elevation or determination of the conservation status of other tiger gecko species and provide critical scientific data for future captive breeding programs. To reduce poaching and to control the trade in wild *Goniurosaurus*, we recommend continued monitoring of the scales and patterns of trade in combination with aforementioned population assessments. We also strongly advise against providing exact locality information for new *Goniurosaurus* populations in future publications, as this action might increase poaching activities at respective sites (Lindenmayer and Scheele 2017; Stuart et al. 2006; Yang and Chan 2015).

In addition to the illegal collection of animals, human impacts on habitats have dramatically increased by means of expanding tourism activities (see also Ngo et al. 2016). Tourism events in caves, causing disturbance by candle light, noisy sounds, and waste might result in the extirpation of *G. catbaensis* within these limestone caves. We suggest that tourism companies should hold such events only on their boats to reduce disturbances in the cave habitats of *G. catbaensis*, or at least restrict tourist access to only limited, selected islands.

Following Ngo et al. (2016), the sites in Viet Hai Village on Cat Ba Island had been recommended as a priority conservation zone for species conservation, since *G. catbaensis* was found to be most abundant at those sites. However, during the most recent survey in July 2016, no specimens of *G. catbaensis* were observed in Viet Hai Commune. We assume that an extensive flood in August 2015 might have killed a large amount of the local wildlife, including the Cat Ba Tiger Gecko, at this site. Viet Hai Commune was isolated for a week after torrential rains brought the water level up to the roofs of local houses. Since *G. catbaensis* was found to generally occur at low elevation ranges (4–132 m asl), and Viet Hai is situated only up to 36 m asl (see Fig. 6B), this species is particularly vulnerable to natural catastrophes such as storms, floods, and sea level rises, throughout its distribution range (see Dessler 2016; Saunders et al. 1991). Since local populations are extremely small, they are especially prone to extinction by catastrophic events. The devastating consequences of such natural disasters underline the importance of maintaining numerous independent subpopulations in order to compensate for such events.

In summary, the insular (sub)populations of *G. catbaensis* are threatened by harvest for the pet trade, human activities within its habitats, and natural catastrophes such as increasingly extreme floods and storms in northeastern Vietnam, probably triggered by climate change (The Governmental Committee on Flood and Storm Prevention 2016). Thus, we herewith emphasize the importance of setting aside priority conservation zones for this species, in order to establish a connected and buffered system that allows (sub) populations to recover from catastrophes. We also recommend the establishment of an assurance population, i.e., an *ex situ* conservation breeding program for the species. Although such an effort has been started at the Me Linh Station for Biodiversity (see Ziegler et al. 2016) in Northern Vietnam, more resources need to be allocated to enhance the effort to conserve the species.

Acknowledgements.—For supporting field work and issuing relevant permits, we thank the authorities of the Cat Ba National Park (CBNP), Hai Phong City, and the Management Department of Ha Long Bay (MDHLB), Quang Ninh Province. We are very thankful to L. Barthel (University of Cologne) and K.X. Nguyen (CBNP) for assistance in the field. We are grateful to T. Pagel and C. Landsberg (Cologne Zoo); M. Bonkowski (University of Cologne); C.X. Le, T.H. Tran, T.H. Vu, C.T. Pham, and T.V. Nguyen (IEBR, Hanoi); M.T. Nguyen, L.V. Vu, and T.T. Nguyen (VNMN, Hanoi); and V.Q. Luu (VNUF, Ha Noi) for their support of conservation-based biodiversity research in Vietnam. Thanks to H.T. Ngo for laboratory assistance. Our research was funded by Cologne Zoo, the Mohamed bin Zayed Species Conservation fund (Project: 170515492), the National Foundation for Science and Technology Development (NAFOSTED, Grant No. 106-NN.06-2016.59), the Idea Wild, and Vietnam National Museum of Nature (VNMN). Cologne Zoo is a partner of the World Association of Zoos and Aquariums (WAZA): Conservation Project 07011 (Herpetodiversity Research). Research of Hai Ngoc Ngo in Germany is funded by the German Academic Exchange Service (DAAD).

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Nature Conservation 33: 1–19 (2019)
doi: 10.3897/natureconservation.33.33590
http://natureconservation.pensoft.net

RESEARCH ARTICLE

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A case study on trade in threatened Tiger Geckos (*Goniurosaurus*) in Vietnam including updated information on the abundance of the Endangered *G. catbaensis*

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Academic editor: *Klaus Henle* | Received 1 February 2019 | Accepted 11 March 2019 | Published 1 April 2019

http://zoobank.org/AFB147A3-617F-4B1D-9F62-CDC195C37B48

Citation: Ngo HN, Nguyen TQ, Phan TQ, van Schingen M, Ziegler T (2019) A case study on trade in threatened Tiger Geckos (*Goniurosaurus*) in Vietnam including updated information on the abundance of the Endangered *G. catbaensis*. Nature Conservation 33: 1–19. https://doi.org/10.3897/natureconservation.33.33590

Abstract

Tiger geckos of the genus *Goniurosaurus* are considered as a susceptible reptile group, due to their restricted distribution ranges, specialisation to specific microhabitats and generally low population densities. While still new species have been discovered recently, *Goniurosaurus* species are threatened by extinction through habitat loss and collection for the pet trade. Of the 19 described species, for only eight species, the conservation status has been assessed within the IUCN Red List between 2016 and 2018 and all have been classified in the threat categories VU (Vulnerable), EN (Endangered) and CR (Critically Endangered). *Goniurosaurus* spp. are popular in the international pet market at least since the 1990s and several species experienced local extirpations as a consequence of massive over-collection in the past. However, tiger geckos have not been paid much attention for conservation, amongst others, due to the lack of comprehensive knowledge on their conservation status and biology. This study provides an overview of international trade in *Goniurosaurus* based on available data from 1999 to 2018 in the U.S. as well as data from online surveys

and interviews in Europe and Vietnam, with the main focus on species native to Vietnam. All five tiger gecko species known from Vietnam were found in the local trade as wild captures for the national and international market and / or in the U.S. and Europe for relatively higher prices. We found that entire trade chains are very long (including several transfers and dealers involved) and that keeping and transport happen under poor conditions. We herein provide updated information on the abundance of the Endangered Cat Ba Tiger Gecko, which was recently shown to not only occur at its type locality, Cat Ba Island, Hai Phong City, North Vietnam, but also to inhabit small offshore islands in the Ha Long Bay, Quang Ninh Province. While the wild effective population was found to be relatively stable on four islands in Ha Long Bay, consisting of about 124 and 129 individuals in July 2017 and April 2018, respectively, the abundance of other sub-populations, impacted by anthropogenic pressures were found to be very low (2–10 individuals). Based on our findings, we propose stringent conservation measures to more efficiently protect wild tiger gecko populations, such as the inclusion in the Governmental Decree in Vietnam, the assessment of remaining species in the IUCN Red List of Threatened Species and the inclusion in the Appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Keywords
Pet markets, Vietnam, abundance, anthropogenic pressures, conservation

Introduction

Tiger geckos of the genus *Goniurosaurus* currently comprise 19 species with a disjunct distribution in Southeast Asia and East Asia (Chen et al. 2014; Grismer et al. 1994, 1999; Honda and Ota 2017; Liang et al. 2018; Yang and Chan 2015; Zhou et al. 2018; Ziegler et al. 2008). The genus contains a high level of local endemism and many species have been recorded only from a single locality, mountain range or archipelago of China, Japan and Vietnam. *Goniurosaurus* is also considered as one of the most susceptible reptile groups due to its generally low population densities and restricted distribution areas, which make tiger geckos particularly threatened by extinction through habitat loss and over-harvesting for the pet trade (Ngo et al. 2016b; Yang and Chan 2015).

Tiger geckos have been recorded in the international pet market at least since the 1990s (Rösler 1995; Stuart et al. 2006; Yang and Chan 2015). Some rare species are fetching high prices in relation to other gekkonids (e.g. US$2000 / per individual of *Goniurosaurus luii*), which provides great incentives for poaching and excessive collection (Grismer et al. 1999; Stuart et al. 2006). However, the scale of the international demand for tiger geckos, as well as trade levels and patterns, are unknown due to tiger geckos are not listed in CITES. Thus, we herein present an attempt to outline domestic and international trade activities in *Goniurosaurus* species in order to inform decision-makers and develop conservation strategies.

The insular Cat Ba Tiger Gecko (*Goniurosaurus catbaensis*) was originally discovered on Cat Ba Island in Hai Phong City, north-eastern Vietnam (Ziegler et al. 2008). A preliminary population assessment of *G. catbaensis* revealed that its effective population size at the type locality is extremely small with less than 24 individuals (Ngo et al. 2016b). The species are considered to be vulnerable to anthropogenic disturbances and

ongoing demand has been recorded in pet markets, as well as on internet platforms for many years (Ngo et al. 2016b; Ngo et al. in press). Over-collection for the pet trade has probably led to local extirpation of *G. luii* and *G. araneus* from their respective type localities in the past (Stuart et al. 2006; Yang and Chan 2015). In addition, habitat destruction for touristic purposes may increase the pressure on the wild *G. catbaensis* population (Ngo et al. 2016b; Nguyen et al. 2018b).

Recently, Ngo et al. (in press) confirmed for the first time that *G. catbaensis* occurs outside its type locality, , by also providing a microhabitat characterisation of *G. catbaensis* throughout its distribution range in Cat Ba Ha Long archipelagos. The present study was conducted to further provide a first assessment on the population size of and threats impacting subpopulations of the Cat Ba Tiger Gecko from Ha Long Bay.

Methods

Analysis of trade

To obtain an overview on the availability and evidence for trade in *Goniurosaurus* spp. in Vietnam, we surveyed several pet markets in both southern and northern Vietnam (including Hai Phong City, Quang Ninh Province, Ha Noi City, Ho Chi Minh City and Dong Nai Province) in March 2018, based on public information on the internet. Five local dealers were questioned in order to determine the origin, availability, demand, price and use of traded species. To investigate the reptile market in the European Union (EU) for the availability of *Goniurosaurus* spp., we further screened online markets (online shops, internet platforms and forums, Facebook) and visited the largest reptile fair "Terraristika" in Hamm, Germany in March and June 2018. Names of interviewees were kept anonymous to ensure data privacy rights.

Furthermore, we analysed import volumes of *Goniurosaurus* spp. into the United States (U.S.). Data were obtained from the LEMIS database of the U.S. Fish & Wildlife Service, which included all recorded imports of *Goniurosaurus* spp. into the U.S. from 1999 to 2018. The purpose of trade in *Goniurosaurus* was categorised as (B) "breeding in captivity or artificial propagation", (H) "hunting trophies", (P) "personal", (S) "scientific", (T) "commercial" and (Z) "zoo". The source of specimens was differentiated between wild (W), captive bred (C), captive born (F) and ranched (R), animals following the CITES definition in Res. Conf. 12.3 (Rev. Cop17).

Field survey

Field surveys were conducted in Ha Long Bay in July 2017 and April 2018 during the non-hibernation season of *Goniurosaurus catbaensis* (Grismer et al. 1999; Ngo et al. 2016b). We conducted a total of 24 night excursions between 19:30 h and 05:00 h of the next day, when the lizards were found to be active (Ngo et al. 2016b; Ziegler et al.

Table 1. Study sites in Ha Long Bay, Quang Ninh Province, Vietnam.

Study sites (Transect)	Transect Length (m)	Area of survey sites (m^2)	Elevation a.s.l. (m)	Habitat types
Island 1 (T-1)	380	5 000	4–99	Shrub vegetation on limestone karst
Island 2 (T-2)	300	2 180	5–20	Shrub vegetation on limestone karst
Island 3 (T-3)	200	1 180	10–72	Shrub vegetation on limestone karst
Island 4 (T-4)	410	5 560	14–67	Shrub vegetation on limestone karst
Total	1290	13 920	4–99	Shrub vegetation on limestone karst

2008). Four survey transects (T-1 to T-4) were set up on four offshore islands, with length of 200 to 410 m each. The islands, covering a total area of 13,920 m^2 (Table 1). Thereof, two transects (T-3, T-4) were selected based on previous surveys by Ngo et al. (2016b) and two further sites were surveyed according to recommendations by interviewed staff of the Management Board of Ha Long Bay (T-1, T-2). Study sites were located within shrub vegetation on limestone outcrops at elevations between 4 and 99 m a.s.l (Table 1). Boat surveys were also conducted at night to search for animals on out-surfaces of limestone karsts close to the oceanic surface. Coordinates and elevations of each captured individual were recorded with a GPS Garmin 64. However, GPS data is not presented herein, to prevent the misuse of the data.

Population analysis

To estimate population, a "mark-recapture method" was applied. In case of one-time mark and recapture event at two sites (T1, T3), the "Lincoln-Peterson Index" and, in the case of several recapture events at two remaining sites (T2, T4) (e.g. Caughley 1980; Schlüpmann and Kupfer 2009; Smith and Smith 2009; Nguyen et al. 2018a), the "Schnabel Index" was applied. Therefore, all encountered individuals were captured and individually marked with passive integrated transponder (PIT) tags (ISO FDX-B Glastransponder, 1.4 × 9 mm). The microchip was injected under the skin on the left body side behind the shoulder. All captured and recaptured individuals were identified with a transponder reader and afterwards released immediately at the spot of capture (van Schingen et al. 2014; Smyth and Nebel 2013). Each transect was repeatedly surveyed in intervals of two days. Estimated population sizes only refer to the surveyed sites and do not encompass the entire wild population of the species. Since it is impossible to survey all potentially suitable habitats in the region, density estimates with reference to transect lines were used as relative abundances.

To assess the population structure of *G. catbaensis*, lizards were categorised into three age classes, based on the snout-vent length (juvenile with SVL < 85 mm, sub-adult with 85 mm ≤ SVL < 105 mm and adult with SVL ≥ 105 mm) (Ngo et al. 2016b). We also differentiated between sexes and between gravid and non-gravid females. Sexes could only be determined clearly for adult and sub-adult specimens as males have enlarged swollen cloacal and 16–21 precloacal pores, while those are lack-

ing in females (Ziegler et al. 2008). Furthermore, the time was noted for each encounter to evaluate the activity pattern of the species. To test for differences in population structure between July 2017 and April 2018, as well as between islands and time of the day, a c^2 test with $P \leq 0.05$ was applied. Statistical analyses were performed with the SPSS software, version 16.0 (SPSS Inc., Chicago).

Anthropogenic Impacts

Potential threats to *G. catbaensis* were investigated in Ha Long Bay and Cat Ba Archipelago. Evidence for harvesting of *G. catbaensis* was obtained through interviews with local dealers, market surveys and a literature survey. Other potential anthropogenic impacts, namely "tourist activities" and "habitat degradation" were recorded by our own observations and interviews with local fishermen (Ngo et al. 2016b; Ngo et al. in press). Depending on the frequency and extent of recorded negative impacts, threats to each of the sub-populations were classified as "not recorded", defined as never being recorded, "low" as being rarely observed, "medium" as being recorded several times, or "high" as being recorded frequently or the extent of destruction was evaluated as too high.

Results

Trade

Most, if not all *Goniurosaurus* species were found being sold in the international pet market in Europe and the U.S. during the present study. According to the LEMIS database of the U.S. Fish & Wildlife Service, a total of 16,714 specimens of *Goniurosaurus* spp. have been imported into the U.S. (mean of 835 ± 1082 individuals annually) between 1999 and 2018 (Fig. 1A). The majority of specimens were imported on genus level as *Goniurosaurus* spp. (44.5%). Amongst the others, the most imported species was *G. lichtenfelderii* (43.6%, n = 7281 individuals), followed by *G. hainanensis* (6%), *G. luii* (3.6%), *G. orientalis* (1.3%) and *G. kuroiwae* (1%) (Fig. 1C). The vast majority of imported specimens were traded for commercial purposes (97%), while only 3% were imported for scientific and zoo purposes (Fig. 2B). A number of 11,515 specimens (68.9%) were wild caught and 5,086 animals (30.4%) were imported as bred in captivity (Fig. 2A). Thereby, most *Goniurosaurus* species imported into the U.S. were from Taiwan (40.5%) as a major exporter, followed by Hong Kong (32.2%), China (15.7%), Indonesia (5.2%) and other CITES Parties (6.4%) (Fig. 1B).

In March 2018, market surveys showed that the trade in *Goniurosaurus* in the EU mainly takes place online, but also in reptile fairs. It was recorded that specimens for sale fetch prices between US$35–200 on the international internet markets, e.g. price for two unsexed juveniles or one male of *G. araneus* was recorded for sale for US$150, *G. bawanglingensis* for €175 per pair (US$200), *G. catbaensis* for US$195–230 per

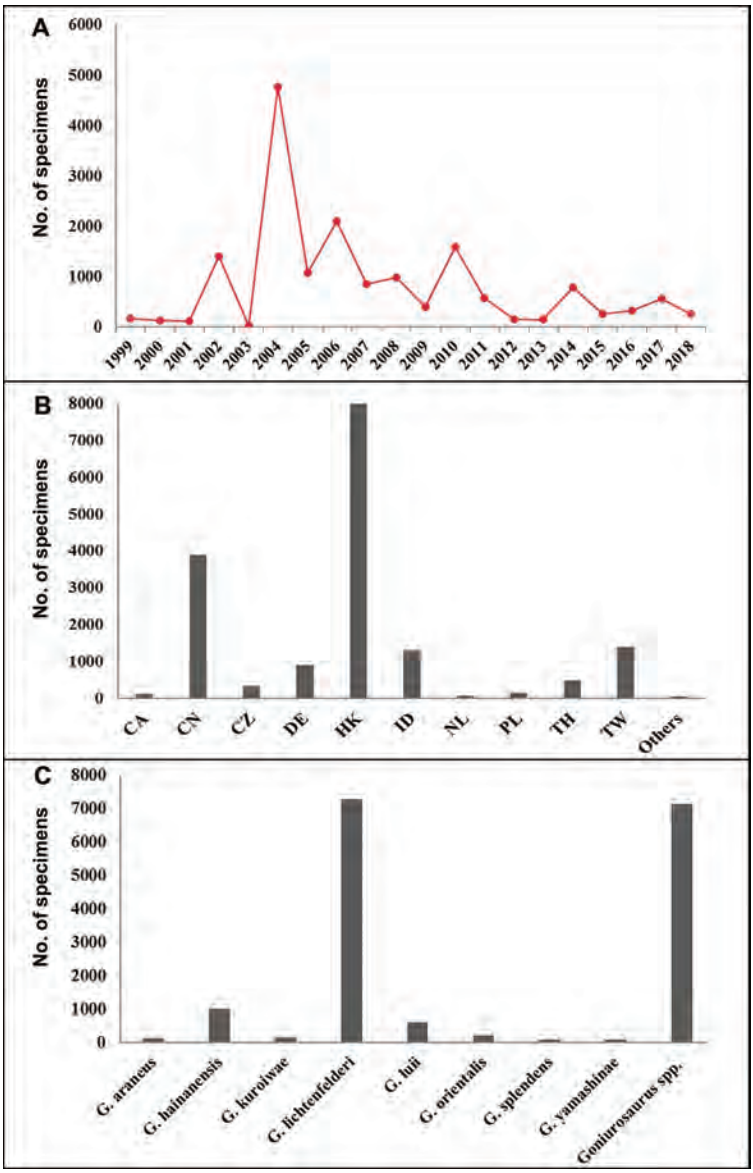

Figure 1. International trade in *Goniurosaurus* species between 1999 to 2018 to or from the U.S. **A** Annual volumes of import into the U.S. **B** number of exported specimens per exporting party (CA = Canada; CN = China; CZ = Czech Republic; DE = Germany; HK = Hong Kong; ID = Indonesia; NL = Netherlands; PL = Poland; TH = Thailand; TW = Taiwan) **C** number of imported specimens per species into US. Source: LEMIS database of the U.S. Fish & Wildlife Service (1999–2018).

specimen or for €300 (US$340) per pair, *G. hainanensis* for US$45–150 per specimen, *G. huuliensis* for US$400 per pair or US$150 for one male, *G. lichtenfelderii* for US$70–100 per specimen and *G. luii* for US$175 per two juveniles or for US$40–60 per pair or one (Table 2).

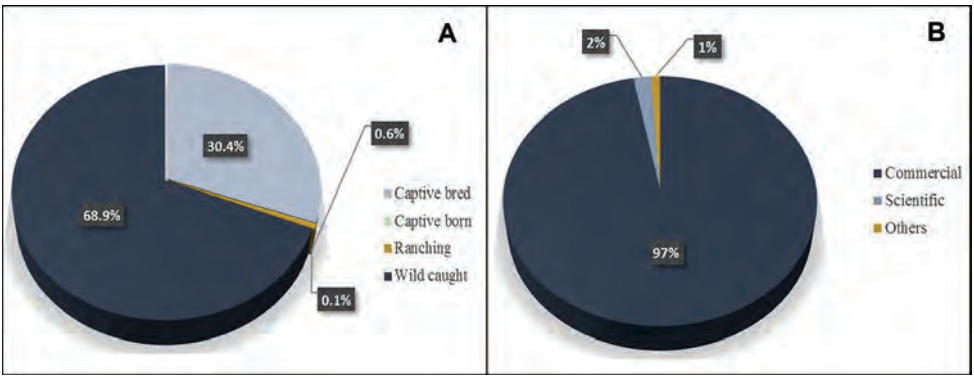

Figure 2. International trade in *Goniurosaurus* species from 1999 to 2018 to or from the U.S. **A** Source of animals **B** purpose of trade. Source: LEMIS database of the U.S. Fish & Wildlife Service (1999–2018).

Table 2. International trade in several *Goniurosaurus* species in Europe based on online investigations and interviews with dealers on reptile fairs (own surveys in 2018 and data from Altherr et al. *in lit.* 2019).

Species	Trade type	Place	Country	Price (USD) per specimen
G. araneus	Offer	Internet Shops	Europe	150–170 (€142)
G. bawanglingensis	Offer	Fair, Internet Shops	Germany, Europe	€67–250 (or €175 per pair)
G. catbaensis	Offer	Fair, Internet Shops	Germany, Europe	195–230 (or €300 per pair)
G. hainanensis	Demand and Offer	Internet Shops, Shops, and Private	Czech Republic, France, Germany	45–150
G. huuliensis	Demand and Offer	Internet Shops and Private	Europe	€160–220 (€400 per pair)
G. lichtenfelderii	Demand and Offer	Internet Shops and Private	Europe	70–100
G. luii	Demand and Offer	Fair, Internet Shops	France, Germany, Europe	40–170

Furthermore, Altherr et al. (*in lit.* 2019) reported a total of 835 specimens of *Goniurosaurus* spp. were observed for sale on 142 different online adverts with prices ranging from €35–300 (US$40–365) between September 2017 and September 2018, whereof, *G. araneus* (n = 56) were offered for sale of €142, *G. bawanglingensis* (n = 102) for €67–250 *G. catbaensis* (n = 29) for €170, *G. hainanensis* (n = 162) for €35–140, *G. huuliensis* (n = 41) for €160–220, *G. lichtenfelderii* (n = 97) and *G. luii* (n=150) for €35–142.

According to interviews with local dealers in Vietnam in March 2018, all five native *Goniurosaurus* species have been frequently recorded in local pet shops from Dong Nai Province and Ho Chi Minh City in northern Vietnam, on Social Media, e.g. Facebook, Zalo online and other internet platforms. These tiger geckos were usually wild-caught by local villagers who live within the species' distribution range and then sold for little money to dealers to be either offered in local pet shops or be sold to other traders. *Goniurosaurus* specimens were found to be locally offered for sale at US$7–25 per animal in pet shops in Vietnam (Table 3). According to dealers in pet shops, *Goniurosaurus* specimens have been regularly exported from Vietnam to Thailand and Indonesia without any permits for higher prices of US$100–150 per individual. Charges consist of at least 20–50 specimens per deal. Afterwards, specimens would allegedly be mainly exported further to Europe and the United States (Table 3).

Table 3. Information on local trade in and international trade pathways for *Goniurosaurus* species in Vietnam based on interviews with local dealers in 2018.

Species	Sources	Offered in pet shops	Country of destination	Minimum quantity per deal for export	Price (USD) per specimen*
G. araneus	China	Dong Nai Province	Thailand, Indonesia, EU and the U.S.	50	(2): 100–150
G. catbaensis	Cat Ba NP, Hai Phong city, Viet Nam	Dong Nai Province, Ho Chi Minh City	Thailand, Indonesia, EU and the U.S	>= 20	(1): 7–25 (2): 150
G. huuliensis	Huu Lien NR, Lang Son Province, Viet Nam	Dong Nai Province, Ho Chi Minh City	Thailand, Indonesia, EU and the U.S.	>= 20	(1): 20–25 (2): 100
G. lichtenfelderii	Yen Tu, Quang Ninh Province, Viet Nam	Dong Nai Province	Thailand, Indonesia, EU and the U.S.	>=20	(1): 20–25 (2): 100
G. luii	Cao Bang Province, Viet Nam	Dong Nai Province, Ho Chi Minh City	Thailand, Indonesia, EU and the U.S.	50	(1): 20–25 (2): 100–150

*(1): for locals; (2): for export

Population status of *Goniurosaurus catbaensis*

We observed a total of 73 animals (54 adults) in July 2017 on four islands and a total of 93 individuals (70 adults) in April 2018 within sites covered by the shrub vegetation on three islands in Ha Long Bay. We did not find any specimens of *Goniurosaurus* on out-surfaces of karst formations by boat surveys. The total population size at the survey areas was estimated at 175 individuals in July 2017 and 180 animals in April 2018. Regarding the effective population size – considering only mature animals – this estimated wild population was relatively similar to about 124 and 129 individuals in July 2017 and April 2018, respectively (Table 4). With respect to each sub-population, the number of estimated animals was highest on island 1 (86 individuals) (Table 4).

The mean density of *G. catbaensis*, along suitable habitat sites in Ha Long Bay, was estimated to be around 6 individuals and 4.5 adults per 100 m transect length during April and 9.1 individuals and 7 adults per 100 m transect length during July. By comparing different sites, the highest abundance was estimated at nearly 12 individuals per 100 m/ transect length at site 1 in April, while we found the lowest density of 2 animals per 100 m/ transect length at site 2 in July (Table 4).

In both investigated months, the sex ratio of adults was relatively balanced with a little higher percentage of females of *G. catbaensis* (57% and 55%, respectively). The percentage of gravid and non-gravid females significantly differed between both months ($c^2 = 21$; df = 2; $P < 0.001$), while 44% of females (n = 14) were gravid in July 2017 (Fig. 3A) and 95% of females (n = 41) were non-gravid in April 2018 (only two females were gravid). With respect to the presence of different age classes, the population structure was relatively similar between two months ($c^2 = 3.04$; df = 2; $P = 0.219$) with most of the observed animals being identified as adults (75% in July 2017 and 80% in April 2018 see Fig. 3B). Frequency histograms of SVL (Min–Max = 53.42–125.28 mm, n = 149) showed a slight shift in the presence of small juveniles between July and April ($c^2 = 19.88$; df = 7; $P = 0.006$). Individuals with the smallest SVL

Table 4. Summary of the population assessment of *Goniurosaurus catbaensis* including observed individuals, densities (D) and population size estimates (N) in Ha Long Bay in July 2017 and April 2018. Ind: individuals; Asterisks indicate missing data (no survey).

	Island 1 (T-1)	Island 2 (T-2)	Island 3 (T-3)	Island 4 (T-4)	Total
July-2017					
Total (observed)	27	7	20	19	73
Mature (obs.)	17	3	16	18	54
D observed [ind/100 m of route]	7.1	2.3	10	4.6	6
D [mature/ 100 m of route]	4.5	1	8	4.4	4.5
N_{mature}	36	4	33	50	**124**
N_{total}	56	16	49	54	**175**
April-2018					
Total (observed)	45	*	15	33	93
Mature (obs.)	28	*	12	30	70
D [ind/100 m of route]	11.8	*	7.5	8.1	9.1
D [mature/100 m of route]	7.3	*	6	7.5	7
N_{mature}	60	*	27	45	**129**
N_{total}	86	*	45	49	**180**

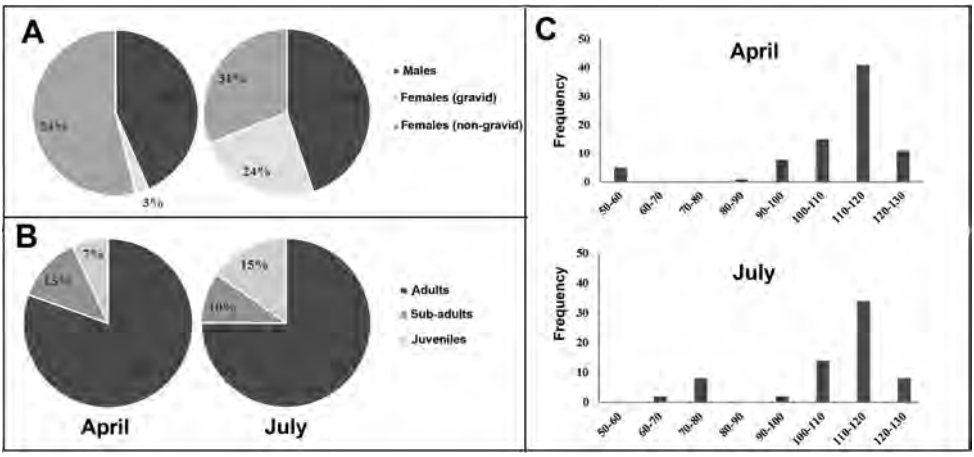

Figure 3. A, B Population structure of *Goniurosaurus catbaensis* from Ha Long Bay (July 2017 and April 2018, respectively) **C** Frequency histogram of snout-vent length of *G. catbaensis* for the months April and July.

(50–60 mm) were only found in April, while juveniles with longer SVL (60–80 mm) were exclusively found in July. The number of adults with SVL ranging between 110–120 mm accounted for the highest percentage in both months (Fig. 3C).

Daily activity

With regard to the daily activity pattern, *G. catbaensis* was found to be active at night from approximately 20:00 h to 04:00 h. The vast majority of lizards (98 animals or

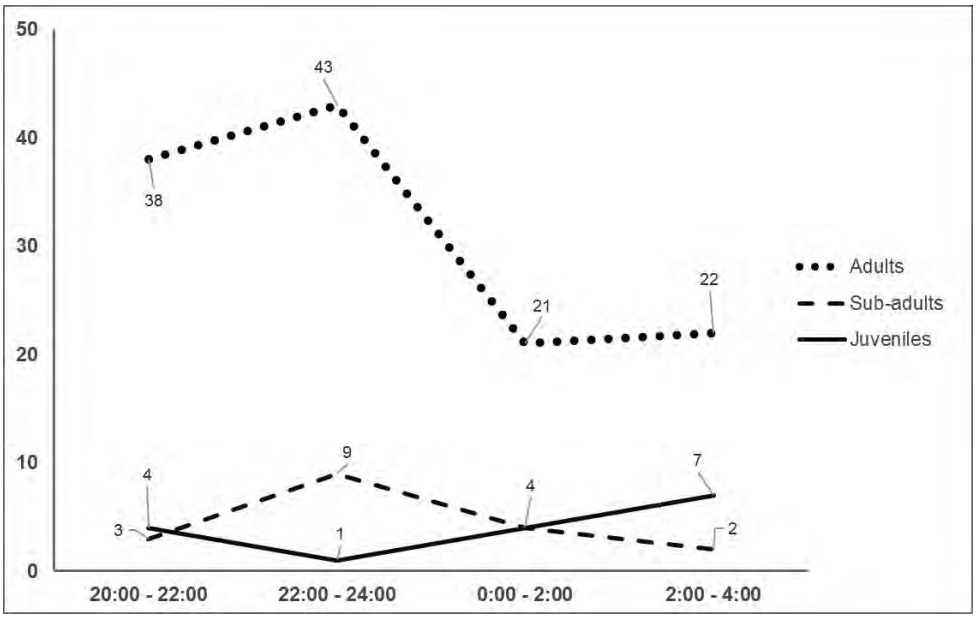

Figure 4. Number of observed *Goniurosaurus catbaensis* specimens at different time intervals in Ha Long Bay.

62% of the recorded lizards) were observed between 22:00 h and 24:00 h. We further found a difference in population structure amongst different times of the day (c^2 = 14.39; df = 6; P = 0.026 < 0.05). Particularly, we observed that more adult specimens were active during the first four hours between 20:00 h and 24:00 h (n = 81 account 65.3% of captured adults), while juveniles were frequently found either before 22:00 h or mainly between 00:00 h and 04:00 h. Most juveniles were found between 02:00 h and 04:00 h (Fig. 4).

Threat evaluation

The number of captured animals and the size of sub-populations of *G. catbaensis* from Ha Long Bay in Quang Ninh Province were compared with other differently affected sub-populations in Cat Ba Archipelago of Hai Phong City. In the Cat Ba National Park and Ha Long Bay's tourist caves, total anthropogenic impacts were considered to be "Medium" and local populations were relatively small (2–10 individuals). A strong flood event in 2015 appeared to have caused the local extirpation of *G. catbaensis* at one site in Viet Hai Commune on Cat Ba Island (Table 5). The mean population size of the species was highest within untouched sites on four islands in Ha Long Bay (Table 5), where total anthropogenic impacts were considered as "Low".

Table 5. Recorded impacts on *Goniurosaurus catbaensis* at known sites. Single impacts were ranked according to severity as "not recorded" defined as never being recorded, "low" as being rarely observed, "medium" as being recorded several times, or "high" as being recorded frequently, or the extent of destruction was evaluated too high.

Study sites	Population size (Mean)	Harvest	Tourist activities	Habitat degradation	Total impacts
Sites near the headquarters of Cat Ba National Park (NP) – Ngo et al. 2016b	5	Medium	High	Medium	Medium
Viet Hai Commune – Cat Ba NP – Ngo et al. 2016b	10	Medium	Medium	Low	Medium
One site in Viet Hai Commune – Cat Ba NP – Ngo et al. in press	0 (in August 2015)	Not recorded	Not recorded	High	High
Ha Long Bay (4 islands) – Current study	51	Not recorded	Not recorded	Low	Low
Ha Long Bay's Caves (4 caves) – Current study	2 (total animals)	Not recorded	High	Medium	Medium

Discussion

Trade

Ngo et al. (in press) provided evidence for the collection of at least three of five native species, namely *G. catbaensis, G. huuliensis* and *G. luii* in Vietnam for the domestic trade. During our recent market surveys in 2018, we further recorded that all five native tiger geckos are being collected for sale and also kept as pets in Vietnam, while some tiger geckos including *G. araneus, G. luii* (Grismer et al. 1999), *G. catbaensis* (Bauer 2009) and *G. lichtenfelderii* (Liu 1993) were reported to be used in traditional medicine in China. Our interviews identified commercial revenues in relation to the domestic and international pet trade as the most common incentive for domestic collection in Vietnam. Janssen and Shepherd (2019) documented that the *Goniurosaurus* is the most popular endemic genus offered for sale on the Nansei Islands in Japan.

All tiger geckos have a restricted distribution ranges and are – like many endemic reptiles – extremely vulnerable to exploitation, so that international trade can quickly become a significant threat for extinction (Janssen and Indenbaum 2019; Janssen and Shepherd 2018; Lyons and Natusch 2013). Accordingly, many endemic species have not been seen any more over a long period of time in recent years and some taxa are considered extinct at their type localities (Lindenmayer and Scheele 2017; Meiri et al. 2018). Evidence from extensive field works in recent years suggests that populations of *G. araneus* in Vietnam and *G. luii* in China have been extirpated at their respective type localities in the past due to over-harvesting for the pet trade (Stuart et al. 2006, Yang and Chan 2015, pers. obs.).

Goniurosaurus spp. have been popular in the international pet market at least since the 1990s (Stuart et al. 2006; Yang and Chan 2015). According to the LEMIS database, a total of 16,714 specimens of *Goniurosaurus* spp. have been imported into the U.S. between 1999 and 2018. The U.S., together with Japan and the European Union, are considered as three important destinations for the transaction of reptile species

including tiger geckos (Auliya et al. 2016; Janssen and Indenbaum 2019; Sollund and Maher 2015). Several individuals of the Huu-Lien Tiger Gecko, endemic to Vietnam, were observed in some reptile shops in Japan (Janssen and Indenbaum 2019). Janssen and Shepherd (2019) found that all *Goniurosaurus* species, endemic to Japan and being nationally protected by law, are offered for sale in the EU and the U.S. in large quantities for prices reaching up to US$714 for single specimens.

We herein observed most *Goniurosaurus* species for sale in the EU online as well as in reptile fairs. Accordingly, Altherr et al. (*in lit.* 2019) spotted a total of 835 specimens of *Goniurosaurus* spp. for sale on different social media platforms between 2017 and 2018. These observations, during random physical as well as internet market surveys, only reflect snapshots of current EU trade in tiger geckos. Actual trade volumes remain unknown – as *Goniurosaurus* spp. are not as yet listed in the CITES Appendices – but are likely to be higher.

Stuart et al. (2006) supported the idea that captive breeding can reduce further demand on wild-caught animals. Our study indeed showed that a large quantity of animals offered for sale was labelled as captive bred in Europe and several reports on successful captive breeding in *Goniurosaurus* species exist (e.g. Einsfelder 2016; Kaverkin 2000). However, wild-caught animals are still being imported into the EU and the U.S. in large quantities. During the recent ten years, there were still about 4,000 imports of wild specimens to U.S. recorded. Endemic tiger geckos of China and Vietnam, which were imported into the U.S. as wild-caught specimens, originated from non-range states, likely without any related permits from countries of origin.

According to interviewees in Vietnam and Europe, captive-bred animals were not yet available in quantities to meet the global demand and wild animals were generally offered for much cheaper prices than captive-bred animals. Furthermore, wild-caught specimens are considered to have a high mortality rate during transport and stockpiling (Sollund and Maher 2015), even though no studies exist that assessed mortality rates between collection and export or between export and country of destination in *Goniurosaurus*. According to local dealers, wild animals are usually kept for a long time clumped together in small boxes and then transported with motorbikes, trains, ships or air freights under poor conditions without supply of food and water. It is likely, that many of the sensitive animals die before reaching their final destination. According to our interviews, local dealers from Vietnam nowadays usually contact local collectors who are living close to the habitats of *Goniurosaurus* species via online wildlife trade groups, for example, on Facebook and pay about US$4 – 5 per individual for collection during the active season of the species. We found *G. araneus* amongst the animals offered in Vietnam (likely imported from China), a species which has probably already been extirpated from its type locality in Vietnam (Ngo et al. 2016b). After collection, specimens are frequently transported via motorbike to Hanoi, northern Vietnam and then transported by train or motorbike to pet shops in Dong Nai and Ho Chi Minh City, southern Vietnam. Some specimens are sold in Vietnam, but the majority of animals are allegedly transported by train or boat to Thailand and Indonesia as intermediary countries without any permits, as they reach higher prices than on the national market. From there, these animals are mainly exported to Europe and the U.S. (Fig. 5). As such, the entire trade chains are rather long as they include numerous stations.

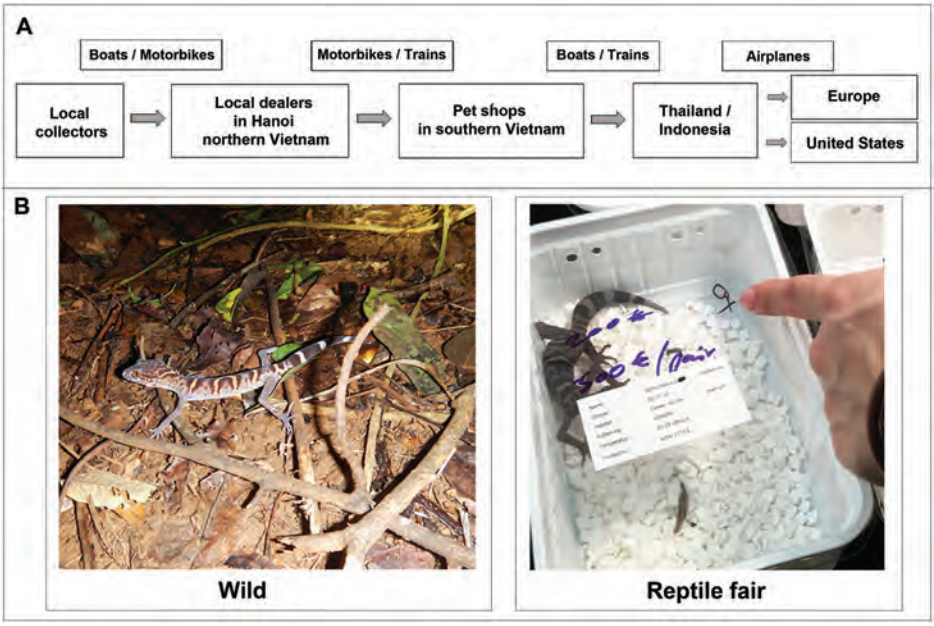

Figure 5. One case example showing the route of local and international trade in *Goniurosaurus catbaensis*.

Population status of *Goniurosaurus catbaensis*

Recent population estimates of the Cat Ba Tiger Gecko at its type locality on Cat Ba Island suggested extremely low population sizes (Ngo et al. 2016b; Nguyen et al. 2018b). Ngo et al. (in press) recently recorded new sub-populations of *G. catbaensis* on further small islands in the adjacent Ha Long Bay. The present data suggest that these sub-populations are stable and actively reproducing. Densities of *G. catbaensis* on islands in Ha Long Bay were, on average, 6 animals / 100 m, some magnitudes higher than on Cat Ba Island (0.08 – 0.17 animals / 100 m, Ngo et al. 2016b). The species is not evenly distributed over the small islands, but only occurs along limited habitat sites. A survey on a population of the closely related *G. luii* in the north of Vietnam revealed a similar low density of 0.08 specimens / 100 m (Ngo et al. 2016b). Extremely high exports and a local extirpation have been reported for this species in the past (Stuart et al. 2006).

Similar research on another enigmatic Vietnamese gecko species, *Cnemaspis psychedelica,* endemic to small islands in the south of Vietnam, revealed a density of 12–19.2 animals / 100 m and an estimated population size of 365–732 individuals (Ngo et al. 2016a). The population of the threatened gecko, *Gonatodes daudini* endemic to St. Vincent and the Grenadines, was estimated at abundances of 87–218 animals / ha in 2010 and has significantly declined to 19 animals / ha) in 2018 (with a total population of 9952 individuals) and over-harvesting being reported as the major threat to the species (Bentz et al. 2011; Shepherd et al. 2019). Overharvesting for the international trade has also been reported as a major threat to *Lygodactylus williamsi*, an electric blue gecko endemic to a small range in Tanzania. Flecks et al. (2012) estimated a density of 353 specimens / ha and

a total population size of 148,684 ± 112,365 adults of this species. As such, these geckos are examples for range restricted, endemic species with small populations that appear to be especially threatened by trade. As a consequence, all three gecko species have been recently included (*C. psychedelica* and *L. williamsi* at CoP17) or proposed for inclusion (*Gonatodes daudini* for CoP18) on CITES Appendix I to regulate international trade in these species.

The recorded abundances in *G. catbaensis* also appear to be extremely low compared to other threatened and endemic geckos. The lowest abundances of *G. catbaensis* were found at touristic sites on Cat Ba Island. Conversely, abundances were relatively stable on the islands in Ha Long Bay, which comprised intact habitats and were not affected by human activities, as they were too small and inaccessible. Harvesting has not been recorded on these small islands so far. Thus, it is likely that the much lower densities of the species on Cat Ba Island are the result of anthropogenic pressures, especially collection for the pet trade.

Conclusions

As *G. catbaensis* was found to occur in very low densities and has extremely restricted habitat ranges (small islands) that are subject to stochastic weather events, the species appears to be extremely vulnerable to harvesting, which appears to be the case for the entire genus.

Endemic species are considered to be especially vulnerable to over-exploitation (Janssen and Indenbaum 2019). The present study confirmed that tiger geckos are not only locally used, but a subject of the international pet market. Compared to the low densities and small populations in the wild, the number of specimens currently found in the international trade appears to be considerably large. As such, it can be assumed that ongoing uncontrolled harvesting might further imperil *Goniurosaurus* spp. in the future. Tiger geckos are neither sufficiently protected by law nor part of conservation programmes, due to the lack of substantial knowledge on the species conservation status and probably due to the general lack of public as well as political interest in biodiversity conservation. To date, exact impacts of trade on the species cannot be identified, as data of legal trade are only recorded for species listed in the CITES Appendices in most countries. However, at the time of writing, the inclusion of all *Goniurosaurus* species from China and Vietnam in CITES Appendix II has been proposed by China, Vietnam and the EU to be decided at the Conference of the parties (CoP18) in May-June 2019, in Sri Lanka.

Recommendations for conservation

Some *Goniurosaurus* taxa are only found within protected areas in Vietnam, for example *G. catbaensis* in Cat Ba National Park and Ha Long Bay World Heritage site, *G. huuliensis* in Huu Lien Nature Reserve, *G. lichtenfelderi* in Bai Tu Long National Park and animals can only be collected with appropriate permits from local authorities. At the time of writing this manuscript, all *Goniurosaurus* species native to Vietnam

have been included in Group IIB of the Governmental Decree 06/2019/ND-CP, which came into force on 10 March 2019 and prohibits the collection of and trade in respective species without permits in Vietnam (The Government of Vietnam 2019). In China, *G. hainanensis* was listed as a species of terrestrial wildlife, which are beneficial or of important economic or scientific value. Furthermore, *G. hainanensis* and *G. bawanglingensis* were listed as wildlife under special protection in Hainan Province. According to Janssen and Shepherd (2019), all *Goniurosaurus* species, endemic to Japan, are currently listed under the law for the Conservation of Endangered Species of Wild Fauna and Flora (LCES), which prohibits – amongst others – the collection and selling of respective species. Eight species of *Goniurosaurus* have been recently included in the IUCN Red List and were assessed in the threat categories VU, EN and CR. In fact, it has been specifically paid more attention regarding conservation activities for *G. catbaensis* after its inclusion in the IUCN Red List as "Endangered" in 2016 (Nguyen et al. 2016). Training programmes have been held by IUCN Vietnam since November 2018 to enhance monitoring skills of researchers in Ha Long Bay and Cat Ba National Park in order to protect wild sub-populations of *G. catbaensis*. Signboards highlighting the conservation needs of *G. catbaensis* have been provided to the scientific department of Ha Long Bay (Fig. 6), which represents a first step towards meaningful conservation of the species.

Figure 6. Signboard handed over to the Ha Long Bay Management Department to point to the threats and conservation need of the Cat Ba tiger gecko in English and Vietnamese languages.

To further improve the conservation status of *Goniurosaurus* species, we recommend the following measures:

- The inclusion of *Goniurosaurus* spp. in the Appendices of CITES in order to better control and monitor trade in wild specimens. The current proposal to include all *Goniurosaurus* species from China and Vietnam in CITES Appendix II should be supported. Likewise, we acknowledge that the Japanese *Goniurosaurus* clade may warrant listing in the CITES Appendices. Therefore, a listing could be considered in the future, as also proposed by Janssen and Shepherd (2019). A listing of the Japanese species in Appendix III, as suggested by Janssen and Shepherd (2019), might be a favourable interim solution.
- As the lack of adequate information on the biology and conservation status of single species can impede conservation measures, a timely assessment of the remaining *Goniurosaurus* species in the IUCN Red List is strongly advised. Therefore, more species specific research is needed to fully understand conservation requirements.
- It is likely that, with more research, further cryptic species or new occurrences of this genus will be discovered in the future. Thus, it is strongly recommended to conceal exact locality data as well as detailed descriptions of localities for such new species or population records in order to prevent targeted collection, as has happened in the past.
- We recommend to improve or establish coordinated ex-situ breeding programmes for all species and to build up a stable captive population in order to a) serve as the backup population for restocking measures (also in the light of extreme population declines e.g. due to stochastic weather events) and b) to meet the demand for tiger geckos in the trade and thereby reduce the pressure on wild populations.

Acknowledgements

For supporting fieldwork and issuing relevant permits, we thank the authorities of the Cat Ba National Park (CBNP), Hai Phong City and the Management Department of Ha Long Bay (MDHLB), Quang Ninh Province. We are very thankful to K. X. Nguyen (CBNP), M. L. Pham (MDHLB) and H. Q. Nguyen (Ha Noi National University of Education) for assistance in the field. We are grateful to T. Pagel and C. Landsberg (Cologne Zoo), M. Bonkowski (University of Cologne), T.H. Tran, T. H. Vu, C. T. Pham, T. V. Nguyen, N. H. Nguyen (IEBR, Hanoi), M.T. Nguyen, L.V. Vu and T.T. Nguyen (VNMN, Hanoi) for their support of conservation-based biodiversity research in Vietnam. Thanks to S. Altherr (Munich) and M. Auliya (Leipzig) for improving a previous version of the manuscript. This research is supported by the National Foundation for Science and Technology Development (NAFOSTED, Grant No. 106.05-2017.329). Field surveys were partially funded by Cologne Zoo, the Mohamed bin Zayed Species Conservation fund (Project: 170515492), equipment was supported by the Idea Wild. Cologne Zoo is partner of the World Association of Zoos and Aquariums (WAZA): Conservation Project 07011, 07012 (Herpetodiversity Re-

search, Amphibian and Reptilian Breeding and Rescue Stations). Research of Hai Ngo in Germany is funded by the German Academic Exchange Service (DAAD).

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Biological Conservation 255 (2021) 108973

Contents lists available at ScienceDirect

Biological Conservation

journal homepage: www.elsevier.com/locate/biocon

Perspective

Using the 2020 global pandemic as a springboard to highlight the need for amphibian conservation in eastern Asia

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ARTICLE INFO

Keywords:
Amphibian
Farming
Trade
Ban
Eastern Asia

ABSTRACT

Emerging infectious diseases are on the rise in many different taxa, including, among others, the amphibian batrachochytrids, the snake fungal disease and the Severe Acute Respiratory Syndrome coronavirus 2 (SARS-CoV-2) virus, responsible for Coronavirus disease 2019 (COVID-19) in mammals. Following the onset of the pandemic linked to COVID-19, eastern Asia has shown strong leadership, taking actions to regulate the trade of potential vector species in several regions. These actions were taken in response to an increase in public awareness, and the need for a quick reaction to mitigate against further pandemics. However, trade restrictions rarely affect amphibians, despite the risk of pathogen transmission, directly, or indirectly through habitat destruction and the loss of vector consumption. Thus, species that help alleviate the risk of zoonoses or provide biological control are not protected. Hence, in view of the global amphibian decline and the risk of zoonoses, we support the current wildlife trade regulations and support measures to safeguard wildlife from overexploitation. The current period of regulation overhaul should be used as a springboard for amphibian conservation. To mitigate risks, we suggest the following stipulations specifically for amphibians. I) Restrictions to amphibian farming in eastern Asia, in relation to pathogen transmission and the establishment of invasive species. II)

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https://doi.org/10.1016/j.biocon.2021.108973
Received 23 July 2020; Received in revised form 28 December 2020; Accepted 11 January 2021

Regulation of the amphibian pet trade, with a focus on potential vector species. III) Expansion of the wildlife trade ban, to limit the wildlife-human-pet interface. The resulting actions will benefit both human and wildlife populations, as they will lead to a decrease in the risk of zoonoses and better protection of the environment.

Significance statement: There is an increasing number of emerging infectious diseases impacting all species, including amphibians, reptiles and mammals. The latest threat to humans is the virus responsible for COVID-19, and the resulting pandemic. Countries in eastern Asia have taken steps to regulate wildlife trade and prevent further zoonoses thereby decreasing the risk of pathogens arising from wild species. However, as amphibians are generally excluded from regulations we support specific trade restrictions: I) Restrictions to amphibian farming; II) regulation of the amphibian pet trade; III) expansion of the wildlife trade ban. These restrictions will benefit both human and wildlife populations by decreasing the risks of zoonoses and better protecting the environment.

1. Background

Emerging infectious diseases are on the rise in many different taxa. For example, batrachochytrids (*Batrachochytrium dendrobatidis* and *B. salamandrivorans*) have devastated amphibian populations worldwide (Scheele et al., 2019), the snake fungal disease (caused by *Ophidiomyces ophiodiicola*) is impacting snakes (Lorch et al., 2016), and the SARS-CoV-2 virus is responsible for COVID-19 in humans and other mammals (Leroy et al., 2020). Thus far, impacts of the 2020 pandemic resulting from COVID-19 have proven more detrimental to human health and the global economy than any other disease in contemporary history (Chakraborty and Maity, 2020). Zoonoses are becoming increasingly common and are having progressively greater impacts on human societies (Jones et al., 2008). The factors responsible for the recent spread of zoonoses include the increase in human-wildlife interaction caused by both human encroachment on natural habitats (Allen et al., 2017; Borzée et al., 2020b) and the increasing animal trade (Aguirre, 2017; Allen et al., 2017; Marco et al., 2020). However, in just a few months, the COVID-19 pandemic may have changed global attitudes about the wildlife trade and its impact on nature conservation (Corlett et al., 2020). Resulting actions such as trade bans can be used as springboards by the conservation community to make inroads into wildlife conservation.

Several animal taxa, including mammals and reptiles, have been (sometimes questionably) implicated in the transfer of the SARS-CoV-2 virus to human populations (Li et al., 2020). In response, and in an unprecedentedly rapid action of global environmental leadership, the government of the People's Republic of China (hereafter China) took the initiative to impose a wildlife trade ban that included the majority of wild vertebrates consumed in China (Li, 2020; Xinhua, 2020). Prior to the pandemic, only 402 species were on the List of Wild Animals Under State Priority Conservation and banned from consumption, resulting in hundreds of non-listed species as potentially consumable. This number however increased following the trade ban and there are now only 18 species that can be legally traded and bred for consumption or other consumables such as skins and furs (Ministry of Agriculture and Rural Affairs of the People's Republic of China, 2020; Shanshui Nature Conservation Center, 2020a; Yang et al., 2020). This initial ban was quickly followed by a proposal for a similar ban from the Ministry of Agriculture and Rural Development in Vietnam, under different specifications (Tatarski, 2020). Likewise, the Republic of Korea (hereafter R Korea) benefited from the shift in public opinion following the 2020 pandemic to ban the import of two invasive freshwater turtles, bringing the total of banned species to four testudinids and one anuran (R Korea; Ministry of Environment, 2020a). Within China, both Jiangxi and Hunan provinces have recently developed special programs and incentives to stop the trade of wildlife, and the city of Wuhan has placed a total ban on the commercial wildlife trade.

These trade bans are considered by many to be a critical step towards reducing the risk of zoonoses and further pandemics, and trade regulations for amphibians are equally important because of the risk of direct and indirect transmission from amphibians intended for consumption and the pet trade (Jensen and Camp, 2003; Gratwicke et al., 2009; Schloegel et al., 2009). Namely, several species of mycobacteria are zoonotic, and arbovirus have shown the potential for zoonoses (Densmore and Green, 2007). In addition, the bans are considered an important move forward for animal conservation because biological resource use is listed as a driver of decline for numerous species listed as threatened by The International Union for Conservation of Nature (IUCN) Red List of Threatened Species (Maxwell et al., 2016; IUCN, 2020). These bans, and stricter regulations, have been shown to have the potential to provide a much-needed respite that could promote the recovery of animal populations that are harvested in the wild (Schindler and Hilborn, 2015). The decrease in harvesting pressures on species and the reduced contact between wildlife and humans could also lower the risk of zoonoses. This is especially true for amphibians, as they naturally control a wide variety of vectors of pathogens (Hocking and Babbitt, 2014). For instance, many amphibian tadpoles compete with and/or prey on mosquito larvae (Spielman and Sullivan, 1974; Blaustein and Margalit, 1994; Blaustein and Margalit, 1996; Petranka and Kennedy, 1999; Rodríguez and González, 2000; Rubbo et al., 2003; Brodman and Dorton, 2006; DuRant and Hopkins, 2008; Rubbo et al., 2011; Valencia-Aguilar et al., 2013; Cortes-Gomez et al., 2015), an important approach to disease control as more than a million humans die each year because of mosquito-borne diseases (Tolle, 2009). In this regard, the role of amphibians should not be ignored, as a single larval mole salamander (*Ambystoma talpoideum*) can eat up to 900 mosquito larvae a day (DuRant and Hopkins, 2008), and there is now evidence linking the amphibian collapse to malaria outbreaks (Springborn et al., 2020). Furthermore, amphibians prey upon flies associated with human diseases (Peltzer and Lajmanovich, 2002) and deter fly oviposition (Blaustein et al., 2004; Rubbo et al., 2011). Amphibians also have other socioeconomic benefits, such as providing pest control in agricultural landscapes (Lajmanovich et al., 2003; Attademo et al., 2005; Peltzer et al., 2005; Attademo et al., 2007a; Attademo et al., 2007b; Peltzer et al., 2010; Hocking and Babbitt, 2014). For instance, amphibians are especially beneficial to crops such as soy (Attademo et al., 2007b; Valencia-Aguilar et al., 2013) and rice (Teng et al., 2016; Propper et al., 2020) by consuming agricultural pests.

However, the Vietnamese trade ban (Instruction No. 29/CT-TTg, issued on 23 July 2020 by the Prime Minister) is likely to be only temporary and other countries in Asia, with numerous wet markets, have not yet implemented any increased regulation. Moreover, the Chinese trade ban was announced by the Chinese Department of Forestry and does not include species under the jurisdiction of the Department of Agriculture. This distinction has resulted in the continued free trade of most fishes, amphibians and reptiles, even though fish-borne zoonoses have been increasing in number and diversity since the 1950s (Shane, 2011); viral zoonoses have arisen in reptiles (Ariel, 2011); and amphibian-borne fungal panzootics such as those driven by batrachochytrids have contributed to the largest documented extinction of species in modern times (Scheele et al., 2019). Consequently, despite being most welcome, the bans need to be expanded to support the conservation of some of the world's most threatened taxa (Wang et al., 2020) while simultaneously preventing further zoonoses. As we highlight here, the eastern Asian region, geographically defined as bordering the Pacific Ocean and associated countries, is also high in amphibian species richness but lacks comprehensive regulation or restriction of their

exploitation (Krishnasamy and Zavagli, 2020).

We acknowledge the subsistence economy that involves the trade and farming of certain species under the legislation of the Department of Agriculture (Jiangxi Provincial Forestry Department, 2018b) and the importance of the wellbeing of such farmers. One such species is the Critically Endangered, but commercially abundant, Chinese giant salamander, *Andrias davidianus* (Cunningham et al., 2016; Fei et al., 2006; Jiang et al., 2016; Liang et al., 2004; Ye et al., 1993). However, we urge a shift away from farming invasive or non-native species (which are known to carry disease-bearing micro-organisms such as batrachochytrids) for human consumption, such as the American bullfrog (*Lithobates catesbeianus*; Schloegel et al., 2012). In addition, we strongly recommend increased restrictions and regulations on the national and international amphibian pet trade, which involves millions of animals annually (Schlaepfer et al., 2005; Auliya et al., 2016). The trade is the most diverse source of pathogens in terms of species richness, and results in increased physical contact between captive animals and pet owners, as well as pathogen pollution to the wider environment. Regulations and restrictions on the amphibian pet trade would provide safer conditions for both humans and wildlife. These recommendations resonate well with ethics in civil societies around the world (Wilson, 2017). For instance, following the implementation of the wildlife trade ban in China, a questionnaire was developed by Chinese conservation organisations to understand the public's point of view. In urban environments the survey received over 100,000 responses with 96.4% supporting a ban on consumption of all wild animals, and over 90% supporting a ban of all trade in wild animals, including for food or medicinal use (Shanshui Nature Conservation Center, 2020b). In another survey conducted in March 2020, covering several eastern Asian regions (Hong Kong SAR of China, Japan, Myanmar, Thailand and Vietnam), 93% of the 5000 respondents highlighted the same willingness to eliminate illegal and unregulated markets, with 82% of respondents wishing to do so because of fear of further zoonoses (GlobeScan, 2020).

Eastern Asia has therefore shown strong leadership following the current pandemic, the resultant increase in public awareness, and in synergy with the need for quick action to mitigate against further pandemics. However, in this region amphibian trade is not well regulated, amphibian species richness is poorly understood and most species are not nationally protected (Stuart et al., 2008; Rowley et al., 2010; Tapley et al., 2018). For instance, only a small proportion of declining amphibian species are currently listed on CITES (the Convention on International Trade in Endangered Species), yet the amphibian trade is a major cause of population declines in several species (Krishnasamy and Zavagli, 2020; Rowley et al., 2016; Warkentin et al., 2009). In view of the global amphibian decline and the risks of zoonoses, we support the current wildlife trade bans, as well as measures to safeguard wildlife from overexploitation, and propose the following recommendations specifically for amphibians.

2. Restriction to amphibian farming in eastern Asia

Southeast Asia is currently the centre of the amphibian trade as food for human consumption. Historically, much of the internationally traded amphibian meat originated in Bangladesh and India (Altherr et al., 2011; Warkentin et al., 2009), until the Indian bullfrog (*Hoplobatrachus tigerinus*) and the Indian green frog (*Euphlyctis hexadactylus*) were included on Appendix II of CITES, and the trade of the species was banned in both countries due to the illegal and unsustainable capture of wild frogs (Kusrini and Alford, 2006). The amphibian legal trade then shifted, primarily to Indonesia, and resulted in an increase from 180 million to 1 billion individual frogs of several species being traded between 1998 and 2007 (Warkentin et al., 2009; Krishnasamy and Zavagli, 2020). The principal importers for the food industry are the European Union and the United States of America (Carpenter et al., 2007; Altherr et al., 2011), although the trade within the region is not negligible (Kusrini and Alford, 2006).

The domestic harvest of native wild amphibians in the USA (e.g. *Rana aurora draytoni* and *Rana pipiens*; Jennings and Hayes, 1985; Lannoo et al., 1994) and France (e.g. *Rana temporaria* and *Rana esculenta*) has already impacted amphibians through the loss of large populations of some species (Le Serrec, 1988; Neveu, 2004; Ohler and Nicolas, 2017). These countries are now relying on imported frog meat that is generally not traceable (Ohler and Nicolas, 2017; Krishnasamy and Zavagli, 2020). In addition, a significant proportion of the current amphibian trade for food and pets is unsustainable, likely to involve laundering of wild-caught specimens as captive-bred (Krishnasamy and Zavagli, 2020; Warkentin et al., 2009), and likely to spread batrachochytrids (Gratwicke et al., 2010; Kolby et al., 2014) and other pathogens (Gilbert et al., 2013). An example of unsustainable trade is the mismatch between the quota set for the white-lipped treefrog (*Nyctimystes infrafrenatus*, formerly *Litoria*) by the Indonesian Captive Breeding Production Plan and the potential reproduction based on breeding biology of the species (Janssen and Chng, 2017). However, the risks linked to trade need to be mitigated for some species, especially in Indonesia - the primary contributor to the amphibian trade.

The Ministry of Agriculture and Rural Development of Vietnam ordered a ban on the trade of wildlife in March 2020, implemented in July by the Prime Minister (Instruction No. 29/CT-TTg), stipulating that wild animals and products thereof cannot be traded or consumed even when authorised by CITES permits. In addition, it recommends the closure of illegal wildlife markets, the improvement of wildlife farming management and the development of a database for threatened species currently in captivity (Group IB in the Decree No. 06 and CITES Appendix I). The ban has already resulted in several amphibian species being removed from the trade (ENV, 2020). However, this is a temporary measure with an extension being discussed (ENV, 2020), and specific licences for farmers can still be legally acquired. Nonetheless, this ban means that the sale of wild native East Asian bullfrogs (*Hoplobatrachus rugulosus*) has been discontinued in the country and the bullfrog populations may improve from a break in wild harvests (Warkentin et al., 2009). Furthermore, the environment may benefit from a decreased risk of pathogen transmission (e.g. *Mycobacterium* sp., Suykerbuyk et al., 2007; batrachochytrid, ranavirus and general clinical condition, Gilbert et al., 2013; batrachochytrid, Auliya et al., 2016). If the trade ban is upheld, amphibians currently in captivity would likely need to be either euthanised or released. While culling without financial subsidy is unlikely, these captive populations would probably be illegally sold or released into the wild, as seen in other species in similar situations (Corlett, 2014). Similar to instances of individuals escaping from farms (Garner et al., 2009), the release of farmed amphibians can result in genetic homogenisation and the loss of genetic diversity across wild populations (Kumschick et al., 2017; Turvey et al., 2018), as well as increasing the likelihood of pathogen transmission between released farmed stock and wild amphibians (Jensen and Camp, 2003; Gratwicke et al., 2009; Schloegel et al., 2009). Genetic homogenisation is a particularly salient problem in species complexes where cryptic species await formal description, such as *H. rugulosus* (Yu et al., 2015) and *Andrias* spp. (Turvey et al., 2019; Yan et al., 2018). Fortunately, in the case of *H. rugulosus*, frogs are generally harvested locally for the establishment of farms, therefore escape or release is unlikely to result in the introduction of individuals from segregated or different populations/species that may threaten genetic integrity (Kriger and Hero, 2009).

Other native species have the potential to be locally farmed, such as *Fejervarya cancrivora* and *Limnonectes macrodon* in Southeast Asia (Gilbert et al., 2013; Kusrini, 2005; Kusrini and Alford, 2006), and *Rana* spp. in North East Asia, where amphibian farming relies on species that are better adapted to cooler climates (Park et al., 2014; Ri, 2018). For instance, there were 152 farms breeding *Rana* in northeastern China in 2007 (Liu et al., 2007). In R Korea, farming of three *Rana* species has been permitted since 2005 (R Korea; Ministry of Environment, 2017), and several dozen facilities are now farming *Rana* species (Park et al., 2014). While farming native species can sometimes be benign, the

available numbers of captive-bred *Rana* are not currently satisfying the market (Maslova, 2016). In R Korea, farms can apply for permits to import the same species as the one they breed, mostly from China (R Korea; Ministry of Environment, 2017). In China and Russia, this translates to illegal harvesting from the wild (Maslova, 2002; Maslova, 2016), smuggling (Lyapustin and Fomenko, 2015), unsustainable export (Maslova and Lyapustin, 2005), and species laundering under the cover of farming following the significant depletion of wild populations (Maslova, 2018).

A complication for the amphibian meat trade arises when a farmed species is non-native, such as the American bullfrog (*Lithobates catesbeianus*; Luque et al., 2014). Multiple escapes and releases have resulted in feral populations of a highly invasive species becoming established in all eastern Asian countries where its ecological requirements are met (Altherr et al., 2011; Groffen et al., 2019; Kusrini, 2005; Mohanty and Measey, 2018; Ri, 2018; Schloegel et al., 2012; Sy, 2014; Wang and Li, 2009). The presence of *L. catesbeianus* has been linked to introduced pathogens and higher pathogen prevalence in native amphibians (Ficetola et al., 2007; Gilbert et al., 2013; Wasserman et al., 2019), as the species is a known reservoir of *Batrachochytrium dendrobatidis* (Bai et al., 2010; Borzée et al., 2017b; Fisher and Garner, 2007; Ribeiro et al., 2019), ranavirus (Gray et al., 2009) and other parasites (Ransangan et al., 2013). The presence of the species outside of its range has been clearly linked to numerous declines in native species (Li and Xie, 2004; Ra et al., 2010; Snow and Witmer, 2010), and negative economic impacts when invasive populations are established (Measey et al., 2016). While upholding the trade ban in Vietnam has a strong conservation benefit for many native species, it may also result in the establishment of farms of invasive species, such as *L. catesbeianus*, and the establishment of invasive populations when farmed individuals release or escape. Similar issues have been expressed about the possibilities of other species becoming invasive. For instance, in the Philippines and in the Malaysian states of Sabah and Sarawak in Borneo, *H. rugulosus* is a non-native species commercially farmed for the food trade as well as for fishing bait and aquaculture feed (Das, 2011; Das et al., 2014; Sy, 2014), despite the climate of the area being adequate for invasions by the species (Mohanty et al., 2020). Additionally, Chinese giant salamanders that were released in Japan after being farmed for food, now hybridise with the native Japanese giant salamanders (*Andrias japonicus*) and threaten their genetic integrity (Fukumoto et al., 2015; Wang, 2015). Consequently, we recommend upholding trade bans, especially for live individuals and threatened species.

While farming of *L. catesbeianus* has not been as successful as expected in some countries, such as Indonesia (Kusrini and Alford, 2006) and the R Korea (Groffen et al., 2019), it is still a widespread practice in some other regions (Kang et al., 2019; Wang et al., 2009), and escapees from farms in all regions continue to threaten the surrounding wildlife. Farming of native frogs has also been developed into a lucrative business (Ding et al., 2015; Zhan and Yang, 2012), with *Hoplobatrachus* spp. individuals reaching marketable size within four months (Fang et al., 2002; Pearson et al., 1997). For comparison, *L. catesbeianus* takes up to three years in natural weather conditions around 40°N, or eight months at 25–30 °C (Lutz and Avery, 1999). Areas with a tropical climate can profitably farm *H. rugulosus* or *Fejervarya* spp., especially given that some of these species are considered to be delicacies in some regions (Truong, 2000). Colder areas can rely on *Rana* spp., where research shows that the farming of *R. chensinensis* and *R. dybowskii* can be profitable (Li et al., 2007; Qian and Chen, 2003; Xu et al., 2018) and where it is now relatively prevalent (Li and Chen, 2005; Liu et al., 2007; Maslova, 2018).

However, the current farming of native species cannot be treated as a net-positive conservation intervention. For instance, harvesters in Indonesia believe that harvested species are declining, although an alternative explanation is competition between harvesters (Kusrini and Alford, 2006). Similarly, populations of the native *H. rugulosus* in China have declined by approximately 30% between the 1980s and 2010s (Xia, 2010), and other large-bodied frog species have declined in Southeast Asia during the last decades (Rowley et al., 2010; Wei et al., 2014). In addition, the genus *Rana* has declined over 60 to 70% of its range despite the active development of amphibian farming in China, resulting in a 21.5% decrease in populations of *Rana* over 15 years (Liu et al., 2014; Liu et al., 2007), on par with the decline in *Rana* populations in Russia (Maslova, 2018). Breeding of these species in farms has not decreased the intensity of harvesting in the wild (Zhan and Yang, 2012), and it is therefore important that the farming of native species starts supporting conservation efforts by relieving pressure on wild populations and that these operations cease the laundering of individuals and contributing to the decline and extirpation of wild populations.

Therefore, we recommend a complete ban on the farming of non-native amphibian species, especially when there is a high potential for feral populations of such species to become established in the environment surrounding the farm, i.e. non-native species to become naturalised. In the absence of alternatives, and when possible and ecologically sustainable, non-native species should be replaced by local native species. A certification system to trace the provenance and source of animals by both sellers and buyers, as used in fisheries, could help identify and curb illegal wild harvests; however, clear mechanisms to prevent fraud are also needed (Veith et al., 2000). Alternatively, regulated harvest of wild populations could still be allowed at specific times of the year and in specific contexts, such as rice fields, as these are the primary habitat of numerous common and non-threatened Asian anuran species (Borzée et al., 2017a; Holzer et al., 2017; Kusrini and Alford, 2006; Naito et al., 2013). Considering this, rice fields would require protection, as an increasingly high number of rice fields are being developed for non-agricultural uses, especially in northern Asia (Fujioka and Lane, 1997; Yan et al., 2015; Borzée et al., 2017a; Deng et al., 2019; NBSC, 2019; Wang et al., 2019).

Finally, it would be important to give consideration to rectifying the negative impact of farming non-native species, such as the local eradication of feral populations of *L. catesbeianus*, already planned by some nations (Democratic People's Republic of Korea, National Biodiversity Strategy and Action Plan, 2017), following precedents set elsewhere (Kamoroff et al., 2020).

3. Regulation of the amphibian pet trade

Amphibian pathogens are spread and introduced through the wildlife trade (Fisher and Garner, 2007; Gilbert et al., 2013; O'Hanlon et al., 2018), and the pet trade is known to be a significant pathway for the spread of amphibian pathogens (Nguyen et al., 2017; Rowley et al., 2016). In addition, the pet trade threaten species (Choquette et al., 2020) and may result in the introduction of feral populations, and while no such species has been reported in Asia, to our knowledge, potentially invasive species have been found in the wild, such as *Xenopus laevis* in R Korea following release or escape (iNaturalist, 2020). Another amphibian invasion related to the trade is *Polypedates megacephalus*, which was introduced at several localities with horticultural plants, and the populations have been increasing ever since (Lee et al., 2019). However, international trade is not the only problem, and trade of species between provinces of a country with different species assemblages results in the same loss. Southeast Asia is a hub for international amphibian trade, and this has a critical impact on threatened species (Nijman, 2010; Sodhi et al., 2004; Krishnasamy and Zavagli, 2020). As a result, several species in the region have exhibited declines in population sizes and have been locally extirpated (Duckworth et al., 2012; Phimmachak et al., 2012; Rowley et al., 2016; Stuart et al., 2006). Specifically, the pet trade is now the primary threat to some Southeast Asian newts, with the USA the largest importer until recently (Krishnasamy and Zavagli, 2020). An example is the Lao warty newt (*Laotriton laoensis*) in Lao People's Democratic Republic, where collection for the pet trade is a principal driver for the species' decline (Rowley et al., 2016). Villagers relied on the sale of 100 individuals to European,

Japanese, and Chinese collectors in 2008 and 2009, an unsustainable number for the species (Krishnasamy and Zavagli, 2020). The situation is additionally worrying in view of the spreading pathogen *Batrachochytrium salamandrivorans* that originated from the region and has an impact on other amphibian species, particularly on Palearctic and Nearctic Caudata (Krishnasamy and Zavagli, 2020; Laking et al., 2017; Martel et al., 2014) and anurans (Nguyen et al., 2017), with potentially catastrophic implications (Martel et al., 2013; Stegen et al., 2017). Therefore, it is important to regulate movement of species that can spread pathogens through the pet trade, such as *Laotriton laoensis* (Rowley et al., 2016), but also species such as the European *Salamandra salamandra* (Sabino-Pinto et al., 2015) that can carry pathogens to countries in East Asia (Beukema et al., 2018; Koo et al., 2020). In addition, amphibians in Southeast Asia are also potentially threatened by emerging diseases from other parts of the globe. While the legal trade may be regulated, the illegal trade results in the movement of numerous individuals, such as dendrobatid frogs, through Lebanon and Kazakhstan, before being sold in Thailand (Krishnasamy and Zavagli, 2020; Nijman and Shepherd, 2009), and these individuals are potential vectors of emerging diseases (Woeltjes et al., 2011). The amphibian trade also results in the death of numerous individuals while they are shipped, an exacerbated problem in the case of the illegal trade.

The current wildlife trade ban implemented by countries such as Vietnam resulted in some threatened species that were legally collected for the pet trade now being protected from harvesting, such as *Theloderma palliatum* (IUCN Species Survival Commission (SSC) Amphibian Specialist Group, 2017) and *Theloderma bambusicolum* (IUCN SSC Amphibian Specialist Group, 2015), both under Governmental Decree No. 06/2019/NC-CP of Vietnam (2019). From the point of view of a recipient country of the trade such as the R Korea, where more than 85 anuran and 37 caudate species are imported in the pet trade (Koo et al., 2020), 28 species such as *Rana lessonae* and *Rana pipiens* have been recently listed as "inflow-cautious organisms" (illustrating their potential as invasive species; R Korea; Ministry of Environment, 2020b) and with efforts made to further limit the trade, now require special importation documentation (Heo, 2008a; Heo, 2008b; Borzée et al., 2020a). It is, however, necessary to acknowledge the benefit of amphibian farming locally for the pet trade in specific circumstances and under appropriate biosecurity measures (Mattioli et al., 2006; Tensen, 2016). In addition, an acceleration of the CITES process regulating trade to better match, and catch-up with the IUCN assessments identifying trade as a risk for a particular species could help improve the situation (Frank and Wilcove, 2019). As an example, if species such as *T. palliatum* were included to CITES Appendix II (and Governmental Decree No. 06/2019 of Vietnam, 2019), the trade of these species would halt, similarly to that of *Hoplobatrachus tigrinus* and *Euphlyctis hexadactylus* (Kusrini and Alford, 2006). Finally, investing in amphibian conservation in the wild in the form of habitat protection, and not their trade would be a valuable second step (Liu et al., 2019).

Therefore, following in the path of other governments regulating pet trade to prevent the spread of zoonotic and panzootic diseases (Gray et al., 2015; Sullivan, 2018), we call for a stricter regulation in the amphibian pet trade. It would be beneficial that local and international trade accessibility be aligned with species extinction risk and specific trade threats highlighted by The IUCN Red list of Threatened Species, National Red Lists or other more recent and authoritative work. Additionally, quotas should be set and national regulations and CITES procedures should be enforced, along with the improvement of reporting and training of the national bodies responsible for enforcement.

4. Expansion of the wildlife trade ban

Species under the jurisdiction of the Department of Agriculture were excluded from the wildlife trade ban in China. This means that aquatic wildlife, with the exception of species explicitly banned by the Wildlife Protection Law (2018) or in protected areas, can be freely harvested and consumed (Feng et al., 2018). The reason for this is that the National People's Congress qualifies aquatic species as a "natural resource and an important agricultural product, as well as a common international practice" (Xinhua News Agency, 2020b). As a result, farmed amphibians on the List of National Key Protected Aquatic Wild Animals for Farming and the List of National Key Protected Economic Aquatic Animals and Plants Resources (Xinhua News Agency, 2020a) can be bred for consumption, or other consumables, and will remain so until further consideration from the Ministry of Agriculture and Rural Affairs from China (Xinhua News Agency, 2020a).

Notable species omitted from the wildlife trade ban include newly described and recently discovered, but undescribed, species of Chinese giant salamanders (*Andrias* spp.) and crocodile newts (*Tylototriton* spp.). While giant salamanders were formerly widely distributed across much of South and Central China, recent phylogenetic developments have split the clade into distinct species: *A. davidianus*, *A. sligoi*, and an undescribed species, known only from farms (Turvey et al., 2019; Yan et al., 2018). Human-mediated translocations, trade, and release for commercial farming have also led to hybridisation and genetic homogenisation, blurring range delineations through population admixture. Wild Chinese giant salamander populations are now critically depleted or extirpated over much of their range (Turvey et al., 2019; Yan et al., 2018), and extinction risk did not improve following the release of hundreds of thousands of farmed individuals into the wild (Lu et al., 2020; Yan et al., 2018). The genus *Tylototriton* contains morphologically similar species (AmphibiaWeb, 2020), several of which are listed as threatened (Endangered and Vulnerable) on The IUCN Red list of Threatened Species and Chinese Red Lists (Jiang et al., 2016). Some of these species are continually threatened by the intense harvesting pressure for the international pet trade and habitat destruction (Hernandez and Hou, 2018). Others, such as *T. yangi*, which is Endangered on The IUCN Red list of Threatened Species (IUCN SSC Amphibian Specialist Group, 2020), are harvested to be dried, sold, and used for traditional medicine (Wang et al., 2017).

The farming of *Andrias* spp. can be used to support ex-situ conservation breeding and has the potential to relieve harvest pressure on wild populations. However, while *Andrias* spp. have now been bred for several generations in commercial breeding farms, there are currently no existing *Andrias* spp. captive breeding programs that can produce offspring suitable for subsequent release into the wild. The often unknown provenance of founding stock, presence of multiple pathogens (and the inability to reliably screen for some of these pathogens), and sometimes sub-optimal biosecurity make current farming and breeding facilities inappropriate for conservation breeding. Furthermore, there is evidence that the exploitation of wild *Andrias* spp. is ongoing despite the existence of the farming industry (Tapley et al., 2020; Turvey et al., 2018). Improved supervision and monitoring by authorities is required to address this situation and it would be beneficial to set trade regulations with regard to genetic screening, provenance and pathogen surveillance in collaboration with scientific institutions. There is a need for co-ordinated monitoring and protection of *Andrias* spp., as well as strengthening of legislation and enforcement to protect any surviving wild populations (Turvey et al., 2018). Thus, termination of commercial farming in or near reserves because of the difficulty in regulating poaching, genetic testing for origin of clade before reintroduction, and the development of ecotourism to raise awareness has been recommended (Lu et al., 2020). While the original intention was likely to use ex situ breeding of *Andrias* spp. to alleviate poverty and protect wild populations through "sustainable" farming practices, farming and conservation are clearly different endeavours. Sustainable farming practices can support community development and relieve the pressure on wild populations; however, for the strengthening of in situ protection to safeguard wild *Andrias* spp., any conservation breeding and release would require strict monitoring. Similarly, several species of *Tylototriton* are now listed as Class II on the List of Endangered Species of China and law enforcement was reinforced during the breeding season of the

species, with habitat restoration and captive breeding programs implemented, with support from local communities (Wang et al., 2017).

It is important to ensure that the sustainable farming practices for these species do not result in an increased risk of zoonoses through pathogens such as *Mycobacterium*, a common bacteria in captive settings (Densmore and Green, 2007). Farms rearing *Andrias* spp. are currently permitted to release untreated effluent from indoor holding tanks directly into streams and rivers, leading to a risk of pathogen transmission (Cunningham et al., 2016). Similarly, consumption of *Tylototriton* spp. as traditional medicine or in food markets can also result in cross-species pathogen transmission through human consumption as food or traditional medicine (Fig. 1). A complete ban on amphibian farming is likely to be harmful to both the environment because of the resulting illegal and non-regulated harvests, and to the human communities who depend economically on the trade. A ban would also likely drive the market underground in addition to the unresolved question regarding either releasing or euthanising the millions of animals now in captivity. The wildlife farming industry is estimated to have employed more than 14 million people and to have generated over £56 billion in China, with food consumption involving species such as the Giant salamander, frogs, and peacocks representing 24% of the total profit (Shuhui, 2008). Therefore, we recommend a gradual shift away from non-sustainable farming practices to alleviate pressure on people affected by an edict (Jiangxi Provincial Forestry Department, 2018a), and with consideration given to the strengthening of wild amphibian populations, to ensure that unintended negative consequences to threatened species can be managed adequately.

5. Conclusion

We recommend that wild individuals of species listed as threatened on The IUCN Red List of Threatened Species (i.e., Vulnerable, Endangered, and Critically Endangered; IUCN, 2020), as well as species listed as Data Deficient and Not Evaluated, should not be legally traded or used without approval from relevant institutions, and never in breach of conservation requirements for the species. Specifically, for species not yet commercially used, or used on a small scale, it would be beneficial to issue and enforce a strict ban. For species that have already been legally commercially farmed and traded at large scales, an impact evaluation on how best to shift to sustainable farming should be conducted including evidence-based recommendations for levels of sustainable use, e.g. through population modelling. A conservation plan with a standardised and regulated methodology should be incorporated into breeding programs for each species. In addition, we recommend that only local native species be farmed to mitigate the risk of introduction and pathogen pollution, while maintaining a distinction between farm- and conservation-orientated breeding, but only if this results in sustainable replacement from wild populations. Ultimately, all amphibian farming needs to be sustainable and contributing to the conservation of the species that are farmed independently of the threat level to the species, and must in no case be detrimental to wild populations.

Fig. 1. *Tylototriton shanjing* being traded at a market in Hainan in August 2019. This is one of the 40 bags available for sale despite being a nationally protected species in the People's Republic of China (photograph by Benjamin Tapley).

National legislation, such as the Catalogue of National Key Protected Wild Animals for Artificial Breeding in China or catalogues with a similar function in other regions would benefit from re-examination to list amphibian species according to the points developed above. Ideally, any species not present on a national list of species for which trade is legal would not be sold domestically or internationally under any circumstances, and it would be best that permits allowing additional domestication and wild capture of species for commercial or consumption purposes not be issued (Shucong, 2015). However, in the case of species that are abundant in the wild, "laundering [through farms may] not pose a conservation risk; it is a compliance issue" (Natusch, 2018). While the harvest of threatened species must be controlled and stringently limited, harvest of species with population sizes similar or higher than that prior to human activities can be of conservation benefit providing incentives for the protection of wild populations and their ecosystems, through benefits accrued by communities conducting the harvests (Hutton and Leader-Williams, 2003). While this system may be difficult to implement, it is not impossible if this measure is adapted contemporarily and examples where villagers actively protect natural habitats from conversion to agriculture exist (Natusch, 2018), and their example should be emulated.

We also suggest discouraging the consumption of threatened and non-native amphibian species and alternatives should be sought, including the resurgence of regional dishes and food varieties that do not include wild or invasive species, or plant-based alternatives (da Fonte and Marin, 2020; D'Cruze et al., 2020). As an example in China, few species other than commonly farmed species were eaten during celebrations before the Song Dynasty (Hughes, 2020). In addition, we recommend a transition to sustainable farming certification schemes for threatened species. However, the current inability to permanently mark amphibians in a way that is tamper-proof makes certification difficult, and we call for research to test marking systems. For instance, trials with microchips to track the *Andrias* spp. trade were attempted in China, but the project was terminated following concerns over consumers biting into the microchips (B. Tapley, pers. comm). Other methods relying on natural colour patterns for individual identification could also be trialled, such as seen on *Bombina* species (Gollmann and Gollmann, 2011) and Hylidae (Kim et al., 2017).

Emerging infectious diseases are linked to the current extinction crisis affecting amphibians (Bishop et al., 2012; Pimm et al., 2014; Stuart et al., 2004), and to cross-region contamination via international trade. We recommend measures that tailor regulations in such a way as to stem future risks. An example of such regulations would be those in the USA to prevent the introduction of *Batrachochytrium salamandrivorans* (Gray et al., 2015). Finally, we recommend the development of amphibian trade bans in all countries and regions following the examples of China and Vietnam, ensuring that amphibians receive the same degree of consideration as other vertebrates while maintaining a clear distinction between sustainable farming of threatened species and conservation programs, which may include a certain level of regulated harvest. This recommendation applies to native species that are not harvested for subsistence or food production, and under stringent control following the recommendations or trade-regulating organisations such as CITES for species that are traded for purposes other than consumption. Strict enforcement should also be conducted to prevent the legal trade from moving underground. This is the ideal time to be taking these steps, in the light of increased global awareness of the potential impacts of wildlife trade.

CRediT authorship contribution statement

Members of the IUCN SSC Amphibian Specialist Group developed the original idea and drafted the first file, and all authors provided critical feedback, writing and review.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgment

We are grateful to Benjamin Tapley and Jonathan Kolby for his their comments on an earlier version of the manuscript and for the image reproduced here as Fig. 1. We would also like to thank Hoa Quynh Nguyen for her help understanding the trade ban in Vietnam and the administrative process behind it, and to Yanping Wu for her help with Mandarin literature. This is a publication of the IUCN SSC Amphibian Specialist Group and we would like thank Prof Phil Bishop, ASG co-chair, for his role as mentor and world leader in amphibian conservation.

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Received: 20 October 2017 | Revised: 26 August 2018 | Accepted: 27 November 2018

DOI: 10.1002/aqc.3038

RESEARCH ARTICLE

WILEY

Monitoring a loss: Detection of the semi-aquatic crocodile lizard (*Shinisaurus crocodilurus*) in inaccessible habitats via environmental DNA

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Funding information
Deutsche Gesellschaft für Herpetologie (DGHT), Grant/Award Number: Hans-Schiemenz-Fonds 2016

Abstract

1. Assessing the conservation status of a species is strongly dependent upon data on species distribution and abundance. With the emergence of novel methods for species monitoring – such as the use of environmental DNA (eDNA) – monitoring success can be improved at reduced expenditure in the field, particularly in remote regions and terrains where access is difficult or dangerous.
2. The highly endangered crocodile lizard (*Shinisaurus crocodilurus* Ahl, 1930) inhabits fragmented sites of the remaining evergreen forest with running water systems in a narrow distribution range in southern China and north-east Vietnam. Crocodile lizards spend most of the day within or above water bodies, which are commonly remote and inaccessible.
3. To monitor recent spatial occurrences, and to confirm the persistence or extinction of previously reported populations (especially in heavily altered habitats), the suitability of using eDNA and quantitative polymerase chain reaction (qPCR) was tested as an alternative method for monitoring this semiaquatic lizard.
4. To assess the accuracy and limitations of this method, eDNA results from the field were compared with eDNA data from mesocosms and census data on the actual abundance of this species in the field.
5. Environmental DNA of the crocodile lizard was detected in all of the positive controls, and in four of six natural sites; thus, all data collected using traditional field surveys were confirmed with eDNA results.
6. eDNA monitoring was found to be a reliable method for assessing the viability of populations; we suggest that it should be developed as a tool for efficient wildlife management, particularly under difficult field and funding conditions.

KEYWORDS

endangered species, reptiles, riparian, species monitoring, streams

1 | INTRODUCTION

Population monitoring is an integral tool in ecological research and conservation biology that yields essential information on the density, distribution, and persistence of organisms (Amano, Lamming, & Sutherland, 2016). Information on population distribution is critical for evaluating restoration and restocking programmes (Erb, Willey, Johnson, Hines, & Cook, 2015; Noon, Bailey, Sisk, & McKelvey, 2012). The increasing use of predictive habitat suitability models requires population monitoring to ground-truth model predictions, so that outputs can be incorporated into regional planning strategies (Beck & Odaya, 2001; Manley, Zielinski, Schlesinger, & Mori, 2004). Without such monitoring, the information necessary for adapting management strategies is unavailable. This data gap may be critical in the case of species undergoing rapid population declines (Strindberg & O'Brien, 2012). The identification of population expansions, but also extinction, is mostly dependent on presence–absence data. The reliability of this information is determined by the specific detection probability of the species, and detection in remote and inaccessible terrain remains challenging. Recently, molecular methods for species monitoring have gained much attention. Environmental DNA (eDNA) detection is a relatively novel method, by which minute traces (e.g. from faeces, skin, or saliva) of DNA from a target species are detected in aqueous media (Biggs et al., 2015; Taberlet, Coissac, Hajibabaei, & Rieseberg, 2012; Thomsen & Willerslev, 2015). The eDNA approach has previously been used to validate the presence or absence of fish, amphibian, and aquatic reptile species in ponds, lakes, and streams (Jerde, Mahon, Chadderton, & Lodge, 2011; Lacoursire-Roussel, Rosabal, & Bernatchez, 2016; Rees, Maddison, Middleditch, Patmore, & Gough, 2014).

The crocodile lizard (*Shinisaurus crocodilurus*, Ahl, 1930) inhabits tropical lowland evergreen forests and is strongly associated with headwater streams, where it prefers inaccessible pools hidden behind small waterfalls (Ning, Huang, Yu, & Dai, 2006; van Schingen et al., 2015; Wu et al., 2007). A large proportion of the global population of *S. crocodilurus* is distributed in very fragmented habitats in the border region between northern Vietnam and Southeast China. The species is at present highly threatened by extinction because of continuing deforestation, habitat destruction, and poaching, which has led to the inclusion of this species on the International Union for Conservation of Nature (IUCN) Red List as Endangered (Nguyen, Hamilton, & Ziegler, 2014). Furthermore, it was transferred from Appendix II to Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 1973) at CITES CoP17, in order to prohibit the international commercial trade in wild specimens. Recent research has even shown that the Chinese and Vietnamese *S. crocodilurus* populations represent distinct taxonomic units, thus emphasizing the importance of improved and minimally invasive *in situ* methods to support practical conservation strategies (van Schingen et al., 2016). Particularly in Vietnam, wild *S. crocodilurus* populations suffered dramatic declines with an estimate of fewer than 150 adult individuals remaining. Several local extirpations have been reported (Auliya et al., 2016; van Schingen et al., 2014; van Schingen et al., 2016). To counteract further population declines, an *ex situ* conservation breeding programme for Vietnamese crocodile lizards has been established at the Me Linh Station for Biodiversity in Vietnam by Cologne Zoo (Germany) and the Institute of Ecology and Biological Resources (IEBR) in Vietnam, with the future goal of restocking wild populations (Ziegler et al., 2016). Simultaneously, the remaining wild populations are regularly monitored by the census count method (e.g. Hill, Fasham, Tucker, Shewry, & Shwa, 2005), in order to identify further threats, improve habitat protection, and evaluate different sites for a future release programme (van van Schingen et al., 2014). Access to sites in this region is often extremely difficult, however owing to the topography and dense vegetation, as well as the severe thunderstorms that occur during the summer. Recent research further indicates that the animals spend periods inactive in burrows even in summer, which further limits the accuracy of such sight-count monitoring (van Schingen, Ha, et al., 2016). This situation is therefore well-suited to explore the suitability of eDNA monitoring as a tool for wildlife conservation management.

This study tested – for the first time – the efficacy of eDNA for monitoring a semi-aquatic reptile species in running waters, and aimed to evaluate the accuracy and limitations of this approach. Therefore, census monitoring data were compared with data derived from eDNA monitoring of six Vietnamese *S. crocodilurus* subpopulations, each characterized by different abundances and poaching pressures, and consequently having different prognoses of persistence. The overall objective of this study was to establish a relatively easy to use and cost-efficient version of an eDNA protocol that is also suitable for less well-equipped and poorly funded projects. We hypothesized that the eDNA method provides a suitable tool for confirming the local persistence of cryptic animal populations.

2 | METHODS

2.1 | Study sites and field sampling

All sites investigated are located in north-east Vietnam in Quảng Ninh Province: Dong Son-Ky Thuong Nature Reserve (DSKT 1, 2, and 3), Hai Ha District (HH), and Bac Giang Province (BG 1 and 2) at the border to China, where *S. crocodilurus* populations had previously been recorded (van Schingen, Ha, et al., 2016). In total, six lowland streams in three areas were surveyed, where the occurrence of *S. crocodilurus* was recently confirmed by visual surveys (until 2015, van Schingen et al., 2016; Figure 1). Detailed information on the location of the sampling sites is not disclosed here to prevent the misuse of these data by poachers, as all populations are currently under severe threat from overexploitation. Poaching pressure was determined by previous surveys that provided intensity estimates (van Schingen, Duc Le, et al., 2016; van Schingen, Ha, et al., 2016).

Sampling was conducted between April and June 2016 during the main activity season of *S. crocodilurus*. During that time, animals are generally found either in close proximity to the water, perched above pool structures along the streams, or within the water (Figure 2; van Schingen et al., 2015). Water was collected with sterile vessels downstream from locations of animal sightings (Table 1). As much water as possible (min. 3.5 L; max. 7 L) was filtered on 47-mm diameter filters (see different types and specifications below) with a hand pump. The

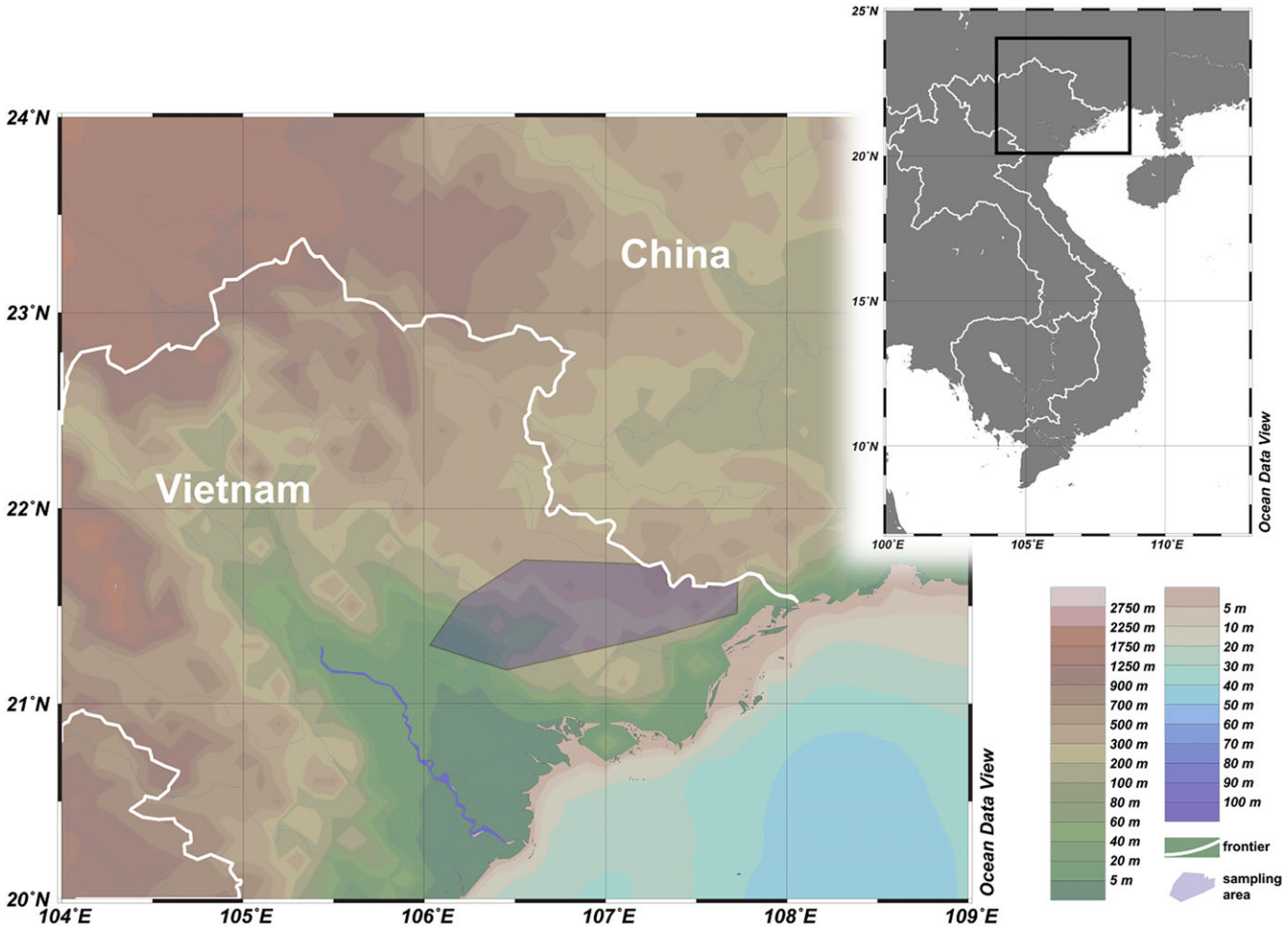

FIGURE 1 Area of investigation in mainland Vietnam (indicated by black box) and potential distribution (purple shading) of the Vietnamese populations of *Shinisaurus crocodilurus*. Colour coding indicates ocean depth (150–5 m below ocean surface) and altitude (5–2750 m a.s.l.). (Map designed with OCEAN DATA VIEW; Schlitzer, 2015)

FIGURE 2 Two crocodile lizards (*Shinisaurus crocodilurus*) in their natural habitat in northern Vietnam. Adult and juvenile perched above the stream run. (Photo courtesy of Leon Barthel)

final filtered volumes varied depending on the number of particles in the water. At least three replicates were collected from each stream. Two different filter types were tested for their suitability to collect eDNA: glass microfibre filters (GF/F; Whatman), and cellulose acetate membrane filters with a pore size of 0.2 µm (CA; Whatman) VWR International. The general DNA yield obtained from different filter

TABLE 1 Location and conditions and habitat parameters of stream sampling sites for *Shinisaurus crocodilurus* environmental DNA (control sites shaded), filter types, and number of replicates (GF/F, glass fibre filter; CA, cellulose acetate filter)

Site type	Province	Name of site	Number of pools	Assumed population status*	Filter type (*n*)
Natural	Bac Giang	BG1	Many	Good	GF/F (3) CA (3)
Natural	Bac Giang	BG2	Many	Good	GF/F (6) CA (6)
Natural	Quang Ninh	DSKT1	Few	Bad	GF/F (3)
Natural	Quang Ninh	DSKT2	Few	Bad	GF/F (3)
Natural	Quang Ninh	DSKT3	Few	Extinct	GF/F (3)
Natural	Hai Ha	HH	Few	Bad	CF/F (3) CA (3)
Mesocosm	Vinh Phuc		–	Abundant	GF/F (6) CA (6)
Control	Vinh Phuc	MLS	Few	None	GF/F (6)

*Population status as assumed from 2015 census monitoring (van Schingen, Ha, et al., 2016)

types was first compared with a positive control, by filtering 1 L of water under laboratory conditions from a 100-L volume in which two *S. crocodilurus* specimens were kept. After collection, filters were stored in sterile microcentrifuge tubes, either immediately immersed in 70% analytical-grade ethanol or frozen at −20°C upon arrival at the field station (Spens et al., 2017). All samples were kept at −20°C until processing.

2.2 | Mesocosms

To validate the eDNA method as an appropriate monitoring tool, further samples serving as positive controls were taken from semi-outdoor enclosures of *S. crocodilurus* at the Me Linh Station for Biodiversity, Vinh Phuc Province, Vietnam, where the species has been kept since 2012 (Ziegler & Nguyen, 2015). Each of the eight standardized enclosures measured 2 × 1 × 2 m, with 65% of the ground area covered in water and including a small waterfall. The water within the enclosures was exchanged completely every few days. The enclosures were each stocked with two adult *S. crocodilurus*. Three replicate samples from three random enclosures were taken, filtering a volume of 50 and 500 mL onto GF/F and CA filters, respectively. Filters were stored in 70% ethanol and kept frozen before further processing. In addition, the stream in direct proximity to the Me Linh station was sampled. It receives both wastewater and residues from cleaning the enclosure (Table 1).

2.3 | Sample collection and eDNA isolation

The extraction of eDNA from filters was conducted at the Aquatic Chemical Ecology laboratory of the University of Cologne, Germany, in which no reptile DNA had ever been processed before, to exclude potential cross-contamination. The collected filters were cut into 5-mm pieces and left to dry overnight in opened microcentrifuge tubes under a fume hood to evaporate the ethanol. DNA was isolated from the filters using a modified protocol for DNA extraction (DNeasy blood and tissue kit; Quiagen, Hilden, Germany). Extraction buffers and proteinase-K treatments were directly applied to the dried filter pieces in fresh microcentrifuge tubes overnight at 57°C on a rocking platform to ensure an appropriate wash-off of all organic material. The extraction was then continued according to the manufacturer's protocol, with a final elution volume of 50 µL of TE buffer (Tris and EDTA) per filter. Nucleic acid concentration and quality (ratios of 260/280 and 260/230) were determined using a NanoPhotometer P330 (Implen GmbH, Munich, Germany).

2.4 | Primer design and specificity test for eDNA detection

The primer design was made using PRIMER EXPRESS 3.0 (Applied Biosystems, Darmstadt, Germany). For the development of the detection assay, the mitochondrial cytochrome *b* (cyt-*b*) gene was used. The species specificity of candidate primer pairs was evaluated by testing them with cyt-*b* sequences of systematically related or sympatrically occurring species. Respective sequences included fish, reptile, and amphibian DNA, as well as human DNA, were tested to ensure there was no product formation with the *S. crocodilurus*-specific primers *in silico*, using MACVECTOR 15.5.2 (MacVector Inc., Apex, NC; Table 2).

2.5 | eDNA detection assay

Quantitative polymerase chain reactions (qPCRs) were conducted using an ABI 7300 qPCR-system (Applied Biosystems). Each reaction contained 2 µL of eDNA sample, 300 nM of forward and reverse primers, 0.2 µL of CXR reagent, and 0.5 vol. of GoTaq® qPCR Master Mix (with BRYT Green® as an intercalating dye; Promega, Mannheim, Germany) in a 20-µL reaction. For efficiency tests, diluted test DNA was used in triplicate (five log-dilution steps in total) originating from a sample that was extracted from moulted skin tissue from a captive

TABLE 2 Genera from which sequences of the mitochondrial cytochrome *b* gene (cyt-*b*) were considered for the design of *Shinisaurus crocodilurus*-specific environmental DNA primers. Shading indicates non-sympatric but taxonomically related genera

Genus	NCBI accession number	Sequence length (bp)
Shinisaurus	AY099995.1	1116
Calotes	NC_009683.1	1125
Ctenotus	KJ505805.1	1143
Danio	NC_002333.2	1140
Heloderma	NC_008776.1	1138
Homo	U09500.1	1143
Kaloula	NC_006405.1	1142
Mabuya	EU443106.1	1154
Rhacophorus	NC_007178.1	1145
Tylototriton	NC_027505.1	1141
Varanus	AB185327.1	1132

S. crocodilurus. qPCR-efficiency was considered sufficient when product duplication ranked between 90% and 110% per cycle, which corresponds to a slope between −3.58 and −3.10. For the detection assay, the most efficient primer pair was chosen, which produces a 97-bp amplicon specific for *Shinisaurus*: Scro_CytB_27_FW, 5′-GCCC ACATCTGCCGAGAT-3′; Scro_CytB_27_RV, 5′-CGATATGAAGGTAA ATGCAGAAGAAA-3′; T_m = 78°C.

The product formation corresponded to a qPCR efficiency of 92.12% (R^2 = 0.99), with a slope of −3.53 and an intercept of 33.86 (required for copy-number calculation). A modified cycling protocol was applied, as recommended by Promega in connection with the kit used (see above), with an initial step at 95°C for only 2 min to activate the DNA polymerase, followed by 40 cycles of 95°C for 15 s and 60°C for 1 min. Baseline and threshold cycles were set to automatic in the sequence detection ABI7300 qPCR-system version 1.3 (Applied Biosystems). All master mixes were controlled by a no-template control to monitor for possible DNA contamination (none detected). For all runs, a positive control (*S. crocodilurus* moult DNA, see above) was also included, which further allowed the validation of sample dissociation curves to monitor the identity and purity of the amplicons. The products were verified by their qPCR melting curves and that only one specific product with the correct melting temperature of 78°C was obtained.

2.6 | Census monitoring and population status confirmation

To confirm the presence of *S. crocodilurus* by eDNA, all sites were further monitored using traditional census counts in transects in all of the streams investigated; observations were made during the night when animals are inactive (van Schingen, Ha, et al., 2016). All observed individuals were sexed – if mature – and categorized by size as juvenile, subadult, or adult.

3 | RESULTS AND DISCUSSION

3.1 | eDNA from different filter types

Environmental DNA predominantly occurs in particles of cell debris and colloids (Turner et al., 2014). As such, free DNA passes filters and should not contribute much to the total quantity of eDNA. The extraction of eDNA was possible from both GF/F and CA filters; however, although the respective DNA yield did not show statistically significant differences between the different filter types (Mann–Whitney *U*-test, $P > 0.99$), the extraction effort differed between the two. Whereas CA membrane filters, however, were easy to extract, the loose structure of the cut GF filters tended to retain the extraction buffers and prevented an easy separation of solid and dissolved components during the extraction process. We thus recommend the use of CA membrane filters, even if this incurs slightly higher costs. The quantity of DNA extracted from the different types of filters ranged from 6.9 to 168 ng μL^{-1}, with a mean (±SD) yield per volume of 20.52 ± 26.28 ng μL^{-1}. The quality of the extracted DNA was moderate, with a mean (±SD) A260/A280 of 1.72 ± 0.32 for CA filters and 0.36 ± 0.17 for GF/F filters.

3.2 | Standardization of eDNA detection in mesocosm environments

The qPCR reliably detected traces of *S. crocodilurus* eDNA in all samples derived from the mesocosms, regardless of filter type, DNA yield, or DNA quality. The overall DNA yield did not constrain the successful detection of *S. crocodilurus* eDNA. As the target eDNA of the PCR was only a very small fraction of the overall DNA content in the sample isolates, correlations between DNA content and target eDNA are only approximate, and do not allow conclusions on the abundance of target organisms in the field (Rees et al., 2014). All mesocosm samples with standardized *S. crocodilurus* densities provided reliable positive results, albeit with high variability in qPCR threshold cycles. Thus, samples from the mesocosm experiments were used thereafter as positive controls. As many samples had DNA concentrations that were too low to standardize the input qPCR DNA quantity, sample content was not adjusted before qPCR. Typical cycle threshold (C_t) signals of undiluted extracts from positive control samples (mesocosm) emerged after 24.3–30.8 cycles of replication. Such C_t values were interpreted as positive signals, as the exponential phase of the amplification arose from here (Table 3). A DNA sample from moult tissue (270 ng μl^{-1}) resulted in a C_t of 13.7, which would correspond to a copy number of cyt-*b* DNA of X_0 = 260.1 copies μL^{-1} (calculated following Gallup, 2011). However the variability of sampling in terms of water volume and the non-standardized yields of DNA from environmental samples did not permit a copy number-based quantification, which would be necessary to estimate abundance. This limitation applies to the majority of eDNA studies (Rees et al., 2014).

3.3 | Site-specific population detection

The presence of *S. crocodilurus* was confirmed at four of the six monitored sites in the eDNA samples (Table 3). As such, eDNA

TABLE 3 Outcome of environmental DNA (eDNA; 2016) and census monitoring (2015 and 2016) at the investigated sites, together with the detection thresholds in quantitative polymerase chain reactions (PCRs). The results of census monitoring in 2016 are given as the total number of individuals observed (*n*)

Site	eDNA samples	Positive eDNA samples	Minimum C_t[a] for eDNA detection	Census 2016 (*n*)	Census 2015[b]
BG 1	6	2	27.2	Yes (16)	Yes
BG 2	6	1	35.1	Few (8)	Yes
HH	12	0	–	Few (1)	Few
DSKT 1	3	1	31.3	Few (8)	Few
DSKT 2	3	1	36	Few (3)	Yes
DSKT 3	3	0	–	No (0)	No
ML	6	1	34.7	No	No
Mesocosms	12	12	24.3	Yes	Yes

[a]Threshold of qPCR cycle after which a product was detected.
[b]Census in 2015, according to van Schingen, Ha, et al. (2016).

monitoring was demonstrated as a suitable method for detecting the presence and absence of *S. crocodilurus* in its natural environment. *Shinisaurus crocodilurus* had been recorded previously from all monitored sites, although its current status was unknown before sampling. Sites BG1 and BG2 were least affected by habitat destruction and the poaching of *S. crocodilurus* (van Schingen, Ha, et al., 2016). Accordingly, the highest numbers of individuals (27 and 25, respectively, in 2015; van Schingen, Ha, et al., 2016; and 16 and eight individuals, respectively, in the current survey) had been observed along stream transects of about 500 m at these sites. The eDNA monitoring confirmed the presence of *S. crocodilurus* in three of six samples at site BG1, and in one of six samples at BG2, reflecting the current census monitoring (Table 3). At site HH, large populations of *S. crocodilurus* had been reported before 2014 by local villagers, but only single juveniles were observed during the present survey, as well as during recent monitoring in 2015, owing to a dramatic increase in the poaching of *S. crocodilurus* (Table 3; pers. comm. with local villagers, 2016). In accordance with the census data, the eDNA monitoring did not detect the presence of *S. crocodilurus* at site HH; any individuals potentially remaining were most probably too scattered to detect.

Owing to dangerous working conditions, and time and climatic constraints, only three eDNA samples could be taken from each stream in Dong Son-Ky Thuong. The eDNA monitoring confirmed the presence of *S. crocodilurus* in one out of three samples from sites DSKT1 and DSKT2, respectively, but not from DSKT3. Census monitoring confirmed the presence of a few individuals at DSKT1 and DSKT2 (eight and three individuals each, Table 3); no individuals were recorded at DSKT3, confirming the survey results from 2015 (van Schingen, Ha, et al., 2016).

Shinisaurus crocodilurus eDNA was also detected in the stream in close proximity to the Me Linh Station for Biodiversity, which is not part of the natural distribution range of this species. A viable native population in this stream is thus extremely unlikely; however, the stream receives the residues from the station, which probably explains the *S. crocodilurus* eDNA signal. A few individuals escaped some time ago, but were recaptured in the stream near the station.

In summary, eDNA monitoring could not confirm the presence of *S. crocodilurus* at the most overexploited sites, where abundances were very low, namely HH and DSKT3, whereas census monitoring still recorded single individuals. Yet, eDNA data might allow an approximate quantification of the population status, provided that DNA content could be standardized (Walker et al., 2017). In the case of very recent population extirpations (within less than a few months), positive eDNA monitoring results must be interpreted with caution, because of the time lag of eDNA decomposition and thus a relatively long persistence of eDNA in aquatic environments (Barnes et al., 2014); however, sites with historic population extirpations (of more than 1 year) could be reliably confirmed to be eDNA-free.

3.4 | Methodological considerations

The number of studies using eDNA in species monitoring has increased steeply in recent years, and will soon be a staple method in monitoring and conservation projects (Lawson Handley, 2015). Examples include various taxa such as amphibians (Fukumoto, Ushimaru, & Minamoto, 2015; Walker et al., 2017) and fish (Lacoursire-Roussel et al., 2016), typically in freshwater and marine environments (Rees et al., 2014). Reptiles (Hunter et al., 2015) and mammals (Padgett-Stewart et al., 2016; Ushio et al., 2017) have been included in eDNA studies, yet reliable detection using eDNA requires some connection to aqueous habitats or moist soil (Walker et al., 2017). eDNA is applicable for monitoring the occurrence of invasive species (Jerde et al., 2013) and for the detection of rare and endangered populations. Typically, specific DNA probes (such as the TaqMan probe) are used for eDNA detection (Rees et al., 2014). This study found that intercalating dyes (such as SYBRgreen™ or BRYT Green®) are equally suitable for answering questions regarding the presence and absence of target species. The approach using an intercalating dye is more cost-efficient and requires far simpler detection machines than TaqMan probes, which makes it particularly suitable for limited budgets and in challenging sampling environments.

To date, few exploratory eDNA studies have been implemented within standard monitoring programmes outside western industrial countries. This study represents the first eDNA study for the endangered crocodile lizard. Furthermore, it seeks to be a pilot study for implementing monitoring techniques in a country with remarkable biodiversity yet limited resources for its protection.

To further develop a pilot study into an area-specific monitoring programme, quality measures must be considered (Goldberg et al., 2016). The distribution of eDNA depends mostly on sedimentation, hydrology, and structural parameters of the riverbed, thereby producing patchy accumulations of organic material and, consequently, patchy eDNA (Barnes et al., 2014; Jane et al., 2015; Shogren et al., 2017). As such, the survey method and regime must be thoroughly planned, with as much *a priori* information as possible. Moreover, the persistence of DNA in the environment depends on specific chemical properties such as acidity (Seymour et al., 2018). The aquatic habitats of the *S. crocodilurus* investigated displayed a wide variety of acidities (pH 4–8) but in the present study, this did not appear to influence the probability of detecting eDNA, presumably because fresh eDNA was available in all positive samples.

3.5 | Applications for monitoring and conservation

The analysis of eDNA provides a sensitive tool to monitor the presence of a semi-aquatic reptile species in stream-associated habitats in addition to census count monitoring. Viable populations can be detected using this approach with relatively little sampling effort. Traces of eDNA could also be detected in two recently overexploited sites, and in one site that potentially received only traces of *S. crocodilurus* wastewater, thus highlighting the sensitivity of this method.

Environmental DNA monitoring might therefore provide more precise and comprehensive information on the present distribution range of species, even in regions with restricted access and difficult working conditions. According to recent species distribution models (van Schingen, Ha, et al., 2016), it is predicted that further suitable

sites exist for Vietnamese crocodile lizards, although no surveys have yet been conducted. The use of an eDNA monitoring protocol helps to verify potential occurrences throughout these predicted habitats, which could also aid in planning restocking programmes for the Vietnamese crocodile lizard.

As the eDNA primers were designed to detect both Chinese and Vietnamese crocodile lizards, this approach could also be applied throughout the distribution range of the species in China, where similar conservation and breeding programmes have begun (Zollweg, 2012). In general, the application of eDNA monitoring provides a tool for cost-effective conservation, and for guiding traditional monitoring in light of international access- and benefit-sharing of regional biodiversity.

ACKNOWLEDGEMENTS

This study was funded by the Hans-Schiemenz-Fonds for conservation of the German Herpetological Society (DGHT). We thank Eric von Elert for support and access to laboratory infrastructure at the Cologne Biocenter. We are very grateful to Cuong The Pham, Hanh Thi Ngo, Dung Thi Kim Pham, Tan Van Nguyen, Leon Barthel, and Alex Laking for their assistance during fieldwork. We thank Phuong Huy Dang, director of the Me Linh Station for Biodiversity for permitting sample collection from the station. We thank Theo Pagel and Christopher Landsberg (Cologne Zoo) as well as Sinh Van Nguyen (IEBR, Hanoi) for their support of our research and conservation activities in Vietnam. We thank the directorates of Tay Yen Tu and Dong Son – Ky Thuong nature reserves and the Forest Protection Departments of Bac Giang and Quang Ninh provinces for support of our fieldwork and for issuing the relevant permits. Field research in Vietnam was further supported by the Institute of Ecology and Biological Resources (IEBR), the Cologne Zoo, the European Union of Aquarium Curators (EUAC). Cologne Zoo is partner of the World Association of Zoos and Aquariums (WAZA): conservation projects 07011, 07012 (Herpetodiversity Research, Amphibian and Reptilian Breeding and Rescue Stations). We thank Amy MacLeod (www.editingzoo.com) for linguistic editing and the improvement of this article.

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How to cite this article: Reinhardt T, van Schingen M, Windisch HS, Nguyen TQ, Ziegler T, Fink P. Monitoring a loss: Detection of the semi-aquatic crocodile lizard (*Shinisaurus crocodilurus*) in inaccessible habitats via environmental DNA. *Aquatic Conserv: Mar Freshw Ecosyst*. 2019;29:353–360. https://doi.org/10.1002/aqc.3038

Update on WAZA Projects 07011 and 07012

Thomas Ziegler[1] & Truong Quang Nguyen[2]

Linking *ex situ* Measures and Ecological Research for the Conservation of the Endangered Psychedelic Rock Gecko

The psychedelic rock gecko (*Cnemaspis psychedelica*) was only recently described from Hon Khoai Island, Ca Mau Province, beneath the southernmost tip of Vietnam. The species' name derives from its very bright colour pattern. Only few years after its discovery, the colourful gecko appeared in the pet trade and has been offered for up to 3,000 Euro per pair. Given the fact that Hon Khoai Island covers only 8 km², and facing the alarming development of the illegal collection of this endemic gecko species, we planned together with Khoi Vu Nguyen from Wildlife at Risk (WAR) as a first conservation measure the building-up of a captive insurance colony as basis for a conservation breeding programme. In 2014, together with Cologne Zoo's terrarium section keeper Anna Rauhaus, we planned and built a gecko house at the grounds of WAR in the south of Vietnam, comprising ten large terraria, a movable rain cover with sun blind and a double-door system to prevent accidently escaped geckos from breaking out. For the front side of the gecko house, we prepared a large water-proof poster that points, both in English and Vietnamese, to the threats to the psychedelic rock gecko and the background of the project.

In 2015, first small gecko breeding groups were transferred from Hon Khoai Island to the gecko house, with relevant permits provided by the respective authorities. This year, we reported about the successful keeping and breeding of the psychedelic rock gecko at WAR's gecko house in southern Vietnam in the journal *Der Zoologische Garten*. In parallel, on behalf of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), and as legwork for the Species Program, UNEP World Conservation Monitoring Centre, Cambridge, UK, our team has analysed the international trade in the species, the results of which were recently summarised in an overview paper on trade in live reptiles and its impact on wild populations in the journal *Biological Conservation*.

Besides aforementioned preliminary trade analysis and our first and fortunately already successful *ex situ* initiative, our team also initiated first *in situ* action with the consent of the local authorities, viz. nature conservation-based ecological field research on Hon Khoai Island. Funded by the BMUB and Rufford Foundation, further supported by the Institute of Ecology and Biological Resources (IEBR), the Vietnam Academy of Science and Technology (VAST) and Cologne Zoo, our students Hai Ngoc Ngo and Tan Van Nguyen collected first data about the psychedelic rock gecko's ecology, population and threat status on Hon Khoai. The first population assessment of the gecko, jointly evaluated with our PhD student Mona van Schingen and Frank Barsch from the BMUB, will be published in the journal *Amphibian and Reptile Conservation*. Our preliminary analysis revealed that the population seems to be rather small, only covering several hundreds of individuals. The preferred habitat, densely forested granitic rocks, is rare and increasingly threatened by human activities (e. g. poaching, building activities, forest destruction, invasive animals). Thus, the timely build-up of an *ex situ* breeding facility and conservation breeding programme in southern Vietnam was reasonable, as negative influences by anthropogenic impact both on the habitat and density of the population are obvious.

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Gecko house in southern Vietnam with large information banner developed by our team.

Now, the development of *in situ* conservation measures is urgently required. For this reason, in March 2016, we have met with the authorities of the Forest Protection Department (FPD) of Ca Mau Province, which is responsible for Hon Khoai. As a first initiative, we have handed over ranger equipment, further materials and self-made panels pointing towards the threats and protection of the psychedelic rock gecko. Together with the Ca Mau FPD and WAR, we try to preserve the psychedelic rock gecko in the long term and jointly engage in habitat protection measures. Here, further population monitoring and extended biodiversity research, currently supported by the Zoological Society for the Conservation of Species and Populations (ZGAP), will be mandatory for the establishment of a reserve.

Our preliminary population assessment and threat evaluation recently already has led to the inclusion of the species in the IUCN Red List of Threatened Species (see http://www.iucnredlist.org/details/97210381/0); our data also were provided for the official application to list the species on the CITES Appendices on the occasion of the seventeenth meeting of the Conference of the Parties (CoP) in Johannesburg, South Africa. Summarised, this is a good example of how interaction between research and conservation in collaboration with zoo engagement can make a contribution towards threatened species' protection – or which role modern, scientifically led zoos can play in international species conservation. ■

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Psychedelic rock gecko (*Cnemaspis psychedelica*).

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4/16
November
2016

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ISSN: 1662-7733

International Zoo Yearbook

Int. Zoo Yb. (2019) **53:** 1–20
DOI:10.1111/izy.12215

New insights into the habitat use and husbandry of crocodile lizards (Reptilia: Shinisauridae) including the conception of new facilities for Vietnamese crocodile lizards *Shinisaurus crocodilurus vietnamensis* in Vietnam and Germany

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The Crocodile lizard *Shinisaurus crocodilurus* is a popular reptile species in the pet trade and has been regularly kept in terrariums by hobbyists since the 1980s. Recent integrative taxonomic research revealed the Chinese representatives to be morphologically, genetically and ecologically distinct from Vietnamese populations, which occur in alarmingly low population sizes. All extant populations are threatened by habitat destruction and poaching for the pet trade. Thus, it will be crucial to manage the Vietnamese and Chinese subspecies separately as different conservation units, both to maintain their genetic integrity and to adjust appropriate husbandry conditions in the frame of *ex situ* conservation programmes. For this reason, we provide a topical review of microhabitat use of the newly described subspecies from Vietnam – the Vietnamese crocodile lizard *Shinisaurus crocodilurus vietnamensis* – based on recent field work as well as husbandry experiences at the Me Linh Station for Biodiversity in North Vietnam. We further compare our new findings with the data available for the nominate subspecies from China. Based on our current knowledge, we update existing minimum husbandry requirements in Germany and elaborate different husbandry parameters for both subspecies. Furthermore, we introduce new husbandry protocols and facility designs for the Vietnamese subspecies both at Me Linh Station for Biodiversity and at Cologne Zoo, Germany.

Key-words: conservation breeding; crocodile lizards; habitat parameters; hibernation; natural history; Shinisauridae; zoo biology.

INTRODUCTION

The Crocodile lizard *Shinisaurus crocodilurus* is a commonly kept reptile species both in zoological gardens and among hobbyists. This species represents an ancient anguid lizard clade, which was described in 1930 by Ernst Ahl as a new species, genus and family (Zhao *et al.*, 1999; Huang *et al.*, 2008). Crocodile lizards are habitat specialists, which prefer small, remote streams along mountain ridges within undisturbed tropical rainforest (Ning *et al.*, 2006; Huang *et al.*, 2008; van Schingen, Ihlow *et al.*, 2014; van Schingen, Pham *et al.*,

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2014). The critical taxonomic position, long evolutionary history as well as specific life-history traits and high sensitivity to environmental conditions make this species particularly important for understanding the evolution and ecology of lizards. Originally only known from southern China, the species has also been proven to occur in Vietnam (Le & Ziegler, 2003). At the time of writing, the distribution range of the Crocodile lizard is restricted to fragmented sites in southern China and northern Vietnam, where suitable habitats are small, isolated and steadily shrinking (Le & Ziegler, 2003; Huang *et al.*, 2008; van Schingen, Ihlow *et al.*, 2014). Only rarely found in lizards, *S. crocodilurus* is lecithotrophic viviparous (ovoviviparous) usually giving birth once a year to two to 12 living juveniles within the water. In natural habitats *S. crocodilurus* reaches maturity relatively late at *c.* 3–4 years of age (Zhang, 2006; Zollweg & Kühne, 2013).

The Crocodile lizard was recently listed as Endangered in the International Union for Conservation of Nature (IUCN) Red List (Nguyen *et al.*, 2014). The research results of our working group, related to population status, microhabitat and trade analyses (van Schingen, Pham *et al.*, 2014, 2015; van Schingen, Schepp *et al.*, 2015), have contributed towards the recent upgrade of the Crocodile lizard from Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) to Appendix I (Ziegler & Nguyen, 2017).

Latest integrative taxonomic research revealed the Chinese populations to be morphologically and genetically distinct from Vietnamese representatives, as well as occupying different microhabitats (van Schingen, Le *et al.*, 2016). Consequently, the importance of conservation-breeding programmes was highlighted, in particular for the newly described subspecies from Vietnam – the Vietnamese crocodile lizard *Shinisaurus crocodilurus vietnamensis* – because population estimates from northern Vietnam are alarmingly low (van Schingen, Pham *et al.*, 2014; van Schingen, Ha *et al.*, 2016). To maintain the genetic integrity of the different subspecies within *ex situ* programmes, it will be crucial to manage the Vietnamese crocodile lizard and Chinese crocodile lizard *Shinisaurus crocodilurus crocodilurus* separately as different conservation units (Plate 1). As the two subspecies are exposed to different ecological conditions and are found in different microhabitats (van Schingen, Schepp *et al.*, 2015; van Schingen, Le *et al.*, 2016), respective husbandry parameters have to be considered in order to optimize the outcomes of breeding projects. Thus, we herein provide a topical review of Vietnamese crocodile lizards habitat use based on our extensive field work in North Vietnam during the last few years and husbandry experiences with the Vietnamese subspecies at the Me Linh Station for Biodiversity in Vietnam (Ziegler *et al.*, 2016). These findings were compared with published data on Chinese crocodile lizards in order to provide recommendations for improved and adjusted husbandry conditions for both subspecies (see Table 1). In addition, we provide updated husbandry protocols and facility designs for the Vietnamese subspecies, both at Me Linh Station for Biodiversity and Cologne Zoo, Germany, which can serve as examples for appropriate husbandry parameters.

MATERIAL AND METHODS

Ecological field surveys occurred in 2013–2016 (in May, June and July each year) in Tay Yen Tu Nature Reserve (NR), Bac Giang Province, Yen Tu NR, Dong Son-Ky Thuong NR and Hai Ha District, Quang Ninh Province, North Vietnam, as well as during winter in January 2016 in Tay Yen Tu NR. During these surveys microhabitat parameters both during summer and winter, habitat selection, thermal niche and activity patterns of wild *S. c. vietnamensis* have been extensively investigated (for detailed methods see van Schingen, Ihlow *et al.*, 2014; van Schingen, Pham *et al.*,

Plate 1. Vietnamese crocodile lizard *Shinisaurus crocodilurus vietnamensis* **from Vietnam:** *top left,* **in Tay Yen Tu Nature Reserve;** *bottom left,* **with juvenile at the Me Linh Station for Biodiversity, northern Vietnam;** *right,* **genetically screened Chinese crocodile lizard** *Shinisaurus crocodilurus crocodilurus* **from China at the Cologne Zoo, Germany.** *Thomas Ziegler.*

HUSBANDRY REQUIREMENTS	STREAM-SHORE DWELLER
Enclosure size for 1.1 (♂.♀) (length × width × height) in SVL	6 × 4 × 4* deep (half of which contains water)
Ambient temperature	20–25°C
Local basking areas	35°C
Social composition	1.1
Comments	hiding places under water and on land; climbing opportunities, partly wet substrate

Table 1. The German minimum husbandry requirements (http://www.bmel.de/cae/servlet/contentblob/383050/publicationFile/22241/HaltungReptilien.pdf) for Crocodile lizards *Shinisaurus crocodilurus* **from South China according to the Federal Ministry of Food and Agriculture. Suggestions for improvement of husbandry requirements for both subspecies are given in the text and in the following tables: SVL, snout–vent length; *, the enclosure should be 6× as long as the SVL, 4x as wide as the SVL and 4x as high as the SVL.**

2014, 2015; van Schingen, Ha *et al.*, 2016; van Schingen, Le *et al.*, 2016; van Schingen, Ziegler *et al.*, 2016; unpubl. data).

Field surveys took place both at night and during the day. In order to record temperatures specifically selected by *S. c. vietnamensis* in natural habitats, backpacks made of CoPoly with integrated temperature dataloggers (Thermochron iButton; measuring interval 2 minutes) were attached to five adults [snout–vent length

(SVL) > 140 mm] for several days (unpubl. data). Animals with data loggers were released at the exact place they had been collected from and were recaptured 4–17 days after release. After recapture, data loggers were removed. In addition, further temperature and light dataloggers were placed in streams as well as on sun-exposed and shadowed branches (unpubl. data).

Experiences and observations of managed *S. c. vietnamensis* mainly originate from the Me Linh Station for Biodiversity, where the subspecies has been kept since 2012 (Ziegler, 2015; Ziegler & Nguyen, 2015; Ziegler *et al.*, 2016); before that time, the subspecies was maintained at the Amphibian Station Hanoi, Vietnam (Ziegler *et al.*, 2011).

Based on these previous studies and further unpublished observations, we reviewed the habitat use and microhabitat parameters of Vietnamese crocodile lizards in order to give concrete recommendations for adjusted husbandry of this subspecies. The data collected from Vietnam were compared with available data from China (after Hu *et al.*, 1984; Zhao *et al.*, 1999; Zhu *et al.*, 2002; Ning *et al.*, 2006; Yu *et al.*, 2006; Zhao *et al.*, 2006; Long, Zhang, Liang, Su & Deng, 2007; Long, Zhang, Liang, Su, Luo & Huang, 2007; Huang *et al.*, 2008; Long, 2008; Wang *et al.*, 2008, 2009; Zollweg, 2012; Zollweg & Kühne, 2013; and personal communications regarding the experiences of private keepers).

RESULTS

Ecological niche of *S. c. vietnamensis*

Habitat Shinisaurus crocodilurus vietnamensis occurred in granitic evergreen broadleaf lowland forests at elevations between 50 and 850 m asl, while *S. c. crocodilurus* is reported to inhabit limestone mountains within evergreen broadleaf forests, intermixed bamboo or shrubbery forests, mixed or conifer and mixed broadleaf forests at elevations between 200 and 1500 m asl (Zhao *et al.*, 1999, 2006; Zhu *et al.*, 2002; Huang *et al.*, 2008) (Table 2). Unfortunately, suitable habitat sites are steadily shrinking (forest clearance, illegal logging, extension of coal mining) and are predicted to decline dramatically in the future because of the impacts of climate change (van Schingen, Le *et al.*, 2016).

In Vietnam, the riparian zones of inhabited streams were usually densely vegetated, mainly by broadleaved trees, ferns, scattered bamboo and canes, while the canopy cover above the stream was generally not entirely closed (Plate 2). In Chinese habitats, streams were reportedly completely

	S. C. VIETNAMENSIS	*S. C. CROCODILURUS*
Forest type	granitic evergreen broadleaf lowland forests	limestone mountains within evergreen broadleaf or intermixed bamboo, conifer or shrubbery forests
Altitudinal range	50–850 m asl	200–1500 m asl
Shore vegetation	densely vegetated shore zones; canopy cover above water parts not entirely closed	water body completely covered by thick vegetation at heights of 50–100 cm
Water body	running freshwater habitats with pools	shallow, slow-running freshwater habitats
General climate	annual continuously moderate temperatures without high fluctuations	higher annual temperature amplitudes and lower temperatures in winter with minimum temperatures occasionally reaching -5·6°C
Relative humidity	78–88%	*c.* 82–83%
Illumination	up to 242 500 lux	data not available

Table 2. Macrohabitat parameters for Vietnamese crocodile lizards *Shinisaurus crocodilurus vietnamensis* **compared with Chinese crocodile lizards** *Shinisaurus crocodilurus crocodilurus:* **asl, above sea level.**

covered by thick vegetation, commonly at heights of between 0·5 and 1 m (Ning *et al.*, 2006; Zollweg & Kühne, 2013).

Even though *S. c. vietnamensis* is adapted to running water, we found that it appeared to prefer locations above backwater pools or sections of impounded water next to small waterfalls with almost no flow velocity (0–0·47 m sec^{-1}) (van Schingen, Pham *et al.*, 2014) (Table 2). If densities of crocodile lizards along streams were high, animals, especially juveniles, were more frequently observed resting above faster-running sections, probably because of the territorial behaviour of the species. In Vietnam, animals usually rested above areas of the stream with depths between 5 and 73 cm and stream widths of 1–8 m, while streams in China were reportedly shallower (mean *c.* 10 cm and generally below 30 cm deep) and narrow, mainly between 1 and 2 m or even less (Ning *et al.*, 2006; Zollweg & Kühne, 2013; van Schingen, Pham *et al.*, 2014).

In Vietnam, streams inhabited by crocodile lizards were characterized as soft waters

Plate 2. Vietnamese crocodile lizard *Shinisaurus crocodilurus vietnamensis: top,* **resting on a perch at night.** *Thomas Ziegler; bottom,* **typical habitat in Tay Yen Tu Nature Reserve, northern Vietnam.** *Mona van Schingen.*

(GH < 1–2), (where GH = general hardness) with a high water quality, indicated by a high oxygen content (6–10 mg litre^{-1}), low nutrient concentrations of nitrogen (NO_2 < 0·01 mg litre^{-1}; NO_3 < 0·5–5 mg litre^{-1}; NH_3/NH_4 < 0·05–0·1 mg litre^{-1}) and phosphate (PO_4 < 0·002–0·1 mg litre^{-1}) as well as no iron and copper contents (van Schingen, Pham *et al.*, 2014; pers. obs, 2016) (Table 3). Thus, hardly any macroalgae were present in stream habitats. Furthermore, the water was found to range from neutral to relatively acidic conditions with pH values ranging from 4·5 to 7·37, while pH values of 6·5 were measured in Dayaoshan Nature Reserve, Guangxi, China (Long, 2008; van Schingen, Pham *et al.*, 2014).

Resting places were usually branches or ferns above the water body (Table 4). Of 215 different animals only two individuals were observed sleeping on granite cliffs above the water, while all others had been found in different kinds of vegetation, but never on the forest floor. Juveniles were found to select ferns, shrubs and canes, while adults were usually found on tree branches, which were more densely vegetated (van Schingen, Pham *et al.*, 2014).

PARAMETER	VALUE
Water temperature	22·5–24·5°C (summer) 17·1–17·5°C (winter)
General hardness	< 1–2 dH
Oxygen	6–10 mg litre^{-1}
Nitrogen	NO_2 < 0·01 mg litre^{-1} NO_3 < 0·5–5 mg litre^{-1} NH_3/NH_4 < 0·05–0·1 mg litre^{-1}
Phosphate	0·002–0·1 mg litre^{-1}
pH value	4·5–7·37 (cf. pH 6·5 at one habitat site in China)
Iron and copper content	absent
Macroalgae	virtually lacking

Table 3. Water parameters at habitat sites of Vietnamese crocodile lizards ***Shinisaurus crocodilurus vietnamensis*****: dH, German degree (deutsche Härte) defined as 10 mg litre^{-1} CaO.**

Preferred perch heights of the adults were, with a median height of *c.* 119·3 cm above the water level, significantly higher than those of juveniles (median 63·5 cm) (van Schingen, Pham *et al.*, 2014). Similarly, interpopulation differences were also found, namely Vietnamese crocodile lizards were observed occupying significantly higher perches (mainly above 1 m) than Chinese crocodile lizards (mainly between 0·5 and 1 m) (van Schingen, Pham *et al.*, 2014) (Table 4). Chinese crocodile lizards show a preference for plants, branches and shrubs above the water body, but were found to spend about one-third of the day in burrows that were characterized by high concealment with vegetation and shielded from sunlight, a depth of 18–132 cm (n = 124 crocodile lizards), a distance to the stream of < 0·5 m, positioned 0·3 m above the water body and in areas of high humidity (Zhao *et al.*, 2006; Long, 2008). Such burrows may be deep and serpentine swallets (sinkholes), tree holes or rock shelters (Zhao *et al.*, 2006).

Recent field research confirmed the diurnal lifestyle of crocodile lizards in Vietnam where the onset of daily activities usually began at sunrise, with peak activity occurring during the morning and at noon (unpubl. data). Animals were found to be inactive during large periods of the day and the whole night (unpubl. data) (Table 5). Crocodile lizards were also reported to be diurnal in China, but spending 98·5% of the day inactive on a perch above a water body or hidden during summer (Zollweg & Kühne, 2013).

Long-term field research revealed extremely small home ranges (unpubl. data); if not disturbed, several animals were even observed to occupy the same branches as resting perches over several years. In China, initial studies revealed home ranges of *c.* 6·8–10·9 m² (n = 4 crocodile lizards), while home ranges were positively affected by the size of respective backwater pools (Long, Zhang, Liang, Su, Luo & Huang, 2007). Furthermore, individuals were found to disperse along streams, mostly only one adult

	S. C. VIETNAMENSIS	*S. C. CROCODILURUS*
Resting places	branches or ferns above the water body; rarely granite cliffs above the water	prefer plants, branches or shrubs above the water body; sometimes on cliffs; diameter of branches < 1 cm
	juveniles select ferns, shrubs and canes; adults on more densely vegetated tree branches (mean diameter *c.* 1·3 cm)	
Preferred perch height above the water body	average *c.* 120 cm (up to 210 cm) for adults 60–65 cm for juveniles	mainly between 50 and 100 cm for adults
Water body	prefer spots above pools next to small waterfalls with almost no flow velocity; when densities are high juveniles can also be found resting above faster-running sections	prefer pools; only one adult per pool
Water depth	5–73 cm	*c.* 10 cm (< 30 cm)
Stream width	1–8 m	1–2 m (or smaller)
Microclimate at perch sites	22·14–31·27°C (mean 25·9°C) in May and June; 13·36–16·33°C in January	data not available
Selected temperature	24·21 ± 1·14°C (range 21·88–30·88°C) *in situ*	22·5–28·3°C under laboratory conditions
Illumination at perch site	up to 38 580 lux at noon at perch sites in summer; winter up to 120 lux around noon	data not available
	photoperiod of 14 hours in summer and 12 hours in winter	

Table 4. Microhabitat parameters within natural habitats of Vietnamese crocodile lizards *Shinisaurus crocodilurus vietnamensis* **compared with Chinese crocodile lizards** *Shinisaurus crocodilurus crocodilurus.*

	S. C. VIETNAMENSIS	*S. C. CROCODILURUS*
Lifestyle	diurnal, with first daily activities starting at sunrise (highest activities during morning and noon); extended inactive periods during day and whole night time	diurnal; during summer spending 70% of the day inactive on perch and 28·5% hidden in burrow
Territoriality	prefer same resting site (e.g. branch); small home ranges	home range *c.* 6·5–11 m² in habitat sites
	usually only one adult per pool; occasionally different sexes or juveniles occur together with adults	only one adult per pool in natural habitat sites
Temperature regulation	dependent on constantly cool water and adjacent terrestrial areas to regulate temperature	behavioural and physiological means
Occupied temperature niche	animals select niche temperatures generally cooler compared with environmental temperatures, but warmer than water temperatures	body temperatures of wild crocodile lizards slightly above substrate temperatures; gravid females and 1 year-old juveniles have highest body temperatures
	active avoidance of high temperatures at sun-exposed spots	
Diet	invertebrates, preference for earthworms	invertebrates and small vertebrates

Table 5. General behaviour of Vietnamese crocodile lizards *Shinisaurus crocodilurus vietnamensis* **compared with Chinese crocodile lizards** *Shinisaurus crocodilurus crocodilurus.*

specimen was observed per pool indicating the territorial behaviour of the species (Table 5). Adult males were observed to attack each other when placed together in an enclosure. However, exceptions were observed during field work for different age classes (juveniles, subadults and adults) as well as different sexes, which were occasionally found aggregated.

Climate Recorded field temperature at perch sites in Vietnam ranged between 22·14 and 31·27°C (mean 25·9°C) in May and June, and between 13·36 and 16·33°C in winter (unpubl. data). Water temperatures were more constant, ranging between 22·5 and 24·5°C in summer, and 17·1 and 17·5°C in winter (unpubl. data) (Table 4). Relative humidity was usually found to be high, at between 78% and 88% (van Schingen, Pham *et al.*, 2014). While illumination values of up to 242 500 lux have been recorded within the macrohabitat, at the perch sites of *S. c. vietnamensis* only values of up to 38 580 lux were reached at noon in summer (unpubl. data). During winter, light intensity was comparably low with recorded values of only up to 120 lux around noon (Table 4). Days were also *c.* 2 hours shorter in January compared to summer. Based on the information gathered from the data loggers attached to the animals, active avoidance of sun-exposed spots with high temperatures was recorded (unpubl. data). Furthermore, it was shown that the occupied temperature niche of crocodile lizards was narrower compared with the environmental fundamental niche, with the temperatures of the animal being generally cooler compared with environmental temperatures. Crocodile lizards were found actively to control their temperature to maintain their optimal body temperature and are thus strongly dependent on constantly cool water and adjacent terrestrial areas. In China, measured body temperatures of wild crocodile lizards were in the range of 20·4–22·55°C slightly above substrate temperatures (18·4–21·5°C) in May (Wang *et al.*, 2008). Wang *et al.* (2009) further demonstrated that animals selected temperatures between 22·5 and 28·3°C out of a complete range of 18–50°C under laboratory conditions and that gravid females as well as 1 year-old juveniles had the highest body temperatures.

The climate in Vietnamese and Chinese habitats differs. In China there are generally higher annual temperature amplitudes, with up to 40°C in summer and minimum winter temperatures occasionally reaching −5·6°C at some sites, which is in contrast to continuously moderate temperatures in Vietnam (Zhao *et al.*, 1999; Long, 2008; Zollweg & Kühne, 2013; unpubl. data). Additional predictions of suitable habitats based on climatic parameters revealed different regions to be suitable for *S. c. vietnamensis* and *S. c. crocodilurus*, respectively, indicating different climatic adaptations of the two subspecies (van Schingen, Le *et al.*, 2016).

Hibernation Recent studies revealed that Vietnamese crocodile lizards also have a period of hibernation (van Schingen, Le *et al.*, 2016; unpubl. data). Observations of crocodile lizards in human care indicate an almost strict inactive phase from December to February, while animals occasionally have short periods of activity during winter (unpubl. data) (Table 6). Field observations confirmed that *S. c. vietnamensis* hide in an inactive state during the winter months, but also provide evidence for further occasional inactive periods during the summer months (unpubl. data). Recent studies of *ex situ* crocodile lizards in Vietnam indicated that preferred spots for hibernation are holes within the earth or trees, whereas field observations provided the first evidence of these lizards digging into the soil (unpubl. data). The frequent usage of burrows during summer has been recorded for Chinese crocodile lizards (Zhao *et al.*, 2006; Long, Zhang, Liang, Su, Luo & Huang, 2007). While Vietnamese crocodile lizards were found to be exclusively terrestrial in *ex situ* facilities and in the wild during hibernation, hibernating crocodile lizards have been

occasionally found within the water in China, which has also been confirmed by numerous hobbyists (Zollweg & Kühne, 2013). However, first evidence exists for the main usage of humid but dry burrows for hibernation in China (Zhao *et al.*, 2006). Chinese crocodile lizards were reported to hibernate from October to April and initiate hibernation at temperatures of between 8 and 11°C. The animals become active at constant temperatures of 15–18°C (Hu *et al.*, 1984; Zhao *et al.*, 1999; Yu *et al.*, 2006; Zollweg & Kühne, 2013). When in human care, Vietnamese crocodile lizards initiated hibernation at mean temperatures of *c.* 17·5°C in December and were starting to become active without a pronounced increase in temperature in March (unpubl. data). Field observations in Vietnam revealed that animals were still inactive at temperatures of between 13·4 and 20°C throughout January (van Schingen, Le *et al.*, 2016) (Table 6). Overall, the hibernation period in Vietnamese crocodile lizards is apparently shorter, with animals not necessarily being inactive over the entire time, and occurs at generally higher average temperatures when compared with the hibernation conditions of lizards in China. However, periods of inactivity without feeding are apparently necessary for the species.

Diet First dietary analyses on *S. c. vietnamensis* indicated a preference for oligochaete worms, as well as invertebrate larvae, followed by cockroaches and crickets; while vertebrates were not found being consumed (Werner, 2015; van Schingen, Le *et al.*, 2016) (Table 5). Chinese crocodile lizards were reported to feed on a wider prey spectrum ranging from aquatic

	S. C. VIETNAMENSIS	*S. C. CROCODILURUS*
Location	holes in the ground and hollow branches are preferred hibernation spots in captivity (but see Plate 4); also, first evidence for digging into the soil in the wild (because soil-covered individuals were found) during hibernation exclusively terrestrial in captivity; similar observations in the wild	mainly humid, but dry burrows (holes in the ground, tree hollows, rock crevices), covered with vegetation; usually close to the stream and at low heights above water body; depth of holes 18–132 cm; hibernation within the water occasionally recorded in the field and frequently in captivity
Initiation	at mean temperatures of *c.* 17·5°C in captivity	at temperatures between 8 and 11°C
Ending	without pronounced increase in temperature in March; still inactive at temperatures of between 13·4°C and 20°C in the field during January	at constant temperatures of 15–18°C in March or April
Duration	hibernation period from December to March in outdoor enclosures in Vietnam generally shorter hibernation period, not strict and at higher average temperatures, but periods of inactivity without feeding required inactive phase during winter (both in the wild and in captivity), occasionally short periods of activity during winter in captivity; occasional inactive periods during summer in the field	hibernation period from October to April in Chinese habitats generally extended hibernation period, strict and at lower average temperatures

Table 6. Hibernation parameters for Vietnamese crocodile lizards *Shinisaurus crocodilurus vietnamensis* **compared with Chinese crocodile lizards** *Shinisaurus crocodilurus crocodilurus.*

invertebrates, such as shrimps, which are frequently consumed, to small vertebrates, such as fish, frogs, tadpoles and small lizards (Zhao *et al.*, 1999; Zollweg, 2012; Zollweg & Kühne, 2013). Stomach-content analysis by Ning (2007) indicated that *S. c. crocodilurus* showed a preference for earthworms of the genus *Pheretima* (34·78%), followed by Araneida (8·70%), Tettigoniidae (8·70%) and Cicadidae (8·70%) out of a range of invertebrate prey species covering more than 20 families. Detailed studies on the time budget of *S. c. crocodilurus* showed that feeding only accounted for about 0·12% of the diurnal time (Long, Zhang, Liang, Su & Deng, 2007).

Adjusted husbandry recommendations

At the time of writing, care for the Vietnamese crocodile lizards followed the German minimum husbandry requirements – guidelines published by the Federal Ministry of Food and Agriculture, and compiled by the expert group for animal welfare and appropriate husbandry of animals held in terrariums (see VDA & DGHT Sachkundenachweis, http://www.skn-dght.de/index.php?id=27) – which were based on the limited information known about Chinese crocodile lizards (Table 1). Here, we summarize the most important facts known about *S. c. vietnamensis*, both from the natural habitat and observations of the subspecies in *ex situ* facilities (treated in detail earlier), and compare these facts to respective data for the Chinese crocodile lizards, as far as available (see Material and Methods) (Tables 2–6). In light of newly acquired knowledge, the following paragraphs will describe the actions necessary to improve enclosures and husbandry practices to meet the natural requirements of the subspecies more closely; where possible, we have tried to distinguish between the different requirements of the Vietnamese and Chinese subspecies (for details refer to the information in Results and Tables 2–6).

Generally, crocodile lizards are good climbers and swimmers. During the active season lizards spend large periods of time on perches above water, as well as in and under the water. They also regularly dig in the soil. To date in Vietnam, *S. c. vietnamensis* has never been found on the forest floor. These findings indicate that crocodile lizards are using vertical rather than horizontal space and, thus, a highly structured environment and the provision of sufficient opportunities for climbing, swimming, hiding and digging are considered most important for constructing a facility for crocodile lizards, rather than the size of the ground area alone. For terrarium construction, *S. crocodilurus* specifically requires a forest-stream habitat with a densely vegetated shore zone. We recommend using larger terrariums than indicated in the currently available minimum husbandry requirements [namely 6 × 4 × 4 SVL (l × w × h)] in Germany. This would equate to 96 cm × 64 cm × 64 cm for *S. c. vietnamensis* individuals, which have an average SVL of 16 cm. Particularly in relation to the terrarium height, however, larger terrariums are recommended, given the preferred perch height of *c.* 120 cm observed in *S. c. vietnamensis*. Additionally, perches, such as branches, need to be offered at different heights and diameters above the still-water area, in order to provide sufficient opportunities to climb and jump into the water, natural behaviours that were observed in both subspecies. In particular, thin branches should be provided for *S. c. vietnamensis* (mean diameter of *c.* 1–3 cm; see Table 4). Water depth must be sufficiently deep, so that individuals that jump into the water from higher resting perches are not injured; therefore, water depth is dependent on the maximum height of the terrarium and placement of the enclosure furniture at the locations from where animals can jump into the water; preferably water depth should be at least 15–30 cm. Generally, the nominate form seems to require shallower waters (*c.* 10 cm, maximum water depth 30 cm), whereas *S. c. vietnamensis* also occurs in nearby deeper water. *Shinisaurus crocodilurus vietnamensis* inhabits distinctly wider

streams (at least 1 m wide) than the nominate form. The water zone in the enclosure should contain both running and still-water sections. Water quality should be excellent, with a high oxygen content (cf. Table 3). A sufficiently high relative humidity of *c.* 75–90% (*S. c. vietnamensis*) or *c.* 80–85% (*S. c. crocodilurus*) must be maintained in the terrarium (see Table 2). The Vietnamese crocodile lizards require an area of land with substrate suitable for digging, but it is recommended that such a substrate is also provided for the Chinese subspecies in light of the husbandry experiences of private keepers. Hiding opportunities, such as bamboo canes and cork tubes, should be available both on land and in the water, and also for hibernation. Direct and intense sun rays should be avoided. In winter, seasonal air- and water-temperature reduction is required to initiate hibernation. Air temperatures in summer should range between 21 and 30°C. High annual temperature fluctuations are only found in China, the nominate form thus requires a greater temperature decrease. In contrast, hibernation temperatures for *S. c. vietnamensis* should not fall below 13°C. Hibernation period in *S. c. vietnamensis* lasts from December to March, while for the nominate subspecies it lasts from October to April in the field. Photoperiod should be shortened during winter, with less-intense illumination. Both subspecies should be kept in pairs [1.1 (♂.♀)], alone or in small groups, if compatible, which only include a single male. If kept in pairs or groups, enough adequate perches and shelter should be provided for each individual to be able to retreat to a safe location, because *S. crocodilurus* are very sensitive to stress.

Conception of new facilities

Me Linh Station for Biodiversity, Vietnam
Since 2012, a group of Vietnamese crocodile lizards has been kept at the Me Linh Station for Biodiversity. This group had been transferred from the Amphibian Station, Hanoi, Vietnam, where it was originally established in earlier years (see Ziegler *et al.*, 2011). At Me Linh, three enclosures with ground areas of *c.* 2 m^2, 6 m^2 and 7 m^2 were built between 2012 and 2014 (for details see Ziegler *et al.*, 2016) (Plate 3). For these enclosures, field research-based findings about ecological requirements of *S. c. vietnamensis* were used to provide the most appropriate enclosures, namely sufficient enclosure height (140–180 cm), high water quality and slow water flow via pumps / permanent freshwater supply, as well as sufficient hiding, climbing and resting opportunities both on land and in the water (Ziegler *et al.*, 2016). Subsequently, boundaries created with stones and concrete were incorporated into all enclosures in order to create areas of land that could be filled with substrate, as more-recent findings showed that *S. c. vietnamensis* is known to bury itself at times during hibernation.

The crocodile lizard *ex situ* breeding project was further prioritized and enlarged in 2016 with new facilities being developed. In total, eight enclosures (each comprising four compartments arranged in two blocks) were set up on a concrete base measuring 4 m × 5 m (Plate 4). The two enclosure blocks were placed at a distance of 95 cm away from each other, with the space in between acting as a service corridor. The bases were constructed as concrete basins (90 cm in height); the tops were made using iron frames (110 cm high) covered with metal gauze, with each compartment having a large keeper door opening to the front. Each enclosure measures 200 cm × 100 cm × 200 cm high. One pump was connected per block (SERA pond pp 3000) to create a water flow (maximum 3500 litres $hour^{-1}$), the water areas of the four compartments were connected by holes (covered with plastic grid) to allow water circulation. There is no filter attached, but fresh running water is constantly led in from water pipes surrounding the facilities through a cascade (constructed with larger stones and concrete) in one corner of each enclosure to maintain the water quality, increase the

Plate 3. Triangular-shaped facility for conservation breeding of Vietnamese crocodile lizard *Shinisaurus crocodilurus vietnamensis* **at the Me Linh Station for Biodiversity, northern Vietnam, was built in 2014 (see Ziegler** *et al.,* **2016). Most recent breeding occurred in this 4 m x 3 m x 3 m deep enclosure in May 2018.** *Thomas Ziegler***.**

oxygen content and provide for different flow velocities, which also increases the choice / variety of resting places for the crocodile lizards. The four inner corners of the block were divided by *c.* 35 cm-high curved boundaries made of bricks and concrete, to provide areas of land, and the water level is kept at *c.* 30 cm using PVC-overflow pipes, which can be removed for complete water discharge. Using these parameters, every enclosure has an area of land (*c.* 35–40% of the enclosure ground area, maximum surface area of *c.* 185 cm × 45 cm) in an inner corner, a 'stream' flowing around the land and a cascade at the outermost corner. Stones fixed with concrete on the outer side of the land walls serve as resting places for the crocodile lizards and facilitate water egress. The terrestrial areas were covered with a layer of stones and gravel for drainage, and a *c.* 20 cm-deep substrate layer (natural soil

Plate 4. A new facility was built in 2016 for conservation breeding of Vietnamese crocodile lizard *Shinisaurus crocodilurus vietnamensis* **at the Me Linh Station for Biodiversity, northern Vietnam:** *top left,* **general view (July 2018).** *Thomas Ziegler; top right,* **single enclosure after building and furnishing (August 2016).** *Anna Rauhaus; bottom,* **fully established enclosure (July 2018).** *Thomas Ziegler***.**

from the surroundings of Me Linh Station) covered with leaves. Furthermore, all terrestrial areas were planted with living plants of different sizes, and climbing, resting and hiding opportunities were provided using various horizontally and obliquely arranged branches, reaching from the land to above the water, stones, roots and bamboo canes (Plates 5 and 6). Large stones positioned in the water also serve as resting places. The facility's entire enclosure block was covered by a roof made of corrugated acrylic glass to protect the crocodile lizards from the weather; suspended roof openings provide natural UV radiation (Plate 4). In 2018 the facility was expanded by two additional enclosure blocks (each 2 m × 2 m) constructed in the same way as described. Hatchlings are raised in glass terrariums or separate plastic (fauna) boxes inside an air-conditioned room during the first few months of life (Plate 5).

Cologne Zoo, Germany In 2016 Cologne Zoo created a unit (700 cm × 265 cm × 238 cm high) for Vietnamese crocodile lizards, in order to extend the reserve population to another institution in another country. The right-hand side of the room is designated for the husbandry of breeding pairs. An enclosure of 600 cm × 80 cm × 200 cm high was developed, consisting of a large polypropylene basin (80 cm in height) and a steel-construction top with metal gauze attached (120 cm in height) (Plate 7). The enclosure can be divided into five compartments, each 120 cm in width, making it possible to

Plate 5. Vietnamese crocodile lizard *Shinisaurus crocodilurus vietnamensis; top,* **in the new facility at the Me Linh Station for Biodiversity, northern Vietnam.** *left, Thomas Ziegler; right, Anna Rauhaus; bottom,* **offspring from May 2018 at** *c.* **2 months old.** *Thomas Ziegler.*

keep up to five pairs of crocodile lizards, or to provide wider enclosures for fewer animals. The dividing walls comprise two parts: lightweight plastic grid board for the lower half (enabling water flow through the whole facility), which can be inserted into tracks in the basin, and acrylic glass slides for the upper half, which can be inserted into slots inside the metal construction. Every compartment is accessible via a keeper door opening to the front. The water level inside the enclosure is adjustable by using a rotatable overflow pipe and, at the time of writing, it is kept at *c.* 30 cm deep. The floor of the basin is slightly bevelled from the left- to the right-hand side of the enclosure; the water is fed through a PVC pipe from the right side via a pump (Aqua Medic DC Runner 5.0) into a filter (Biotec Screenmatic 12) at the left side of the enclosure and from there pumped back into the enclosure, creating a slow-water circulation. The water can also be completely discharged via a separate plug valve. Terrestrial areas filled with substrate were also created using waterproof rectangular plastic-flowerpots (80 cm × 30 cm × 35 cm high), which were placed above the surface of the water on 30 cm-high sockets made of expanded polystyrene. Plastic gauze was arranged on the back walls and flowerpots, and artificial rocks and stones were modelled out of extruded polystyrene, and covered with adhesive and reinforcement mortar to create climbable walls, water–land transition ramps and resting places (Plate 7). The sockets were also covered with mortar, forming 'caves' that provide hiding places for the crocodile lizards under the substrate, comprising a mixture of sand and unfertilized potting soil. Branches in different sizes and of different thicknesses

Plate 6. Unusual hibernation position of Vietnamese crocodile lizard *Shinisaurus crocodilurus vietnamensis* **in branches at** *c.* **1·7 m height in the new lizard facility at the Me Linh Station for Biodiversity, northern Vietnam. The photograph was taken on 3 February 2018 during the day at a temperature of 11°C. This individual had been observed resting in this position for the previous 2 weeks. When the sun came out for the first time after a cooler period, the individual woke up on the following day and moved to the water area of the enclosure.** *Thomas Ziegler***.**

were arranged around the enclosure reaching from the areas of land above the water to the top of the enclosures (Plate 8). A variety of plants was brought in – *Aeschynanthus* sp, *Aglaonema* sp, *Alocasia lowii*, *Asplenium nidus*, *Caryota mitis*, *Ficus binnendijkii*, *Ficus pumila*, *Hemionitis arifolia*, *Hoya carnosa*, *Pilea cadierei* and *Schefflera arboricola* – and some of the ground and the artificial rocks were covered with moss. Additional fresh water can be fed into the enclosure from the front of each compartment. Removable cascades made of woven filter medium covered with adhesive and reinforcement mortar were constructed to provide further naturalistic enclosure structures, and climbing and resting opportunities. The plan is to use the left-hand side of the room for rearing juveniles or keeping surplus adults. Shelves in this area hold a

Plate 7. Construction and furnishing of the large new facility for Vietnamese crocodile lizard *Shinisaurus crocodilurus vietnamensis* **in the terrarium section of the Cologne Zoo, Germany.** *Anna Rauhaus.*

selection of terrariums (two at 120 cm × 56 cm × 75 cm high; six at 60 cm × 56 cm × 45 cm high) and there is one empty shelf where juveniles can be housed individually in plastic boxes. Illumination for all enclosures is provided via LED strips (basic illumination), mercury vapour lamps (temperature range and UV access) and UV compact lamps (UV access for juveniles). The basic room temperature is kept at *c.* 24–25°C between April and November, the room was supplied with an air conditioner to facilitate cooling to *c.* 14°C during the hibernation period.

DISCUSSION

At the time of writing, despite these newest insights into the different habitat requirements of both subspecies of *S. crocodilurus*, there are still questions to be answered about husbandry and natural history. As discussed by van Schingen, Le *et al.* (2016), the geographic line separating the Vietnamese and Chinese subspecies is not yet known. At the time of writing we assume that it coincides with the border between China and Vietnam; however, it cannot be ruled out that the Vietnamese subspecies also ranges into southern China. It is also a possibility that China harbours more than one form of crocodile lizard, which can only be resolved following comprehensive morphological and molecular analyses of inter-population variation. In the case that the Chinese populations represent different forms, the husbandry requirements for the Chinese populations would likewise have to be revised according to potential regional differences.

Because Vietnamese crocodile lizards recently have increasingly appeared in the

Plate 8. Completely furnished large facility for Vietnamese crocodile lizard *Shinisaurus crocodilurus vietnamensis* **in the terrarium section of the Cologne Zoo, Germany.** *Thomas Ziegler, Anna Rauhaus.*

international pet trade (van Schingen, Schepp *et al.*, 2015; Auliya *et al.*, 2016), it is crucial to identify the origin of *ex situ* individuals to maintain genetically pure conservation units, and avoid hybridization within the breeding population that may potentially be used for future restocking / release efforts (Plate 9). Genetic screening of crocodile lizards kept in Europe is currently carried out by our team in concert with the University of Braunschweig, Germany, and Hanoi National University, Vietnam, the results of which will be reported elsewhere. This genetic approach certainly provides the best results; however, head shape can also be helpful in giving the first clues needed to distinguish between the subspecies (van Schingen, Le *et al.*, 2016). As previously stated, the variation of the Chinese populations so far is insufficiently studied, so that final conclusions cannot be made at this time. Another helpful and promising approach might be the analysis of isotopic signatures, as by employing this technique we were able to distinguish between wild-caught crocodile lizards and those in human care, which was the first case study of its kind for lizards (van Schingen, Ziegler *et al.*, 2016). Future analyses must prove whether this method is also able to distinguish between different natural populations, which seems to be realistic, as habitats in Vietnam and China are different, with distinct, separate trophic networks. Last but not least, the husbandry models / facilities suggested here have to be tested in the long term and adapted as necessary. Given the rarity of these range-restricted reptiles in the wild, their specific life-history traits and the severe threats they face (i.e. habitat destruction and the pet trade), crocodile lizards are ideal flagship taxa for regional zoo-collection plans or for conservation-breeding programmes.

Plate 9. Genetically screened Vietnamese crocodile lizard *Shinisaurus crocodilurus vietnamensis,* **obtained from a confiscation, in the large facility in the terrarium section of the Cologne Zoo, Germany.** *Anna Rauhaus.*

Plate 10. First birth of Vietnamese crocodile lizard *Shinisaurus crocodilurus vietnamensis* **young at Cologne Zoo, Germany, on 19 February 2019.** *Thomas Ziegler.*

AUTHORS' NOTE

On 19 February 2019, a female Vietnamese crocodile lizard at Cologne Zoo gave birth to six healthy young (Plate 10). This is the first recorded birth outside of Vietnam and the first known worldwide scale zoo breeding for this subspecies. These births provide confirmation that the husbandry and management parameters described herein are appropriate for the care and breeding of Vietnamese crocodile lizards.

ACKNOWLEDGEMENTS

We thank T. Pagel and C. Landsberg (Cologne), and T. H. Tran (Hanoi) for their support of these research and conservation activities. We are grateful to the directorates of the Tay Yen Tu, Yen Tu and Dong Son – Ky Thuong nature reserves, and the Forest Protection Departments of Bac Giang and Quang Ninh provinces for support of our field work and issuing relevant permits. We thank H. T. An (Hanoi), L. Barthel (Cologne), M. Bernardes (Cologne), M. Bonkowski (Cologne), M. D. Le (Hanoi), H. T. Ngo (Hanoi), Q. Q. Ha (Hanoi), H. N. Ngo (Hanoi), T. V. Nguyen (Hanoi), T. Q. Le (Hanoi) and M. Vences (Brunswick) for their assistance in the field and in the laboratory. For their help with facility construction we thank W. Brass, C. Niggemann and R. Springborn (Cologne). The Kölner Kulturstiftung der Kreissparkasse Köln (Cologne) kindly supported the building of the crocodile lizard facility at the Cologne Zoo. SERA kindly sponsored equipment, such as filters, water tests, fish food, etc, for supporting the Me Linh Station. This research is supported by the National Foundation for Science and Technology Development (NAFOSTED, Grant No. 106.05-2017.329), the Cologne Zoo, the European Union of Aquarium Curators (EUAC) and the University of Cologne. Cologne Zoo is partner of the World Association of Zoos and Aquariums (WAZA): Conservation Projects 07011, 07012 (Herpetodiversity Research, Amphibian and Reptilian Breeding and Rescue Stations).

PRODUCTS MENTIONED IN THE TEXT

Aqua Medic DC Runner 5.0: universal pump for aquariums, manufactured by AB Aqua Medic GmbH, 49143 Bissendorf, Germany.

Biotec Screenmatic 12: flow-through filter, manufactured by Oase GmbH, 48477 Hörstel, Germany.

SERA Pond pp 3000: water pump for pond, manufactured by Sera, 52525 Heinsberg, Germany.

Thermochron iButton: thermal dataloggers, manufactured by Thermochron, Baulkham Hills, NSW 2153, Australia.

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Manuscript submitted 7 July 2018; revised 21 December 2018; accepted 22 February 2019

Developing a conservation breeding network for threatened Vietnamese Crocodile Newts

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The Vietnamese Crocodile Newt (*Tylototriton vietnamensis*) was described fifteen years ago (Böhme et al. 2005). This salamander species is endemic to northern Vietnam where it is known only from three localities (Bernardes et al. 2020). It inhabits evergreen lowland forests and was uplisted from Near Threatened to Endangered in the IUCN Red List (IUCN 2016). In the Vietnam Red Data Book (Tran et al. 2007) it is likewise listed as Endangered.

Two years ago we reported about the first successful reproduction of the Vietnamese Crocodile Newt in captivity (Rauhaus et al. 2018). Initially, a few larvae were transferred from the Me Linh Station for Biodiversity in North Vietnam to the Terrarium section of the Cologne Zoo in Germany, to share assurance colony resources and to build up an additional breeding approach abroad. Within a Vietnamese-German cooperation frame, we have jointly built indoor and outdoor amphibian and reptile facilities at the Me Linh Station in order to combine husbandry and breeding of threatened and poorly-known species with research and conservation measures, as well as housing and releasing rescued, mostly confiscated animals (Ziegler et al. 2016). The Me Linh Station belongs to the Institute of Ecology and Biological Resources in Hanoi.

Of the four larvae sent to the Cologne Zoo in 2013, only two survived the first year. Fortunately, these two remaining individuals developed well and turned out to be a male-female pair, which finally successfully reproduced (Rauhaus et al. 2018).

This report is an update about what has happened since then regarding the growth of a conservation breeding network for this and other threatened Vietnamese Crocodile Newt species at the Cologne Zoo.

The first clutch of the Vietnamese crocodile newt was laid in March 2018 and comprised about 100 eggs. From these, sixty larvae hatched, and finally fifty developed into terrestrial newts. After this first breeding success, in 2019 another reproduction event happened between the established breeding pair. However, due to an aspergillosis (*Aspergillus niger*) infection, introduced through

Offspring of the Vietnamese Crocodile Newts (*Tylototriton vietnamensis*) at Cologne Zoo. Photo: Thomas Ziegler.

Tubifex worms, breeding success was low that year, resulting in only nineteen terrestrial newts. Most interestingly, in 2020 the first F1 offspring became mature after only one and a half years, and started to reproduce F2 clutches, resulting in a total of 160 terrestrial F2 newts. To date 229 terrestrial Vietnamese Crocodile Newts have been reared at the Cologne Zoo, and we still have around forty aquatic larvae at the Terrarium section, which will soon become terrestrial.

Of the Vietnamese Crocodile Newts reared between 2018 and 2020, twenty were transferred to other institutions and breeders throughout Europe to build up a stable conservation breeding network. Thirty others were provided to Citizen Conservation, a program initiated by “Frogs & Friends” (www.frogs-friends.org/en/) which enables private individuals to participate in conservation breeding networks (see www.citizen-conservation.org/?lang=en).

Repatriation of the Vietnamese Crocodile Newts - packing the animals at the amphibian breeding room in the Terrarium section of Cologne Zoo in Germany. Photo: Thomas Ziegler.

180° view of the new salamander breeding room in the Terrarium section of Cologne Zoo. Photo: Christian Niggemann.

Breeding pair of the Laos Warty Newt (*Laotriton laoensis*) at Cologne Zoo. Photo: Thomas Ziegler.

At the end of 2019 the first offspring of the Vietnamese Crocodile Newts bred in the Cologne Zoo were able to be sent back to Vietnam. They were welcomed back by the Me Linh Station and are now available for future restocking, and fortunately, both the F1 offspring sent back to Vietnam and those provided to Citizen Conservation participants have already successfully reproduced.

To avoid inbreeding processes, we have received a new genetic lineage of the Vietnamese Crocodile Newt. This was made possible with the collaboration of Prof. Dr. Frank Pasmans from Ghent University in Belgium, from whom we have also received offspring of Ziegler's Crocodile Newt (*Tylototriton ziegleri*) in the past.

However, the Covid outbreak affected our plans to fully implement the One Plan Approach, which is supported by the IUCN and aims to develop integrative strategies to combine *in situ* and *ex situ* measures with groups of experts, for the purpose of species conservation. After the very positive development of the conservation breeding network we had plans to combine that with conservation activities in Vietnam. Within the frame of a master's thesis and as a continuation of the dissertation project of one of the authors (Marta Bernardes), status and condition of known wild sites and the status of existing Vietnamese Crocodile Newt populations should be investigated. This will also act as groundwork for potential future release and restocking measures through surplus animals from the Me Linh Station and from the Cologne Zoo, respectively. However, this well-planned timeline was not able to be followed, as the pandemic did not enable field work in 2020. We hope to proceed with the conservation-based field research at the next opportunity.

Based on population and threat analyses conducted in the frame of the above mentioned dissertation, which was funded by Cologne Zoo, the German Society for Herpetology and Herpetoculture (DGHT), the European Association of Zoos and Aquaria (EAZA) and Stiftung Artenschutz, we are aware of the severe fragmentation and vulnerability to further degradation that the natural habitats of Vietnamese Crocodile Newts are experiencing in the wild (Bernardes et al. 2013; Bernardes et al. 2017a). In addition, this and other species of the *Tylototriton* genus are known to be collected for use in traditional medicine, and are sold in the national and the international pet trade, adding unsustainable harvesting as another threat factor for the species (IUCN 2016). As a consequence, the Vietnamese Crocodile Newt, all *Tylototriton* congeners, the warty newts (*Paramesotriton* species) and most of the spiny newts (*Echinotriton* species), were officially included in 2019 in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

In a recent manuscript, *Amphibians in zoos: a global approach on distribution patterns of threatened amphibians in zoological collections* (Jacken et al. 2020) we demonstrated that amphibian holdings in zoos still consist of too many unprotected species and as a response to this alarming matter, we have adjusted amphibian keeping at the Terrarium section of the Cologne Zoo. Some years ago, we began to systematically develop holdings and conservation projects for threatened amphibian and reptile taxa at Cologne Zoo's Terrarium, Aquarium and Insectarium sections (Ziegler 2020). At that time we kept more than thirty amphibian species, with about half of them already successfully bred, along with a substantial number of threatened taxa with a focus on Southeast Asian species, in particular salamanders. Only recently we have developed a breeding facility for threatened Indochinese salamanders, among them the endemic Laos Warty Newt (*Laotriton laoensis*), which suffered an estimated 50% population decline in the last decade and has an Endangered IUCN Red List status (IUCN 2014); the Vietnam Warty Newt (*Paramesotriton deloustali*), with natural populations and habitat quality in decline (IUCN 2017a) and which was recently included with its congeners in CITES Appendix II; and the Ziegler's Crocodile Newt (*Tylototriton ziegleri*), another species discovered in North Vietnam which is included in the IUCN Red List as Vulnerable (IUCN 2017b).

Offspring of the Vietnamese Warty Newt (*Paramesotriton deloustali*) at Cologne Zoo. Photo: Thomas Ziegler.

Currently we are rearing the first offspring from our Vietnam Warty Newts with twenty-five terrestrial juveniles from the years 2019 and 2020 produced so far. The Ziegler's Crocodile Newts laid approximately eighty-five eggs for the first time in late August 2020. This reproductive success has resulted in about forty larvae, which are starting to move onto the land, and on 17th November, the first terrestrial newt was observed after only two months of larval stage. The larval development and breeding ecology of this species was already studied by our team in

Aquaria for Laos Warty Newt (*Laotriton laoensis*) (top) and *Paramesotriton deloustali* (bottom) in the new salamander breeding room in the Terrarium section of Cologne Zoo. Photo: Anna Rauhaus.

the field (Bernardes et al. 2017b) as well as the first research on longevity (Ziegler et al. 2018). Now our group is focusing on *ex situ* reproduction. We have already observed some differences related to rearing Vietnamese Crocodile Newts such as Ziegler's Crocodile Newt larvae being more territorial, and intraspecifically more aggressive. Finally, we likewise aim to build up a conservation breeding network for this species similar to the successful program for Vietnamese Crocodile Newts.

Taking into account that the network that has been developed for the Vietnamese Crocodile Newt and the large number of offspring reared and available, we consider this conservation breeding program to be a success. Being still endangered in the wild, at least a stable population in human care was built up and by doing so an assurance colony established for this species. There is still surplus Vietnamese Crocodile Newts available for other zoos or Citizen Conservation attendees who would like to participate in the conservation breeding network.

We now hope to be able to proceed without further delays, with our ecological and population status analyses in the field in northern Vietnam. This is essential research for basic conservation measures and for improved zoo keeping, as we can attest based on our experience and successful breeding results with Vietnamese Crocodile Newts at the Cologne Zoo.

Unfortunately, as in many amphibian taxa, the taxonomy of the group is still poorly resolved. However, this knowledge is crucial for proper conservation measures as well as appropriate breeding programs of pure newt stocks. In the past, the Black Knobby Newt (*Tylototriton asperrimus*) was believed to have a wide distribution range resulting in a low threat level if at all. Subsequently, a number of new species have been discovered in the frame of integrative taxonomic analyses, among them the Vietnamese Crocodile Newt (Böhme et al. 2005), Ziegler's Crocodile Newt (Nishikawa et al 2013) and *Tylototriton pasmansi* and *Tylototriton sparreboomi*, which were both only described this year (Bernardes et al. 2020). Thus, the Black Knobby Newt meanwhile has become range restricted in Southeast China and is certainly more threatened than previously thought.

The One Plan Approach is successfully being implemented, both in-country in Vietnam and within the international conservation community. Application of species distribution modelling in concert with ecological *in situ* research has identified further suitable habitat for this species in northern Vietnam, although further potential habitats were very fragmented and mostly lacking protection. Continued threat assessments documented habitat loss and degradation, and also after analyses of trade, the species has received international protection status (e.g., CITES). We have continuously invested in improving the knowledge on this species' natural history, ecology and habitat requirements, and based on this information, we were finally able to successfully breed the Vietnamese Crocodile Newt. We have provided surplus captive-bred animals to other zoos, institutions and Citizen Conservation participants (mitigating the number of wild-caught animals and trade and preventing

the spread of diseases) and have provided support for the capacity building and breeding program in Vietnam. But there is still much to be done in facing the global amphibian crisis and the number of data deficient and threatened taxa, and the time to address this is now.

Cologne Zoo is partner of the World Association of Zoos and Aquariums (WAZA) with Conservation Projects 07011 (Herpetodiversity Research - To study the diversity and ecology of amphibians and reptilians in Vietnam and Laos), and 07012 (Amphibian and Reptilian Breeding and Rescue Stations - To establish and maintain breeding and rescue stations for amphibians and reptilians in Vietnam).

Juvenile Vietnamese Crocodile Newts at the Cologne Zoo from 2018 (left) and 2019 (right). Photo: Thomas Ziegler.

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THE GOVERNMENT ---	SOCIALIST REPUBLIC OF VIETNAM Independence - Freedom - Happiness ---
No.06/2019/ND-CP	*Hanoi, January 22, 2019*

DECREE

ON MANAGEMENT OF ENDANGERED, PRECIOUS AND RARE SPECIES OF FOREST FAUNA AND FLORA AND OBSERVATION OF CONVENTION ON INTERNATIONL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA

Pursuant to the Law on Government of organization dated June 19, 2015;

Pursuant to the Law on Forestry dated November 15, 2017;

Pursuant to the Law on Fisheries dated November 21, 2017;

Pursuant to the Convention on International Trade in Endangered Species of Wild Fauna and Flora;

At the request of the Minister of Agriculture and Rural Development;

The Government promulgates a Decree on management of endangered, rare and precious species of forest fauna and flora and observation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

Chapter I

GENERAL PROVISIONS

Article 1. Scope

This Decree provides for a list of endangered, precious and rare species of forest fauna and flora; management and protection of and procedures for exploitation endangered, precious and rare species of forest fauna and flora; nurture of usual forest fauna; observation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (hereinafter referred to as "CITES") in Vietnam.

Article 2. Regulated entities

This Decree applies to regulatory agencies, domestic organizations, family households and individuals; Vietnamese people who permanently resides in foreign countries and foreign organizations and individuals performing activities related to endangered, precious and rare

species of forest fauna and flora and endangered species of wild fauna and flora on the CITES Appendices; nurture of usual forest fauna within the territory of Vietnam.

Article 3. Definition

For the purposes of this Decree, the terms below shall be construed as follows:

1. “species” means any species, subspecies or geographically separate population thereof.

2. “hybrid” means the result of cross or transplant between two species or two subspecies of animals or plants. If the hybrid is generated by cross or transplant between two species in different Groups or Appendices, such hybrid shall be managed like the species in the Group or Appendix which is entitled to a level of protection greater than the others.

3. CITES permits and CITES certificates issued by the CITES management authority of Vietnam shall apply to legal export, import, re-export, re-import and introduction from the sea of CITES-listed endangered species of wild fauna and flora; export of specimens of endangered, precious and rare species of forest fauna and flora prescribed herein and not on the list of species specified in CITES Appendices.

4. CITES Appendices include:

a) Appendix I listing species threatened with extinction, prohibited from export, import, re-export, introduction from the sea and transit of natural specimens for commercial purposes.

b) Appendix II listing species that, although currently not threatened with extinction, may become so without control of export, import, re-export, introduction from the sea and transit of natural specimens thereof for commercial purposes.

c) Appendix III listing species for which a CITES party has asked other Parties to assist in controlling export, import, re-export for commercial purpose.

5. “organ of endangered wild fauna and flora” means any raw or processed (maintained or polished) component such as skin, husk or root of a species which shows a sign of identification of such species.

6. “derivative of fauna and flora” means any form of substances generated by animals and plants such as blood and bile of animals; resin and essential oil of plants or parts of animals and plants that has been processed such as medicines, perfume, watches, bags and so on.

7. “specimen of endangered species of wild fauna and flora” means any alive or dead wild animal and plant, egg, larva, organ and derivative thereof.

8. “normal forest fauna" include species in the mamma, aves, reptilia and amphinia class and not on the list of endangered, precious and rare species of forest fauna and flora issued by the

Government or CITES-listed species; the list of domesticated animals under provisions of the law on animal husbandry.

9. “exploitation of specimens of fauna and flora " means sampling wild fauna and flora in a natural environment.

10. “for commercial purpose" means any transaction of wild animal and plant specimens for profit.

11. “for non-profit purpose” means any activities serving foreign affairs, scientific research, exchanges among zoos, arboreta and museums; exhibition for product introduction; circus performance; exchange and return of specimens among CITES management authorities.

12. “zoo” means a place used for collection and nurture of wild fauna for the purpose of exhibition, multiplication, environmental education and scientific research.

13. “arboretum” means a place used for collection and nurture of wild flora for the purpose of exhibition, multiplication, environmental education and scientific research.

14. “introduction from the sea” means transportation into the territory of Vietnam of specimens of any species of wild fauna and flora which were taken in the marine environment not under the jurisdiction of any State.

15. “re-export" means export of specimens previously imported.

16. “ controlled environment” means an environment under human management for the purpose of generating purebreds or hybrids. The controlled environment must meet conditions for prevention spread or break-in of fauna, flora, eggs, gametes, zygotes, seeds, germs and epidemics out of or at such environment.

17. "raising facility" means any facility rearing, breeding endangered, precious and rare species of forest fauna and/or CITES-listed endangered species of wild fauna and flora and/or normal forest fauna; facility of artificial production of endangered, precious and rare species of flora and/or CITES-listed wild flora for profit or non-profit purposes.

18. “rearing” means nurturing naturally-generated young wild fauna and eggs of wild fauna for growing and caring purpose until they can give births to their babies in the controlled environment.

19. “breeding" means nurturing wild fauna for reproduction of next generations in the controlled environment.

20. “artificial production” means growing or transplanting flora from seeds, germs, zygotes or other methods for multiplication of wild flora in the controlled environment.

21. “cultivar source" means the legal first animal individual nurtured in a breeding facility for production of individuals of next generations.

22. "F1 hybrid" include individuals generated in the controlled environment whose one of their parents is exploited from nature.

23. “F2 hybrid or the subsequent generations include individuals generated in the controlled environment by couples of F1 hybrids and subsequent generations.

24. “personal belongings and home appliances originated from wild fauna and flora” mean specimens with legal origin of individuals or family households. Alive specimens shall not be considered personal belongings or home appliances.

25. “souvenir specimen” means any personal belonging or home appliance taken from the outside of the State in which the owner thereof is permanently resides. Alive animals shall not be considered souvenir specimens.

26. “hunted specimen” means any specimen collected from legal hunting.

27. “pre-Convention specimen” means any specimen collected prior to the day on which such specimen is included into CITES Appendices or before participation in the CITES of range states if:

a) such specimen is taken out from its natural habitat;

b) such specimen is generated in the controlled environment;

c) the owner thereof holds the legal ownership of such specimen.

28. “CITES party” means any state for which the CITES has entered to force.

Chapter II

LIST AND MANAGEMENT OF ENDANGERED, PRECIOUS AND RARE SPECIES OF FOREST FAUNA AND FLORA; NURTURE OF NORMAL FOREST FAUNA

Article 4. List of endangered, precious and rare species of forest fauna and flora

1. The list of endangered, precious and rare species of forest fauna and flora issued thereto includes:

a) Group I including species of forest fauna and flora threatened with extinction and banned from exploitation or use for commercial purpose and species in CITES Appendix I naturally inhabiting Vietnam.

Group IA including forest flora.

Group IB including forest fauna.

b) Group II including species of forest fauna and flora that, although currently not threatened with extinction but may become so without strict control of exploitation and use for commercial purpose and species specified in CITES Appendix II naturally inhabiting Vietnam.

Group IIA including forest flora.

Group IIB including forest fauna.

2. Amendments to the list of endangered, precious and rare species of forest fauna and flora.

The Ministry of Agriculture and Rural Development shall send a proposal of amendments to the list of endangered, precious and rare species of forest fauna and flora once every five years or in case there is any change in species specified in Clause 1 this Article or the list of species provided in CITES Appendix I and II related to species of forest fauna and flora naturally inhabiting Vietnam.

Article 5. Protection of endangered, precious and rare species of forest fauna and flora

1. Hunting, capture exploitation, nurture, slaughter, storage, processing, transportation and sale of endangered, precious and rare species of forest fauna and flora must not produce harmful effects on the existence, growth and development of such species in nature.

2. Hunting, capture, exploitation, nurture, slaughter, storage, processing, transportation, sale, promotion, exhibition, export, import, temporary import for export, temporary export for import of specimens of endangered, precious and rare species of forest fauna and flora must be managed to ensure legal origin thereof.

3. Permanent habitat of endangered, precious and rare species of forest fauna and flora shall be studied as a basis for establishment of special-use forest areas.

4. Organizations, family households and individuals conducting production, construction, investigation, survey, research, sightseeing, travelling or performing other activities within the areas with endangered, species and rare species of forest fauna and flora must comply with regulations hereof and other relevant law provisions.

Article 6. Investigation into and assessment of current state of endangered, precious and rare species of forest fauna and flora

1. Endangered, precious and rare species of forest fauna and flora shall be investigated and assessed in conjunction with forest investigation under regulations on forest management.

2. The Ministry of Agriculture and Rural Development shall carry out investigation into and assessment of endangered, precious and rare species of forest fauna and flora nationwide while

provincial-level People's Committees shall carry out investigation and assessment in provincial forest areas.

3. The State shall encourage forest owners to carry out investigation into and assessment of current state and development of endangered, precious and rare species of forest fauna and flora in the area allocated or leased out by the State.

Article 7. Scientific research on endangered, precious and rare species of forest fauna and flora

1. Scientific research on preservation and sustainable development of endangered, precious and rare species of forest fauna and flora shall be conducted according to the approved topic and project and shall comply with regulations on forest management.

2. A written report shall be sent to the forest owner and provincial-level forestry state management agency for supervision purpose before such scientific research.

Article 8. Actions taken in case of harm or threat to human life by endangered, precious and rare species of forest fauna and flora

1. In case endangered, precious and rare forest fauna cause harm to or pose a threat to human life or assets; organizations and individual shall take measures to drive away such fauna but restrict harm to them and notify the nearest forestry administration or commune-level or provincial People's Committee.

2. In case endangered, precious and rare forest fauna pose a direct threat to human life outside special-use and protection forests, Chairpersons of provincial People's Committees shall decide and give guidelines on trapping, hunting or capturing such fauna if obtaining no result after taking measures to drive them away.

3. Handling of hunted, trapped or captured specimens of wild fauna specified in Clause 2 this Article shall comply with regulations in Article 10 and 32 hereof.

Article 9. Exploitation, raising, processing, promotion, transportation and export of and trade in specimens of endangered, precious and rare species of forest fauna and flora

1. Exploitation, raising, processing, promotion, exhibition, export, transportation, storage of and trade in specimens of Group I endangered, precious and rare species of forest fauna and flora shall comply with regulations hereof for species specified in CITES Appendix I.

2. Exploitation, raising, processing, promotion, exhibition, export, transportation, storage of and trade in specimens of Group II endangered, precious and rare species of forest fauna and flora shall comply with regulations hereof for species specified in CITES Appendix II.

3. The CITES permit for import may be excluded from the application for a license for export of specimens of Group I endangered, precious and rare species of forest fauna and flora not included in CITES Appendix I.

Article 10. Handling of seized endangered, precious and rare species of forest fauna and flora

1. Handling of alive specimens:

a) Post-seizure handling of alive specimens must provide care for such specimens to avoid risks of death thereof.

b) Specimens shall be transferred to the local forestry administration after handling for the purpose of care and maintenance. Alive specimens shall be handled in the following order of priority: reintroduction of specimens into the natural environment suitable for their living conditions and natural distribution if such specimens are found healthy; or transfer to animal rescue agencies, zoos or arboretum in case such specimens are needed to be rescued or eliminated.

2. Specimens of endangered, precious and rare species of forest fauna and flora not specified in Clause 1 this Article shall be handled as follows:

a) Specimens of Group IA and IB species shall be handled in compliance with provisions of the law on management and use of public assets;

b) Specimens of Group IIA and IIB species shall be transferred to research organizations, environmental education institutions or specialized museums for exhibition purpose for preservation education; or sold, through auction, to organizations or individuals raising, processing or trading such species as per law provisions; or destructed in case it is impossible to implement other measures.

Article 11. Nurture of normal forest fauna

Every facility nurturing normal forest fauna must:

1. ensure their forest fauna has legal origin under law provisions;

2. ensure safety of human and comply with law provisions on environment and veterinary;

3. record development of their animals in to a logbook according to Form No.16 provided in the Appendix issued thereto and notify the local forestry administration of nurture of normal forest fauna within 3 working days from the day on which such fauna is taken to the nurturing facility for monitoring and management purpose.

Chapter III

CITES OBSERVATION

Section 1: EXPLOITATION

Article 12. Exploitation of specimens of endangered species of wild fauna and flora specified in CITES Appendix I and II

1. Natural specimens of species specified in CITES Appendix I shall be exploited to:

a) serve scientific research themes and projects;

b) generate the source of original breed for breeding and artificial production purpose;

c) serve foreign affairs under decisions issued by the Prime Minister

2. Natural specimens of species specified in CITES Appendix II shall be exploited to:

a) serve scientific research themes and projects;

b) generate the source of original breed for breeding and artificial planting purpose;

c) serve foreign affairs under decisions issued by the Prime Minister

d) serve the purpose of sustainable trade as per law provisions

3. Entities exploiting the aforesaid specimens are required to:

a) have an exploitation plan according Form No.01 and 02 provided in Appendix issued thereto.

b) notify the exploitation to the provincial-level state management agency in forestry or fisheries before such exploitation;

c) exploit such specimens in such a way that no harmful effect is produced on preservation and sustainable development of the species.

d) comply with Vietnamese law provisions and CITES provisions on exploitation of specimens of endangered, precious and rare species of wild fauna and flora.

Article 13. Inspection and supervision of exploitation of specimens of endangered species of wild fauna and flora specified in CITES Appendix I and II

1. Provincial-level forestry state management agencies shall conduct inspection and supervision of exploitation and origin of specimens of species provided in CITES Appendix I and II in the areas under management.

2. Provincial-level fisheries state management agencies shall conduct inspection and supervision of fisheries and origin of specimens of species provided in CITES Appendix I and II in the areas under management.

Section 2: RAISING

Article 14. Conditions for raising of CITES-listed endangered wild fauna and flora for non-profit purpose

1. There must exist the approved scientific research topic and project and raising plan according to Form No.04, 05, 06 and 07 provided in Appendix issued thereto.

2. The raising facility shall be suitable for growing characteristics of the raised species and must ensure safety of human and animals, environmental hygiene and take measures to prevent diseases.

3. The breed and plant varieties shall be sourced in a legal manner; specimens shall be seized as per law provisions after handling and endangered species of wild fauna and flora shall be imported in a legal manner or specimens thereof shall be imported from other legal raising facilities.

4. The raising facility shall keep a logbook of animal raising according to Form No.16 or one of plant raising according to Form No.17 provided in Appendix issued thereto and send periodic reports to the provincial-level state management agency in fisheries and in forestry and stay under their management.

Article 15. Conditions for raising of CITES-listed endangered wild fauna and flora for commercial purpose

1. With regard to fauna:

a) The breed must be legally sourced; specimens shall be seized as per provisions after handling and import of fauna shall be carried out in a legal manner or specimens must be imported from other legal raising facilities;

b) Animal housings shall be constructed suitable for characteristics of the species and meet conditions for safety of human and animals, environmental hygiene and disease prevention.

c) The raised species is the ones declared by the CITES scientific authority of Vietnam to have potential for giving birth to young individuals through generations in the controlled environment; breeding and rearing of such species have been certified not to produce any impact on existence of such species and relevant ones in nature by the CITES scientific authority of Vietnam;

d) There must be a raising plan according to Form No.04 and 06 provided in Appendix issued thereto.

2. With regard to flora:

a) The plant varieties shall be legally sourced; specimens shall be seized as per law provisions after handling and the flora shall be imported in a legal manner or plant specimens shall be imported from other legal raising facilities.

b) The raising facility must be suitable for characteristics of the species;

c) There must be a raising plan according to Form No.05 and 07 provided in Appendix issued thereto.

3. The raising facility shall keep a raising logbook according to Form No.16 and 17 provided in Appendix issued thereto and send periodic reports to the provincial-level state management agency in fisheries and in forestry, and stay under their management.

Article 16. Codes of raising facilities

1. The code shall include name, address and contacting information of the raising facility, information about the raised species according to Form No.08 provided in Appendix issued thereto.

2. Code's meanings:

a) The two first letters of the code represent the Appendix and type of the specimen, to be specific: IA means the plant listed in Appendix I or Group I; IB shows the animal listed in Appendix I or Group I; IIA means the plant included in Appendix II or Group II and IIB shows the animal specified in Appendix II or Group II provided in the list issued thereto;

b) The next letters of the code express the purpose of the raising facility, to be specific: they will be the national code in case of raising for non-profit purpose or abbreviated name of the province in which the facility of animal and plant raising for commercial purpose is located. The convention on abbreviation of city or provincial names shall be specified in Form No.08 provided in Appendix issued thereto.

c) The next numbers of the code shows the order number of the raising facility in the province.

3. In case one facility simultaneously raises specimens of more than one species subject to different protection regulations, the code of such facility shall be given according to the species with the highest level of management and protection.

Article 17. Registration of codes of facilities raising endangered wild fauna and flora specified in CITES Appendix I

1. Code issuer

The CITES management authority of Vietnam shall take charge of issuing codes of facilities raising species included in CITES Appendix I ("hereinafter referred to as "the code").

2. The application for registration of the code includes:

a) An application form for issuance of the code according to Form No.3 provided in Appendix issued thereto;

b) The original copy of raising plan according to Form No.04 or No.05 provided in Appendix issued thereto.

3. Procedures for receiving applications and issuance of the code

a) The legal representative of the raising facility shall send, directly or by post or via the national single-window system, an application specified in Article 2 this Article to the CITES management authority of Vietnam;

b) The CITES management authority of Vietnam shall grant the code to the facility within 5 working days from the day on which the satisfactory application is received. In case field inspection of raising conditions specified Article 14 and 15 hereof is required, the CITES management authority of Vietnam shall take charge and cooperate with the CITES scientific authority of Vietnam and other organizations in carrying out such inspection and grant the code within 30 days.

In case the application is found unsatisfactory, the CITES management authority of Vietnam shall notify the facility within 3 working days from the day on which such application is received;

c) The facility raising fauna and flora specified in CITES Appendix I for commercial purpose shall make a code registration with the CITES secretariat and the CITES management authority of Vietnam shall prepare a satisfactory application within 15 working days and send it to the CITES secretariat, and grant the code within 3 working days from the day on which the secretariat's notice is received.

d) The CITES management authority of Vietnam shall post the issued code its website within 1 working day from the day the code is issued.

4. In case the facility raises more than one species, including the one specified in CITES Appendix I, its code shall be issued as prescribed in this Article.

5. The code shall be discarded if requested by the raising facility or if the raising facility fails to meet raising conditions or if it commits violations against regulations specified herein and relevant law provisions.

6. Handling of fauna and flora voluntarily returned to the State by the raising facility owner:

a) The legal representative of the raising facility which voluntarily returns the fauna and flora to the State shall notify such return to:

the provincial-level fisheries state management agency (for aquatic species);

the Forest Protection Department (for other species of fauna and flora);

b) Handling of fauna and flora voluntarily returned by the raising facility owner:

The agencies specified in Point a this Clause shall handle the fauna and flora voluntarily returned by the owner of the raising facility within 15 working days from the day on which the notification from such owner is received in the following order of priority:

Release into the natural environment suitable for the habitat and natural distribution of the returned species if such species is healthy and has the potential for re-production;

Transfer to the animal rescue agency; zoo or arboreta or the scientific research institution, environmental education institution or the specialized museum for preservation research and education purpose;

Destroy in case the returned fauna and flora suffer from a disease or when the actions mentioned above fail to be taken;

c) The agencies specified in Point a this Clause shall send a report on the handling results to the CITES management authority of Vietnam and the owner of the raising facility that voluntarily return the fauna and flora within 3 working days from the day on which the returned fauna and flora is completely handled.

Article 18. Registration of codes of facilities raising endangered wild fauna and flora specified in CITES Appendix II and III

1. Code issuer

a) Provincial forestry administrations shall take charge of granting codes to facilities raising species specified in CITES Appendix II and II not provided in Point b this Clause;

a) Provincial-level fisheries state management agencies shall take charge of granting codes to facilities raising aquatic species specified in CITES Appendix II;

2. The application for registration of codes of raising facilities includes:

a) An application form for issuance of the code according to Form No.3 provided in Appendix issued thereto;

b) The original copy of the raising plan according to Form No.06 or No.07 provided in Appendix issued thereto.

3. Procedures for receiving applications and issuance of the code

a) The legal representative of the raising facility shall send, directly or by post or via the national single-window system, an application specified in Article 2 this Article to the agency specified in Clause 1 this Article;

b) The agency specified in Clause 1 this Article shall grant the code to the facility within 5 working days from the day on which the satisfactory application is received. In case field inspection of raising conditions specified Article 14 and 15 hereof is required, the code issuer shall take charge and cooperate with relevant agencies in carrying out such inspection and shall grant the code within 30 days.

In case the application is found unsatisfactory, code issuer shall notify the facility in writing within 3 working days from the day on which such application is received;

c) The code issuer shall send the code information to the CITES management authority of Vietnam for posting such code on the website of CITES management authority of Vietnam within 1 working day from the day on which the code is issued.

4. The code shall be discarded if requested by the raising facility or if the raising facility fails to meet raising conditions or if it commits violations against regulations specified herein and relevant law provisions.

5. Handling of fauna and flora voluntarily returned to the State by the raising facility owner:

Fauna and flora voluntarily returned to the State by the owner of the raising facility shall be handled as prescribed in Point a and b Clause 6 Article 17 hereof.

The facility handling fauna and flora voluntarily returned by the owner of the raising facility shall notify the handling results to such owner within 3 working days from the day on which such fauna and flora are completely handled.

Section 3: EXPORT, IMPORT, RE-EXPORT, INTRODUCTION FROM THE SEA AND TRANSIT

Article 19. Conditions for export, import, re-export and introduction from the sea of natural specimens of CITES-listed endangered species of wild fauna and flora

1. A CITES permit or certificate prescribed in Article 22 hereof is required.

2. Specimens of CITES-listed species that are personal belongings or family appliances may be exempt from the CITES permit or certificate if:

a) they are not used for commercial purpose;

b) they are associated to their owner or are family appliances;

c) their number does not exceed the number specified by the CITES management authority of Vietnam.

Article 20. Conditions for export, import, re-export of specimens used for breeding, rearing and artificial production of CITES-listed endangered species of wild fauna and flora

1. With regard to specimens of species included in CITES Appendix I:

a) A CITES permit or certificate prescribed in this Decree is required;

b) Animal specimens from the F2 hybrid and subsequent generations shall be generated at the breeding facility issued with a code prescribed in Article 17 and 18 hereof;

c) Specimens of flora must be collected from the artificial production facility issued with a code prescribed in Article 17 and 18 hereof.

2. With regard to specimens of species included in CITES Appendix II and III:

a) A CITES permit or certificate prescribed in this Decree is required;

b) Animal specimens from the F1 hybrid and subsequent generations shall be generated at the breeding facility or rearing facility issued with a code prescribed in Article 17 and 18 hereof;

c) Specimens of plant species included in CITES Appendix II and III must be collected from the artificial production facility issued with a code prescribed in Article 17 and 18 hereof.

Article 21. Conditions for transit of alive specimens of CITES-listed endangered wild fauna and flora

1. A CITES permit for export or re-export issued by the CITES management authority of the exporting country is required.

2. A copy of the CITES permit for export or re-export shall be sent to the CITES management authority of Vietnam within 15 working days before the day of transit procedure.

3. Safety of human and animals in transit shall be ensured and conditions for care for and humane treatment of animals shall be satisfied during the transportation.

Article 22. CITES permits and certificates

1. The CITES permit according to Form No.09 provided in the Appendix issued thereto shall apply to export, import, re-export and introduction from the sea of CITES-listed endangered species of wild fauna and flora and endangered, precious and rare species of forest fauna and flora. The CITES permit must include sufficient information and bear a CITES stamp or bar code, signature and seal of the CITES management authority of Vietnam.

2. The CITES certificate of export of souvenir specimens according to Form 10 provided in the Appendix issue thereto shall apply to souvenir specimens specified in CITES Appendices. The CITES certificate of export of souvenir specimens must include sufficient information and bear signature and full name of the raising facility owner.

3. The pre-Convention specimen certificate according to Form No.11 provided in the Appendix issued thereto shall apply to pre-Convention specimens.

4. The maximum effective period of the export or re-export permit or certificate shall not exceed 6 months and it will be 12 months for the import permit from the day on which such certificate is issued.

5. The CITES permit or certificate shall be granted only once with the CITES specimens.

6. The issuer of CITES permits and pre-Convention specimen certificates is the CITES management authority of Vietnam.

7. The processing or trading facility shall directly issue the CITES certificate applied to souvenir specimens.

Article 23. Procedures for issuing CITES permits for export or re-export of specimens of CITES-listed endangered species of wild fauna and flora

1. The CITES management authority of Vietnam shall take charge of issuing export or re-export CITES permits.

2. The application for a CITES permit shall include:

a) An application form for a permit according to Form No.12 provided in the Appendix issued thereto;

b) A copy of document proving that the specimen is legally sourced in compliance with regulations hereof;

c) In case of export or re-export of specimens for non-profit but for scientific research and foreign affair, in addition to the application’s components specified in Point a and b this Clause, the applicant is required to submit a copy of the import permit issued by the CITES management authority of the importing country for specimens of species included in CITES Appendix I; or a copy of agreement on the research collaboration program approved by the competent authority for cases in which export/re-export serves the scientific research; or a written document confirming that the specimens are presented to diplomatic missions of other countries issued by the competent authority for cases in which specimens are exported/re-exported for foreign affair purpose.

d) In case of export or re-export of specimens for non-profit purpose but for exhibition or circus performance, in addition to the application's components specified in Point a and b this Clause,

the applicant is required to submit a copy of decision on assignment of participation in foreign exhibition or circus performance issued by the competent authority or the invitation letter of the foreign agency; or a copy of import permit issued by the CITES management authority of the importing country for specimens specified in CITES Appendix I;

dd) In case of export or re-export of hunted specimens, in addition to the application's components specified in Point a and b this Clause, the applicant is required to submit a copy of dossier on legal origin of the specimen or a copy of permit or certificate applied to hunted specimens issued by the competent authority of the relevant country;

e) In case of export or re-export of pre-Convention specimens, in addition to the application's component specified in Point a this Clause, the applicant is required to submit a copy of pre-Convention specimen dossier; or a copy of CITES permit for import in case of specimen re-export.

3. Procedures for receiving applications for permit:

a) The entity requires an export or re-export permit shall send an application specified in Clause 2 this Article to the CITES management authority of Vietnam directly or by post or via the national single-window system;

b) If the application is found unsatisfactory, the CITES management authority of Vietnam shall notify the applicant within 3 working days from the day on which such application is received;

c) The CITES management authority of Vietnam shall grant the permit within 8 working days from the day on which the satisfactory application is received. In case of request for advice of the CITES scientific authority of Vietnam or relevant authorities of the importing country, the CITES management authority of Vietnam shall ask for such advice and grant the permit within 30 working days;

d) The CITES management authority of Vietnam shall give the permit to the applicant and post the issuance results on its website within 1 working day from the day on which such permit is issued.

Article 24. Procedures for issuing CITES certificates of export of souvenir specimens

1. The CITES management authority shall grant the certificate to owners of processing and trading facilities.

2. Every facility may be granted a certificate if:

a) the souvenir specimen is sourced from the raising facility issued with a code;

b) it keeps a logbook according to Form No.14 provided in the Appendix issued thereto;

c) it pays the cost for printing the certificate to the CITES management authority of Vietnam.

3. The application for CITES certificate of souvenir specimen export shall include:

a) An application form for a certificate according to Form No.13 provided in the Appendix issued thereto;

b) A copy of the logbook according to Form No.14 provided in the Appendix issued thereto.

4. Procedures for receiving applications for CITES certificates:

The processing or trading facility requiring a CITES certificate of export of souvenir specimens shall send an application specified in Clause 3 this Article to the CITES management authority of Vietnam;

b) The CITES management authority of Vietnam shall grant the CITES certificate of export of souvenir specimens to the applicant within 5 working days from the day on which the satisfactory is received.

In case the application is found unsatisfactory, the CITES management authority of Vietnam shall notify the facility within 3 working days from the day on which such application is received;

5. The CITES certificate of souvenir specimen export shall apply only to final products in souvenir stores. Each CITES certificate of souvenir specimen export may allow selling of 4 specimens, at the maximum, to one customer.

6. The processing or trading facility shall directly issue the CITES certificate of souvenir specimen export to its customers.

7. The certificate issuer shall take actions under the guidance and inspection of the CITES management authority of Vietnam and provincial-level state management agency and send a report on certificate use before December 01 of every year and the unused certificates before January 15 of the following year to the CITES management authority of Vietnam.

Article 25. Procedures for issuing CITES permits for import of specimens of CITES-listed endangered species of wild fauna and flora

1. The CITES management authority of Vietnam shall take charge of issuing import CITES permits.

2. The application for a CITES permit shall include:

a) An application form for a permit according to Form No.12 provided in the Appendix issued thereto;

b) A copy of the export CITES permit issued by the CITES management authority of the exporting country or the re-exporting country;

c) In case of import of alive specimens of fauna or flora that are imported for the first time and are not naturally distributed in Vietnam, in addition to the application's components specified in Point a and b this Clause, the applicant shall send a written confirmation on eligibility and capacity for nurturing and caring the specimen issued by the CITES management authority of Vietnam;

d) In case of import for non-profit purpose serving the scientific research, foreign affair and participation in exhibition and circus performance, in addition to the application's components specified in Point a this Clause, the applicant is required to submit one of the following documents: a copy of the written agreement on the research collaboration program approved by the competent authority in case of import for scientific research purpose; written confirmation on present given to the diplomatic mission of other countries approved by the competent authority for the case in which the import serves foreign affair purpose; a copy of letter of invitation to the exhibition or circus performance issued by the competent authority for import serving non-profit exhibition or circus performance;

dd) In case of import of pre-Convention specimens or hunted specimens, in addition to the application's components specified in Point a this Clause, the applicant is required to submit a copy of pre-Convention specimen dossier and a certificate issued by the CITES management authority of the exporting country for pre-Convention specimens; or a copy of the export CITES permit and a certificate of hunted specimens issued by the competent authority of the exporting country for the hunted specimens.

3. Procedures for receiving applications for permit:

a) The entity requires an import permit shall send an application specified in Clause 2 this Article to the CITES management authority of Vietnam directly or by post or via the national single-window system;

b) The CITES management authority of Vietnam shall grant the permit within 8 working days from the day on which the satisfactory application is received. In case of request for advice of the CITES scientific authority of Vietnam or relevant authorities of the exporting country, the CITES management authority of Vietnam shall ask for such advice and grant the permit within 30 working days;

In case the application is found unsatisfactory, the CITES management authority of Vietnam shall notify the applicant within 3 working days from the day on which such application is received;

c) The CITES management authority of Vietnam shall give the permit to the applicant and post the issuance results on its website within 1 working day from the day on which such permit is issued.

Article 26. Procedures for issuing CITES permits for introduction from the sea of specimens of endangered species of wild fauna and flora included in CITES Appendix I and II

1. The CITES management authority of Vietnam shall take charge of issuing CITES permits for introduction from the sea.

2. The application for a CITES permit shall include:

a) An application form for a permit for introduction from the sea according to Form No.15 provided in the Appendix issued thereto;

b) A copy of the confirmation issued by the CITES scientific authority of Vietnam at the request of the CITES management authority of Vietnam which declares that the introduction of species from the sea will not produce any effect on existence of such species in nature;

c) The code of the raising facility or document proving the eligibility for nurture and humane treatment of the alive specimens for the facility not registered a code;

d) A document proving that the introduced specimen is not used for commercial purpose for species specified in CITES Appendix I.

3. Procedures for receiving applications for permit:

a) The entity requiring an import permit shall send an application specified in Clause 2 this Article to the CITES management authority of Vietnam directly or by post or via the national single-window system;

b) The CITES management authority of Vietnam shall grant the permit within 8 working days from the day on which the satisfactory application is received. In case of request for advice of the CITES scientific authority of Vietnam, central fishery management authority and relevant authorities, the CITES management authority of Vietnam shall ask for such advice and grant the permit within 30 working days;

In case the application is found unsatisfactory, the CITES management authority of Vietnam shall notify the applicant within 3 working days from the day on which such application is received;

c) The CITES management authority of Vietnam shall give the permit to the applicant and post the issuance results on its website within 1 working day from the day on which such permit is issued.

Article 27. Procedures for issuing CITES certificates of pre-Convention specimens of CITES-listed endangered species of wild fauna and flora

1. The CITES management authority of Vietnam shall take charge of issuing CITES certificates of pre-Convention specimens.

2. The application for a CITES certificate shall include:

a) An application form for a certificate of pre-Convention specimen according to Form No.15 provided in the Appendix issued thereto;

b) A copy of the dossier on legal origin of the specimen.

3. Procedures for receiving applications for certificate:

a) The entity requiring a CITES certificate of pre-Convention specimens shall send an application specified in Clause 2 this Article to the CITES management authority of Vietnam directly or by post or via the national single-window system;

b) The CITES management authority of Vietnam shall grant the CITES certificate of pre-Convention specimens within 8 working days from the day on which the satisfactory application is received. In case of request for advice of relevant authorities of the exporting country, the CITES management authority of Vietnam shall ask for such advice and grant the certificate within 30 working days;

In case the application is found unsatisfactory, the CITES management authority of Vietnam shall notify the applicant within 3 working days from the day on which such application is received;

Article 28. Regulations on issuance of CITES permits via the national single-window system for administrative procedure

1. The applicant who has sent an electronic application through the national single-window system for administrative procedure is not required to submit a hard copy of the application. The components of the application submitted via the system shall comply with regulations in Article 23, 24, 25, 26 ad 27 hereof. Documents posted on the system must be copied from the original ones.

2. The results of application processing shall be sent to the applicant directly or by post or via the national single-window system for administrative procedure.

3. The applicant shall retain the original copies of relevant documents under regulations on applicant's components specified in Article 23, 24, 25, 26 and 27 hereof within 5 days from the day on which the application is sent and must represent such documents to the competent authority if required.

Section 4: PROCESSING, TRADE, TRANSPORTATION AND STORAGE

Article 29. Processing, promotion, exhibition of and trade in specimens of CITES-listed endangered species of wild fauna and flora

1. Conditions for processing and trade:

a) The processing or trading facility and processing of and trade in specimens of endangered species of wild fauna and flora shall comply with provisions provided herein, provisions of the law on environmental protection, animal protection, veterinary, food safety and hygiene and current State's regulations;

b) Specimens of such species shall be legally sourced as prescribed herein;

c) The processing or trading facility shall keep a logbook of its operation according to Form No.14 issued thereto and shall be subject to inspection of the CITES management authority of Vietnam and competent state management agency as per law provisions.

2. Specimens that are processed, traded, promoted or exhibited for commercial purpose shall be:

a) specimens of species included in CITES Appendix II legally exploited from nature;

b) specimens of F2 hybrid and subsequent generations of fauna included in CITES Appendix I generated by breeding; F1 hybrid and subsequent generation of fauna specified in CITES Appendix II generated by breeding and specimens of species of flora specified in CITES Appendix I artificially planted under provisions hereof;

c) Specimens of species included in CITES Appendix II shall be seized after processing.

3. Products derived from CITES-listed endangered wild fauna and flora shall be managed as follows:

a) The entity processing endangered wild fauna and flora shall keep a logbook of its operation according to Form No.14 provided in the Appendix issued thereto including monitoring of input materials and outputs of the processing consistent with the processed species;

b) The provincial-level fisheries state management agency shall check the origin and processing of aquatic products derived from wild aquatic animals and plants base upon the aforesaid logbook;

c) The local forestry administration shall check the origin and processing of products derived from CITES-listed wild fauna and flora not specified in Point b this Clause according to the logbook.

Article 30. Transportation and storage of specimens of CITES-listed endangered species of wild fauna and flora

1. Transportation of specimens must meet the following requirements:

s) A legal document as regulated by the law on management of forest products and aquatic products must be provided;

b) A certificate of quarantine of animals or animal products is required in conformity with provisions of the law on veterinary and the law on animal protection if the specimen is taken out of the province;

c) Safety of alive specimens and concerned people is ensured during the transportation and at the receiving facility.

2. Specimens of CITES-listed endangered wild fauna and flora with legal origin must be stored.

Section 5. APPRAISAL AND POST-SEIZURE HANDLING

Article 31. Appraisal of CITES-listed endangered species of wild fauna and flora

1. Specimens of CITES-listed endangered species of fauna and flora shall be appraised:

a) if necessary for accurately identifying the species, subspecies or a population of wild fauna and flora with the aim of observing regulations consistent with provisions of the Vietnamese law and CITES regulations;

b) to serve investigation and handling of violations in endangered wild fauna and flora;

c) in other cases in which the CITES management authority of Vietnam and competent authorities find that such appraisal is necessary in order to ensure conformity with the law;

d) if there is any request for specimen appraisal from the importing country.

2. Sampling for appraisal of CITES-listed endangered species of wild fauna and flora shall comply with provisions of the Vietnamese law and CITES regulations.

3. The appraisal cost shall be paid by the specimen owner or the entity requesting such appraisal.

4. The CITES scientific authority of Vietnam shall take charge of appraising CITES specimens.

Article 32. Handling of seized specimens of CITES-listed endangered species of wild fauna and flora

1. Handling of alive specimens and seized alive specimens shall comply with regulations specified in Clause 1 Article 10 hereof.

2. In case the seized specimens undergoing handling process are declared to be the carrier of an infectious disease, destruction is required as per law provisions.

3. Seized specimens sourced from foreign states shall be handled as follows:

a) Director of the CITES management authority of Vietnam shall consider and decide to return the specimens back to their origin countries for specimens of CITES-listed species of which

origin is clearly defined. The cost for caring, maintaining and returning the specimens shall be paid by the origin country.

The specimens shall be seized and handled under provisions of the Vietnamese law if the CITES management authority of the origin country fails to give its response or refuse to receive the specimens within 30 working days from the day on which the written notification from the CITES management authority of Vietnam is received.

b) Seized specimens but not stored in a secured place shall be transferred to the local forestry administration for specimens of forest fauna and flora; the provincial-level fisheries state management agency for specimens of aquatic species; the rescue agency for alive specimens or the nearest animal and plant quarantine agency by the seizure entity to be handled as per current regulations of the Vietnamese law and CITES regulations.

Section 6: METHODS FOR ENSURING CITES OBSERVATION

Article 33. CITES management authority of Vietnam

1. The Ministry of Agriculture and Rural Development shall provide regulations on the organizational structure of the CITES management authority of Vietnam in conformity with CITES regulations and Vietnamese law provisions which is responsible to assist the Ministry of Agriculture and Rural Development in complying with regulations specified herein.

2. The CITES management authority of Vietnam has its own legal status, stamp and account; headquarters in Hanoi and two other representative offices in the Middle and the South of Vietnam.

3. Functions and duties of the CITES management authority of Vietnam:

a) Participate in meetings between CITES parties and exercise rights and obligations of a CITES party on behalf of Vietnam;

b) Take charge and cooperate with the CITES scientific authority of Vietnam and relevant entities in observing the CITES in Vietnam;

c) Perform activities related to international cooperation and disseminate CITES observation and prevention of illegal trade in endangered wild fauna and flora by the media;

d) Translate and publish the list of CITES-listed endangered species of wild fauna and flora after amendments to such list are approved in the conference of CITES parties and publish the CITES guidance on sampling for appraisal of endangered wild fauna and flora;

dd) Propose amendments to the list of endangered species of wild fauna and flora specified in CITES Appendices;

e) Grant and revoke permits and certificates specified herein and grant confirmation as requested by the importing country;

g) Print and issue CITES permits and certificates;

h) Provide guidelines on, issue and discard the code of facilities raising endangered, precious and rare forest animals and plants and CITES-listed endangered wild fauna and flora; make registration of facilities raising endangered wild fauna and flora specified in CITES Appendix I for commercial purpose that are eligible to export species mentioned above with the CITES secretariat;

i) Carry out inspection of export, import, re-export, introduction from the sea and transit of specimens of endangered, precious and rare species of forest fauna and flora and CITES-listed endangered species of wild fauna and flora at the border checkpoint;

k) Handle and provide guidelines on handling CITES specimens seized under the Vietnamese law provisions and CITES provisions;

l) Take charge and cooperate with relevant parties in providing professional training for management authorities, organizations, family households and individuals related to CITES observation;

m) Sign bilateral and multilateral agreements on control of trade in specimens of CITES-listed endangered wild fauna and flora on behalf of Vietnam;

4. The State shall provide funding for activities performed by the CITES management authority of Vietnam and encourage domestic and foreign organizations, family households and individuals to support the aforesaid activities.

Article 34. CITES scientific authority of Vietnam

1. The Minister of Agriculture and Rural Development shall appoint scientific authority with appropriate professional skills and capacity as the CITES scientific authority of Vietnam and notify such appointment to the CITES secretariat.

2. Functions and duties of the CITES scientific authority of Vietnam:

Give advice to the CITES management authority of Vietnam and relevant management authorities about the following matters if required:

a) Current state of the population, distribution area and endangered, precious or rare level of endangered wild fauna and flora in nature and establishment of an exploitation quota;

b) Grant of CITES permits and certificates for export, import, re-export and transit of specimens of CITES-listed endangered species of wild fauna and flora;

c) Scientific names of fauna and flora;

d) Appraisal of specimens of wild fauna and flora;

dd) Rescue of and care for alive specimens;

e) Appropriate habitat and distribution area for the purpose of releasing the seized wild animals;

g) Breeding, rearing and artificial production of wild fauna and flora; appraisal of projects on breeding, rearing or artificial production of wild fauna and flora;

h) Disclosure of the list of species with potential for breeding for commercial purpose.

3. Be authorized in writing by the CITES management authority of Vietnam to check breeding, rearing or artificial production facilities, export, import, re-export, introduction from the sea and transit of specimens if necessary.

4. Participate in international conferences, meetings and seminars related to CITES observation.

5. Compile scientific documents and proposals concerning CITES observation; prepare technical reports as required by the CITES secretariat; cooperate with the CITES management authority of Vietnam and other law enforcement bodies in sampling for appraisal of specimens if required.

6. The State shall provide funding for activities carried out by the CITES scientific authority of Vietnam related to provisions of advice on management of endangered, precious and rare forest fauna and flora and CITES observation for the CITES management authority.

Article 35. Disclosing international export quota and setting up an exploitation quota

1. Disclosing international export quota:

a) The CITES management authority of Vietnam shall post the export quota applied to species under international export quota announced by the CITES secretariat on the website of the Government and the Ministry of Agriculture and Rural Development;

b) The international export quota shall be used for determining the quantity and weight of the specimen of an exploited species.

2. Setting up an exploitation quota

The CITES management authority of Vietnam shall give advice to the CITES scientific authority of Vietnam about the exploitation potential to decide whether to set up an exploitation quota in case of request for exploitation of the specimen of a species subject to the export quota as regulated by CITES.

The exploitation quota shall not be established if such exploitation is declared to produce negative effects on the existence of such species in nature by the CITES scientific authority of Vietnam.

The CITES management authority of Vietnam shall cooperate with the CITES scientific authority of Vietnam in setting up an exploitation quota under the CITES guidance if such exploitation is declared not to produce any negative effect on the existence of such species in nature by the CITES scientific authority of Vietnam.

Article 36. Revocation and return of CITES permits and certificates

1. The CITES management authority of Vietnam shall revoke CITES permits and certificates if:

a) they are granted inconsistent with the regulations;

b) they are used for wrong purposes;

c) the entity issued with the permit or certificate commits violations against provisions of the law on management and protection of endangered, precious and rare forest animals and plant and CITES regulations.

2. Return of expired permits and certificates:

a) The organization, family household and individual issued the with a permit or certificate shall return the expired permit or certificate to the CITES management authority of Vietnam within 10 days from the day on which such permit or certificate is expired and no longer in use.

b) The CITES management authority of Vietnam may refuse to issuance the new permit or certificate if the aforesaid entity fails to return the expired permit or certificate before requests for new issuance.

Article 37. Statistical data and storage of specimens of CITES-listed endangered species of wild fauna and flora after seizure

1. The Ministry of Finance shall provide information and statistical data on specimens of CITES-listed endangered species of wild fauna and flora stored by its affiliated entities under regulations of the law on management and use of public assets to the Ministry of Agriculture and Rural Development which are then reported in the Conference of CITES parties under CITES regulations before December 31 of every year.

2. The provided information shall include the quantity and weight of specimens of each specific species currently stored and their origin.

3. The CITES management authority of Vietnam shall send a consolidated report on the quantity of specimens of CITES-listed endangered species of wild fauna and flora currently stored if required by the CITES secretariat.

Chapter IV

IMPLEMENTATION

Article 38. Responsibilities for management of breeding, rearing and artificial production facilities of endangered, precious and rare species of forest fauna and flora and CITES-listed endangered species of wild fauna and flora

1. Provincial forestry administrations shall manage and check breeding, rearing and artificial production facilities for endangered, precious and rare species of forest fauna and flora and CITES-listed endangered species of wild fauna and flora not specified in Clause 2 this Article.

2. Provincial-level fisheries state management agencies shall manage and check breeding, rearing and artificial production facilities for CITES-listed aquatic species.

3. Provincial forestry administrations and provincial-level fisheries state management agencies shall manage, monitor and record the latest updated information into a logbook of animal raising according to Form No.16 or a logbook of plant raising according to Form No.17 provided in the Appendix issued thereto after each inspection.

The logbook system shall be kept in the form of hardcopy and electronic file.

The code issuer and the agency controlling raising facilities shall encourage such facilities to report their operations in the form of electronic file.

4. Management authorities specified in Clause 1 and 2 this Article shall send the latest updated information after each inspection with a report according to Form No.18 provided in the Appendix issued thereto to the Department of Agriculture and Rural Development and the CITES management authority of Vietnam for data update purpose to serve the management work in each specific period before November 30 of every year and cooperate with the CITES management authority of Vietnam and other relevant agencies in carrying out inspection of raising facilities of species specified in CITES Appendix I and II. Such inspection shall be carried out corresponding to each stage of the life cycle of each species.

5. Inspection shall be reported in writing according to Form No.19, 20, 21 and 22 provided in the Appendix issued thereto.

Article 39. Responsibilities for control of export, import, re-export and introduction from the sea of specimens of endangered, precious and rare forest fauna and flora and CITES-listed endangered species of wild fauna and flora assigned to relevant agencies

1. Customs authorities shall confirm the quantity of specimens exported or re-exported in reality and record such quantity into the permit and certificate specified in Article 22 hereof issued by the CITES management authority of Vietnam; return the export or re-export permit to the exporter which is then sent together with the goods; record the serial number and issuance date of the permit or certificate into the customs declaration; sent the copy of permits and certificates

verified in each quarter to the CITES management authority of Vietnam within the first week of the next quarter.

As for exported specimens, the customs authority shall verify the exported quantity in reality provided in the export permit, collect and retain the export permit; record the serial number and issuance date of the permit and certificate into the customs declaration; return the export or re-export permit granted by the exporting country to the exporter; send the copy of permits and certificates verified in each quarter to the CITES management authority of Vietnam within the first week of the next quarter.

2. Forestry administrations, fisheries management authorities, customs authorities, public security forces, Border Defense Force, tax agencies, market management authorities, veterinary authorities, animal quarantine and plant quarantine agencies, environment protection agencies and agencies in charge of biological diversity preservation, as authorized and assigned, shall:

a) carry out inspection and handling of violations in management of export, import, re-export, transit and introduction from the sea, breeding, rearing, artificial production of specimens of endangered, precious and rare species of forest fauna and flora and CITES-listed endangered species of wild fauna and flora; nurture of usual forest animals as per law provisions;

b) provide information and cooperate with the CITES management authority of Vietnam in handling violations related to export, import, re-export, transist and introduction from the sea of specimens of endangered, precious and rare species of forest fauna and flora and CITES-listed endangered species of wild fauna and flora if required by the CITES.

Chapter V

IMPLEMENTATION PROVISIONS

Article 40. Effect

1. This Decree comes into force from March 19, 2019.

2. The following documents shall expire from the effective date of this Decree:

a) Decree No.32/2006/ND-CP dated March 30, 2006 of the Government on management of endangered, precious and rare forest animals and plants;

b) Decree No.82/2006/ND-CP dated August 10, 2006 of the Government on management of export, import, re-export, introduction from the sea, transit, breeding, rearing and artificial production of endangered, precious and rare forest animals and plants;

c) Article 5 of Decree No.98/2011/ND-CP dated October 26, 2011 of the Government on amendments to a number of Articles of Decrees on agriculture;

d) Chapter IV of Decree No.66/2016/ND-CP dated July 01, 2016 of the Government on conditions for investment in protection and quarantine of plants, plant varieties; nurture of usual forest animals; animal husbandry; fisheries and food products;

dd) Circular No.47/2012/TT-BNNPTNT dated September 25, 2012 of the Minister of Agriculture and Rural Development on management of exploitation from nature and nurture of usual forest animals;

e) Circular No.16/2007/TT-BNN dated February 14, 2007 of the Minister of Agriculture and Rural Development providing guidelines for management and use of sample certificates of export of souvenir specimens specified in CITES Appendices;

g) Decision No.95/2008/QD-BNN dated September 29, 2008 of the Minister of Agriculture and Rural Development on promulgation of regulations on domesticated bear management.

3. Species that are both on the list of endangered, precious and rare forest fauna and flora and the list of endangered species of wild fauna and flora shall be managed under regulations provided herein, except for exploitation for the purpose of generating the first breed/seed serving scientific research.

4. Export, re-export, import, temporary import for re-export, temporary export for re-import, introduction from the sea and transit of CITES specimens shall comply with regulations hereof.

Article 41. Trasnsition clauses

1. Raising facilities for non-profit purpose founded before the effective date of this Decree shall prepare and keep a logbook of animal raising according to Form No.16 or a logbook of plant raising according to Form No.17 provided in the Appendix issued thereto within 3 months from the effective date of this Decree and send such logbook to the competent authority for issuance of the code of the raising facility.

2. Biological diversity preservation facilities issued with a certificate of biological diversity preservation by provincial People's Committees shall send the logbook for monitoring of input animals or of specimens of plants produced artificially to the code issuer in compliance with regulations herein.

3. Organizations or individuals whose applications for a permit/certificate or permission for specimen transit submitted before the effective date of this Decree not yet processed by the competent authority shall take actions specified herein.

4. Organizations or individuals whose applications for registration of breeding, rearing or artificial production facilities not yet processed by the competent authority shall take actions specified herein.

Article 42. Implementation responsibilities

Ministers, Directors of ministerial agencies and Governmental agencies, Chairpersons of People's Committees of provinces and centrally-affiliated cities shall take responsibility to implement this Decree./.

PP. THE GOVERNMENT
PRIME MINISTER

Nguyen Xuan Phuc

THE GOVERNMENT ---	THE SOCIALIST REPUBLIC OF VIETNAM **Independence – Freedom – Happiness** ---
No.: 35/2019/ND-CP	*Hanoi, April 25, 2019*

DECREE

PENALTIES FOR ADMINISTRATIVE VIOLATIONS AGAINST REGULATIONS ON FORESTRY

Pursuant to the Law on Government organization dated June 19, 2015;

Pursuant to the Law on forestry dated November 15, 2017;

Pursuant to the Law on Penalties for administrative violations dated June 20, 2012;

At the request of the Minister of Agriculture and Rural Development;

The Government promulgates a Decree providing for penalties for administrative violations against regulations on forestry.

Chapter I

GENERAL PROVISIONS

Article 1. Scope

1. This Decree deals with violations, penalties, fines, remedial measures against administrative violations, the power to impose administrative penalties and the power to make records of administrative violations against regulations on forestry.

2. Other administrative violations against regulations on forestry which are not prescribed in this Decree shall be governed by other relevant Government's decrees on penalties for administrative violations within the scope of state management.

Article 2. Regulated entities

1. This Decree applies to domestic and foreign organizations and individuals that commit violations against regulations on forestry in the territory of Vietnam; the persons that have the power to record violations and the ones competent to impose administrative penalties in accordance with regulations herein.

2. Organizations mentioned in Clause 1 of this Article include:

a) Regulatory authorities committing violations which are not related to their assigned management tasks;

b) Enterprises that are established and operate under the law of Vietnam; branches and representative offices operating in Vietnam of foreign enterprises;

c) Co-operatives and cooperative unions;

d) Public service providers;

dd) Professional organizations operating in the forestry sector.

3. Individuals mentioned in Clause 1 of this Article include entities that are not prescribed in Clause 2 of this Article.

Article 3. Definitions

For the purposes of this Decree, the below are construed as follows:

1. “forest ranger” means an official who is in charge of forest management and on the payroll of forest protection authorities.

2. “vital body parts” mean animal body parts which have specialized functions and the separation of which from the animal body will lead to the death of such animal (e.g. head, heart, skin, skeleton and liver, etc.).

3. “products of forest animals” mean products which originate from forest animals such as meat, eggs, milk, sperm, embryo, blood, bile, internal organs, skin, fur, bones, horn, ivory, legs and hoofs, etc. or articles whose ingredients are processed or prepared parts of forest animals such as bone glue, handbags, purses and belts made from skins of forest animals.

4. “regenerating forest without reserve volume” refers to forest composed of trees established through either natural regeneration or assisted natural regeneration with the standing volume of 10 m^3/ha.

5. Exhibits and instrumentalities for committing administrative violations include:

a) Forest products which are exploited, traded, transported, stored or processed against the law;

b) Devices, tools and petrol chainsaws of various types used to commit administrative violations;

c) Vehicles, including bicycles, non-motorized vehicles, motorcycles, motor vehicles, vessels, boats, motorboats, lighters and other vehicles which are used to commit administrative violations.

6. “illegally appropriated vehicle" means a vehicle which is stolen, robbed, extorted or appropriated by the violator by abuse of trust or when its legal owner is unable to prevent such act of appropriation, or a vehicle the possession, management or utilization of which is illegally taken by the violator.

7. “illegally used vehicle” means a vehicle which is lent or leased out, operated or used by a person who is hired by the legal owner, manager or user to use it for lawful purposes but is deliberately used for committing an administrative violation by the borrower, lessee or hired person.

Article 4. Penalties and remedial measures

1. The organization or individual must incur a warning or a fine when committing an administrative violation against regulations on forestry.

2. Depending on the nature and severity of each administrative violation, the violating organization or individual may face one or some of the following additional penalties:

a) Confiscation of the exhibits and instrumentalities for committing administrative violations;

b) Suspension of forest harvesting for a fixed period of 06 - 12 months;

c) Suspension of the processing of forest products for a fixed period of 06 - 12 months.

3. In addition to administrative penalties, the violating organization or individual may be liable to one or some of the following remedial measures:

a) Enforced restoration to original condition;

b) Enforced demolition of buildings or structures which have been built without the license or inconsistently with the license;

c) Enforced implementation of measures for control of environmental pollution and prevention of the spread of epidemics;

d) Enforced destruction of goods or articles which cause harm to human health, domestic animals, plants or environment;

dd) Enforced transfer of illegal benefits obtained from administrative violations or enforced transfer of amounts of money equivalent to the value of the exhibits and/or instrumentalities of administrative violations which have been sold, liquidated, hidden or destroyed inconsistently with the law;

e) Enforced reforestation or payment of reforestation cost equivalent to the standard afforestation investment applicable by local government at the time of committing administrative violations;

g) Enforced revocation of issued sustainable forest management certificate;

h) Enforced payment for forest environmental services and interests on late payments (if any) corresponding to late payment amounts and period;

i) Enforced payment for forest environmental services to entities in charge of forest protection under signed contracts;

k) Enforced destruction of tree seed or seedling shipments;

l) Enforced removal of waste, hazardous, flammable, explosive, ignitable chemicals from forests;

m) Enforced establishment of ecotourism, resort or recreation area project which must comply with law or be conformable with the ecotourism, resort or recreation area scheme approved by a competent authority;

n) Enforced formulation and submission of sustainable foreign management plans to competent authorities for approval;

o) Enforced reforestation in the next season.

Article 5. Units used in damage calculation

1. Forest area or immature forest area is calculated by m^2.

2. Timber volume is calculated by m^3.

3. Units and methods for determining quantities and volumes of forest products shall conform to regulations of the Ministry of Agriculture and Rural Development. When imposing administrative penalties, the exhibits of violations which are timber must be converted into logs. Sawn wood or roughly squared wood may be converted into logs by multiplying a coefficient of 1.6.

4. The value of forest animals of common species, body parts or products thereof, endangered, rare and precious animals of Group IIB, body parts or products thereof, endangered, rare and precious animals of Group IB, body parts or products thereof, non-timber forest plants and timber products shall be determined in VND.

Article 6. Imposition of administrative penalties

1. The fine for every administrative violation prescribed herein shall be imposed on individual and shall not exceed VND 500,000,000. The fine imposed on an organization is twice as much as that imposed on an individual for the same administrative violation and shall not exceed VND 1,000,000,000.

2. Penalties for administrative violations involving endangered, rare timber or non-timber forest plants that need protection shall be the same as those for endangered, rare and precious timber or non-timber forest plants of Group IA.

3. Penalties for administrative violations involving species in Appendix I of CITES shall be the same as those for endangered, rare and precious plants or animals of Group I. Penalties for administrative violations involving species in Appendix II of CITES shall be the same as those for endangered, rare and precious plants or animals of Group II.

4. Penalties for administrative violations involving endangered, rare and precious animals of Group IB or Group IIB or in Appendix I or Appendix II of CITES but classified as endangered, rare animals that need protection shall be the same as those for endangered, rare animals that need protection.

5. The violation which has been handled by a criminal proceedings agency but then is classified as an administrative violation according to the decision not to institute criminal proceedings, decision to drop criminal charges, decision to terminate investigative activities or decision to dismiss a case as prescribed in Article 63 of the Law on penalties for administrative violations shall be handled according to its nature, severity and consequence as regulated herein. In case the exhibits of violations are endangered, rare animals that need protection, they shall be treated as endangered, rare and precious animals of Group IB.

If the seriousness of the violation exceeds the maximum fine in the fine bracket, the maximum fine will be imposed.

6. If a violation causes damage to various forest categories, including production forest, protective forest, special-use forest, or has exhibits comprising of various forest products but is not liable to criminal prosecution, the fine for this violation shall be imposed according to each forest category or forest product type.

7. Any violation involving the forest which is planned to be used for other purposes but the repurposing decision is not yet in effect shall be handled in the same manner as the violation involving the forest before it is repurposed.

8. If the forest owner detects any violation which causes damage to his/her forest products, he/she shall record the violation, protect the scene and exhibits, submit a report and transfer the case to a competent authority/ official within 03 days from the detection of violation, and then is required to cooperate with competent authority/ official in handling the case according to regulations herein. Confiscated forest products shall be returned to the forest owner if they are extracted from the forest planted by using the forest owner's funding only.

9. Exhibits/vehicles which have been impounded because they have been illegally appropriated or used by violators shall be handled according to Clause 1 Article 126 of the Law on penalties for administrative violations.

Chapter II

ADMINISTRATIVE VIOLATIONS, PENALTIES AND REMEDIAL MEASURES

Section 1. VIOLATIONS AGAINST REGULATIONS ON FOREST MANAGEMENT AND UTILIZATION

Article 7. Forest trespass

The following penalties shall be imposed for illegal relocation of forest boundaries/ boundary markers or appropriation of forest land of other persons or publicly owned forests which are not yet allocated or leased out:

1. A fine ranging from VND 1,000,000 to VND 3,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of less than 5,000 m^2;

b) The violation involves the production forest with an area of less than 3,000 m^2;

c) The violation involves the protective forest with an area of less than 2,000 m^2;

d) The violation involves the special-use forest with an area of less than 1,000 m^2.

2. A fine ranging from VND 3,000,000 to VND 7,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 5,000 m^2 to under 10,000 m^2;

b) The violation involves the production forest with an area of from 3,000 m^2 to under 5,000 m^2;

c) The violation involves the protective forest with an area of from 2,000 m^2 to under 4,000 m^2;

d) The violation involves the special-use forest with an area of from 1,000 m^2 to under 3,000 m^2.

3. A fine ranging from VND 7,000,000 to VND 15,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 10,000 m^2 to under 20,000 m^2;

b) The violation involves the production forest with an area of from 5,000 m^2 to under 8,000 m^2;

c) The violation involves the protective forest with an area of from 4,000 m^2 to under 6,000 m^2;

d) The violation involves the special-use forest with an area of from 3,000 m^2 to under 4,000 m^2.

4. A fine ranging from VND 15,000,000 to VND 25,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 20,000 m^2 to under 30,000 m^2;

b) The violation involves the production forest with an area of from 8,000 m^2 to under 10,000 m^2;

c) The violation involves the protective forest with an area of from 6,000 m^2 to under 8,000 m^2;

d) The violation involves the special-use forest with an area of from 4,000 m^2 to under 5,000 m^2.

5. A fine ranging from VND 25,000,000 to VND 32,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 30,000 m^2 to under 40,000 m^2;

b) The violation involves the production forest with an area of from 10,000 m^2 to under 15,000 m^2;

c) The violation involves the protective forest with an area of from 8,000 m^2 to under 12,000 m^2;

d) The violation involves the special-use forest with an area of from 5,000 m^2 to under 7,000 m^2.

6. A fine ranging from VND 32,000,000 to VND 40,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 40,000 m^2 to under 50,000 m^2;

b) The violation involves the production forest with an area of from 15,000 m^2 to under 20,000 m^2;

c) The violation involves the protective forest with an area of from 12,000 m^2 to under 15,000 m^2;

d) The violation involves the special-use forest with an area of from 7,000 m^2 to under 10,000 m^2.

7. A fine ranging from VND 40,000,000 to VND 50,000,000 shall be imposed in one of the following circumstances:

a) The violation involves an immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of ≥ 50,000 m^2;

b) The violation involves the production forest with an area of ≥ 20,000 m^2;

c) The violation involves the protective forest with an area of ≥ 15,000 m^2;

d) The violation involves the special-use forest with an area of ≥ 10,000 m^2.

8. Remedial measures:

The violator is compelled to restore the original condition which is changed by one of the violations specified in Clause 1 through 7 of this Article.

Article 8. Illegal use of forest land, illegal services and business activities in forests

1. A fine ranging from VND 1,000,000 to VND 5,000,000 shall be imposed for organization of tourism activities or sightseeing in the forest without the forest owner's permission.

2. A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed for the commission of one of the following violations:

a) Provision of services or performance of business activities in the forest without the forest owner's permission;

b) Organization of vacation or entertainment activities within the strictly protected area of the special-use forest.

3. A fine ranging from VND 10,000,000 to VND 25,000,000 shall be imposed for investment in ecotourism, resort or recreation area in the special-use forest or protective forest in one of the following circumstances:

a) The investor fails to establish an ecotourism, resort or recreation area project as regulated;

b) The ecotourism, resort or recreation area project is not conformable with the ecotourism, resort or recreation area scheme approved by a competent authority.

4. Remedial measures:

a) The violator is compelled to restore the original condition which is changed by the violation specified in Clause 2 of this Article;

b) The violator is compelled to establish an ecotourism, resort or recreation area project in conformity with the ecotourism, resort or recreation area scheme approved by a competent authority if the violation specified in Clause 3 of this Article is committed.

5. If any violation specified in this Article causes damage to the forest or forest products, the violator shall also incur penalties prescribed in Article 13 or Article 20 hereof.

Article 9. Violations against regulations on payments for forest environments services

1. The following penalties shall be imposed for failure to enter into the payments for forest environmental services contract within 03 months from the date of enjoyment of forest environmental services:

a) A fine ranging from VND 3,000,000 to VND 5,000,000 shall be imposed on the user who fails to enter into the contract with the forest owner in case of direct payment;

b) A fine ranging from VND 10,000,000 to VND 20,000,000 shall be imposed on the user who fails to enter into the contract with the Provincial Forest Protection and Development Fund in case of indirect payment;

c) A fine ranging from VND 40,000,000 to VND 50,000,000 shall be imposed on the user who fails to enter into the contract with Vietnam Forest Protection and Development Fund in case of indirect payment.

2. The following penalties shall be imposed for failure to make statement of amounts payable for forest environmental services in case of indirect payment:

a) A fine ranging from VND 1,000,000 to VND 2,000,000 shall be imposed if the amount payable is less than VND 50,000,000;

b) A fine ranging from VND 2,000,000 to VND 3,000,000 shall be imposed if the amount payable is from VND 50,000,000 to under VND 200,000,000;

c) A fine ranging from VND 3,000,000 to VND 5,000,000 shall be imposed if the amount payable is from VND 200,000,000 to under VND 300,000,000;

d) A fine ranging from VND 5,000,000 to VND 7,000,000 shall be imposed if the amount payable is from VND 300,000,000 to under VND 500,000,000;

dd) A fine ranging from VND 7,000,000 to VND 10,000,000 shall be imposed if the amount payable is ≥ VND 500,000,000.

3. The following penalties shall be imposed for failure to make payment or full payment for forest environment services:

a) A fine ranging from VND 1,000,000 to VND 2,000,000 shall be imposed for failure to make payment or full payment for forest environmental services for over 03 months from the agreed payment date specified in the signed contract in case the amount payable is less than VND 20,000,000;

b) A fine ranging from VND 2,000,000 to VND 3,000,000 shall be imposed for failure to make payment or full payment for forest environmental services for over 03 months from the agreed payment date specified in the signed contract in case the amount payable is from VND 20,000,000 to under VND 30,000,000;

c) A fine ranging from VND 3,000,000 to VND 5,000,000 shall be imposed for failure to make payment or full payment for forest environmental services for over 03 months from the agreed payment date specified in the signed contract in case the amount payable is from VND 30,000,000 to under VND 50,000,000;

d) A fine ranging from VND 5,000,000 to VND 15,000,000 shall be imposed for failure to make payment or full payment for forest environmental services for over 03 months from the agreed payment date specified in the signed contract in case the amount payable is from VND 50,000,000 to under VND 100,000,000;

dd) A fine ranging from VND 15,000,000 to VND 25,000,000 shall be imposed for failure to make payment or full payment for forest environmental services for over 03 months from the agreed payment date specified in the signed contract in case the amount payable is from VND 100,000,000 to under VND 200,000,000;

e) A fine ranging from VND 25,000,000 to VND 40,000,000 shall be imposed for failure to make payment or full payment for forest environmental services for over 03 months from the agreed payment date specified in the signed contract in case the amount payable is from VND 200,000,000 to under VND 500,000,000;

g) A fine ranging from VND 40,000,000 to VND 50,000,000 shall be imposed for failure to make payment or full payment for forest environmental services for over 03 months from the agreed payment date specified in the signed contract in case the amount payable is ≥ VND 500,000,000.

4. The following penalties shall be imposed for failure to make payment or full/timely payment for forest environmental services to the person in charge of forest protection under the contract signed with the forest owner:

a) A fine ranging from VND 1,000,000 to VND 2,000,000 shall be imposed if the amount payable is less than VND 5,000,000;

b) A fine ranging from VND 2,000,000 to VND 3,000,000 shall be imposed if the amount payable is from VND 5,000,000 to under VND 20,000,000;

c) A fine ranging from VND 3,000,000 to VND 5,000,000 shall be imposed if the amount payable is from VND 20,000,000 to under VND 50,000,000;

d) A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed if the amount payable is ≥ VND 50,000,000.

5. Remedial measures:

a) The violator is compelled to make full payment for forest environmental services and late payment interests (if any) within 01 month from the issuance of decision on penalty imposition in case of the violation specified in Clause 3 of this Article.

The interest is charged on the late payment amount for the duration of late payment according to the basic interest rate announced by the State Bank of Vietnam at the time closest to the date of issuance of the decision on penalty imposition.

b) The violator is compelled to make full payment for forest environmental services to the person in charge of forest protection under the contract signed with the forest owner within 01 month from the issuance of decision on penalty imposition in case of the violation specified in Clause 4 of this Article.

Article 10. Violations against regulations on sustainable forest management

1. A fine ranging from VND 1,000,000 to VND 3,000,000 shall be imposed for failure to formulate and submit the sustainable forest management plan to a competent authority for approval or failure to comply with the one approved by a competent authority.

2. A fine ranging from VND 3,000,000 to VND 5,000,000 shall be imposed for examination and issuance of sustainable forest management certificates against regulations on sustainable forest management criteria.

3. Remedial measures:

a) The violator is compelled to formulate and submit the sustainable forest management plan to a competent authority for approval in case of the violation specified in Clause 1 of this Article;

b) The sustainable forest management certificate shall be revoked in case of the violation specified in Clause 2 of this Article.

Article 11. Violations against regulations on documents and procedures for extraction of forest products of lawful origin

1. A fine ranging from VND 500,000 to VND 1,000,000 shall be imposed for failure to prepare adequate documents or follow procedures for extraction of forest products as regulated by laws when carrying out the logging, full exploitation or salvage logging of timber of lawful origin from the planted forest whose owner is represented by the State.

2. A fine ranging from VND 1,000,000 to VND 5,000,000 shall be imposed for failure to prepare adequate documents or follow procedures for extraction of forest products as regulated by laws when carrying out the logging, full exploitation or salvage logging of forest products of lawful origin from natural forests.

Article 12. Violations against regulations on repurposing of forests

The following penalties shall be imposed for failure to follow procedures for forest repurposing although all repurposing requirements are satisfied:

1. A fine ranging from VND 1,000,000 to VND 5,000,000 shall be imposed in one of the following circumstances:

a) The repurposed forest is the production forest with an area of less than 800 m^2;

b) The repurposed forest is the protective forest with an area of less than 600 m^2;

c) The repurposed forest is the special-use forest with an area of less than 400 m^2.

2. A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed in one of the following circumstances:

a) The repurposed forest is the production forest with an area of from 800 m^2 to under 1,400 m^2;

b) The repurposed forest is the protective forest with an area of from 600 m^2 to under 1,000 m^2;

c) The repurposed forest is the special-use forest with an area of from 400 m^2 to under 800 m^2.

3. A fine ranging from VND 10,000,000 to VND 25,000,000 shall be imposed in one of the following circumstances:

a) The repurposed forest is the production forest with an area of from 1,400 m^2 to under 3,000 m^2;

b) The repurposed forest is the protective forest with an area of from 1,000 m^2 to under 2,000 m^2;

c) The repurposed forest is the special-use forest with an area of from 800 m^2 to under 1,500 m^2.

4. A fine ranging from VND 25,000,000 to VND 40,000,000 shall be imposed in one of the following circumstances:

a) The repurposed forest is the production forest with an area of from 3,000 m^2 to under 5,000 m^2;

b) The repurposed forest is the protective forest with an area of from 2,000 m^2 to under 3,000 m^2;

c) The repurposed forest is the special-use forest with an area of from 1,500 m^2 to under 2,500 m^2.

5. A fine ranging from VND 40,000,000 to VND 60,000,000 shall be imposed in one of the following circumstances:

a) The repurposed forest is the production forest with an area of from 5,000 m^2 to under 7,000 m^2;

b) The repurposed forest is the protective forest with an area of from 3,000 m^2 to under 5,000 m^2;

c) The repurposed forest is the special-use forest with an area of from 2,500 m^2 to under 3,500 m^2.

6. A fine ranging from VND 60,000,000 to VND 80,000,000 shall be imposed in one of the following circumstances:

a) The repurposed forest is the production forest with an area of from 7,000 m^2 to under 10,000 m^2;

b) The repurposed forest is the protective forest with an area of from 5,000 m^2 to under 7,500 m^2;

c) The repurposed forest is the special-use forest with an area of from 3,500 m^2 to under 5,000 m^2.

7. A fine ranging from VND 80,000,000 to VND 100,000,000 shall be imposed in one of the following circumstances:

a) The repurposed forest is the production forest with an area of $\geq$ 10,000 m^2;

b) The repurposed forest is the protective forest with an area of $\geq$ 7,500 m^2;

c) The repurposed forest is the special-use forest with an area of $\geq$ 5,000 m^2.

Article 13. Illegal extraction of forests

Any entities that extract forest products without permission from competent authorities shall incur penalties. To be specific:

1. Illegal logging in production forests:

a) Illegal logging of timber of common species:

A fine ranging from VND 500,000 to VND 1,000,000 shall be imposed for illegal extraction of less than 0.4 m^3 of timber in a planted forest or less than 0.2 m^3 of timber in a natural forest;

A fine ranging from VND 1,000,000 to VND 5,000,000 shall be imposed for illegal extraction of from 0.4 m^3 to under 01 m^3 of timber in a planted forest or from 0.2 m^3 to under 0.5 m^3 of timber in a natural forest;

A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed for illegal extraction of from 01 m^3 to under 02 m^3 of timber in a planted forest or from 0.5 m^3 to under 01 m^3 of timber in a natural forest;

A fine ranging from VND 10,000,000 to VND 25,000,000 shall be imposed for illegal extraction of from 02 m^3 to under 05 m^3 of timber in a planted forest or from 01 m^3 to under 2.5 m^3 of timber in a natural forest;

A fine ranging from VND 25,000,000 to VND 35,000,000 shall be imposed for illegal extraction of from 05 m^3 to under 07 m^3 of timber in a planted forest or from 2.5 m^3 to under 3.5 m^3 of timber in a natural forest;

A fine ranging from VND 35,000,000 to VND 50,000,000 shall be imposed for illegal extraction of from 07 m^3 to under 10 m^3 of timber in a planted forest or from 3.5 m^3 to under 05 m^3 of timber in a natural forest;

A fine ranging from VND 50,000,000 to VND 70,000,000 shall be imposed for illegal extraction of from 10 m^3 to under 15 m^3 of timber in a planted forest or from 05 m^3 to under 07 m^3 of timber in a natural forest;

A fine ranging from VND 70,000,000 to VND 100,000,000 shall be imposed for illegal extraction of from 15 m^3 to under 20 m^3 of timber in a planted forest or from 07 m^3 to under 10 m^3 of timber in a natural forest.

b) Illegal logging of timber of endangered, rare or precious species in Group IIA:

A fine ranging from VND 1,000,000 to VND 3,000,000 shall be imposed for illegal extraction of less than 0.3 m^3 of timber in a planted forest or less than 0.2 m^3 of timber in a natural forest;

A fine ranging from VND 3,000,000 to VND 7,000,000 shall be imposed for illegal extraction of from 0.3 m^3 to under 0.5 m^3 of timber in a planted forest or from 0.2 m^3 to under 0.4 m^3 of timber in a natural forest;

A fine ranging from VND 7,000,000 to VND 10,000,000 shall be imposed for illegal extraction of from 0.5 m^3 to under 01 m^3 of timber in a planted forest or from 0.4 m^3 to under 0.6 m^3 of timber in a natural forest;

A fine ranging from VND 10,000,000 to VND 25,000,000 shall be imposed for illegal extraction of from 01 m^3 to under 1.5 m^3 of timber in a planted forest or from 0.6 m^3 to under 01 m^3 of timber in a natural forest;

A fine ranging from VND 25,000,000 to VND 35,000,000 shall be imposed for illegal extraction of from 1.5 m^3 to under 02 m^3 of timber in a planted forest or from 01 m^3 to under 1.5 m^3 of timber in a natural forest;

A fine ranging from VND 35,000,000 to VND 50,000,000 shall be imposed for illegal extraction of from 02 m^3 to under 03 m^3 of timber in a planted forest or from 1.5 m^3 to under 02 m^3 of timber in a natural forest;

A fine ranging from VND 50,000,000 to VND 100,000,000 shall be imposed for illegal extraction of from 03 m^3 to under 07 m^3 of timber in a planted forest or from 02 m^3 to under 03 m^3 of timber in a natural forest;

A fine ranging from VND 100,000,000 to VND 150,000,000 shall be imposed for illegal extraction of from 07 m^3 to under 10 m^3 of timber in a planted forest or from 03 m^3 to under 05 m^3 of timber in a natural forest;

A fine ranging from VND 150,000,000 to VND 200,000,000 shall be imposed for illegal extraction of from 10 m^3 to under 15 m^3 of timber in a planted forest or from 05 m^3 to under 07 m^3 of timber in a natural forest.

c) Illegal logging of timber of endangered, rare or precious species in Group IA:

A fine ranging from VND 10,000,000 to VND 25,000,000 shall be imposed for illegal extraction of less than 0.3 m^3 of timber;

A fine ranging from VND 25,000,000 to VND 50,000,000 shall be imposed for illegal extraction of from 0.3 m^3 to under 0.5 m^3 of timber;

A fine ranging from VND 50,000,000 to VND 75,000,000 shall be imposed for illegal extraction of from 0.5 m^3 to under 0.7 m^3 of timber;

A fine ranging from VND 75,000,000 to VND 100,000,000 shall be imposed for illegal extraction of from 0.7 m^3 to under 01 m^3 of timber.

2. Illegal logging in protective forests:

a) Illegal logging of timber of common species:

A fine ranging from VND 1,000,000 to VND 4,000,000 shall be imposed for illegal extraction of less than 0.5 m^3 of timber in a planted forest or less than 0.3 m^3 of timber in a natural forest;

A fine ranging from VND 4,000,000 to VND 8,000,000 shall be imposed for illegal extraction of from 0.5 m^3 to under 01 m^3 of timber in a planted forest or from 0.3 m^3 to under 0.5 m^3 of timber in a natural forest;

A fine ranging from VND 8,000,000 to VND 15,000,000 shall be imposed for illegal extraction of from 01 m^3 to under 02 m^3 of timber in a planted forest or from 0.5 m^3 to under 01 m^3 of timber in a natural forest;

A fine ranging from VND 15,000,000 to VND 25,000,000 shall be imposed for illegal extraction of from 02 m^3 to under 04 m^3 of timber in a planted forest or from 01 m^3 to under 02 m^3 of timber in a natural forest;

A fine ranging from VND 25,000,000 to VND 50,000,000 shall be imposed for illegal extraction of from 04 m^3 to under 06 m^3 of timber in a planted forest or from 02 m^3 to under 03 m^3 of timber in a natural forest;

A fine ranging from VND 50,000,000 to VND 70,000,000 shall be imposed for illegal extraction of from 06 m^3 to under 10 m^3 of timber in a planted forest or from 03 m^3 to under 05 m^3 of timber in a natural forest;

A fine ranging from VND 70,000,000 to VND 100,000,000 shall be imposed for illegal extraction of from 10 m^3 to under 15 m^3 of timber in a planted forest or from 05 m^3 to under 07 m^3 of timber in a natural forest.

b) Illegal logging of timber of endangered, rare or precious species in Group IIA:

A fine ranging from VND 1,000,000 to VND 5,000,000 shall be imposed for illegal extraction of less than 0.3 m^3 of timber in a planted forest or less than 0.2 m^3 of timber in a natural forest;

A fine ranging from VND 5,000,000 to VND 7,000,000 shall be imposed for illegal extraction of from 0.3 m^3 to under 0.6 m^3 of timber in a planted forest or from 0.2 m^3 to under 0.3 m^3 of timber in a natural forest;

A fine ranging from VND 7,000,000 to VND 15,000,000 shall be imposed for illegal extraction of from 0.6 m^3 to under 01 m^3 of timber in a planted forest or from 0.3 m^3 to under 0.5 m^3 of timber in a natural forest;

A fine ranging from VND 15,000,000 to VND 25,000,000 shall be imposed for illegal extraction of from 01 m^3 to under 1.5 m^3 of timber in a planted forest or from 0.5 m^3 to under 0.7 m^3 of timber in a natural forest;

A fine ranging from VND 25,000,000 to VND 50,000,000 shall be imposed for illegal extraction of from 1.5 m^3 to under 02 m^3 of timber in a planted forest or from 0.7 m^3 to under 01 m^3 of timber in a natural forest;

A fine ranging from VND 50,000,000 to VND 70,000,000 shall be imposed for illegal extraction of from 02 m^3 to under 03 m^3 of timber in a planted forest or from 01 m^3 to under 1.5 m^3 of timber in a natural forest;

A fine ranging from VND 70,000,000 to VND 100,000,000 shall be imposed for illegal extraction of from 03 m^3 to under 05 m^3 of timber in a planted forest or from 1.5 m^3 to under 2.5 m^3 of timber in a natural forest;

A fine ranging from VND 100,000,000 to VND 150,000,000 shall be imposed for illegal extraction of from 05 m^3 to under 07 m^3 of timber in a planted forest or from 2.5 m^3 to under 04 m^3 of timber in a natural forest;

A fine ranging from VND 150,000,000 to VND 200,000,000 shall be imposed for illegal extraction of from 07 m^3 to under 10 m^3 of timber in a planted forest or from 04 m^3 to under 05 m^3 of timber in a natural forest.

c) Illegal logging of timber of endangered, rare or precious species in Group IA:

A fine ranging from VND 25,000,000 to VND 50,000,000 shall be imposed for illegal extraction of less than 0.1 m^3 of timber;

A fine ranging from VND 50,000,000 to VND 85,000,000 shall be imposed for illegal extraction of from 0.1 m^3 to under 0.3 m^3 of timber;

A fine ranging from VND 85,000,000 to VND 120,000,000 shall be imposed for illegal extraction of from 0.3 m^3 to under 0.5 m^3 of timber.

3. Illegal logging in special-use forests:

a) Illegal logging of timber of common species:

A fine ranging from VND 1,000,000 to VND 5,000,000 shall be imposed for illegal extraction of less than 0.5 m^3 of timber in a planted forest or less than 0.3 m^3 of timber in a natural forest;

A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed for illegal extraction of from 0.5 m^3 to under 01 m^3 of timber in a planted forest or from 0.3 m^3 to under 0.5 m^3 of timber in a natural forest;

A fine ranging from VND 10,000,000 to VND 25,000,000 shall be imposed for illegal extraction of from 01 m^3 to under 02 m^3 of timber in a planted forest or from 0.5 m^3 to under 01 m^3 of timber in a natural forest;

A fine ranging from VND 25,000,000 to VND 50,000,000 shall be imposed for illegal extraction of from 02 m^3 to under 05 m^3 of timber in a planted forest or from 01 m^3 to under 02 m^3 of timber in a natural forest;

A fine ranging from VND 50,000,000 to VND 100,000,000 shall be imposed for illegal extraction of from 05 m^3 to under 10 m^3 of timber in a planted forest or from 02 m^3 to under 03 m^3 of timber in a natural forest.

b) Illegal logging of timber of endangered, rare or precious species in Group IIA:

A fine ranging from VND 2,000,000 to VND 6,000,000 shall be imposed for illegal extraction of less than 0.3 m^3 of timber in a planted forest;

A fine ranging from VND 6,000,000 to VND 10,000,000 shall be imposed for illegal extraction of from 0.3 m^3 to under 0.5 m^3 of timber in a planted forest or less than 0.2 m^3 of timber in a natural forest;

A fine ranging from VND 10,000,000 to VND 25,000,000 shall be imposed for illegal extraction of from 0.5 m^3 to under 01 m^3 of timber in a planted forest or from 0.2 m^3 to under 0.4 m^3 of timber in a natural forest;

A fine ranging from VND 25,000,000 to VND 50,000,000 shall be imposed for illegal extraction of from 01 m^3 to under 02 m^3 of timber in a planted forest or from 0.4 m^3 to under 0.6 m^3 of timber in a natural forest;

A fine ranging from VND 50,000,000 to VND 70,000,000 shall be imposed for illegal extraction of from 02 m^3 to under 03 m^3 of timber in a planted forest or from 0.6 m^3 to under 0.8 m^3 of timber in a natural forest;

A fine ranging from VND 70,000,000 to VND 100,000,000 shall be imposed for illegal extraction of from 03 m^3 to under 05 m^3 of timber in a planted forest or from 0.8 m^3 to under 01 m^3 of timber in a natural forest.

c) Illegal logging of timber of endangered, rare or precious species in Group IA:

A fine ranging from VND 25,000,000 to VND 50,000,000 shall be imposed for illegal extraction of less than 0.1 m^3 of timber;

A fine ranging from VND 50,000,000 to VND 85,000,000 shall be imposed for illegal extraction of from 0.1 m^3 to under 0.3 m^3 of timber;

A fine ranging from VND 85,000,000 to VND 120,000,000 shall be imposed for illegal extraction of from 0.3 m^3 to under 0.5 m^3 of timber.

4. Illegal extraction of non-timber forest plants:

a) Illegal extraction of non-timber forest plants of common species, anthracite and charcoal:

A fine ranging from VND 500,000 to VND 1,000,000 shall be imposed if the violation causes damage to forest products assessed at < VND 1,000,000;

A fine ranging from VND 1,000,000 to VND 3,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 1,000,000 to under VND 2,000,000;

A fine ranging from VND 3,000,000 to VND 5,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 2,000,000 to under VND 3,000,000;

A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 3,000,000 to under VND 6,000,000;

A fine ranging from VND 10,000,000 to VND 25,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 6,000,000 to under VND 15,000,000;

A fine ranging from VND 25,000,000 to VND 50,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 15,000,000 to under VND 30,000,000;

A fine ranging from VND 50,000,000 to VND 70,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 30,000,000 to under VND 50,000,000;

A fine ranging from VND 70,000,000 to VND 100,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 50,000,000 to under VND 70,000,000;

A fine ranging from VND 100,000,000 to VND 125,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 70,000,000 to under VND 85,000,000;

A fine ranging from VND 125,000,000 to VND 150,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 85,000,000 to under VND 100,000,000.

b) Illegal extraction of non-timber forest plants of endangered, rare or precious species in Group IIA:

A fine ranging from VND 1,000,000 to VND 2,000,000 shall be imposed if the violation causes damage to forest products assessed at < VND 1,000,000;

A fine ranging from VND 2,000,000 to VND 5,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 1,000,000 to under VND 2,000,000;

A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 2,000,000 to under VND 5,000,000;

A fine ranging from VND 10,000,000 to VND 25,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 5,000,000 to under VND 10,000,000;

A fine ranging from VND 25,000,000 to VND 50,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 10,000,000 to under VND 20,000,000;

A fine ranging from VND 50,000,000 to VND 70,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 20,000,000 to under VND 30,000,000;

A fine ranging from VND 70,000,000 to VND 100,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 30,000,000 to under VND 50,000,000.

c) Illegal extraction of non-timber forest plants of endangered, rare or precious species in Group IA:

A fine ranging from VND 1,000,000 to VND 2,000,000 shall be imposed if the violation causes damage to forest products assessed at < VND 1,000,000;

A fine ranging from VND 2,000,000 to VND 5,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 1,000,000 to under VND 2,000,000;

A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 2,000,000 to under VND 5,000,000;

A fine ranging from VND 10,000,000 to VND 25,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 5,000,000 to under VND 10,000,000;

A fine ranging from VND 25,000,000 to VND 50,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 10,000,000 to under VND 15,000,000;

A fine ranging from VND 50,000,000 to VND 70,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 15,000,000 to under VND 20,000,000;

A fine ranging from VND 70,000,000 to VND 100,000,000 shall be imposed if the violation causes damage to forest products assessed at from VND 20,000,000 to under VND 30,000,000.

5. In case trees with a diameter of < 8 cm (measured at a height of 1.3 m) are illegally extracted but timber volume cannot be determined, penalties shall be imposed according to the deforested area as regulated in Article 20 hereof; in case scattered individual trees are illegally extracted and deforested area cannot be determined, a fine of VND 100,000 shall be imposed for each tree cut provided that total fine imposed for a violation shall not exceed VND 100,000,000.

6. Penalties specified in Clause 1 of this Article shall be imposed for illegal extraction of trees scattered on fields which originate from natural forests managed by the State, illegal full exploitation of lying timber or illegal collection of timber from river, stream, ponds or lakes in forests.

7. A forest owner who has the forest allocated or leased by the State for commercial purposes as regulated by law but fails to fulfill forest management, protection, development and utilization obligations as defined in Regulations on forest management or fails to carry out inspection for detecting illegal forest harvesting acts shall incur corresponding penalties in Clause 1 or Point a Clause 4 of this Article.

8. Additional penalties:

a) Exhibits of violation shall be confiscated in case of commission of any of the violations specified in Clause 1, Clause 2, Clause 3, Clause 4, Clause 5, and Clause 6 of this Article;

b) Devices, tools and petrol chainsaws of various types shall be confiscated in case of commission of any of the violations specified in Clause 1, Clause 2, Clause 3, Clause 4, Clause 5, and Clause 6 of this Article;

c) Vehicle shall be confiscated if it is used for:

Illegal extraction of ≥ 05 m^3 of timber in a planted forest or ≥ 2.5 m^3 of timber in a natural forest in case of commission of the violation specified in Point a Clause 1; or ≥ 04 m^3 of timber in a planted forest or ≥ 02 m^3 of timber in a natural forest in case of commission of the violation specified in Point a Clause 2; or ≥ 02 m^3 of timber in a planted forest or ≥ 01 m^3 of timber in a natural forest in case of commission of the violation specified in Point a Clause 3;

Illegal extraction of ≥ 02 m^3 of timber in a planted forest or ≥ 1.5 m^3 of timber in a natural forest in case of commission of the violation specified in Point b Clause 1; or ≥ 1.5 m^3 of timber in a planted forest or ≥ 0.7 m^3 of timber in a natural forest in case of commission of the violation specified in Point b of either Clause 2 or Clause 3;

Illegal extraction of ≥ 0.5 m^3 of timber in case of commission of the violation specified in Point c Clause 1; or ≥ 0.3 m^3 in case of commission of the violation specified in Point c Clause 2 or Clause 3;

Illegal extraction of non-timber forest products assessed at ≥ VND 15,000,000 in case of commission of the violation specified in Point a Clause 4, or ≥ VND 10,000,000 in case of commission of the violation specified in Point c or Point c Clause 4;

d) Forest harvesting shall be suspended for 06 – 12 months in case the failure to comply with the harvesting plan causes damage as follows: Illegal extraction of ≥ 05 m^3 of timber in case of the violation specified in Point a Clause 1, or ≥ 03 m^3 of timber in case of the violation specified in Point a Clause 2, or ≥ 02 m^3 of timber in case of the violation specified in Point a Clause 3; illegal extraction of ≥ 03 m^3 of timber in case of the violation specified in Point b Clause 1, or ≥ 1.5 m^3 of timber in case of the violation specified in Point b Clause 2, or ≥ 01 m^3 of timber in case of the violation specified in Point b Clause 3; illegal extraction of ≥ 0.3 m^3 of timber in case of the violation specified in Point c of Clause 1, Clause 2, or Clause 3.

9. Remedial measures:

The violator is compelled to transfer illegal benefits obtained from the administrative violation or an amount of money equivalent to the value of the exhibits and/or instrumentalities of the administrative violation which have been sold, liquidated, hidden or destroyed inconsistently with the law in case of commission of any of the violations specified in Clause 1, Clause 2, Clause 3, Clause 4, Clause 5 and Clause 6 of this Article.

Section 2. VIOLATIONS AGAINST REGULATIONS ON FOREST DEVELOPMENT AND PROTECTION

Article 14.Violations against regulations on major forest tree cultivars

1. The following penalties shall be imposed for trading of major forest tree seeds originating from a seed source of which the recognition decision has been invalidated or the one which has not yet been recognized by a competent authority:

a) A fine ranging from VND 10,000,000 to VND 15,000,000 shall be imposed for the violation involving a quantity of < 05 kg of tree seeds;

b) A fine ranging from VND 15,000,000 to VND 25,000,000 shall be imposed for the violation involving a quantity of ≥ 05 kg of tree seeds.

2. The following penalties shall be imposed for trading of major forest plant breeds propagated from a cultivar or cultivar source of which the recognition decision has been invalidated or the one which has not yet been recognized by a competent authority:

a) A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed if the cultivar lot is assessed at from VND 10,000,000 to under VND 20,000,000;

b) A fine ranging from VND 10,000,000 to VND 15,000,000 shall be imposed if the cultivar lot is assessed at from VND 20,000,000 to under VND 30,000,000;

c) A fine ranging from VND 15,000,000 to VND 20,000,000 shall be imposed if the cultivar lot is assessed at from VND 30,000,000 to under VND 40,000,000;

d) A fine ranging from VND 20,000,000 to VND 30,000,000 shall be imposed if the cultivar lot is assessed at from VND 40,000,000 to under VND 60,000,000;

dd) A fine ranging from VND 30,000,000 to VND 40,000,000 shall be imposed if the cultivar lot is assessed at from VND 60,000,000 to under VND 80,000,000;

e) A fine ranging from VND 40,000,000 to VND 50,000,000 shall be imposed if the cultivar lot is assessed at ≥ VND 80,000,000.

3. Remedial measures:

The violator is compelled to destroy the forest tree seed lots or cultivar lots in case of commission of any of the violations specified in Clause 1 and Clause 2 of this Article.

Article 15. Violations against regulations on alternative afforestation

The following penalties shall be imposed for delaying the implementation of the alternative afforestation plan approved by a competent authority:

1. A fine ranging from VND 1,000,000 to VND 5,000,000 shall be imposed for delaying the alternative afforestation for over 01 year with an area of < 01 ha.

2. A fine ranging from VND 5,000,000 to VND 15,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of from 01 ha to under 03 ha;

b) Delaying the alternative afforestation for over 02 years with an area of < 01 ha.

3. A fine ranging from VND 15,000,000 to VND 25,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of from 03 ha to under 05 ha;

b) Delaying the alternative afforestation for over 02 years with an area of from 01 ha to under 03 ha.

4. A fine ranging from VND 25,000,000 to VND 50,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of from 05 ha to under 08 ha;

b) Delaying the alternative afforestation for over 02 years with an area of from 03 ha to under 05 ha;

c) Delaying the alternative afforestation for over 03 years with an area of < 01 ha.

5. A fine ranging from VND 50,000,000 to VND 75,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of from 08 ha to under 15 ha;

b) Delaying the alternative afforestation for over 02 years with an area of from 05 ha to under 10 ha;

c) Delaying the alternative afforestation for over 03 years with an area of from 01 ha to under 05 ha.

6. A fine ranging from VND 75,000,000 to VND 100,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of from 15 ha to under 25 ha;

b) Delaying the alternative afforestation for over 02 years with an area of from 10 ha to under 15 ha;

c) Delaying the alternative afforestation for over 03 years with an area of from 05 ha to under 07 ha.

7. A fine ranging from VND 100,000,000 to VND 125,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of from 25 ha to under 30 ha;

b) Delaying the alternative afforestation for over 02 years with an area of from 15 ha to under 20 ha;

c) Delaying the alternative afforestation for over 03 years with an area of from 07 ha to under 10 ha.

8. A fine ranging from VND 125,000,000 to VND 150,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of from 30 ha to under 35 ha;

b) Delaying the alternative afforestation for over 02 years with an area of from 20 ha to under 25 ha;

c) Delaying the alternative afforestation for over 03 years with an area of from 10 ha to under 15 ha.

9. A fine ranging from VND 150,000,000 to VND 175,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of from 35 ha to under 40 ha;

b) Delaying the alternative afforestation for over 02 years with an area of from 25 ha to under 30 ha;

c) Delaying the alternative afforestation for over 03 years with an area of from 15 ha to under 20 ha.

10. A fine ranging from VND 175,000,000 to VND 200,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of from 40 ha to under 45 ha;

b) Delaying the alternative afforestation for over 02 years with an area of from 30 ha to under 35 ha;

c) Delaying the alternative afforestation for over 03 years with an area of from 20 ha to under 25 ha.

11. A fine ranging from VND 200,000,000 to VND 225,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of from 45 ha to under 50 ha;

b) Delaying the alternative afforestation for over 02 years with an area of from 35 ha to under 40 ha;

c) Delaying the alternative afforestation for over 03 years with an area of from 25 ha to under 30 ha.

12. A fine ranging from VND 225,000,000 to VND 250,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of from 50 ha to under 55 ha;

b) Delaying the alternative afforestation for over 02 years with an area of from 40 ha to under 45 ha;

c) Delaying the alternative afforestation for over 03 years with an area of from 30 ha to under 35 ha.

13. A fine ranging from VND 250,000,000 to VND 275,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of from 55 ha to under 60 ha;

b) Delaying the alternative afforestation for over 02 years with an area of from 45 ha to under 50 ha;

c) Delaying the alternative afforestation for over 03 years with an area of from 35 ha to under 40 ha.

14. A fine ranging from VND 275,000,000 to VND 300,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of from 60 ha to under 65 ha;

b) Delaying the alternative afforestation for over 02 years with an area of from 50 ha to under 55 ha;

c) Delaying the alternative afforestation for over 03 years with an area of from 40 ha to under 45 ha.

15. A fine ranging from VND 300,000,000 to VND 325,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of from 65 ha to under 70 ha;

b) Delaying the alternative afforestation for over 02 years with an area of from 55 ha to under 60 ha;

c) Delaying the alternative afforestation for over 03 years with an area of from 45 ha to under 50 ha.

16. A fine ranging from VND 325,000,000 to VND 350,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of from 70 ha to under 75 ha;

b) Delaying the alternative afforestation for over 02 years with an area of from 60 ha to under 65 ha;

c) Delaying the alternative afforestation for over 03 years with an area of from 50 ha to under 55 ha.

17. A fine ranging from VND 350,000,000 to VND 375,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of from 75 ha to under 80 ha;

b) Delaying the alternative afforestation for over 02 years with an area of from 65 ha to under 70 ha;

c) Delaying the alternative afforestation for over 03 years with an area of from 55 ha to under 60 ha.

18. A fine ranging from VND 375,000,000 to VND 400,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of from 80 ha to under 85 ha;

b) Delaying the alternative afforestation for over 02 years with an area of from 70 ha to under 75 ha;

c) Delaying the alternative afforestation for over 03 years with an area of from 60 ha to under 65 ha.

19. A fine ranging from VND 400,000,000 to VND 425,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of from 85 ha to under 90 ha;

b) Delaying the alternative afforestation for over 02 years with an area of from 75 ha to under 80 ha;

c) Delaying the alternative afforestation for over 03 years with an area of from 65 ha to under 70 ha.

20. A fine ranging from VND 425,000,000 to VND 450,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of from 90 ha to under 95 ha;

b) Delaying the alternative afforestation for over 02 years with an area of from 80 ha to under 85 ha;

c) Delaying the alternative afforestation for over 03 years with an area of from 70 ha to under 75 ha.

21. A fine ranging from VND 450,000,000 to VND 475,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of from 95 ha to under 100 ha;

b) Delaying the alternative afforestation for over 02 years with an area of from 85 ha to under 90 ha;

c) Delaying the alternative afforestation for over 03 years with an area of from 75 ha to under 80 ha.

22. A fine ranging from VND 475,000,000 to VND 500,000,000 shall be imposed for commission of one of the following violations:

a) Delaying the alternative afforestation for over 01 year with an area of ≥ 100 ha;

b) Delaying the alternative afforestation for over 02 years with an area of ≥ 90 ha;

c) Delaying the alternative afforestation for over 03 years with an area of ≥ 80 ha.

23. Remedial measures:

The violator is compelled to carry out reforestation or make payment of reforestation cost according to the standard afforestation investment applicable by local government at the time of committing the violation in case of commission of any of the violations specified in Clause 1 through 22 of this Article.

Article 16. Violations against the State general regulations on forest protection

1. A fine ranging from VND 100,000 to VND 300,000 shall be imposed for commission of one of the following violations:

a) The forest owner fails to submit reports on changes in allocated land area to competent authorities as prescribed by law;

b) The forest owner fails to submit periodical and ad hoc reports on forest fire prevention and fighting as prescribed by law;

c) The forest owner fails to promptly inform competent authorities of changes related to the safety of forest fire prevention and fighting.

2. A fine ranging from VND 300,000 to VND 500,000 shall be imposed for commission of one of the following violations:

a) The forest owner fails to comply with regulations, internal rules, safety conditions and/or measures for forest fire prevention and fighting announced by competent authorities;

b) The forest owner fails to develop and promulgate regulations, internal rules and measures for forest fire prevention and fighting in the forest area under his management;

c) The forest owner fails to organize dissemination of laws and knowledge about forest fire prevention and fighting;

d) The forest owner fails to provide necessary tools and equipment for forest fire prevention and fighting;

dd) The forest owner fails to reforest in the next season after clearcutting of a forest area of < 01 ha.

3. A fine ranging from VND 500,000 to VND 1,000,000 shall be imposed for commission of one of the following violations:

a) Using less than 10 devices for trapping or catching forest animals in no-hunting areas;

b) Bringing working animals into a forest to draw devices and equipment for extraction of timber and non-timber forest plants;

c) Pasturing cattle, poultry or domestic animals within the strictly protected area of a special-use forest;

d) Setting up camps or tents in a special-use forest without permission from the forest owner;

dd) The forest owner fails to reforest in the next season after clearcutting of a forest area of from 01 ha to under 03 ha.

4. A fine ranging from VND 1,000,000 to VND 1,500,000 shall be imposed for commission of one of the following violations:

a) Organizing scientific research, education or training activities or collection of specimens/genetic resources in a forest without permission from the forest owner;

b) Using 10 devices or more for trapping or catching forest animals in no-hunting areas;

c) Using hunting devices in no-hunting forests; bringing domestic animals into the forest for hunting/catching forest animals without permission from the forest owner;

d) Bringing vehicles/devices into the strictly protected area of a special-use forest without permission from the forest owner;

dd) Carrying out advertising for trading forest plants, forest animals and their products inconsistently with law;

e) Pasturing cattle, poultry or domestic animals in a newly afforested area which requires care;

g) The forest owner fails to reforest in the next season after clearcutting of a forest area of from 03 ha to under 10 ha.

5. A fine ranging from VND 1,500,000 to VND 3,000,000 shall be imposed for commission of one of the following violations:

a) Illegal use of fire in the strictly protected area of a special-use forest;

b) Making/using fire for hunting or catching forest animals, collecting honey or war scrap items;

c) Failure to organize training in forest fire prevention and fighting;

d) Failure to provide adequate funding for forest fire prevention and fighting in accordance with applicable regulations of the State;

dd) Failure to ensure fire safety when using fire or heat sources at works, construction sites or buildings to be built in a forest as regulated;

e) Failure to comply with regulations on controlled burning for the purposes of preparing land for planting new trees and reducing flammable materials in forests;

g) Illegally bringing waste, toxic chemicals, explosives, flammable or ignitable chemicals into a forest; illegally building coal burning stoves/furnaces in a forest;

h) The forest owner fails to reforest in the next season after clearcutting of a forest area of ≥ 10 ha.

6. A fine ranging from VND 2,000,000 to VND 5,000,000 shall be imposed upon the owner of the forest which is allocated or leased by the State for commission of one of the following violations:

a) Failure to develop forest fire prevention and fighting plan or failure to build structures or systems serving the forest fire prevention and fighting;

b) Failure to maintain the minimum volume of water stored for forest fire prevention and fighting in channels, ditches, storage tanks, dams or reservoirs in the dry season;

c) Failure to organize patrols or watch posts for preventing forest fire in his forest area in case of a fire danger of level III or higher;

d) Illegally raising or spreading animals or plants of invasive species in a special-use forest.

7. A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed upon the forest owner for failure to establish, manage and maintain the operation of forest firefighting teams or crews.

8. Additional penalties:

Devices/tools shall be confiscated in case of commission of any of the violations specified in Clause 3 and Clause 4 of this Article.

9. Remedial measures:

a) The violator is compelled to restore the original condition which is changed by the violation specified in Point d Clause 3 of this Article;

b) The violator is compelled to bring waste, toxic chemicals, explosives, flammable or ignitable chemicals out of the forest in case of commission of the violation specified in Point g Clause 5 of this Article;

c) The violator is compelled to implement measures for controlling the environmental pollution and the spread of epidemics in case of commission of the violation specified in Point d Clause 6 of this Article;

d) The violator is compelled to reforest in the next season in case of commission of any of the violations specified in Point dd Clause 2, Point dd Clause 3, Point g Clause 4 and Point h Clause 5 of this Article.

10. If any violation specified in this Article causes damage to the forest or forest products, the violator shall also incur the penalties prescribed in Article 13, Article 17, Article 20, Article 21 or Article 22 hereof.

Article 17. Violations against regulations on forest fire prevention and fighting resulting in forest fire

Penalties shall be imposed for commission of violations against regulations on forest fire prevention and fighting resulting in forest fire. To be specific:

1. A fine ranging from VND 1,000,000 to VND 2,000,000 shall be imposed in one of the following circumstances:

a) The violation involves an immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of < 500 m^2;

b) The violation involves the production forest with an area of < 400 m^2;

c) The violation involves the protective forest with an area of < 200 m^2;

d) The violation involves the special-use forest with an area of < 50 m^2;

dd) The violation causes damage to forest products assessed at < VND 2,000,000 in case the damaged forest area cannot determined.

2. A fine ranging from VND 2,000,000 to VND 5,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 500 m^2 to under 1,500 m^2;

b) The violation involves the production forest with an area of from 400 m^2 to under 600 m^2;

c) The violation involves the protective forest with an area of from 200 m^2 to under 400 m^2;

d) The violation involves the special-use forest with an area of from 50 m^2 to under 100 m^2;

dd) The violation causes damage to forest products assessed at from VND 2,000,000 to under VND 5,000,000 in case the damaged forest area cannot determined.

3. A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 1,500 m^2 to under 5,000 m^2;

b) The violation involves the production forest with an area of from 600 m^2 to under 800 m^2;

c) The violation involves the protective forest with an area of from 400 m^2 to under 600 m^2;

d) The violation involves the special-use forest with an area of from 100 m^2 to under 200 m^2;

dd) The violation causes damage to forest products assessed at from VND 5,000,000 to under VND 10,000,000 in case the damaged forest area cannot determined.

4. A fine ranging from VND 10,000,000 to VND 25,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 5,000 m^2 to under 10,000 m^2;

b) The violation involves the production forest with an area of from 800 m^2 to under 1,000 m^2;

c) The violation involves the protective forest with an area of from 600 m^2 to under 800 m^2;

d) The violation involves the special-use forest with an area of from 200 m^2 to under 300 m^2;

dd) The violation causes damage to forest products assessed at from VND 10,000,000 to under VND 25,000,000 in case the damaged forest area cannot determined.

5. A fine ranging from VND 25,000,000 to VND 40,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 10,000 m^2 to under 15,000 m^2;

b) The violation involves the production forest with an area of from 1,000 m^2 to under 1,500 m^2;

c) The violation involves the protective forest with an area of from 800 m^2 to under 1,000 m^2;

d) The violation involves the special-use forest with an area of from 300 m^2 to under 500 m^2;

dd) The violation causes damage to forest products assessed at from VND 25,000,000 to under VND 40,000,000 in case the damaged forest area cannot determined.

6. A fine ranging from VND 40,000,000 to VND 60,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 15,000 m^2 to under 20,000 m^2;

b) The violation involves the production forest with an area of from 1,500 m^2 to under 2,500 m^2;

c) The violation involves the protective forest with an area of from 1,000 m^2 to under 1,500 m^2;

d) The violation involves the special-use forest with an area of from 500 m^2 to under 700 m^2;

dd) The violation causes damage to forest products assessed at from VND 40,000,000 to under VND 60,000,000 in case the damaged forest area cannot determined.

7. A fine ranging from VND 60,000,000 to VND 80,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 20,000 m^2 to under 25,000 m^2;

b) The violation involves the production forest with an area of from 2,500 m^2 to under 3,500 m^2;

c) The violation involves the protective forest with an area of from 1,500 m^2 to under 2,500 m^2;

d) The violation involves the special-use forest with an area of from 700 m^2 to under 900 m^2;

dd) The violation causes damage to forest products assessed at from VND 60,000,000 to under VND 80,000,000 in case the damaged forest area cannot determined.

8. A fine ranging from VND 80,000,000 to VND 100,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 25,000 m^2 to under 30,000 m^2;

b) The violation involves the production forest with an area of from 3,500 m^2 to under 5,000 m^2;

c) The violation involves the protective forest with an area of from 2,500 m^2 to under 3,000 m^2;

d) The violation involves the special-use forest with an area of from 900 m^2 to under 1,000 m^2;

dd) The violation causes damage to forest products assessed at from VND 80,000,000 to under VND 100,000,000 in case the damaged forest area cannot determined.

9. Remedial measures:

The violator is compelled to implement measures for controlling the environmental pollution and the spread of epidemics; carry out reforestation or make payment of reforestation cost according to the standard afforestation investment applicable by local government at the time of committing the violation in case of commission of any of the violations specified in Clause 1 through 8 of this Article.

10. Penalties in Article 20 hereof shall be imposed for deliberate acts of arson or intentional fires to forest.

Article 18. Violations against regulations on forest pest management and control

1. A fine ranging from VND 1,000,000 to VND 5,000,000 shall be imposed upon the forest owner for failure to adopt methods for preventing and controlling forest pests as prescribed by law or failure to implement measures for killing serious pests upon detection resulting in the spread of epidemics over an area of < 01 ha of allocated or leased forest.

2. A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed upon the forest owner for failure to adopt methods for preventing and controlling forest pests as prescribed by law or failure to implement measures for killing serious pests upon detection resulting in the spread of epidemics over an area of from 01 ha to under 05 ha of allocated or leased forest.

3. A fine ranging from VND 10,000,000 to VND 25,000,000 shall be imposed upon the forest owner for failure to inform competent authorities of detecting forest pests in the allocated or leased forest area for receiving guidelines and assistance in controlling/zoning for forest pests resulting in the spread of epidemics over a forest area of ≥ 05 ha.

4. Remedial measures:

The violator is compelled to implement measures for controlling the environmental pollution and the spread of epidemics in case of commission of any of the violations specified in Clause 1 through 3 of this Article.

Article 19. Destruction of works serving forest protection and development

1. A fine ranging from VND 500,000 to VND 1,000,000 shall be imposed for one of the following violations: Writing, drawing or erasing information and/or images on safety signs, warning signs or boards containing forest protection-related information.

2. A fine ranging from VND 1,000,000 to VND 5,000,000 shall be imposed for removal of warning signs, prohibition signs or guidance signs that contain forest protection-related information.

3. A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed for commission of one of the following violations:

a) Destroying forest roads or paths dedicated to forest patrols;

b) Destroying firebreaks, channels, ditches, drains or dams preventing water flows or tanks or reservoirs storing water serving forest firefighting;

c) Destroying fences or boundary markers of forests, forest sub-zones, plots and lots.

4. A fine ranging from VND 10,000,000 to VND 25,000,000 shall be imposed for one of the following violations: Destroying boards containing forest protection-related information, fire towers, working places, assets and vehicles serving the patrolling of forests; destroying other works serving the forest protection and development.

5. Remedial measures:

The violator is compelled to restore the original condition which is changed by any of the violations specified in Clause 1 through 4 of this Article.

Article 20. Forest destruction

The following penalties shall be imposed for cutting, burning or destroying forest trees; digging, excavating or blasting; damming or preventing water flows; discharging toxic chemicals or other

acts causing damage to the forest for any purposes (except the violations specified in Article 13 hereof) without permission from competent authorities:

1. A fine ranging from VND 3,000,000 to VND 7,000,000 shall be imposed in one of the following circumstances:

a) The violation involves an immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of < 3,000 m^2;

b) The violation involves the production forest with an area of < 500 m^2;

c) The violation involves the protective forest with an area of < 300 m^2;

d) The violation involves the special-use forest with an area of < 100 m^2;

dd) The violation involves forest plants of common species assessed at < VND 5,000,000, or forest plants of endangered, rare or precious species in Group IIA assessed at < VND 4,000,000, or forest plants of endangered, rare or precious species in Group IA assessed at < VND 3,000,000 in case the damaged forest area cannot be determined.

2. A fine ranging from VND 7,000,000 to VND 15,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 3,000 m^2 to under 6,000 m^2;

b) The violation involves the production forest with an area of from 500 m^2 to under 1,000 m^2;

c) The violation involves the protective forest with an area of from 300 m^2 to under 600 m^2;

d) The violation involves the special-use forest with an area of from 100 m^2 to under 200 m^2;

dd) The violation involves forest plants of common species assessed at from VND 5,000,000 to under VND 10,000,000, or forest plants of endangered, rare or precious species in Group IIA assessed at from VND 4,000,000 to under VND 7,000,000, or forest plants of endangered, rare or precious species in Group IA assessed at from VND 3,000,000 to under VND 5,000,000 in case the damaged forest area cannot be determined.

3. A fine ranging from VND 15,000,000 to VND 25,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 6,000 m^2 to under 9,000 m^2;

b) The violation involves the production forest with an area of from 1,000 m^2 to under 1,500 m^2;

c) The violation involves the protective forest with an area of from 600 m^2 to under 900 m^2;

d) The violation involves the special-use forest with an area of from 200 m^2 to under 300 m^2;

dd) The violation involves forest plants of common species assessed at from VND 10,000,000 to under VND 20,000,000, or forest plants of endangered, rare or precious species in Group IIA assessed at from VND 7,000,000 to under VND 10,000,000, or forest plants of endangered, rare or precious species in Group IA assessed at from VND 5,000,000 to under VND 7,000,000 in case the damaged forest area cannot be determined.

4. A fine ranging from VND 25,000,000 to VND 50,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 9,000 m^2 to under 12,000 m^2;

b) The violation involves the production forest with an area of from 1,500 m^2 to under 2,000 m^2;

c) The violation involves the protective forest with an area of from 900 m^2 to under 1,200 m^2;

d) The violation involves the special-use forest with an area of from 300 m^2 to under 400 m^2;

dd) The violation involves forest plants of common species assessed at from VND 20,000,000 to under VND 30,000,000, or forest plants of endangered, rare or precious species in Group IIA assessed at from VND 10,000,000 to under VND 20,000,000, or forest plants of endangered, rare or precious species in Group IA assessed at from VND 7,000,000 to under VND 10,000,000 in case the damaged forest area cannot be determined.

5. A fine ranging from VND 50,000,000 to VND 75,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 12,000 m^2 to under 15,000 m^2;

b) The violation involves the production forest with an area of from 2,000 m^2 to under 2,500 m^2;

c) The violation involves the protective forest with an area of from 1,200 m^2 to under 1,500 m^2;

d) The violation involves the special-use forest with an area of from 400 m^2 to under 500 m^2;

dd) The violation involves forest plants of common species assessed at from VND 30,000,000 to under VND 40,000,000, or forest plants of endangered, rare or precious species in Group IIA

assessed at from VND 20,000,000 to under VND 30,000,000, or forest plants of endangered, rare or precious species in Group IA assessed at from VND 10,000,000 to under VND 15,000,000 in case the damaged forest area cannot be determined.

6. A fine ranging from VND 75,000,000 to VND 100,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 15,000 m^2 to under 18,000 m^2;

b) The violation involves the production forest with an area of from 2,500 m^2 to under 3,000 m^2;

c) The violation involves the protective forest with an area of from 1,500 m^2 to under 1,800 m^2;

d) The violation involves the special-use forest with an area of from 500 m^2 to under 600 m^2;

dd) The violation involves forest plants of common species assessed at from VND 40,000,000 to under VND 50,000,000, or forest plants of endangered, rare or precious species in Group IIA assessed at from VND 30,000,000 to under VND 40,000,000, or forest plants of endangered, rare or precious species in Group IA assessed at from VND 15,000,000 to under VND 20,000,000 in case the damaged forest area cannot be determined.

7. A fine ranging from VND 100,000,000 to VND 125,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 18,000 m^2 to under 21,000 m^2;

b) The violation involves the production forest with an area of from 3,000 m^2 to under 3,500 m^2;

c) The violation involves the protective forest with an area of from 1,800 m^2 to under 2,100 m^2;

d) The violation involves the special-use forest with an area of from 600 m^2 to under 700 m^2.

8. A fine ranging from VND 125,000,000 to VND 150,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 21,000 m^2 to under 24,000 m^2;

b) The violation involves the production forest with an area of from 3,500 m^2 to under 4,000 m^2;

c) The violation involves the protective forest with an area of from 2,100 m^2 to under 2,400 m^2;

d) The violation involves the special-use forest with an area of from 700 m^2 to under 800 m^2.

9. A fine ranging from VND 150,000,000 to VND 175,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 24,000 m^2 to under 27,000 m^2;

b) The violation involves the production forest with an area of from 4,000 m^2 to under 4,500 m^2;

c) The violation involves the protective forest with an area of from 2,400 m^2 to under 2,700 m^2;

d) The violation involves the special-use forest with an area of from 800 m^2 to under 900 m^2.

10. A fine ranging from VND 175,000,000 to VND 200,000,000 shall be imposed in one of the following circumstances:

a) The violation involves the immature forest or regenerating forest without reserve volume classified as production forest, protective forest or special-use forest and having an area of from 27,000 m^2 to under 30,000 m^2;

b) The violation involves the production forest with an area of from 4,500 m^2 to under 5,000 m^2;

c) The violation involves the protective forest with an area of from 2,700 m^2 to under 3,000 m^2;

d) The violation involves the special-use forest with an area of from 900 m^2 to under 1,000 m^2.

11. In case of starving trees, drilling into the tree's trunk, killing trees by injecting chemicals, grinding stumps or pouring chemicals into the root zone of trees with the aims of adversely affecting the growth of forest trees, a fine of VND 100,000 shall be imposed for each tree with a diameter of < 8 cm (measured at a height of 1.3 m) provided that total fine imposed for a violation shall not exceed VND 200,000,000.

12. A forest owner who has the forest allocated or leased by the State for commercial purposes as regulated by law but fails to fulfill forest management, protection, development and utilization obligations as defined in Regulations on forest management or fails to carry out inspection for detecting illegal forest harvesting acts shall incur corresponding penalties specified in Point b Clause 1, Point b Clause 2, Point b Clause 3, Point b Clause 4, Point b Clause 5, Point b Clause 6, Point b Clause 7, Point b Clause 8, Point b Clause 9 or Point b Clause 10 of this Article.

13. Additional penalties:

Exhibits, devices and vehicles shall be confiscated in case of commission of any of the violations specified in Clause 1 – 10 of this Article.

14. Remedial measures:

The violator is compelled to restore the original condition; implement measures for controlling the environmental pollution and the spread of epidemics; transfer illegal benefits obtained from the administrative violation or an amount of money equivalent to the value of the exhibits and/or instrumentalities of the administrative violation which have been sold, liquidated, hidden or destroyed inconsistently with the law; carry out reforestation or make payment of reforestation cost according to the standard afforestation investment applicable by local government at the time of committing the violation in case of commission of any of the violations specified in Clause 1 through 10 of this Article.

Article 21. Violations against regulations on forest animal protection

The following penalties shall be imposed for illegally hunting, catching, killing or imparking forest animals.

1. A fine ranging from VND 5,000,000 to VND 15,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species assessed at < VND 10,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB assessed at < VND 5,000,000.

2. A fine ranging from VND 15,000,000 to VND 25,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species assessed at from VND 10,000,000 to under VND 20,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB assessed at from VND 5,000,000 to under VND 10,000,000.

3. A fine ranging from VND 25,000,000 to VND 50,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species assessed at from VND 20,000,000 to under VND 40,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB assessed at from VND 10,000,000 to under VND 20,000,000.

4. A fine ranging from VND 50,000,000 to VND 80,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species assessed at from VND 40,000,000 to under VND 70,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB assessed at from VND 20,000,000 to under VND 35,000,000.

5. A fine ranging from VND 80,000,000 to VND 110,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species assessed at from VND 70,000,000 to under VND 100,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB assessed at from VND 35,000,000 to under VND 50,000,000.

6. A fine ranging from VND 110,000,000 to VND 140,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species assessed at from VND 100,000,000 to under VND 130,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB assessed at from VND 50,000,000 to under VND 65,000,000.

7. A fine ranging from VND 140,000,000 to VND 170,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species assessed at from VND 130,000,000 to under VND 160,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB assessed at from VND 65,000,000 to under VND 80,000,000.

8. A fine ranging from VND 170,000,000 to VND 210,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species assessed at from VND 160,000,000 to under VND 190,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB assessed at from VND 80,000,000 to under VND 95,000,000.

9. A fine ranging from VND 210,000,000 to VND 240,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species assessed at from VND 190,000,000 to under VND 220,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB assessed at from VND 95,000,000 to under VND 110,000,000.

10. A fine ranging from VND 240,000,000 to VND 270,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species assessed at from VND 220,000,000 to under VND 250,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB assessed at from VND 110,000,000 to under VND 125,000,000.

11. A fine ranging from VND 270,000,000 to VND 300,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species assessed at from VND 250,000,000 to under VND 300,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB assessed at from VND 125,000,000 to under VND 150,000,000.

12. A fine ranging from VND 300,000,000 to VND 330,000,000 shall be imposed for the violation whose exhibits are endangered, rare and precious animals of Group IB and which involves less than 03 individuals of class Aves or class Reptilia or animals of other classes;

13. A fine ranging from VND 330,000,000 to VND 360,000,000 shall be imposed for the violation whose exhibits are endangered, rare and precious animals of Group IB and which involves 01 individual of class Mammalia, or 03 - 04 individuals of class Aves or class Reptilia, or 03 - 05 individuals of other classes.

14. A fine ranging from VND 360,000,000 to VND 400,000,000 shall be imposed for the violation whose exhibits are endangered, rare and precious animals of Group IB and which involves 02 individuals of class Mammalia, or 05 - 06 individuals of class Aves or class Reptilia, or 06 - 09 individuals of other classes.

15. Additional penalties:

a) Exhibits, devices and tools of the violation shall be confiscated in case of commission of any of the violations specified in Clause 1 – 14 of this Article;

b) Instrumentalities of the violation shall be confiscated in case of commission of any of the violations specified in Clause 3 – 14 of this Article.

16. Remedial measures:

The violator is compelled to implement measures for controlling the environmental pollution and the spread of epidemics; destroy goods or articles which cause harm to human health, domestic animals, plants or environment in case of commission of any of the violations specified in Clause 1 through 14 of this Article.

Section 3. VIOLATIONS AGAINST FOREST PRODUCT MANAGEMENT

Article 22. Illegal transport of forest products

The following penalties shall be imposed for failure to prepare a lawful dossier when transporting forest products (from the time they are loaded onto the vehicle) or inconsistency between the dossier which is deemed lawful and forest products actually transported.

1. A fine ranging from VND 5,000,000 to VND 15,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at < VND 15,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at < VND 7,000,000;

c) The violation involves a volume of < 02 m^3 of timber of common species;

b) The violation involves a volume of < 01 m^3 of timber of endangered, rare or precious species in Group IIA;

dd) The violation involves a volume of < 0.2 m^3 of timber of endangered, rare or precious species in Group IA;

e) The violation involves non-timber forest plants assessed at < VND 15,000,000;

g) The violation involves products made from timber without lawful dossier and assessed at < VND 15,000,000.

2. A fine ranging from VND 15,000,000 to VND 25,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 15,000,000 to under VND 25,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 7,000,000 to under VND 15,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at < VND 1,000,000;

d) The violation involves a volume of from 02 m^3 to under 05 m^3 of timber of common species;

dd) The violation involves a volume of from 01 m^3 to under 2.5 m^3 of timber of endangered, rare or precious species in Group IIA;

e) The violation involves a volume of from 0.2 m^3 to under 0.4 m^3 of timber of endangered, rare or precious species in Group IA;

g) The violation involves non-timber forest plants assessed at from VND 15,000,000 to under VND 25,000,000;

h) The violation involves products made from timber without lawful dossier and assessed at from VND 15,000,000 to under VND 25,000,000.

3. A fine ranging from VND 25,000,000 to VND 50,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 25,000,000 to under VND 50,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 15,000,000 to under VND 25,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 1,000,000 to under VND 3,000,000;

d) The violation involves a volume of from 05 m^3 to under 08 m^3 of timber of common species;

dd) The violation involves a volume of from 2.5 m^3 to under 04 m^3 of timber of endangered, rare or precious species in Group IIA;

e) The violation involves a volume of from 0.4 m^3 to under 0.6 m^3 of timber of endangered, rare or precious species in Group IA;

g) The violation involves non-timber forest plants assessed at from VND 25,000,000 to under VND 50,000,000;

h) The violation involves products made from timber without lawful dossier and assessed at from VND 25,000,000 to under VND 50,000,000.

4. A fine ranging from VND 50,000,000 to VND 70,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 50,000,000 to under VND 70,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 25,000,000 to under VND 35,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 3,000,000 to under VND 5,000,000;

d) The violation involves a volume of from 08 m^3 to under 11 m^3 of timber of common species;

dd) The violation involves a volume of from 04 m^3 to under 5.5 m^3 of timber of endangered, rare or precious species in Group IIA;

e) The violation involves a volume of from 0.6 m^3 to under 0.9 m^3 of timber of endangered, rare or precious species in Group IA;

g) The violation involves non-timber forest plants assessed at from VND 50,000,000 to under VND 70,000,000;

h) The violation involves products made from timber without lawful dossier and assessed at from VND 50,000,000 to under VND 70,000,000.

5. A fine ranging from VND 70,000,000 to VND 90,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 70,000,000 to under VND 90,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 35,000,000 to under VND 45,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 5,000,000 to under VND 10,000,000;

d) The violation involves a volume of from 11 m^3 to under 14 m^3 of timber of common species;

dd) The violation involves a volume of from 5.5 m^3 to under 07 m^3 of timber of endangered, rare or precious species in Group IIA;

e) The violation involves a volume of from 0.9 m^3 to under 1.2 m^3 of timber of endangered, rare or precious species in Group IA;

g) The violation involves non-timber forest plants assessed at from VND 70,000,000 to under VND 90,000,000;

h) The violation involves products made from timber without lawful dossier and assessed at from VND 70,000,000 to under VND 90,000,000.

6. A fine ranging from VND 90,000,000 to VND 120,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 90,000,000 to under VND 120,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 45,000,000 to under VND 60,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 10,000,000 to under VND 20,000,000;

d) The violation involves a volume of from 14 m^3 to under 17 m^3 of timber of common species;

dd) The violation involves a volume of from 07 m^3 to under 8.5 m^3 of timber of endangered, rare or precious species in Group IIA;

e) The violation involves a volume of from 1.2 m^3 to under 1.5 m^3 of timber of endangered, rare or precious species in Group IA;

g) The violation involves non-timber forest plants assessed at from VND 90,000,000 to under VND 120,000,000;

h) The violation involves products made from timber without lawful dossier and assessed at from VND 90,000,000 to under VND 120,000,000.

7. A fine ranging from VND 120,000,000 to VND 150,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 120,000,000 to under VND 150,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 60,000,000 to under VND 75,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 20,000,000 to under VND 30,000,000;

d) The violation involves a volume of from 17 m^3 to under 20 m^3 of timber of common species;

dd) The violation involves a volume of from 8.5 m^3 to under 10 m^3 of timber of endangered, rare or precious species in Group IIA;

e) The violation involves non-timber forest plants assessed at from VND 120,000,000 to under VND 150,000,000;

g) The violation involves products made from timber without lawful dossier and assessed at from VND 120,000,000 to under VND 150,000,000.

8. A fine ranging from VND 150,000,000 to VND 180,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 150,000,000 to under VND 180,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 75,000,000 to under VND 90,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 30,000,000 to under VND 40,000,000;

d) The violation involves non-timber forest plants assessed at from VND 150,000,000 to under VND 180,000,000;

dd) The violation involves products made from timber without lawful dossier and assessed at from VND 150,000,000 to under VND 180,000,000.

9. A fine ranging from VND 180,000,000 to VND 210,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 180,000,000 to under VND 210,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 90,000,000 to under VND 105,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 40,000,000 to under VND 50,000,000;

d) The violation involves < 0.3 kg of elephant ivory;

dd) The violation involves non-timber forest plants assessed at from VND 180,000,000 to under VND 210,000,000;

e) The violation involves products made from timber without lawful dossier and assessed at from VND 180,000,000 to under VND 210,000,000.

10. A fine ranging from VND 210,000,000 to VND 240,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 210,000,000 to under VND 240,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 105,000,000 to under VND 120,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 50,000,000 to under VND 60,000,000;

d) The violation involves from 0.3 kg to under 0.6 kg of elephant ivory;

dd) The violation involves non-timber forest plants assessed at from VND 210,000,000 to under VND 240,000,000;

e) The violation involves products made from timber without lawful dossier and assessed at from VND 210,000,000 to under VND 240,000,000.

11. A fine ranging from VND 240,000,000 to VND 270,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 240,000,000 to under VND 270,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 120,000,000 to under VND 135,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 60,000,000 to under VND 70,000,000;

d) The violation involves from 0.6 kg to under 0.9 kg of elephant ivory;

dd) The violation involves non-timber forest plants assessed at from VND 240,000,000 to under VND 270,000,000;

e) The violation involves products made from timber without lawful dossier and assessed at from VND 240,000,000 to under VND 270,000,000.

12. A fine ranging from VND 270,000,000 to VND 300,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 270,000,000 to under VND 300,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 135,000,000 to under VND 150,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 70,000,000 to under VND 80,000,000;

d) The violation involves from 0.9 kg to under 1.2 kg of elephant ivory;

dd) The violation involves endangered, rare and precious animals of Group IB or vital body parts thereof with less than 03 individuals of class Aves or class Reptilia or animals of other classes;

e) The violation involves non-timber forest plants assessed at from VND 270,000,000 to under VND 300,000,000;

g) The violation involves products made from timber without lawful dossier and assessed at from VND 270,000,000 to under VND 300,000,000.

13. A fine ranging from VND 300,000,000 to VND 330,000,000 shall be imposed in one of the following circumstances:

a) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 80,000,000 to under VND 90,000,000;

b) The violation involves from 1.2 kg to under 1.5 kg of elephant ivory or < 0.03 kg of rhino horns;

c) The violation involves endangered, rare and precious animals of Group IB or vital body parts thereof with 01 individual of class Mammalia, or 03 - 04 individuals of class Aves or class Reptilia, or 03 - 05 individuals of other classes;

d) The violation involves products made from timber without lawful dossier and assessed at from VND 300,000,000 to under VND 330,000,000.

14. A fine ranging from VND 330,000,000 to VND 360,000,000 shall be imposed in one of the following circumstances:

a) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 90,000,000 to under VND 100,000,000;

b) The violation involves from 1.5 kg to under 02 kg of elephant ivory, or from 0.03 kg to under 0.05 kg of rhino horns;

c) The violation involves endangered, rare and precious animals of Group IB or vital body parts thereof with 02 individuals of class Mammalia, or 05 - 06 individuals of class Aves or class Reptilia, or 06 - 09 individuals of other classes;

d) The violation involves products made from timber without lawful dossier and assessed at from VND 330,000,000 to under VND 360,000,000.

15. A fine ranging from VND 360,000,000 to VND 390,000,000 shall be imposed for illegal transport of products made from timber without lawful dossier and assessed at from VND 360,000,000 to under VND 390,000,000.

16. A fine ranging from VND 390,000,000 to VND 420,000,000 shall be imposed for illegal transport of products made from timber without lawful dossier and assessed at from VND 390,000,000 to under VND 420,000,000.

17. A fine ranging from VND 420,000,000 to VND 450,000,000 shall be imposed for illegal transport of products made from timber without lawful dossier and assessed at from VND 420,000,000 to under VND 450,000,000.

18. A fine ranging from VND 450,000,000 to VND 475,000,000 shall be imposed for illegal transport of products made from timber without lawful dossier and assessed at from VND 450,000,000 to under VND 475,000,000.

19. A fine ranging from VND 475,000,000 to VND 500,000,000 shall be imposed for illegal transport of products made from timber without lawful dossier and assessed at ≥ VND 475,000,000.

20. Additional penalties:

a) Exhibits of the violation shall be confiscated in case of commission of any of the violations specified in Clause 1 through 19 of this Article (except the violation involving timber with lawful dossier and origin but the actual volume of timber exceeds the permissible deviations announced by the Ministry of Agriculture and Rural Development).

b) Instrumentalities of the violation shall be confiscated in case of commission of any of the violations specified in Clause 1 through 19 of this Article in one of the following circumstances:

The violation is committed by an organized group or in case of repeated violation.

The violation involves a vehicle which is modified without permission, a vehicle without a corresponding certificate of vehicle registration issued by a competent authority as prescribed by law, or a vehicle bearing a fake license plate.

The violation involves the transport of a volume of ≥ 05 m^3 of timber of common species, or a volume of ≥ 2.5 m^3 of timber of endangered, rare or precious species in Group IIA, or a volume of ≥ 0.4 m^3 of timber of endangered, rare or precious species in Group IA, or non-timber forest plants assessed at ≥ VND 25,000,000, or products made from timber without lawful dossier and assessed at ≥ VND 25,000,000.

The violation involves the transport of forest animals of common species, bode parts or products thereof assessed at ≥ VND 25,000,000, or endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at ≥ VND 15,000,000, or endangered, rare and precious animals of Group IB, body parts or products thereof assessed at ≥ VND 1,000,000.

The violation involves the transport of endangered, rare and precious animals of Group IB or vital body parts thereof, elephant ivory or rhino horns.

The violation involves the illegal transport of ≥ 02 categories of timber (whether or not of endangered, rare or precious species) or forest products of various categories other than timber of endangered, rare or precious species in case the volume of timber of each category or the value of forest products of each category is not so serious that the instrumentalities of the violation must be confiscated but total volume of timber of all categories illegally transported is ≥ 05 m^3 or total value of non-timber forest products illegally transported is ≥ VND 25,000,000.

21. Remedial measures:

a) The violator is compelled to implement measures for controlling the environmental pollution and the spread of epidemics; destroy goods or articles which cause harm to human health, domestic animals, plants or the environment in case of commission of any of the violations specified in Points a and b Clause 1, Points a, b and c of Clause 2 through 11, Points a, b, c and dd Clause 12, Points a and c Clause 13 and Clause 14 of this Article;

b) The violator is compelled to transfer illegal benefits obtained from the administrative violation or an amount of money equivalent to the value of the exhibits and/or instrumentalities of the administrative violation which have been sold, liquidated, hidden or destroyed inconsistently with the law in case of commission of any of the violations specified in Clause 1 through 19 of this Article.

22. The person that transports forest products of lawful origin without a dossier prepared as prescribed by law or the vehicle operator or the forest product owner who fails to present dossier of transported forest products to the official in charge of inspecting the vehicle within 24 hours from the time of inspection shall incur penalties as regulated in Article 24 hereof.

23. The forest product owner shall incur penalties for trading of forest products as regulated in Article 23 hereof. If the forest product owner is also the vehicle owner, or his/her authorized manager or user, illegally transporting forest products, he/she shall incur both penalties for illegal transport of forest products as regulated in this Article and penalties for illegal trading of forest products as regulated in Article 23 hereof.

24. If anthracite and charcoal are found to be illegally transported from a natural forest, the forest product owner shall incur the penalty specified in Clause 4 Article 13 hereof.

25. If a vehicle owner or his/her authorized manager or user deliberately lets another person operate or use the vehicle to illegally transport forest products, he/she shall incur the same penalties as those incurred by the person directly transports forest products inconsistently with law as prescribed in this Article.

Article 23. Illegal storage, trading and processing of forest products

The following penalties shall be imposed for storage, trading or processing of forest products without a lawful dossier or which are not conformable with the presented dossier which is deemed lawful.

1. A fine ranging from VND 5,000,000 to VND 15,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at < VND 15,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at < VND 7,000,000;

c) The violation involves a volume of < 02 m^3 of timber of common species;

b) The violation involves a volume of < 01 m^3 of timber of endangered, rare or precious species in Group IIA;

dd) The violation involves a volume of < 0.2 m^3 of timber of endangered, rare or precious species in Group IA;

e) The violation involves non-timber forest plants assessed at < VND 15,000,000;

g) The violation involves products made from timber without lawful dossier and assessed at < VND 15,000,000.

2. A fine ranging from VND 15,000,000 to VND 25,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 15,000,000 to under VND 25,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 7,000,000 to under VND 15,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at < VND 1,000,000;

d) The violation involves a volume of from 02 m^3 to under 05 m^3 of timber of common species;

dd) The violation involves a volume of from 01 m^3 to under 2.5 m^3 of timber of endangered, rare or precious species in Group IIA;

e) The violation involves a volume of from 0.2 m^3 to under 0.4 m^3 of timber of endangered, rare or precious species in Group IA;

g) The violation involves non-timber forest plants assessed at from VND 15,000,000 to under VND 25,000,000;

h) The violation involves products made from timber without lawful dossier and assessed at from VND 15,000,000 to under VND 25,000,000.

3. A fine ranging from VND 25,000,000 to VND 50,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 25,000,000 to under VND 50,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 15,000,000 to under VND 25,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 1,000,000 to under VND 3,000,000;

d) The violation involves a volume of from 05 m^3 to under 08 m^3 of timber of common species;

dd) The violation involves a volume of from 2.5 m^3 to under 04 m^3 of timber of endangered, rare or precious species in Group IIA;

e) The violation involves a volume of from 0.4 m^3 to under 0.6 m^3 of timber of endangered, rare or precious species in Group IA;

g) The violation involves non-timber forest plants assessed at from VND 25,000,000 to under VND 50,000,000;

h) The violation involves products made from timber without lawful dossier and assessed at from VND 25,000,000 to under VND 50,000,000.

4. A fine ranging from VND 50,000,000 to VND 70,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 50,000,000 to under VND 70,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 25,000,000 to under VND 35,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 3,000,000 to under VND 5,000,000;

d) The violation involves a volume of from 08 m^3 to under 11 m^3 of timber of common species;

dd) The violation involves a volume of from 04 m^3 to under 5.5 m^3 of timber of endangered, rare or precious species in Group IIA;

e) The violation involves a volume of from 0.6 m^3 to under 0.9 m^3 of timber of endangered, rare or precious species in Group IA;

g) The violation involves non-timber forest plants assessed at from VND 50,000,000 to under VND 70,000,000;

h) The violation involves products made from timber without lawful dossier and assessed at from VND 50,000,000 to under VND 70,000,000.

5. A fine ranging from VND 70,000,000 to VND 90,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 70,000,000 to under VND 90,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 35,000,000 to under VND 45,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 5,000,000 to under VND 10,000,000;

d) The violation involves a volume of from 11 m^3 to under 14 m^3 of timber of common species;

dd) The violation involves a volume of from 5.5 m^3 to under 07 m^3 of timber of endangered, rare or precious species in Group IIA;

e) The violation involves a volume of from 0.9 m^3 to under 1.2 m^3 of timber of endangered, rare or precious species in Group IA;

g) The violation involves non-timber forest plants assessed at from VND 70,000,000 to under VND 90,000,000;

h) The violation involves products made from timber without lawful dossier and assessed at from VND 70,000,000 to under VND 90,000,000.

6. A fine ranging from VND 90,000,000 to VND 120,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 90,000,000 to under VND 120,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 45,000,000 to under VND 60,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 10,000,000 to under VND 20,000,000;

d) The violation involves a volume of from 14 m^3 to under 17 m^3 of timber of common species;

dd) The violation involves a volume of from 07 m^3 to under 8.5 m^3 of timber of endangered, rare or precious species in Group IIA;

e) The violation involves a volume of from 1.2 m^3 to under 1.5 m^3 of timber of endangered, rare or precious species in Group IA;

g) The violation involves non-timber forest plants assessed at from VND 90,000,000 to under VND 120,000,000;

h) The violation involves products made from timber without lawful dossier and assessed at from VND 90,000,000 to under VND 120,000,000.

7. A fine ranging from VND 120,000,000 to VND 150,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 120,000,000 to under VND 150,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 60,000,000 to under VND 75,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 20,000,000 to under VND 30,000,000;

d) The violation involves a volume of from 17 m^3 to under 20 m^3 of timber of common species;

dd) The violation involves a volume of from 8.5 m^3 to under 10 m^3 of timber of endangered, rare or precious species in Group IIA;

e) The violation involves non-timber forest plants assessed at from VND 120,000,000 to under VND 150,000,000;

g) The violation involves products made from timber without lawful dossier and assessed at from VND 120,000,000 to under VND 150,000,000.

8. A fine ranging from VND 150,000,000 to VND 180,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 150,000,000 to under VND 180,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 75,000,000 to under VND 90,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 30,000,000 to under VND 40,000,000;

d) The violation involves non-timber forest plants assessed at from VND 150,000,000 to under VND 180,000,000;

dd) The violation involves products made from timber without lawful dossier and assessed at from VND 150,000,000 to under VND 180,000,000.

9. A fine ranging from VND 180,000,000 to VND 210,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 180,000,000 to under VND 210,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 90,000,000 to under VND 105,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 40,000,000 to under VND 50,000,000;

d) The violation involves < 0.3 kg of elephant ivory;

dd) The violation involves non-timber forest plants assessed at from VND 180,000,000 to under VND 210,000,000;

e) The violation involves products made from timber without lawful dossier and assessed at from VND 180,000,000 to under VND 210,000,000.

10. A fine ranging from VND 210,000,000 to VND 240,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 210,000,000 to under VND 240,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 105,000,000 to under VND 120,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 50,000,000 to under VND 60,000,000;

d) The violation involves from 0.3 kg to under 0.6 kg of elephant ivory;

dd) The violation involves non-timber forest plants assessed at from VND 210,000,000 to under VND 240,000,000;

e) The violation involves products made from timber without lawful dossier and assessed at from VND 210,000,000 to under VND 240,000,000.

11. A fine ranging from VND 240,000,000 to VND 270,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 240,000,000 to under VND 270,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 120,000,000 to under VND 135,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 60,000,000 to under VND 70,000,000;

d) The violation involves from 0.6 kg to under 0.9 kg of elephant ivory;

dd) The violation involves non-timber forest plants assessed at from VND 240,000,000 to under VND 270,000,000;

e) The violation involves products made from timber without lawful dossier and assessed at from VND 240,000,000 to under VND 270,000,000.

12. A fine ranging from VND 270,000,000 to VND 300,000,000 shall be imposed in one of the following circumstances:

a) The violation involves forest animals of common species, body parts or products thereof assessed at from VND 270,000,000 to under VND 300,000,000;

b) The violation involves endangered, rare and precious animals of Group IIB, body parts or products thereof assessed at from VND 135,000,000 to under VND 150,000,000;

c) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 70,000,000 to under VND 80,000,000;

d) The violation involves from 0.9 kg to under 1.2 kg of elephant ivory;

dd) The violation involves endangered, rare and precious animals of Group IB or vital body parts thereof with less than 03 individuals of class Aves or class Reptilia or animals of other classes;

e) The violation involves non-timber forest plants assessed at from VND 270,000,000 to under VND 300,000,000;

g) The violation involves products made from timber without lawful dossier and assessed at from VND 270,000,000 to under VND 300,000,000.

13. A fine ranging from VND 300,000,000 to VND 330,000,000 shall be imposed in one of the following circumstances:

a) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 80,000,000 to under VND 90,000,000;

b) The violation involves from 1.2 kg to under 1.5 kg of elephant ivory, or < 0.03 kg of rhino horns;

c) The violation involves endangered, rare and precious animals of Group IB or vital body parts thereof with 01 individual of class Mammalia, or 03 - 04 individuals of class Aves or class Reptilia, or 03 - 05 individuals of other classes;

d) The violation involves products made from timber without lawful dossier and assessed at from VND 300,000,000 to under VND 330,000,000.

14. A fine ranging from VND 330,000,000 to VND 360,000,000 shall be imposed in one of the following circumstances:

a) The violation involves products of endangered, rare and precious animals of Group IB assessed at from VND 90,000,000 to under VND 100,000,000;

b) The violation involves from 1.5 kg to under 02 kg of elephant ivory, or from 0.03 kg to under 0.05 kg of rhino horns;

c) The violation involves endangered, rare and precious animals of Group IB or vital body parts thereof with 02 individuals of class Mammalia, or 05 - 06 individuals of class Aves or class Reptilia, or 06 - 09 individuals of other classes;

d) The violation involves products made from timber without lawful dossier and assessed at from VND 330,000,000 to under VND 360,000,000.

15. A fine ranging from VND 360,000,000 to VND 390,000,000 shall be imposed for the violation the exhibits of which are products made from timber without lawful dossier and assessed at from VND 360,000,000 to under VND 390,000,000.

16. A fine ranging from VND 390,000,000 to VND 420,000,000 shall be imposed for the violation the exhibits of which are products made from timber without lawful dossier and assessed at from VND 390,000,000 to under VND 420,000,000.

17. A fine ranging from VND 420,000,000 to VND 450,000,000 shall be imposed for the violation the exhibits of which are products made from timber without lawful dossier and assessed at from VND 420,000,000 to under VND 450,000,000.

18. A fine ranging from VND 450,000,000 to VND 475,000,000 shall be imposed for the violation the exhibits of which are products made from timber without lawful dossier and assessed at from VND 450,000,000 to under VND 475,000,000.

19. A fine ranging from VND 475,000,000 to VND 500,000,000 shall be imposed for the violation the exhibits of which are products made from timber without lawful dossier and assessed at ≥ VND 475,000,000.

20. Additional penalties:

a) Exhibits of the violation shall be confiscated in case of commission of any of the violations specified in Clause 1 through 19 of this Article.

b) Operations of the forest product processing establishment shall be suspended for 06-12 months in case of commission of any of the violations specified in Clause 5 through 19 of this Article.

21. Remedial measures:

a) The violator is compelled to implement measures for controlling the environmental pollution and the spread of epidemics; destroy goods or articles which cause harm to human health, domestic animals, plants or the environment in case of commission of any of the violations specified in Points a and b Clause 1, Points a, b and c of Clause 2 through 11, Points a, b, c and dd Clause 12, Points a and c Clause 13 and Clause 14 of this Article;

b) The violator is compelled to transfer illegal benefits obtained from the administrative violation or an amount of money equivalent to the value of the exhibits and/or instrumentalities of the administrative violation which have been sold, liquidated, hidden or destroyed inconsistently with the law in case of commission of any of the violations specified in Clause 1 through 19 of this Article.

22. In case of trading, storage or processing of forest products which are found to be of lawful origin but lack a dossier prepared in accordance with law, penalties in Article 24 hereof shall be imposed.

23. In case timber is found to be illegally stored upon an inspection but there are no grounds for determining whether the timber is of the house owner or the processing establishment's owner and the violator cannot be identified, the official competent to impose penalties shall issue a decision on confiscation of timber according to Clause 2 Article 65 of the Law on penalties for administrative violations.

Article 24. Violations against regulations on management of dossiers of forest products during transport, trading, storage and processing

1. A fine ranging from VND 500,000 to VND 1,000,000 shall be imposed for commission of one of the following violations:

a) The forest product owner transports, trades, stores or processes non-timber forest plants, or forest animals or body parts or products thereof of lawful origin but fails to fully comply with regulations on lawful forest product dossiers;

b) The forest product owner transports, trades, stores or processes timber extracted from planted forests, home gardens or scattered trees of lawful origin but fails to fully comply with regulations on lawful forest product dossiers;

c) The vehicle operator or the forest product owner fails to present a lawful forest product dossier to the official competent to inspect vehicles used for transporting forest products within 24 hours from the time of inspection.

2. A fine ranging from VND 1,000,000 to VND 2,000,000 shall be imposed for commission of one of the following violations:

a) The owner of an establishment processing and/or trading in forest products or raising forest animals fails to record forest products received or delivered;

b) The owner of an establishment raising or planting forest animals or plants on the list of forest animals and plants of endangered, rare and precious species or in appendixes of CITES fails to record the raising or planting process as prescribed by law;

c) The owner of an establishment raising forest animals of common species fails to keep a monitoring book or fails to submit a report to competent authorities by the prescribed deadline when bringing forest animals into his/her establishment.

3. A fine ranging from VND 2,000,000 to VND 5,000,000 shall be imposed for commission of one of the following violations:

a) The forest product owner transports, trades, stores or processes imported or confiscated forest products of lawful origin but fails to fully comply with regulations on lawful forest product dossiers;

b) The owner of an establishment raising or planting forest animals or plants on the list of forest animals and plants of endangered, rare and precious species or in appendixes of CITES of lawful origin for commercial purposes fails to apply for registration of animal raising or planting operation as prescribed by lawsoft.

4. A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed upon the forest product owner who transports, trades, stores or processes forest products extracted from natural forests of lawful origin but fails to fully comply with regulations on lawful forest product dossiers.

Chapter III

POWER TO IMPOSE ADMINISTRATIVE PENALTIES

Article 25. Power to record administrative violations

The persons below are entitled to make records of administrative violations:

1. The persons entitled to impose administrative penalties mentioned herein.

2. Officials, public employees and persons of people's army or people's police working in the authorities mentioned in Article 26 through 33 hereof in the performance of their assigned duties to carry out inspection of the compliance with regulations on forest management, development, use and protection, and forest product management.

Article 26. Power to impose penalties of forest protection forces

1. Forest rangers on duty shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 500,000.

2. Heads of forest ranger stations shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 10,000,000;

c) Confiscate the exhibits and instrumentalities of administrative violations worth less than VND 10,000,000.

3. Heads of forest ranger offices, including: Heads of forest ranger offices of rural districts, heads of forest ranger offices of protective forests, heads of forest ranger offices of special-use forests, heads of mobile forest ranger and forest fire teams shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 25,000,000;

c) Confiscate the exhibits and instrumentalities of administrative violations worth less than VND 25,000,000;

d) Enforce the remedial measures specified in Points a, c, d, dd, e, g, h, I, k, l, m, n and o Clause 3 Article 4 of this Decree.

4. Directors of provincial-level forest protection sub-departments and head of special forest protection team affiliated to the Forest Protection Department shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 50,000,000;

c) Suspend the forest harvesting for 06-12 months or suspend operation of forest product processing establishment for 06-12 months;

d) Confiscate the exhibits and instrumentalities of administrative violations worth less than VND 50,000,000;

dd) Enforce the remedial measures specified in Clause 3 Article 4 of this Decree.

5. Director of the Forest Protection Department shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 500,000,000;

c) Suspend the forest harvesting for 06-12 months or suspend operation of forest product processing establishment for 06-12 months;

d) Confiscate the exhibits and instrumentalities of administrative violations;

dd) Enforce the remedial measures specified in Clause 3 Article 4 of this Decree.

Article 27. Power to impose penalties of Chairpersons of people's committees at all levels

1. Chairpersons of People's Committees of communes shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 5,000,000;

c) Confiscate the exhibits and instrumentalities of administrative violations worth less than VND 5,000,000;

d) Enforce the remedial measures mentioned in Points a, b, c and d Clause 3 Article 4 of this Decree.

2. Chairpersons of People's Committees of districts shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 50,000,000;

c) Suspend the forest harvesting for 06-12 months or suspend operation of forest product processing establishment for 06-12 months;

d) Confiscate the exhibits and instrumentalities of administrative violations worth less than VND 50,000,000;

dd) Enforce the remedial measures specified in Clause 3 Article 4 of this Decree.

3. Chairpersons of People's Committees of provinces shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 500,000,000;

c) Suspend the forest harvesting for 06-12 months or suspend operation of forest product processing establishment for 06-12 months;

d) Confiscate the exhibits and instrumentalities of administrative violations;

dd) Enforce the remedial measures specified in Clause 3 Article 4 of this Decree.

4. Local forest protection authorities shall provide advice for People's Committees of the same level about imposing administrative penalties within their competence as prescribed in this Article.

Article 28. Power to impose penalties of specialized inspectorates in forestry sector

1. In the performance of their duties, inspectors of agriculture and rural development sector and the persons assigned to conduct specialized inspections in forestry shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 500,000;

c) Confiscate the exhibits and instrumentalities of administrative violations worth less than VND 500,000;

d) Enforce the remedial measures mentioned in Points a, c and d Clause 3 Article 4 of this Decree.

2. Heads of inspectorates of Vietnam Administration of Forestry, chief inspectors of Provincial Departments of Agriculture and Rural Development, and heads of specialized inspection teams of Provincial Departments of Agriculture and Rural Development shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 50,000,000;

c) Suspend the forest harvesting for 06-12 months or suspend operation of forest product processing establishment for 06-12 months;

d) Confiscate the exhibits and instrumentalities of administrative violations worth less than VND 50,000,000;

dd) Enforce the remedial measures specified in Clause 3 Article 4 of this Decree.

3. Heads of specialized inspection teams established by the Ministry of Agriculture and Rural Development shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 250,000,000;

c) Suspend the forest harvesting for 06-12 months or suspend operation of forest product processing establishment for 06-12 months;

d) Confiscate the exhibits and instrumentalities of administrative violations worth less than VND 250,000,000;

dd) Enforce the remedial measures specified in Clause 3 Article 4 of this Decree.

4. The Chief Inspector of the Ministry of Agriculture and Rural Development, and Director General of Vietnam Administration of Forestry shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 500,000,000;

c) Suspend the forest harvesting for 06-12 months or suspend operation of forest product processing establishment for 06-12 months;

d) Confiscate the exhibits and instrumentalities of administrative violations;

dd) Enforce the remedial measures specified in Clause 3 Article 4 of this Decree.

Article 29. Power to impose penalties of people's police forces

People's police forces shall have the power to impose administrative penalties, additional penalties and enforce remedial measures as regulated in Article 39 of the Law on penalties for administrative violations.

Article 30. Power to impose penalties of border guard forces

1. Soldiers on duty of border guard forces shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 500,000.

2. Heads of border guard stations, and leaders of the soldiers mentioned in Clause 1 of this Article shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 2,500,000.

3. Heads of border-guard stations, commanders of border-guard flotillas, commanders of border-guard sub-zones, and commanders of port border guards shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 25,000,000;

c) Confiscate the exhibits and instrumentalities of administrative violations worth less than VND 25,000,000;

d) Enforce the remedial measures mentioned in Points a, c, d, e and l Clause 3 Article 4 of this Decree.

4. Commanders of provincial-level border guard forces and commanders of border guard fleets affiliated to the Border Guard High Command shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 500,000,000;

c) Suspend the forest harvesting for 06-12 months or suspend operation of forest product processing establishment for 06-12 months;

d) Confiscate the exhibits and instrumentalities of administrative violations;

dd) Enforce the remedial measures mentioned in Points a, c, d, dd, e and l Clause 3 Article 4 of this Decree.

Article 31. Power to impose penalties of coast guard forces

1. Coast guard officers on duty shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 1,500,000.

2. Coastguard team leaders shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 5,000,000.

3. Coastguard squad leaders and captains of coastguard stations shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 10,000,000;

c) Enforce the remedial measures mentioned in Points a, c and d Clause 3 Article 4 of this Decree.

4. Commanders of coastguard platoons shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 25,000,000;

c) Confiscate the exhibits and instrumentalities of administrative violations worth less than VND 25,000,000;

d) Enforce the remedial measures mentioned in Points a, c and d Clause 3 Article 4 of this Decree.

5. Commanders in chief of coastguard squadrons shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 50,000,000;

c) Confiscate the exhibits and instrumentalities of administrative violations worth less than VND 50,000,000;

d) Enforce the remedial measures mentioned in Points a, c and d Clause 3 Article 4 of this Decree.

6. Commanders of Regional Coast Guards shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 100,000,000;

c) Confiscate the exhibits and instrumentalities of administrative violations worth less than VND 100,000,000;

d) Enforce the remedial measures mentioned in Points a, c and d Clause 3 Article 4 of this Decree.

7. Commanders of Coastguard Headquarters shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 500,000,000;

c) Suspend operation of forest product processing establishments for 06 - 12 months;

d) Confiscate the exhibits and instrumentalities of administrative violations;

dd) Enforce the remedial measures mentioned in Points a, b, c and d Clause 3 Article 4 of this Decree.

Article 32. Power to impose penalties of market surveillance forces

1. Market controllers on duty shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 500,000.

2. Leaders of market surveillance teams shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 25,000,000;

c) Confiscate the exhibits and instrumentalities of administrative violations worth less than VND 25,000,000;

d) Impose the remedial measures specified in Points a, d and dd Clause 3 Article 4 of this Decree.

3. Directors of Provincial Market Surveillance Departments and Director of Market Surveillance Operations Department affiliated to Vietnam Directorate of Market Surveillance shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 50,000,000;

c) Suspend operation of forest product processing establishments for 06 - 12 months;

d) Confiscate the exhibits and instrumentalities of administrative violations worth less than VND 50,000,000;

dd) Enforce the remedial measures mentioned in Points a, c, d and dd Clause 3 Article 4 of this Decree.

4. Director General of Vietnam Directorate of Market Surveillance shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 500,000,000;

c) Suspend operation of forest product processing establishments for 06 - 12 months;

d) Confiscate the exhibits and instrumentalities of administrative violations;

dd) Enforce the remedial measures mentioned in Points a, c, d and dd Clause 3 Article 4 of this Decree.

Article 33. Power to impose penalties of customs agencies

1. Customs officials on duty shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 500,000.

2. Team leaders of Customs Branches and team leaders of Post-clearance Audit Branches shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 5,000,000.

3. Directors of Customs Branches, Directors of Post-clearance Audit Branches, leaders of customs control teams affiliated to Customs Departments of provinces, leaders of anti-smuggling control teams, commanders of marine control squads and leaders of intellectual property protection and control teams affiliated to Anti-smuggling and Investigation Department of General Department of Customs shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 25,000,000;

c) Confiscate the exhibits and instrumentalities of administrative violations worth less than VND 25,000,000;

d) Enforce the remedial measures mentioned in Points d and dd Clause 3 Article 4 of this Decree.

4. Directors of Anti-smuggling and Investigation Department and Post-clearance Audit Department affiliated to General Department of Customs, and Directors of Customs Departments of provinces shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 50,000,000;

c) Suspend operation of forest product processing establishments for 06 - 12 months;

d) Confiscate the exhibits and instrumentalities of administrative violations worth less than VND 50,000,000;

dd) Enforce the remedial measures mentioned in Points d and dd Clause 3 Article 4 of this Decree.

5. Director General of General Department of Customs shall have the power to:

a) Issue warnings;

b) Impose a fine up to VND 500,000,000;

c) Confiscate the exhibits and instrumentalities for committing administrative violations;

d) Enforce the remedial measures mentioned in Points d and dd Clause 3 Article 4 of this Decree.

Article 34. Delegation of power to impose penalties

1. Competent officials of forest protection authorities, People's Committees at all levels, specialized inspectorates and People's police forces shall have the power to impose administrative penalties, impose additional penalties and enforce remedial measures against the administrative violations herein within their competence prescribed in Article 26 through 29 hereof and within the ambit of their assigned functions, duties and powers.

2. Competent officials of border guard forces shall have the power to impose administrative penalties, impose additional penalties and enforce remedial measures against the administrative violations specified in Article 13, Article 17, and Article 20 through 24 hereof within their competence prescribed in Article 30 hereof and within the ambit of their assigned functions, duties and powers.

3. Competent officials of coast guard forces shall have the power to impose administrative penalties, impose additional penalties and enforce remedial measures against the administrative violations specified in Article 22, Article 23 and Article 24 hereof within their competence prescribed in Article 31 hereof and within the ambit of their assigned functions, duties and powers.

4. Competent officials of market surveillance forces shall have the power to impose administrative penalties, impose additional penalties and enforce remedial measures against the administrative violations specified in Article 23 and Article 24 hereof within their competence prescribed in Article 32 hereof and within the ambit of their assigned functions, duties and powers.

5. Competent officials of customs authorities shall have the power to impose administrative penalties, impose additional penalties and enforce remedial measures against the administrative violations specified in Article 22 and Article 23 hereof within their competence prescribed in Article 33 hereof and within the ambit of their assigned functions, duties and powers.

Article 35. Determination of power to impose penalties

1. Determination and delegation of the power to impose administrative penalties and enforce remedial measures shall comply with Article 52 of the Law on penalties for administrative violations.

2. Determination of the exhibits of violations (including forest products of endangered, rare and precious species) for using as the basis for determining fines and power to impose penalties shall be carried out in accordance with Article 60 of the Law on penalties for administrative violations and relevant laws.

Chapter IV

IMPLEMENTATION PROVISIONS

Article 36. Effect

1. This Decree comes into force from June 10, 2019.

2. This Decree supersedes the Government's Decree No. 157/2013/ND-CP dated November 11, 2013 and Article 3 of the Government's Decree No. 41/2017/ND-CP dated April 05, 2017.

3. Administrative violations against regulations on major forest tree cultivars which are also prescribed in the Government's Decree No. 31/2016/ND-CP dated May 06, 2016 shall be handled in accordance with regulations herein.

Article 37. Transition clauses

1. The administrative violations committed before the effective date of this Decree shall be handled in accordance with regulations laid down in the Government's Decree No. 157/2013/ND-CP dated November 11, 2013, the Government's Decree No. 41/2017/ND-CP dated April 05, 2017, and the Government's Decree No. 31/2016/ND-CP dated May 06, 2016.

2. The administrative violations against regulations on forest management, development and protection and forest product management regarding trading of forest tree cultivars committed before this Decree takes effect and discovered afterwards shall be handled in accordance with regulations that are advantageous to the organizations and individuals at fault.

Article 38. Responsibility for implementation

1. The Minister of Agriculture and Rural Development shall instruct and organize the implementation of this Decree.

2. Ministers, heads of ministerial agencies, heads of Governmental agencies and Chairpersons of People's Committees of provinces shall be responsible for the implementation of this Decree./.

ON BEHALF OF THE GOVERNMENT
THE PRIME MINISTER

Nguyen Xuan Phuc

THE GOVERNMENT -------	THE SOCIALIST REPUBLIC OF VIETNAM Independence – Freedom – Happiness ----------
No.: 42/2019/ND-CP	*Hanoi, May 16, 2019*

DECREE

PENALTIES FOR ADMINISTRATIVE VIOLATIONS AGAISNT REGULATIONS ON FISHERIES

Pursuant to the Law on Government organization dated June 19, 2015;

Pursuant to the Law on Penalties for administrative violations dated June 20, 2012;

Pursuant to the Law on fisheries dated November 21, 2017;

At the request of the Minister of Agriculture and Rural Development;

The Government promulgates a Decree providing for penalties for administrative violations agaisnt regulations on fisheries.

Chapter I

GENERAL PROVISIONS

Article 1. Scope

1. This Decree deals with administrative violations, penalties, fines, remedial measures against each violation, the power to impose penalties, fines imposed by authorized title holders, and the power to record administrative violations against regulations on fisheries.

2. Other administrative violations against regulations on fisheries which are not prescribed in this Decree shall be governed by other relevant Government's decrees on penalties for administrative violations within the scope of state management.

Article 2. Regulated entities

1. Vietnamese and foreign organizations and individuals (hereinafter referred to as “entities”) that commit administrative violations specified in this Decree.

2. The organizations mentioned in Clause 1 of this Article include:

a) Economic organizations that are duly established under the Law on enterprises, consisting of: Private enterprises, joint-stock companies, limited liability companies, partnerships and their affiliates (including branches and representative offices);

b) Economic organizations that are duly established under the Law on co-operatives, consisting of: Co-operatives and cooperative unions;

c) Organizations that are duly established under the Law on investment, consisting of: Domestic investors, foreign investors and foreign-invested economic organizations; representative offices and branches of foreign traders in Vietnam; representative offices of foreign trade promotion organizations in Vietnam;

d) Social organizations, socio-politial organizations, and socio-professional organizations;

dd) Administrative units and other organizations as prescribed by law.

3. Household businesses that are required to register their business as prescribed by law and business families shall incur the same penalties as those incurred by individuals for committing administrative violations specified in this Decree.

Article 3. Prescriptive periods for administrative violations punishable

The prescriptive period for imposition of penalties for fisheries offences is 01 year. The prescriptive period for imposition of penalties for administrative violations against regulations on production, trading, import and export of fishing vessels, aquatic breeds, aquatic feeds, products used for remediation of aquaculture environment and protection of aquatic resources shall be 02 years.

Article 4. Penalties and remedial measures

1. The entity that knowingly commits any of the administrative violations in fishing industry shall be fined.

2. The violating entity shall, subject to the nature and severity of each administrative violation, also incur one or some of additional penalties as follows:

a) Suspension of license or practicing certificate or operations for a fixed period;

b) Confiscation of exhibits and instrumentalities of administrative violations, including: Fishing vessels, fishing gears, electrofishing equipment, chemicals, banned chemicals, toxins, fish and fishery products, certificates, licenses, permits or written approvals whose contents are erased or altered.

3. In addition to the remedial measures specified in Clause 1 Article 28 of the Law on penalties for administrative violations, this Decree also provides remedial measures as follows:

a) Enforced release of live aquatic animals;

b) Enforced transfer of dead aquatic animals of endangered, rare and precious species to regulatory authorities;

c) Enforced additional farming of endangered, rare and precious aquatic species as prescribed;

d) Enforced restoration to original conditions of functional sub-areas of marine protected areas, habitats of aquatic animals, marine areas, land areas, waters and facilities of fishing ports;

dd) Enforced destruction or repurposing of aquatic breeds, aquatic species, fishery products, aquatic feeds and aqua environmental remediation products;

e) Enforced re-export of aquatic breeds, aquatic species, aquatic breeds and aqua environmental remediation products;

g) Enforced recycling of aquatic breeds and aqua environmental remediation products;

h) Fishing vessel owners are compelled to cover costs for bringing their fishermen seized by foreign regulatory authorities into Vietnam;

i) Enforced destruction of fishing vessels which are prohibited from development or the ones built or modified without written approval from regulatory authorities;

k) Enforced flying of the national flag of the Socialist Republic of Vietnam or the flag of the ship's nationality;

l) Enforced return of encroached areas;

m) Enforced re-export of fishing vessels.

Article 5. Fines and power to impose fines

1. The maximum fine for a violation against regulations on fisheries incurred by an individual is VND 1,000,000,000.

2. The fines prescribed in Chapter II hereof are imposed for administrative violations committed by individuals, except the administrative violations mentioned in Article 40 hereof. The fine incurred by an organization is twice as much as that incurred by an individual for committing the same administrative violation.

3. The fines imposed by the persons mentioned in Chapter III hereof are incurred by individuals. The fines they may impose upon organizations are twice as much as the fines they impose upon individuals.

Chapter II

ADMINISTRATIVE VIOLATIONS, PENALTIES AND REMEDIAL MEASURES

Section 1. VIOLATIONS AGAINST REGULATIONS ON AQUATIC RESOURCE PROTECTION

Article 6. Violations against regulations on protection of aquatic habitats

1. The following fines shall be imposed for violations against regulations on protection of aquatic habitats if not liable to criminal prosecution:

a) A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed for failure to leave movement pathways of fishes when carrying out fishing operations by using fixed fishing gears in rivers, lakes and lagoons; failure to create migration corridors or movement pathways for aquatic species when building, modifying or demolishing building structures or carrying out other operations affecting the movement of aquatic animals; illegally blocking the natural movement of aquatic species;

b) A fine ranging from VND 50,000,000 to VND 100,000,000 shall be imposed for destroying aquatic resources, aquatic ecosystems, areas where fishes live in the breeding season, or areas where juvenile fishes live; destroying the habitats of endangered, rare and precious aquatic species or endangered, rare and precious aquatic species that need protection;

c) A fine ranging from VND 100,000,000 to VND 150,000,000 shall be imposed for encroaching, appropriating or harming protected areas of aquatic resources;

d) A fine ranging from VND 150,000,000 to VND 200,000,000 shall be imposed for the acts of exploring/exploiting natural resources or building/demolishing structures underwater or within subaqueous soil that deteriorate or cause loss of aquatic resources or harm the areas where fishes live in the breeding season or where juvenile fishes live or the migration corridors of aquatic species.

2. Additional penalties:

Exhibits and instrumentalities for committing the violations specified in Clause 1 of this Article shall be confiscated.

3. Remedial measures:

The violator is compelled to restore the original condition which is changed by any of the violations specified in Points a, c and d Clause 1 of this Article.

Article 7. Violations against regulations on areas banned from commercial fishing

1. The following fines shall be imposed for commercial fishing in no-take areas or areas banned from commercial fishing for a fixed term if not liable to criminal prosecution:

a) A fine ranging from VND 10,000,000 to VND 15,000,000 shall be imposed for the commercial fishing using fishing vessels whose length overall is < 12 m or commercial fishing without using fishing vessels;

b) A fine ranging from VND 20,000,000 to VND 30,000,000 shall be imposed for the commercial fishing using fishing vessels whose length overall is from 12 m to under 15 m;

c) A fine ranging from VND 30,000,000 to VND 40,000,000 shall be imposed for the commercial fishing using fishing vessels whose length overall is from 15 m to under 24 m;

d) A fine ranging from VND 40,000,000 to VND 50,000,000 shall be imposed for the commercial fishing using fishing vessels whose length overall is ≥ 24 m.

2. The fines imposed for the violations specified in Clause 1 of this Article and involving fishing vessels used in trawls, light-combined fishing occupations and gears (except squid hand-lining) shall be twice as much as the fines specified in Clause 1 of this Article.

3. Additional penalties:

Fishing gears shall be confiscated in case of commission of any of the violations specified in Clause 1 and Clause 2 of this Article.

4. Remedial measures:

a) The violator is compelled to release fishes alive into their habitats in case of commission of any of the violations specified in Clause 1 and Clause 2 of this Article;

b) The violator is compelled to transfer dead aquatic animals of endangered, rare and precious species in group I to regulatory authorities in case of commission of any of the violations specified in Clause 1 and Clause 2 of this Article.

Article 8. Violations against regulations on management of endangered, rare and precious aquatic species

1. A fine ranging from VND 10,000,000 to VND 20,000,000 shall be imposed for failure to comply with the written approval or plan for catching of endangered, rare and precious aquatic species.

2. The following fines shall be imposed for illegal fishing of endangered, rare and precious aquatic species in Group II if not liable to criminal prosecution:

a) A fine ranging from VND 3,000,000 to VND 5,000,000 shall be imposed for the violation involving a total catch of < 10 kg;

b) A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed for the violation involving a total catch of from 10 kg to under 20 kg;

c) A fine ranging from VND 20,000,000 to VND 30,000,000 shall be imposed for the violation involving a total catch of from 20 kg to under 50 kg;

d) A fine ranging from VND 30,000,000 to VND 40,000,000 shall be imposed for the violation involving a total catch of from 50 kg to under 100 kg;

dd) A fine ranging from VND 40,000,000 to VND 50,000,000 shall be imposed for the violation involving a total catch of ≥ 100 kg.

3. The following fines shall be imposed for illegal fishing of endangered, rare and precious aquatic species in Group I if not liable to criminal prosecution:

a) A fine ranging from VND 30,000,000 to VND 40,000,000 shall be imposed for the violation involving a total catch of < 10 kg;

b) A fine ranging from VND 40,000,000 to VND 50,000,000 shall be imposed for the violation involving a total catch of from 10 kg to under 20 kg;

c) A fine ranging from VND 50,000,000 to VND 60,000,000 shall be imposed for the violation involving a total catch of from 20 kg to under 50 kg;

d) A fine ranging from VND 60,000,000 to VND 70,000,000 shall be imposed for the violation involving a total catch of from 50 kg to under 100 kg;

dd) A fine ranging from VND 70,000,000 to VND 100,000,000 shall be imposed for the violation involving a total catch of ≥ 100 kg.

4. A fine ranging from VND 50,000,000 to VND 100,000,000 shall be imposed for failure to release the required amount of produced aquatic breeds of endangered, rare and precious species into natural waters within the prescribed time limit when obtaining permission from a regulatory authority to catch endangered, rare and precious aquatic species for the purposes of research, creation and production of aquatic breeds.

5. Additional penalties:

The fishing license shall be suspended for 03 - 06 months in case of commission of any of the violations specified in Points d and dd Clauses 2, Points d and dd Clause 3 of this Article.

6. Remedial measures:

a) The violator is compelled to release fishes alive into their habitats in case of commission of any of the violations specified in Clause 2 and Clause 3 of this Article;

b) The violator is compelled to transfer dead aquatic animals of endangered, rare and precious species to regulatory authorities in case of commission of any of the violations specified in Clause 2 and Clause 3 of this Article;

c) The violator is compelled to additionally release endangered, rare and precious aquatic species as regulated in case of commission of the violation specified in Clause 4 of this Article.

Article 9. Violations against regulations on management of marine protected areas (MPAs)

1. A fine ranging from VND 50,000,000 to VND 70,000,000 shall be imposed for commission of one of the following violations within the buffer zones of MPAs:

a) Illegally placing buoys;

b) Carrying out investigations or scientific research without the approval from a regulatory authority;

c) Illegally operating fishing vessels, ships or other waterway vehicles;

d) Illegally providing tourist services and other services;

dd) Illegally executing infrastructure works;

e) Carrying out illegal aquaculture or commercial fishing.

2. A fine ranging from VND 70,000,000 to VND 100,000,000 shall be imposed for commission of one of the violations specified in Clause 1 of this Article within service-administrative zones of MPAs.

3. A fine ranging from VND 100,000,000 to VND 150,000,000 shall be imposed for commission of one of the following violations within ecological restoration zones of MPAs:

a) Committing any of the violations specified in Points a, b, c and d Clause 1 of this Article;

b) Performing any prohibited acts in ecological restoration zones.

4. A fine ranging from VND 150,000,000 to VND 200,000,000 shall be imposed for commission of one of the following violations within highly protected zones:

a) Committing the violation specified in Point a or Point b Clause 1 of this Article;

b) Performing any prohibited acts in highly protected zones.

5. Remedial measures:

The violator is compelled to restore the original condition which is changed by the violation specified in Point dd Clause 1 of this Article.

Section 2. VIOLATIONS AGAINST REGULATIONS ON AQUATIC BREEDS

Article 10. Violations against regulations on production, raising and testing for aquatic breeds

1. A fine ranging from VND 3,000,000 to VND 5,000,000 shall be imposed for commission of one of the following violations:

a) Failure to submit reports on production and raising of aquatic breeds as prescribed;

b) Failure to submit written notification of using parent aquatic breeds to the relevant provincial fishery authority;

c) Failure to record or keep records of production/ raising of aquatic breeds for tracing purpose.

2. A fine ranging from VND 20,000,000 to VND 30,000,000 shall be imposed for commission of one of the following violations:

a) Failure to comply with regulations on prescribed time limits for use of parent aquatic breeds;

b) Failure to correctly announce testing results.

3. A fine ranging from VND 30,000,000 to VND 40,000,000 shall be imposed for production/ raising of aquatic breeds without obtaining a Certificate of eligibility as prescribed.

4. A fine ranging from VND 40,000,000 to VND 60,000,000 shall be imposed for production/ raising of parent aquatic breeds without obtaining a Certificate of eligibility as prescribed.

5. Remedial measures:

a) The violator is compelled to repurpose aquatic breeds if they are qualified for the new purpose or destroy aquatic breeds/ parent aquatic breeds if the repurposing cannot be made in case of commission of any of the violations specified in Point a Clause 2, Clause 3 and Clause 4 of this Article;

b) The violator is compelled to correct testing results in case of commission of the violation specified in Point b Clause 2 of this Article.

Article 11. Violations against regulations on export of aquatic breeds

1. A fine ranging from VND 50,000,000 to VND 60,000,000 shall be imposed for failure to meet exporting conditions when exporting aquatic breeds of species on the List of aquatic species subject to conditional export, unless permitted by regulatory authorities.

2. Remedial measures:

The violator is compelled to release aquatic breeds alive into their habitats or destroy aquatic breeds if such release cannot be made in case of commission of the violation specified in Clause 1 of this Article.

Article 12. Violations against regulations on naming of aquatic breeds

1. A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed for naming aquatic breeds inconsistently with applicable regulations.

2. Remedial measures:

The violator is compelled to destroy labels and correct names of aquatic breeds specified in relevant documents in case of commission of the violation specified in Clause 1 of this Article.

Section 3. VIOLATIONS AGAINST REGULATIONS ON AQUATIC FEEDS AND AQUA ENVIRONMENTAL REMEDIATION PRODUCTS

Article 13. Violations against regulations on provision of information about aquatic feeds and aqua environmental remediation products

1. The following fines shall be imposed for failure to send required information to the Ministry of Agriculture and Rural Development before authorizing aquatic feeds and aqua environmental remediation products for marketing:

a) A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed for failure to send information about less than 03 products;

b) A fine ranging from VND 10,000,000 to VND 15,000,000 shall be imposed for failure to send information about from 03 products to under 05 products;

c) A fine ranging from VND 30,000,000 to VND 40,000,000 shall be imposed for failure to send information about from 05 products to under 10 products;

d) A fine ranging from VND 40,000,000 to VND 50,000,000 shall be imposed for failure to send information about 10 products or more.

2. Remedial measures:

The violator is compelled to carry out recycling or repurposing or destruction of products, whichever appropriate, in case of commission of the violation specified in Clause 1 of this Article.

Article 14. Violations against requirements to be satisfied by establishments manufacturing, trading and importing aquatic feeds and aqua environmental remediation products

1. A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed upon importing and/or trading establishments for commission of one of the following violations:

a) Failure to display and store aquatic feeds and aqua environmental remediation products separately from pesticides, fertilizers and toxic chemicals;

b) Failure to use appropriate equipment and devices for storing aquatic feeds and aqua environmental remediation products as prescribed.

2. A fine ranging from VND 30,000,000 to VND 50,000,000 shall be imposed for manufacturing aquatic breeds and aqua environmental remediation products without a Certificate of eligibility as prescribed.

3. Remedial measures:

The violator is compelled to carry out repurposing or destruction of batches of products, whichever appropriate, in case of commission of the violation specified in Clause 2 of this Article.

Article 15. Violations against regulations on manufacturing, importing and trading of aquatic feeds and aqua environmental remediation products

1. The following fines shall be imposed for failure to record or keep records of manufacturing operations according to manufacturing, quality control and biosafety procedures:

a) A fine ranging from VND 3,000,000 to VND 5,000,000 shall be imposed for the violation involving less than 5 products;

b) A fine ranging from VND 5,000,000 to VND 7,000,000 shall be imposed for the violation involving from 5 to under 10 products;

c) A fine ranging from VND 7,000,000 to VND 10,000,000 shall be imposed for the violation involving from 10 to under 15 products;

d) A fine ranging from VND 10,000,000 to VND 15,000,000 shall be imposed for the violation involving 15 products or more.

2. The following fines shall be imposed for using raw materials of unknown origin for manufacturing of aquatic feeds and aqua environmental remediation products:

a) A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed for the violation involving less than 3 products;

b) A fine ranging from VND 10,000,000 to VND 15,000,000 shall be imposed for the violation involving from 3 to under 5 products;

c) A fine ranging from VND 15,000,000 to VND 20,000,000 shall be imposed for the violation involving from 5 to under 10 products;

d) A fine ranging from VND 20,000,000 to VND 30,000,000 shall be imposed for the violation involving 10 products or more.

3. A fine ranging from VND 40,000,000 to VND 50,000,000 shall be imposed for manufacturing or importing aquatic feeds or aqua environmental remediation products containing ingredients which are not on the List of chemicals, biological, microorganisms and ingredients contained in aquatic feeds permitted for use in Vietnam.

4. Remedial measures:

a) The violator is compelled to carry out recycling or repurposing or destruction of products, whichever appropriate, in case of commission of the violation specified in Clause 2 and the violation involving domestically manufactured products specified in Clause 3 of this Article;

b) The violator is compelled to carry out re-export or destruction of imported aquatic feeds and aqua environmental remediation products, whichever appropriate, in case of commission of the violation specified in Clause 3 of this Article.

Article 16. Violations against regulations on testing for aquatic feeds and aqua environmental remediation products

1. A fine ranging from VND 30,000,000 to VND 40,000,000 shall be imposed for failure to announce correct testing results.

2. Remedial measures:

The violator is compelled to correct testing results in case of commission of the violation specified in Clause 1 of this Article.

Section 4. VIOLATIONS AGAINST REGULATIONS ON AQUACULTURE

Article 17. Violations against eligibility requirements for aquaculture

1. A fine ranging from VND 10,000,000 to VND 15,000,000 shall be imposed for failure to carry out procedures for registration of cage culture or major cultured species.

2. A fine ranging from VND 10,000,000 to VND 20,000,000 shall be imposed for failure to meet material facilities or technical equipment requirements as prescribed.

3. A fine ranging from VND 20,000,000 to VND 30,000,000 shall be imposed for carrying out marine aquaculture without permission from regulatory authorities as prescribed.

4. Remedial measures:

The violator is compelled to relocate or demolish aquaculture facilities in case of commission of the violation specified in Clause 3 of this Article.

Article 18. Violations against regulations on import and export of live aquatic animals and plants

1. A fine ranging from VND 30,000,000 to VND 40,000,000 shall be imposed for importing live aquatic animals and/or plants for foods, decoration or entertainment without permission from a regulatory authority as prescribed.

2. A fine ranging from VND 40,000,000 to VND 50,000,000 shall be imposed for failure to meet exporting conditions when exporting live aquatic animals and/or plants of species on the List of aquatic species subject to conditional export, unless permitted by regulatory authorities.

3. Additional penalties:

Aquatic product shipments shall be confiscated in case of commission of the violation specified in Clause 1 or Clause 2 of this Article.

Article 19. Violations against regulations on rearing, breeding and artificial propagation of endangered, rare and precious aquatic species in CITES Appendices

1. A fine ranging from VND 1,000,000 to VND 2,000,000 shall be imposed for failure to record the breeding, rearing and artificial propagation of endangered, rare and precious aquatic species as prescribed.

2. A fine ranging from VND 2,000,000 to VND 5,000,000 shall be imposed for failure to carry out procedures for registration of the breeding, rearing and artificial propagation of endangered, rare and precious aquatic species in CITES Appendices as prescribed.

3. A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed for breeding, rearing and artificial propagation of endangered, rare and precious aquatic species of unknown origin.

4. Additional penalties:

Aquatic species of unknown origin shall be confiscated in case of commission of the violation specified in Clause 3 of this Article.

Section 5. VIOLATIONS AGAINST REGULATIONS ON COMMERCIAL FISHING

Article 20. Serious violations against regulations on commercial fishing

1. A fishing vessel owner shall face a fine ranging from VND 300,000,000 to VND 500,000,000 for commission of one of the following violations:

a) Failing to obtain a fishing license or using an expired one when carrying out fishing operations within the territorial waters of Vietnam with fishing vessel of from 15 m to under 24 m in length overall;

b) Using a fishing vessel of ≥ 24 m in length overall to transfer catches from a fishing vessel which is found to carry out fishing operations without fishing license or with an expired one or to facilitate the exploration, search for, trapping or transport of catches of another vessel which is found to carry out illegal fishing, except force majeure events;

c) Failing to install vessel tracking unit (VTU) on a fishing vessel of from 15 m to under 24 m in length overall;

d) Failing to maintain the operation of or knowingly disabling VTU of a fishing vessel of ≥ 24 m in length overall during its operations at sea, except force majeure events;

dd) Failing to record fishing operations, purchase or transshipment of catches carried out by using the fishing vessel of ≥ 24 m in length overall;

e) Providing VTU that fails to meet technical requirements for fishers.

2. A fishing vessel owner shall face a fine ranging from VND 500,000,000 to VND 700,000,000 for commission of one of the following violations:

a) Failing to obtain a fishing license or using an expired one when carrying out fishing operations within the territorial waters of Vietnam with using a fishing vessel of from 15 m to under 24 m in length overall in case of repeated violation;

b) Using a fishing vessel of ≥ 24 m in length overall to transfer catches from a fishing vessel which is found to carry out fishing operations without a fishing license or with an expired one or to facilitate the exploration, search for, trapping or transport of catches of another vessel which is found to carry out illegal fishing in case of repeated violation, except force majeure events;

c) Failing to install VTU on a fishing vessel of from 15 m to under 24 m in length overall in case of repeated violation;

d) Failing to maintain the operation of or knowingly disabling VTU of a fishing vessel of ≥ 24 m in length overall during its operations at sea in case of repeated violation, except force majeure events;

dd) Failing to record fishing operations, purchase or transshipment of catches carried out by using a fishing vessel of ≥ 24 m in length overall in case of repeated violation;

e) Hiding, fabricating or destroying evidence of violations against regulations on commercial fishing and protection of aquatic resources;

g) Failing to keep fishing logbook or recording or reporting fishing operations against requirements of the regional fisheries organization when carrying out fishing operations within the waters under the jurisdiction of the regional fisheries organization;

h) Carrying out fishing operations in excess of total allowable catch approved by the regional fisheries organization.

3. A fishing vessel owner shall face a fine ranging from VND 800,000,000 to VND 1,000,000,000 for commission of one of the following violations:

a) Failing to obtain a fishing license or using an expired one when carrying out fishing operations within the territorial waters of Vietnam with a fishing vessel of ≥ 24 m in length overall;

b) Failing to obtain a fishing license or written approval or using an expired one when carrying out fishing operations in waters under the jurisdiction of another State or territory or under the jurisdiction of the regional fisheries organization;

c) Operating a foreign fishing vessel in the territorial waters of Vietnam without obtaining a fishing license or using an expired one;

d) Engaging in unauthorized fishing in waters under the jurisdiction of a regional fisheries organization by vessels without nationality, or by those flying the flag of a State not party to that organization;

dd) Engaging in fishing operations inconsistently with regulations on fishing and protection of aquatic resources in international waters beyond the jurisdiction of regional fisheries organizations;

e) Operating fishing vessels against regulations on management and conservation practices in international waters under the jurisdiction of one of regional fisheries organizations to which Vietnam is a Party;

g) Failing to install VTU on a fishing vessel of ≥ 24 m in length overall;

h) Hiding, fabricating or destroying evidence of violations against regulations on commercial fishing and protection of aquatic resources in case of repeated violation;

i) Carrying out fishing operations in excess of total allowable catch approved by regional fisheries organizations in case of repeated violation.

4. Additional penalties:

a) Fish and fishery products which are illegally caught or transshipped shall be confiscated in case of commission of any of the violations specified in Points a and b Clause 1, Points a, b and h Clause 2, Points a, b, c, d, dd and i Clause 3 of this Article;

b) Fishing vessels shall be confiscated in case of commission of any of the violations specified in Points b, c, d, dd and e Clause 3 of this Article;

c) The captain's license or certificate of competence to operate Vietnamese-flagged fishing vessels shall be suspended for 06 - 12 months in case of commission of any of the violations specified in Clause 1, Clause 2 and Clause 3 of this Article;

h) The fishing license shall be suspended for 06 - 12 months in case of commission of any of the violations specified in Point g Clauses 2, Points dd, e and g Clause 3 of this Article.

5. Remedial measures:

Fishing vessel owners are compelled to cover costs for bringing their fishermen who are seized by foreign regulatory authorities into Vietnam and relevant expenses in case of commission of the violation specified in Point b Clause 3 of this Article.

Article 21. Violations against regulations on fishing zones

1. A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed for engaging in unauthorized fishing operations in coastal zones of another province by fishing vessels of less than 12 m in length overall.

2. A fine ranging from VND 10,000,000 to VND 15,000,000 shall be imposed for engaging in fishing operations in inshore or offshore zones by fishing vessels of less than 12 m in length overall.

3. A fine ranging from VND 15,000,000 to VND 20,000,000 shall be imposed for engaging in fishing operations in coastal or offshore zones by fishing vessels of from 12 m to under 15 m in length overall.

4. A fine ranging from VND 20,000,000 to VND 30,000,000 shall be imposed for engaging in fishing operations in coastal or inshore zones by fishing vessels of from 15 m to under 24 m in length overall.

5. A fine ranging from VND 30,000,000 to VND 40,000,000 shall be imposed for engaging in fishing operations in coastal or inshore zones by fishing vessels of $\geq$ 24 m in length overall.

6. The fines imposed for the violations specified in Clauses 3, 4 and 5 of this Article and involving fishing vessels used in trawls, light-combined fishing occupations and gears (except squid hand-lining) in coastal zones shall be twice as much as the fines specified in Clauses 3, 4 and 5 of this Article.

7. Additional penalties:

a) The fishing license shall be suspended for 06 - 12 months in case of commission of the violation specified in Clause 6 of this Article;

b) The captain's license or certificate of competence to operate fishing vessels shall be suspended for 01 - 06 months in case of commission of any of the violations specified in Clauses 3, 4, 5 and 6 of this Article.

Article 22. Violations against regulations on fishing quotas

1. A fine ranging from VND 20,000,000 to VND 30,000,000 shall be imposed upon the holder of fishing license if total catch exceeds his/her quota limit by 10% to under 20%.

2. A fine ranging from VND 30,000,000 to VND 40,000,000 shall be imposed upon the holder of fishing license if total catch exceeds his/her quota limit by 20% to under 30%.

3. A fine ranging from VND 40,000,000 to VND 50,000,000 shall be imposed upon the holder of fishing license if total catch exceeds his/her quota limit by 30% or more.

4. Additional penalties:

a) The exceeding amount of catches shall be confiscated in case of commission of the violation specified in Clause 1, Clause 2 or Clause 3 of this Article.

b) The fishing license shall be suspended for 06 - 12 months in case of commission of the violation specified in Clause 3 of this Article.

Article 23. Violations against regulations on fishing license

1. A fine ranging from VND 20,000,000 to VND 30,000,000 shall be imposed for commission of one of the following violations:

a) Failing to obtain a fishing license or using an expired one when carrying out fishing operations within the territorial waters of Vietnam by a fishing vessel of from 06 m to under 12 m in length overall;

b) Using a fishing vessel of less than 15 m in length overall for engaging in a fishing occupation other than the one specified in the fishing license.

2. A fine ranging from VND 30,000,000 to VND 50,000,000 shall be imposed for commission of one of the following violations:

a) Failing to obtain a fishing license or using an expired one when carrying out fishing operations within the territorial waters of Vietnam by a fishing vessel of from 12 m to under 15 m in length overall;

b) Using a fishing vessel of $\geq$ 15 m in length overall for engaging in a fishing occupation other than the one specified in the fishing license.

3. A fine ranging from VND 50,000,000 to VND 70,000,000 shall be imposed for repeating one of the following violations:

a) Failing to obtain a fishing license or using an expired one when carrying out fishing operations within the territorial waters of Vietnam with using a fishing vessel of from 12 m to under 15 m in length overall in case of repeated violation;

b) Using a fishing vessel of ≥ 15 m in length overall for engaging in a fishing occupation other than the one specified in the fishing license in case of repeated violation.

4. Additional penalties:

a) Catches shall be confiscated in case of commission of any of the violations specified in Clause 1, Clause 2 and Clause 3 of this Article;

b) Fishing gears shall be confiscated in case of commission of any of the violations specified in Point b Clause 1, Clause 2 and Clause 3 of this Article;

c) The captain's license or certificate of competence to operate fishing vessels shall be suspended for 06 - 12 months in case of commission of any of the violations specified in Clause 2 and Clause 3 of this Article.

Article 24. Violations against regulations on transshipment or facilitating illegal fishing operations

1. A fine ranging from VND 100,000,000 to VND 200,000,000 shall be imposed for using a fishing vessel of less than 24 m in length overall to transship fish caught by other vessels illegally or to facilitate the exploration, search for, trapping or transport of catches of another vessel which is found to carry out illegal fishing, except force majeure events.

2. A fine ranging from VND 200,000,000 to VND 300,000,000 shall be imposed if the violation specified in Clause 1 of this Article is repeated.

3. Additional penalties:

a) The fishing license, the captain's license or certificate of competence to operate fishing vessels shall be suspended for 06 - 12 months in case of commission of the violation specified in Clause 2 of this Article;

b) Fish illegally caught shall be confiscated in case of commission of the violation specified in either Clause 1 or Clause 2 of this Article.

Article 25. Violations against regulations on logbooks and reports on fishing operations, purchase and transshipment

1. A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed for commission of any of the following violations:

a) Failing to submit reports on fishing operations conducted by a fishing vessel of from 06 m to under 12 m in length overall;

b) Incorrect or insufficient recording of fishing operations, purchase or transshipment of catches carried out by a fishing vessel of less than 24 m in length overall.

2. A fine ranging from VND 20,000,000 to VND 30,000,000 shall be imposed for failure to keep, record or submit logbooks of fishing operations, purchase or transshipment of catches conducted by a fishing vessel of less than 24 m in length overall.

3. A fine ranging from VND 40,000,000 to VND 50,000,000 shall be imposed for failure to have logbooks of fishing operations, purchase or transshipment of catches conducted by a fishing vessel of from 15 m to under 24 m in length overall in case of repeated violation.

4. Additional penalties:

The fishing license, the captain's license or certificate of competence to operate fishing vessels shall be suspended for 01 - 03 months in case of commission of the violation specified in Clause 3 of this Article.

Article 26. Violations against regulations on fishing operations carried out by foreign organizations and individuals in territorial waters of Vietnam

1. A fine ranging from VND 50,000,000 to VND 100,000,000 shall be imposed for commission of one of the following violations:

a) Failure to inform a regulatory authority of Vietnam before operating vessels into the territorial waters of Vietnam;

b) Failure to enter the ports specified in the license for fishing operations, except force majeure events;

c) Failure to carry on board all documents required by the law of Vietnam;

d) Failure to have or record or provide sufficient information or submit logbooks of fishing operations, purchase or transshipment of catches or failure to comply with regulations on reporting;

dd) Failure to receive supervisors or failure to disembark them at the prescribed locations or failure to ensure working and living conditions for them as regulated by the law of Vietnam.

2. A fine ranging from VND 100,000,000 to VND 200,000,000 shall be imposed for failure to carry out fishing operations in the licensed zones or engaging in a fishing occupation or scope of activity other than the one specified in the license for fishing operations.

3. A fine ranging from VND 200,000,000 to VND 300,000,000 shall be imposed if the violation specified in Clause 1 or Clause 2 of this Article is repeated.

4. Additional penalties:

a) The license for fishing operations shall be suspended for 03 - 06 months in case of commission of the violation specified in Clause 1 of this Article;

b) The license for fishing operations shall be suspended for 06 - 12 months in case of commission of the violation specified in Clause 2 or Clause 3 of this Article.

Article 27. Violations against regulations on fishing gears

1. A fine ranging from VND 2,000,000 to VND 3,000,000 shall be imposed for illegally discarding fishing gears into natural waters.

2. A fine ranging from VND 3,000,000 to VND 5,000,000 shall be imposed for failure to mark fishing gears or marking of fishing gears against regulations.

3. A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed for the use of fishing gears which obstructs or causes damage to other organizations or individuals carrying out legal fishing operations or anchoring at the place where the fishing gear of another organization or individual is legally placed, except force majeure events.

4. A fine ranging from VND 10,000,000 to VND 20,000,000 shall be imposed for production, trading, transport or storage of fishing gears banned from use in commercial fishing.

5. A fine ranging from VND 20,000,000 to VND 30,000,000 shall be imposed for the performance of commercial fishing by using banned fishing gears if not liable to criminal prosecution.

6. Additional penalties:

a) Fishing gears banned from use in commercial fishing shall be confiscated in case of commission of the violation specified in Clause 4 or Clause 5 of this Article;

b) The fishing license shall be suspended for 03 - 06 months in case of commission of the violation specified in Clause 5 of this Article.

Article 28. Violations against regulations on use of electricity in commercial fishing

1. A fine ranging from VND 3,000,000 to VND 5,000,000 shall be imposed for the use of electrofishing equipment in case of commercial fishing without fishing vessels.

2. A fine ranging from VND 10,000,000 to VND 15,000,000 shall be imposed for storage, transport or trading in electrofishing equipment.

3. The following fines shall be imposed for engaging in commercial fishing by using electrofishing equipment or electric current directly from generators on board fishing vessels:

a) A fine ranging from VND 15,000,000 to VND 20,000,000 shall be imposed for the violation involving a fishing vessel of less than 12 m in length overall;

b) A fine ranging from VND 20,000,000 to VND 30,000,000 shall be imposed for the violation involving a fishing vessel of from 12 m to under 15 m in length overall;

c) A fine ranging from VND 30,000,000 to VND 40,000,000 shall be imposed for the violation involving a fishing vessel of ≥ 15 m in length overall.

4. A fine ranging from VND 40,000,000 to VND 50,000,000 shall be imposed for the performance of commercial fishing by using electricity current (electrofishing nets) if not liable to criminal prosecution.

5. Additional penalties:

a) Electrofishing equipment, generators and fishing gears shall be confiscated in case of commission of any of the violations specified in Clause 1 through 4 of this Article;

b) The fishing license shall be suspended for 03 - 06 months in case of commission of the violation specified in Clause 3 or Clause 4 of this Article.

Article 29. Violations against regulations on storage and use of banned substances, banned and toxic chemicals in commercial fishing

1. A fine ranging from VND 10,000,000 to VND 20,000,000 shall be imposed for storage of banned substances, banned and/or toxic chemicals on board fishing vessels.

2. A fine ranging from VND 50,000,000 to VND 70,000,000 shall be imposed for the performance of commercial fishing by using banned substances, banned chemicals, toxic chemicals or other chemicals if not liable to criminal prosecution.

3. Additional penalties:

a) The fishing license shall be suspended for 03 - 06 months in case of commission of the violation specified in Clause 1 or Clause 2 of this Article;

b) Banned substances, banned chemicals, toxic chemicals, other chemicals and fish caught shall be confiscated in case of commission of the violation specified in either Clause 1 or Clause 2 of this Article.

4. Remedial measures:

The violator is compelled to restore the original condition which is changed by the violation specified in Clause 2 of this Article.

Article 30. Violations against regulations on flying of nationality flags or national flag of the Socialist Republic of Vietnam

1. A fine ranging from VND 2,000,000 to VND 4,000,000 shall be imposed on Vietnamese fishing vessels for failure to fly or improperly flying the national flag of the Socialist Republic of Vietnam.

2. A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed on foreign fishing vessels for failure to fly or improperly flying either the flag of their country of registration or the national flag of the Socialist Republic of Vietnam.

3. Remedial measures:

The violator is compelled to fly the flag of the Socialist Republic of Vietnam or the flag of the ship's country of registration in case of commission of the violation specified in Clause 1 or Clause 2 of this Article.

Section 6. VIOLATIONS AGAINST REGULATIONS ON FISHING VESSELS, FISHING PORTS AND SHELTERED ANCHORAGES

Article 31. Violations against regulations on building and modification of fishing vessels

1. A fine ranging from VND 20,000,000 to VND 30,000,000 shall be imposed for failure to comply with the approved technical designs in case of building or modification of fishing vessels.

2. A fine ranging from VND 30,000,000 to VND 50,000,000 shall be imposed for building or modification of fishing vessels without approved technical designs.

3. A fine ranging from VND 80,000,000 to VND 100,000,000 shall be imposed for building and modification of fishing vessels without Certificate of eligibility to engage in building and modification of fishing vessels as regulated or failure to comply with the Certificate of eligibility to engage in building and modification of fishing vessels.

4. A fine ranging from VND 100,000,000 to VND 200,000,000 shall be imposed for building or modification of fishing vessels without written approval from regulatory authorities.

5. Additional penalties:

The Certificate of eligibility to engage in building and modification of fishing vessels shall be suspended for 01 - 03 months in case of commission of any of the violations specified in Clauses 1, 2 and 3 of this Article.

6. Remedial measures:

The violator is compelled to carry out demolition of fishing vessels in case of commission of the violation specified in Clause 2 or Clause 4 of this Article.

Article 32. Violations against regulations on import of fishing vessels (except fishing vessels donated by foreign governments, organizations or individuals)

1. A fine ranging from VND 50,000,000 to VND 70,000,000 shall be imposed for import of a fishing vessel with technical parameters or characteristics different from those specified in the import license.

2. Remedial measures:

The violator is compelled to re-export fishing vessels in case of commission of the violation specified in Clause 1 of this Article.

Article 33. Violations against regulations on technical safety of fishing vessels

1. A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed for failure to provide safety equipment or insufficient provision of safety equipment when engaging in commercial fishing by using a fishing vessel of less than 12 m in length overall.

2. A fine ranging from VND 10,000,000 to VND 15,000,000 shall be imposed for failure to provide safety equipment or insufficient provision of safety equipment when engaging in commercial fishing by using a fishing vessel of ≥ 12 m in length overall.

3. A fine ranging from VND 15,000,000 to VND 20,000,000 shall be imposed for failure to obtain a Certificate of technical safety of fishing vessel or using an expired one when engaging in commercial fishing by a fishing vessel of ≥ 12 m in length overall.

Article 34. Violations against regulations on surveying of fishing vessels

1. A fine ranging from VND 5,000,000 to VND 7,000,000 shall be imposed for inadequate reporting of surveying of fishing vessels as prescribed.

2. A fine ranging from VND 7,000,000 to VND 10,000,000 shall be imposed for failure to submit reports on surveying of fishing vessels as prescribed.

3. A fine ranging from VND 10,000,000 to VND 15,000,000 shall be imposed for signing or using specialized seal and records against regulations when preparing documents concerning the surveying of fishing vessels and equipment on board fishing vessels.

4. A fine ranging from VND 15,000,000 to VND 20,000,000 shall be imposed for falsifying surveying results or performing surveys inconsistently with national technical regulations on classification and building of ships or carrying out surveying procedures for a fishing vessel without markings as prescribed.

5. A fine ranging from VND 30,000,000 to VND 50,000,000 shall be imposed for commission of one of the following violations:

a) Carrying out surveys of fishing vessels without obtaining a certificate of eligibility to perform surveying of fishing vessels as prescribed;

b) Carrying out inspection of fishing vessels inconsistently with the issued certificate of eligibility to perform surveying of fishing vessels;

c) Failing to maintain the satisfaction of eligibility requirements during the surveying of fishing vessels.

6. Additional penalties:

a) The surveyor card shall be suspended for 03 – 06 months in case of commission of the violation specified in Clause 3 of this Article;

b) The Certificate of eligibility to perform surveying of fishing vessels shall be suspended for 01 - 03 months in case of commission of any of the violations specified in Clause 4 and Points a, b and c Clause 5 of this Article.

Article 35. Violations against regulations on communications equipment and vessel tracking units on board fishing vessels

1. A fine ranging from VND 3,000,000 to VND 5,000,000 shall be imposed for removal of VTUs installed on board a fishing vessel without the supervision of VTU supplier.

2. A fine ranging from VND 20,000,000 to VND 30,000,000 shall be imposed for commission of one of the following violations:

a) Failure to provide communications equipment as prescribed;

b) Failure to maintain the operation of or knowingly disabling VTU installed on board a fishing vessel of from 15 m to under 24 m in length overall during its operations at sea, except force majeure events;

c) Failure to comply with procedures in case of VTU failure, except force majeure events;

d) Failure to report or improper reporting of the installation of VTUs on board a fishing vessel to regulatory authorities for inspection as prescribed;

dd) Failure to use lead seal after installing VTUs on board a fishing vessel as prescribed or failure to send the specimen of lead seal to regulatory authorities as prescribed;

e) Failure to maintain confidentiality of vessel monitoring data as prescribed.

3. A fine ranging from VND 30,000,000 to VND 50,000,000 shall be imposed if any of the violations specified in Clause 1 and Points b, c and d Clause 3 of this Article is repeated.

4. Additional penalties:

The captain's license or certificate of competence to operate fishing vessels shall be suspended for 03 - 06 months in case of commission of the violation specified in Point b Clause 2 or Clause 3 of this Article.

Article 36. Violations against regulations on marking of fishing vessels

1. A fine ranging from VND 3,000,000 to VND 5,000,000 shall be imposed for failure to mark or improper marking of the fishing vessel of from 12 m to under 15 m in length overall.

2. A fine ranging from VND 5,000,000 to VND 7,000,000 shall be imposed for failure to mark or improper marking of the fishing vessel of from 15 m to under 24 m in length overall.

3. A fine ranging from VND 7,000,000 to VND 10,000,000 shall be imposed for failure to mark or improper marking of the fishing vessel of ≥ 24 m in length overall.

Article 37. Violations against regulations on registration of fishing vessels

1. A fine ranging from VND 2,000,000 to VND 3,000,000 shall be imposed for failure to display registration number or displaying registration number on the fishing vessel inconsistently with regulations.

2. A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed for failure to carry out procedures for registration or re-registration of fishing vessel as prescribed.

Article 38. Violations against regulations on crew members and other persons on board fishing vessels

1. A fine ranging from VND 300,000 to VND 500,000 shall be imposed upon a crew member or another person working on board for failure to carry identity papers.

2. A fine ranging from VND 1,000,000 to VND 2,000,000 shall be imposed upon a crew member working on board whose name is not included in the crew book.

3. A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed for commission of one of the following violations:

a) The captain or chief engineer fails to possess qualifications or certifications as prescribed.

b) Failure to have a crew book on board fishing vessel as prescribed.

4. The following fines shall be imposed for failure to buy insurance for crew members working on board a fishing vessel:

a) A fine ranging from VND 5,000,000 to VND 7,000,000 shall be imposed upon the vessel owner for failure to buy insurance for less than 03 crew members working on board the fishing vessel;

b) A fine ranging from VND 7,000,000 to VND 10,000,000 shall be imposed upon the vessel owner for failure to buy insurance for from 03 to under 05 crew members working on board the fishing vessel;

c) A fine ranging from VND 10,000,000 to VND 15,000,000 shall be imposed upon the vessel owner for failure to buy insurance for from 05 to under 10 crew members working on board the fishing vessel;

d) A fine ranging from VND 15,000,000 to VND 20,000,000 shall be imposed upon the vessel owner for failure to buy insurance for 10 crew members or more working on board the fishing vessel.

Article 39. Violations against regulations on fishing ports and sheltered anchorages

1. A fine ranging from VND 2,000,000 to VND 5,000,000 shall be imposed for commission of one of the following violations:

a) Failure to provide notification or provision of inadequate notification of the vessel's arrival at or departure from the fishing port to the port authority.

b) The fishing vessel of ≥ 15 m in length overall enters ports other than designated fishing ports for unloading of their catches;

c) Failure to comply with internal regulations and shifting orders given by the authority of a fishing port or sheltered anchorage.

2. A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed for the use of a fishing vessel or any waterway vehicles as a means to cause damage to the port facility.

3. A fine ranging from VND 10,000,000 to VND 15,000,000 shall be imposed for destruction, removal, alteration or replacement of any equipment and systems of the fishing port.

4. A fine ranging from VND 20,000,000 to VND 30,000,000 shall be imposed for unlawful occupation of land, waters or any facilities of the fishing port.

5. Additional penalties:

Exhibits for committing the violation specified in Clause 3 of this Article shall be confiscated.

6. Remedial measures:

a) The violator is compelled to restore the original condition which is changed by the violation specified in Clause 2 or Clause 3 of this Article;

b) The violator is compelled to return the land area, waters or facilities unlawfully occupied in case of commission of the violation specified in Clause 4 of this Article.

Article 40. Violations against regulations on fishing port management

1. A fine ranging from VND 3,000,000 to VND 5,000,000 shall be imposed for commission of one of the following violations:

a) Failure to collect logbooks of fishing operations, purchase and transshipment of catches, and reports on fishing operations;

b) Failure to promulgate and post the port's internal regulations at the fishing port;

c) Failure to provide working place for regulatory authorities to carry out inspection of compliance with laws at the fishing port;

d) Failure to immediately inform regulatory authorities of illegal fishing vessels;

dd) Failure to supervise total catches unloaded at the port;

e) Operating a fishing port before its opening is announced as prescribed.

2. A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed for failure to certify fish and fishery products unloaded at the port or making certification against regulations on origin of catches unloaded at fishing ports.

3. A fine ranging from VND 40,000,000 to VND 50,000,000 shall be imposed for allowing the unloading of catches of illegal origin at the fishing port.

Section 7. VIOLATIONS AGAINST REGULATIONS ON COLLECTION, PRELIMINARY PROCESSING, PROCESSING, PRESERVATION AND TRANSPORT OF FISH AND FISHERY PRODUCTS

Article 41. Violations against regulations on collection, trading, handling, preliminary processing, processing, preservation and transport of fish and fishery products

1. The following fines shall be imposed for illegal collection, trading, handling, preliminary processing, processing, preservation or transport of endangered, rare and precious aquatic species in Group II or fish, fishery products and parts thereof of unknown origin of endangered, rare and precious species in Appendix II of CITES if not liable to criminal prosecution:

a) A fine ranging from VND 10,000,000 to VND 15,000,000 shall be imposed for the violation involving an amount of fishery products of < 20 kg;

b) A fine ranging from VND 15,000,000 to VND 20,000,000 shall be imposed for the violation involving an amount of fishery products of from 20 kg to under 50 kg;

c) A fine ranging from VND 20,000,000 to VND 30,000,000 shall be imposed for the violation involving an amount of fishery products of from 50 kg to under 100 kg;

d) A fine ranging from VND 30,000,000 to VND 40,000,000 shall be imposed for the violation involving an amount of fishery products of from 100 kg to under 200 kg;

dd) A fine ranging from VND 40,000,000 to VND 50,000,000 shall be imposed for the violation involving an amount of fishery products of from 200 kg to under 500 kg;

e) A fine ranging from VND 50,000,000 to VND 60,000,000 shall be imposed for the violation involving an amount of fishery products of ≥ 500 kg.

2. The following fines shall be imposed for illegal collection, trading, handling, preliminary processing, processing, preservation or transport of fish, fishery products and parts thereof of endangered, rare and precious species in Group I or those of unknown origin of endangered, rare and precious species in Appendix I of CITES if not liable to criminal prosecution:

a) A fine ranging from VND 30,000,000 to VND 40,000,000 shall be imposed for the violation involving an amount of fishery products of < 10 kg;

b) A fine ranging from VND 40,000,000 to VND 50,000,000 shall be imposed for the violation involving an amount of fishery products of from 10 kg to under 20 kg;

c) A fine ranging from VND 50,000,000 to VND 60,000,000 shall be imposed for the violation involving an amount of fishery products of from 20 kg to under 50 kg;

d) A fine ranging from VND 60,000,000 to VND 70,000,000 shall be imposed for the violation involving an amount of fishery products of from 50 kg to under 100 kg;

dd) A fine ranging from VND 70,000,000 to VND 80,000,000 shall be imposed for the violation involving an amount of fishery products of from 100 kg to under 500 kg;

e) A fine ranging from VND 80,000,000 to VND 100.000.000 shall be imposed for the violation involving an amount of fishery products of ≥ 500 kg.

3. A fine ranging from VND 30,000,000 to VND 40,000,000 shall be imposed for collection, trading, preliminary processing, processing, preservation or transport of fishery products of unknown origin.

4. Additional penalties:

Fishery products shall be confiscated in case of commission of the violation specified in Clause 1 or Clause 2 of this Article.

Article 42. Violations against regulations on import, temporary import, re-export and transit of fishery products from illegal, unreported and unregulated (IUU) fishing; export and import of fishery products

1. The following fines shall be imposed for import, temporary import, re-export or transit of fishery products originating from illegal fishing:

a) A fine ranging from VND 50,000,000 to VND 100,000,000 shall be imposed for the shipment of less than 100 kg of fishery products;

b) A fine ranging from VND 100,000,000 to VND 300,000,000 shall be imposed for the shipment of from 100 kg to under 500 kg of fishery products;

c) A fine ranging from VND 300,000,000 to VND 500,000,000 shall be imposed for the shipment of from 500 kg to under 1,000 kg of fishery products;

d) A fine ranging from VND 500,000,000 to VND 800,000,000 shall be imposed for the shipment of from 1,000 kg to under 2,000 kg of fishery products;

dd) A fine ranging from VND 800,000,000 to VND 1,000,000,000 shall be imposed for the shipment of ≥ 2,000 kg of fishery products.

2. The following fines shall be imposed for illegal export of fishery products on the List of aquatic species subject to conditional export when they fail to meet prescribed exporting conditions:

a) A fine ranging from VND 50,000,000 to VND 100,000,000 shall be imposed for the shipment of less than 100 kg of fishery products;

b) A fine ranging from VND 100,000,000 to VND 300,000,000 shall be imposed for the shipment of from 100 kg to under 500 kg of fishery products;

c) A fine ranging from VND 300,000,000 to VND 500,000,000 shall be imposed for the shipment of from 500 kg to under 1,000 kg of fishery products;

d) A fine ranging from VND 500,000,000 to VND 800,000,000 shall be imposed for the shipment of from 1,000 kg to under 2,000 kg of fishery products;

dd) A fine ranging from VND 800,000,000 to VND 1,000,000,000 shall be imposed for the shipment of ≥ 2,000 kg of fishery products.

3. A fine ranging from VND 50,000,000 to VND 60,000,000 shall be imposed for illegal import of aquatic species that are not on the List of aquatic species licensed for sale in Vietnam if not liable to criminal prosecution.

4. Additional penalties:

Fishery product shipments shall be confiscated in case of commission of any of the violations specified in Clause 1, Clause 2 and Clause 3 of this Article.

5. Remedial measures:

The violator is compelled to carry out re-export or repurposing or destruction of fishery products, whichever appropriate, in case of commission of the violation specified in Clause 3 of this Article.

Section 8. OBSTRUCTION OF STATE MANAGEMENT OF FISHERIES

Article 43. Acts of obstructing state management of fisheries

1. A fine ranging from VND 5,000,000 to VND 10,000,000 shall be imposed for obstruction of investigation or exploration of aquatic resources, protection of aquatic resources, or collection or fisheries data collection performed by regulatory authorities.

2. The following fines shall be imposed for failure to bear the inspection of regulatory authorities:

a) A fine ranging from VND 3,000,000 to VND 5,000,000 shall be imposed for failure to bear the inspection of regulatory authorities in respect of aquaculture operations;

b) A fine ranging from VND 15,000,000 to VND 20,000,000 shall be imposed for failure to bear the inspection of regulatory authorities in respect of commercial fishing and protection of aquatic resources.

Article 44. Violations against regulations on certifications, licenses and written approvals and other regulations on fisheries

1. A fine ranging from VND 20,000,000 to VND 30,000,000 shall be imposed for knowingly erasing, altering or falsifying contents of any certifications, licenses or written approvals issued in fisheries sector.

2. A fine ranging from VND 40,000,000 to VND 50,000,000 shall be imposed for commission of one of the following violations:

a) Taking advantage of investigation and assessment of aquatic resources to cause adverse influence on lawful rights and interests of other organizations or individuals;

b) Illegal provision, access or use of data or information about aquatic resources;

3. Additional penalties:

Certifications, licenses or written approvals shall be confiscated or revoked in case of commission of the violation specified in Clause 1 of this Article.

Chapter III

POWER TO RECORD ADMINISTRATIVE VIOLATIONS AND IMPOSE PENALTIES

Article 45. Power to record administrative violations

The persons below are entitled to make records of administrative violations:
1. The officials having the power to impose administrative penalties mentioned in Article 46 through 53 of this Decree.

2. Officials and public employees of people's army or people's police working at regulatory authorities mentioned in Article 47, Article 48 and Article 49 hereof; officials and public employees who are performing their assigned duties and state management tasks in fisheries sector.

Article 46. Power of Chairpersons of people's committees

1. Chairpersons of People's Committees of communes shall have the power to:

a) Impose a fine up to VND 5,000,000;

b) Confiscate the exhibits and instrumentalities of administrative violation worth less than the fine specified in Point a of this Clause;

c) Enforce the remedial measures mentioned in Points a, b, c and dd Clause 1 Article 28 of the Law on penalties for administrative violations.

2. Chairpersons of People's Committees of districts shall have the power to:

a) Impose a fine up to VND 50,000,000;

b) Suspend operations for a fixed period or suspend licenses, certifications or practicing certificates issued by regulatory authorities or institutions;

c) Confiscate the exhibits and instrumentalities of administrative violation worth less than the fine specified in Point a of this Clause;

d) Enforce the remedial measures mentioned in Points a, b, c, dd, e, h and i Clause 1 Article 28 of the Law on penalties for administrative violations and Points a, b, c, d, dd, e, g, k, l and m Clause 3 Article 4 herein.

3. Chairpersons of People's Committees of provinces shall have the power to:

a) Impose a fine up to VND 1,000,000,000;

b) Suspend operations for a fixed period or suspend licenses, certifications or practicing certificates issued by regulatory authorities or institutions;

c) Confiscate the exhibits and instrumentalities of administratvie violations;

d) Enforce the remedial measures mentioned in Clause 1 Article 28 of the Law on penalties for administrative violations and those mentioned in Clause 3 Article 4 herein.

Article 47. Power of people's police force

1. Soldiers on duty of people's police force shall have the power to:

Impose a fine up to VND 500,000.

2. Heads of police stations, and leaders of the soldiers mentioned in Clause 1 of this Article shall have the power to:

Impose a fine up to VND 1,500,000.

3. Heads of commune-level police authorities, heads of police stations, heads of police stations at checkpoints or export processing zones shall have the power to:

a) Impose a fine up to VND 2,500,000;

b) Confiscate the exhibits and instrumentalities of administrative violation worth less than the fine specified in Point a of this Clause;

c) Enforce the remedial measures mentioned in Points a, c and dd Clause 1 Article 28 of the Law on penalties for administrative violations.

4. Heads of district-level police authorities and heads of environmental police departments of provinces shall have the power to:

a) Impose a fine up to VND 25,000,000;

b) Suspend operations for a fixed period or suspend licenses, certifications or practicing certificates issued by regulatory authorities or institutions;

c) Confiscate the exhibits and instrumentalities of administrative violation worth less than the fine specified in Point a of this Clause;

d) Enforce the remedial measures mentioned in Points a, c, dd and k Clause 1 Article 28 of the Law on penalties for administrative violations and Points a, b, c, d, dd, e, g, i, k, l and m Clause 3 Article 4 herein.

5. Directors of Provincial-level Public Security Departments shall have the power to:

a) Impose a fine up to VND 50,000,000;

b) Suspend operations for a fixed period or suspend licenses, certifications or practicing certificates issued by regulatory authorities or institutions;

c) Confiscate the exhibits and instrumentalities of administrative violation worth less than the fine specified in Point a of this Clause;

d) Enforce the remedial measures mentioned in Points a, c, dd and i Clause 1 Article 28 of the Law on penalties for administrative violations and Points a, b, c, d, dd, e, g, i, k, l and m Clause 3 Article 4 herein.

6. Director of the Traffic Police Department shall have the power to:

a) Impose a fine up to VND 1,000,000,000;

b) Suspend operations for a fixed period or suspend licenses, certifications or practicing certificates issued by regulatory authorities or institutions;

c) Confiscate the exhibits and instrumentalities of administratvie violations;

d) Enforce the remedial measures mentioned in Points a, c, dd and i Clause 1 Article 28 of the Law on penalties for administrative violations and in Points a, b and d Clause 3 Article 4 herein.

Article 48. Power of border guard force

1. Soldiers on duty of border guard force shall have the power to:

Impose a fine up to VND 500,000.

2. Heads of border guard stations, and leaders of the soldiers mentioned Clause 1 of this Article shall have the power to:

Impose a fine up to VND 2,500,000.

3. Heads of border-guard posts, commanders of border-guard flotillas, commanders of border-guard sub-zones, and commanders of port border guards shall have the power to:

a) Impose a fine up to VND 25,000,000;

b) Confiscate the exhibits and instrumentalities of administrative violation worth less than the fine specified in Point a of this Clause;

c) Enforce the remedial measures mentioned in Points a, c and dd Clause 1 Article 28 of the Law on penalties for administrative violations and in Points a, b, d and k Clause 3 Article 4 herein.

4. Commanders of provincial-level border guard force and commanders of border guard fleets affiliated to the Border Guard High Command shall have the power to:

a) Impose a fine up to VND 1,000,000,000;

b) Suspend operations for a fixed period or suspend licenses, certifications or practicing certificates issued by regulatory authorities or institutions;

c) Confiscate the exhibits and instrumentalities of administratvie violations;

d) Enforce the remedial measures mentioned in Points a, b, c, d and i Clause 1 Article 28 of the Law on penalties for administrative violations and in Points a, b, d, h, k and l Clause 3 Article 4 herein.

Article 49. Power of coast guard force

1. Coast guard officers on duty shall have the power to:

Impose a fine up to VND 1,500,000.

2. Coastguard team leaders shall have the power to:

Impose a fine up to VND 5,000,000.

3. Coastguard squad leaders and captains of coastguard stations shall have the power to:

a) Impose a fine up to VND 10,000,000;

b) Enforce the remedial measures mentioned in Points a, b and dd Clause 1 Article 28 of the Law on penalties for administrative violations.

4. Commanders of coastguard platoons shall have the power to:

a) Impose a fine up to VND 25,000,000;

b) Confiscate the exhibits and instrumentalities of administrative violation worth less than the fine specified in Point a of this Clause;

c) Enforce the remedial measures mentioned in Points a, c, d and dd Clause 1 Article 28 of the Law on penalties for administrative violations and in Points a, b, d, k and l Clause 3 Article 4 herein.

5. Commanders in chief of coastguard squadrons shall have the power to:

a) Impose a fine up to VND 50,000,000;

b) Confiscate the exhibits and instrumentalities of administrative violation worth less than the fine specified in Point a of this Clause;

c) Enforce the remedial measures mentioned in Points a, c, d and dd Clause 1 Article 28 of the Law on penalties for administrative violations and in Points a, b, d, k and l Clause 3 Article 4 herein.

6. Commanders of regional coastguard command centers shall have the power to:

a) Impose a fine up to VND 100,000,000;

b) Confiscate the exhibits and instrumentalities of administrative violation worth less than the fine specified in Point a of this Clause;

c) Enforce the remedial measures mentioned in Points a, c, d and dd Clause 1 Article 28 of the Law on penalties for administrative violations and in Points a, b, d, k and l Clause 3 Article 4 herein.

7. Commanders of Coastguard Headquaters shall have the power to:

a) Impose a fine up to VND 1,000,000,000;

b) Suspend operations for a fixed period or suspend licenses, certifications or practicing certificates issued by regulatory authorities or institutions;

c) Confiscate the exhibits and instrumentalities of administratvie violations;

d) Enforce the remedial measures mentioned in Points a, b, c, d and dd Clause 1 Article 28 of the Law on penalties for administrative violations and in Points a, b, d, h, k and l Clause 3 Article 4 herein.

Article 50. Power of customs agencies

1. Customs officials on duty shall have the power to:

Impose a fine up to VND 500,000.

2. Team leaders of Customs Branches and team leaders of Post-clearance Audit Branches shall have the power to:

Impose a fine up to VND 5,000,000.

3. Directors of Customs Branches and Post-clearance Audit Branches, leaders of customs enforcement teams affiliated to provincial, inter-provincial or city Customs Departments, leaders of anti-smuggling and control teams, leaders of customs procedure teams, leaders of marine control squads and leaders of intellectual property protection and control teams, affiliated to Anti-smuggling and Investigation Department, Vietnam Customs, shall have the power to:

a) Impose a fine up to VND 25,000,000;

b) Confiscate the exhibits and instrumentalities of administrative violation worth less than the fine specified in Point a of this Clause;

c) Enforce the remedial measures mentioned in Points d, dd, g and i Clause 1 Article 28 of the Law on penalties for administrative violations and in Points dd, e, g and m Clause 3 Article 4 herein.

4. Directors of Anti-smuggling and Investigation Department and Post-clearance Audit Department affiliated to General Department of Customs, and Directors of Customs Departments of provinces shall have the power to:

a) Impose a fine up to VND 50,000,000;

b) Confiscate the exhibits and instrumentalities of administrative violation worth less than the fine specified in Point a of this Clause;

c) Suspend licenses or practicing certificates, or suspend operations for fixed periods;

d) Enforce the remedial measures mentioned in Points d, dd, g and i Clause 1 Article 28 of the Law on penalties for administrative violations and in Points dd, e, g and m Clause 3 Article 4 herein.

5. Director General of General Department of Customs shall have the power to:

a) Impose a fine up to VND 1,000,000,000;

b) Confiscate the exhibits and instrumentalities for committing administratvie violations;

c) Enforce the remedial measures mentioned in Points d, dd, g and i Clause 1 Article 28 of the Law on penalties for administrative violations and in Points dd, e, g and m Clause 3 Article 4 herein.

Article 51. Power of market surveillance force

1. Market controllers on duty shall have the power to:

Impose a fine up to VND 500,000.

2. Leaders of market surveillance teams shall have the power to:

a) Impose a fine up to VND 25,000,000;

b) Confiscate the exhibits and instrumentalities of administrative violation worth less than the fine specified in Point a of this Clause;

c) Enforce the remedial measures mentioned in Points a, dd, e, g and i Clause 1 Article 28 of the Law on penalties for administrative violations and in Points dd, e and g Clause 3 Article 4 herein.

3. Directors of Provincial Market Surveillance Departments and Director of Market Surveillance Operations Department affiliated to Vietnam Directorate of Market Surveillance shall have the power to:

a) Impose a fine up to VND 50,000,000;

b) Suspend operations for a fixed period or suspend licenses, certifications or practicing certificates issued by regulatory authorities or institutions;

c) Confiscate the exhibits and instrumentalities of administrative violation worth less than the fine specified in Point a of this Clause;

d) Enforce the remedial measures mentioned in Points a, c, d, dd, e, g, h and i Clause 1 Article 28 of the Law on penalties for administrative violations and in Points dd, e and g Clause 3 Article 4 herein.

4. Director General of Vietnam Directorate of Market Surveillance shall have the power to:

a) Impose a fine up to VND 1,000,000,000;

b) Suspend operations for a fixed period or suspend licenses, certifications or practicing certificates issued by regulatory authorities or institutions;

c) Confiscate the exhibits and instrumentalities of administratvie violations;

d) Enforce the remedial measures mentioned in Points a, c, d, dd, e, g, h and i Clause 1 Article 28 of the Law on penalties for administrative violations and in Points dd, e and g Clause 3 Article 4 herein.

Article 52. Power of inspecting authorities

1. On-duty inspectors of agriculture and rural development sector and persons who are assigned to conduct specialized inspections of fishery operations, quality control of agricultural products, forest products and aquatic products shall have the power to:

a) Impose a fine up to VND 500,000;

b) Confiscate the exhibits and instrumentalities of administrative violation worth less than the fine specified in Point a of this Clause.

2. Chief Inspectors of Provincial Departments of Agriculture and Rural Development, Directors of Sub-departments of Fisheries performing the function of inspection of fishery operations, quality control of agricultural products, forest products and aquatic products; heads of specialized inspections teams of Directorate of Fisheries, National Agro-Forestry-Fisheries Quality Assurance Department; heads of specialized inspections teams of Provincial Departments of Agriculture and Rural Development; heads of specialized inspections teams of Sub-departments performing the function of inspection of fishery operations, quality control of agricultural products, forest products and aquatic products shall have the power to:

a) Impose a fine up to VND 50,000,000;

b) Suspend operations for a fixed period or suspend licenses, certifications or practicing certificates issued by regulatory authorities or institutions;

c) Confiscate the exhibits and instrumentalities of administrative violation worth less than the fine specified in Point a of this Clause;

d) Enforce the remedial measures mentioned in Clause 1 Article 28 of the Law on penalties for administrative violations and those mentioned in Clause 3 Article 4 herein.

3. Heads of specialized inspection teams in fisheries sector established by the Ministry of Agriculture and Rural Development shall have the power to:

a) Impose a fine up to VND 250,000,000;

b) Suspend operations for a fixed period or suspend licenses, certifications or practicing certificates issued by regulatory authorities or institutions;

c) Confiscate the exhibits and instrumentalities of administrative violation worth less than the fine specified in Point a of this Clause;

d) Enforce the remedial measures mentioned in Clause 1 Article 28 of the Law on penalties for administrative violations and those mentioned in Clause 3 Article 4 herein.

4. The Chief Inspector of Ministry of Agriculture and Rural Development, Director General of Directorate of Fisheries, Director of Department of Animal Health, Director of the National Agro-Forestry-Fisheries Quality Assurance Department (NAFIQAD) shall have the power to:

a) Impose a fine up to VND 1,000,000,000;

b) Suspend operations for a fixed period or suspend licenses, certifications or practicing certificates issued by regulatory authorities or institutions;

c) Confiscate the exhibits and instrumentalities of administratvie violations;

d) Enforce the remedial measures mentioned in Clause 1 Article 28 of the Law on penalties for administrative violations and in Points a, b, c, d, dd, e, g, i, k, l and m Clause 3 Article 4 herein.

Article 53. Power of fisheries resources surveillance force

1. Fisheries resources surveillance officials on duty shall have the power to:

a) Impose a fine up to VND 500,000;

b) Confiscate the exhibits and instrumentalities of administrative violation worth less than the fine specified in Point a of this Clause;

2. Heads of fisheries resources surveillance stations affiliated to regional sub-departments of fisheries resources surveillance shall have the power to:

a) Impose a fine up to VND 10,000,000;

b) Confiscate the exhibits and instrumentalities of administrative violation worth less than the fine specified in Point a of this Clause;

c) Enforce the remedial measures mentioned in Points a, b and i Clause 1 Article 28 of the Law on penalties for administrative violations and in Points a, b, d, k and l Clause 3 Article 4 herein.

3. Directors of regional sub-departments of fisheries resources surveillance shall have the power to:

a) Impose a fine up to VND 100,000,000;

b) Confiscate the exhibits and instrumentalities of administrative violation worth less than the fine specified in Point a of this Clause;

c) Enforce the remedial measures mentioned in Points a, b, d and i Clause 1 Article 28 of the Law on penalties for administrative violations and in Points a, b, d, k and l Clause 3 Article 4 herein.

4. Director of Department of fisheries resource surveillance shall have the power to:

a) Impose a fine up to VND 1,000,000,000;

b) Suspend operations for a fixed period or suspend licenses, certifications or practicing certificates issued by regulatory authorities or institutions;

c) Confiscate the exhibits and instrumentalities for committing administrative violation worth less than the fine specified in Point a of this Clause;

d) Enforce the remedial measures mentioned in Points a, b and i Clause 1 Article 28 of the Law on penalties for administrative violations and in Points a, b, d, k and l Clause 3 Article 4 herein.

Article 54. Delegation of power to impose penalties

1. Director General of Directorate of Fisheries and Chairpersons of Provincial People's Committees shall have the power to impose penalties for the administrative violations specified in Article 6 through 44 hereof.

2. Power to impose penalties of Chairpersons of people’s committees of communes and of districts:

a) Chairpersons of people’s committees of communes shall have the power to impose penalties for the administrative violations specified in Clauses 1, 2 Article 19, Clause 1 Article 27, Clause 1 Article 28, Clause 1 Article 30, Clause 1 Article 35, Clause 1 Article 36, Clause 1 Article 37, Clause 1 and Clause 2 Article 38, Clause 1 Article 39, Clause 1 Article 40 and Point a Clause 2 Article 43 hereof;

b) Chairpersons of people’s committees of districts shall have the power to impose penalties for the administrative violations specified in Clause 1 Article 6, Clause 1 Article 7, Clauses 1, 2 and Points a, b Clause 3 Article 8, Article 12 through 19, Article 21, Clauses 1, 2 Article 23, Article 25, Article 27, Article 28, Clause 1 Article 29, Article 30, Article 33, Article 35 through 40, Points a, b, c, d and dd Clause 1 and Points a, b Clause 2, Clause 3 Article 41, Article 43 and Article 44 hereof.

3. Power to impose penalties of people’s police force:

a) Soldiers on duty of people’s police force shall have the power to impose penalties for the administrative violations specified in Clause 1 Article 38 hereof;

b) Heads of police stations, and leaders of the soldiers of people’s police force shall have the power to impose penalties for the administrative violations specified in Clauses 1, 2 Article 38 hereof;

c) Heads of commune-level police authorities and heads of police stations shall have the power to impose penalties for the administrative violations specified in Clauses 1 and 2 Article 19, Clause 1 Article 37 and Clauses 1, 2 Article 38 hereof;

d) Heads of district-level police authorities shall have the power to impose penalties for the administrative violations specified in Point a Clause 1 Article 6, Points a, b Clause 1 Article 7, Clause 1 and Points a, b and c Clause 2 Article 8, Clauses 1, 2 Article 10, Article 12, Article 13, Clause 1 Article 14, Clauses 1, 2 Article 15, Article 17, Article 19, Clauses 1, 2, 3 and 4 Article 21, Clause 1 Article 23, Clauses 1, 2 Article 25, Article 27, Clauses 1, 2 and Points a, b Clause 3 Article 28, Clause 1 Article 29, Article 30, Article 33, Clauses 1, 2 Article 35, Article 36 through 39, Clauses 1, 2 Article 40, Points a, b and c Clause 1 Article 41, Article 43 and Clause 1 Article 44 hereof;

dd) Heads of environmental police departments of provinces shall have the power to impose penalties for the administrative violations specified in Point a Clause 1 Article 6 hereof;

e) Directors of Provincial-level Public Security Departments shall have the power to impose penalties for the administrative violations specified in Point a Clause 1 Article 6, Clause 1 Article 7, Clauses 1, 2 and Points a, b Clause 3 Article 8, Article 10, Article 12 through 19, Clause 1 through 5 Article 21, Clauses 1, 2 Article 23, Article 25, Article 27, Article 28, Clause 1 Article 29, Article 30, Article 33, Article 35 through 40, Points a, b, c, d and dd Clause 1, Points a, b Clause 2 Article 41, Article 43 and Article 44 hereof;

g) Director of Traffic Police Department shall have the power to impose penalties for the administrative violations specified in Article 6, Point a Clause 1 Article 7, Clause 1 Article 21, Clause 1 Article 23, Article 28, Article 29, Clause 1 Article 33, Article 41, Article 43, Clause 1 Article 44 hereof.

4. Power to impose penalties of border guard force:

a) Soldiers on duty of border guard force shall have the power to impose penalties for the administrative violations specified in Clause 1 Article 38 hereof;

b) Heads of border guard stations, and leaders of the soldiers of border guard force shall have the power to impose penalties for the administrative violations specified in Clause 1 Article 27, Clause 1 Article 37, Clauses 1, 2 Article 38 hereof;

c) Heads of border-guard posts, commanders of border-guard flotillas, commanders of border-guard sub-zones shall have the power to impose penalties for the administrative violations specified in Point a Clause 1 Article 6, Points a, b Clause 1 Article 7, Points a, b and c Clause 2 Article 8, Clauses 1, 2, 3 and 4 Article 21, Clause 1 Article 23, Article 27, Clauses 1, 2 and Points a, b Clause 3 Article 28, Clause 1 Article 29, Article 30, Article 33, Clauses 1, 2 and Clause 3 Article 35, Article 36, Article 37, Article 38, Article 43 and Clause 1 Article 44 hereof;

d) Commanders of provincial-level border guard force and commanders of border guard fleets affiliated to the Border Guard High Command shall have the power to impose penalties for the

administrative violations specified in Article 6 through 8, Article 21, Article 23 through 30, Article 33, Article 35 through 38, Clause 1 and Point b Clause 2 Article 43 and Clause 1 Article 44 hereof.

5. Power to impose penalties of coast guard force:

a) Coast guard officers on duty shall have the power to impose penalties for the administrative violations specified in Clauses 1, 2 Article 38 hereof;

b) Coastguard team leaders shall have the power to impose penalties for the administrative violations specified in Clause 1 Article 27, Clause 1 Article 30, Clause 1 Article 37, Clauses 1, 2 Article 38 hereof;

c) Coastguard squad leaders and captains of coastguard stations shall have the power to impose penalties for the administrative violations specified in Point a Clause 1 Article 6, Points a, b Clause 2 Article 8, Clause 1 Article 21, Clause 1 Article 25, Clauses 1, 2, 3 Article 27, Clause 1 Article 28, Article 30, Clause 1 Article 33, Clause 1 Article 35, Article 36, Article 37, Clauses 1, 2, 3 and Points a, b Clause 4 Article 38 and Clause 1 Article 43 hereof;

d) Commanders of coastguard platoons shall have the power to impose penalties for the administrative violations specified in Point a Clause 1 Article 6, Points a, b Clause 1 Article 7, Clause 1, Points a, b, c Clause 2 Article 8, Clauses 1, 2 Article 25, Article 27, Clauses 1, 2 and Points a, b Clause 3 Article 28, Clause 1 Article 29, Article 30, Article 33, Clauses 1, 2 Article 35, Article 36, Article 37, Article 38, Points a, b Clause 1 Article 41, Clause 1 and Point b Clause 2 Article 43 and Clause 1 Article 44 hereof;

dd) Commanders in chief of coastguard squadrons shall have the power to impose penalties for the administrative violations specified in Point a Clause 1 Article 6, Clause 1 Article 7, Clauses 1, 2, Points a, b Clause 3 Article 8, Clause 1 through 5 Article 21, Clauses 1, 2 Article 23, Article 25, Article 27, Article 28, Clause 1 Article 29, Article 30, Article 33, Article 35 through 38, Points a, b Clause 1 Article 41, Clause 1 and Point b Clause 2 Article 43, Clause 1 Article 44 hereof;

e) Commanders of regional coastguard command centers shall have the power to impose penalties for the administrative violations specified in Points a, b Clause 1 Article 6, Article 7, Article 8, Clause 1 Article 9, Article 21, Article 23, Article 25, Clause 1 Article 26, Article 27 through 30, Article 33, Article 35 through 39, Article 41, Clause 1 and Point b Clause 2 Article 43 and Clause 1 Article 44 hereof;

g) Commanders of Coastguard Headquaters shall have the power to impose penalties for the administrative violations specified in Article 6 through 9, Article 21, Article 23 through 30, Article 33, Article 35 through 39, Article 41, Clause 1 and Point b Clause 2 Article 43 and Clause 1 Article 44 hereof.

6. Power to impose penalties of customs agencies:

a) Directors of Customs Branches and Post-clearance Audit Branches, leaders of customs enforcement teams affiliated to provincial, inter-provincial or city Customs Departments, leaders of anti-smuggling and control teams, leaders of customs procedure teams, leaders of marine control squads and leaders of intellectual property protection and control teams, affiliated to Anti-smuggling and Investigation Department, Vietnam Customs, shall have the power to impose penalties for the administrative violations specified in Clause 1 Article 44 hereof;

b) Directors of Anti-smuggling and Investigation Department and Post-clearance Audit Department affiliated to General Department of Customs, and Directors of Customs Departments of provinces shall have the power to impose penalties for the administrative violations specified in Clause 3 Article 15, Article 18 and Clause 1 Article 44 hereof;

c) Director General of General Department of Customs shall have the power to impose penalties for the administrative violations specified in Article 11, Clause 3 Article 15, Article 18, Article 32, Article 42 and Clause 1 Article 44 hereof.

7. Power to impose penalties of market surveillance force:

a) Leaders of market surveillance teams shall have the power to impose penalties for the administrative violations specified in Article 12, Article 13, Clause 1 Article 14, Clause 3 Article 19, Points a, b, c Clause 1 Article 41 and Clause 1 Article 44 hereof;

b) Directors of Provincial Market Surveillance Departments and Director of Market Surveillance Operations Department affiliated to Vietnam Directorate of Market Surveillance shall have the power to impose penalties for the administrative violations specified in Article 11, Clause 1 Article 14, Clause 2 Article 15, Clause 1 Article 18, Clause 3 Article 19 and Clause 1 Article 44 hereof;

c) Director General of Vietnam Directorate of Market Surveillance shall have the power to impose penalties for the administrative violations specified in Article 11, Clause 1 Article 14, Clauses 2 and 3 Article 15, Article 18, Clause 3 Article 19, Article 32, Article 41, Article 42 and Clause 1 Article 44 hereof.

8. Power to impose administrative penalties of inspecting authorities:

a) Inspectors of agriculture and rural development sector and persons who are assigned to conduct specialized inspections of fishery operations shall have the power to impose penalties for the administrative violations specified in Clause 1 Article 38 hereof;

b) Chief Inspectors of Provincial Departments of Agriculture and Rural Development, heads of specialized inspections teams of Provincial Departments of Agriculture and Rural Development, Directors of Sub-departments of Fisheries performing the function of inspection of fishery operations, heads of specialized inspections teams of Sub-departments performing the function of inspection of fishery operations, and heads of specialized inspections teams of Directorate of Fisheries shall have the power to impose penalties for the administrative violations specified in Clause 1 Article 6, Clause 1 Article 7, Clauses 1, 2, Points a, b Clause 3 Article 8, Article 10,

Article 12 through 19, Clause 1 through 5 Article 21, Article 22, Clauses 1, 2 Article 23, Article 25, Article 27, Article 28, Clause 1 Article 29, Article 30, Clauses 1, 2 Article 31, Article 33 through 40, Points a, b, c, d and dd Clause 1, Points a, b Clause 2, Clause 3 Article 41, Article 43 and Article 44 hereof;

c) Directors of Branches of National Agro-Forestry-Fisheries Quality Assurance Department (NAFIQAD), heads of specialized inspections teams of NAFIQAD, heads of specialized inspections teams of Sub-departments performing the function of inspection of quality of agricultural products, forest products and aquatic products shall have the power to impose penalties for the administrative violations specified in Points a, b, c, d, dd Clause 1 and Points a, b Clause 2 Article 41 and Clause 1 Article 44 hereof;

d) Heads of specialized inspection teams in fisheries sector established by the Ministry of Agriculture and Rural Development shall have the power to impose penalties for the administrative violations specified in Article 8, Article 10 through 19, Article 31 through 41, Points a, b Clause 1, Points a, b Clause 2, Clause 3 Article 42, Article 43 and Article 44 hereof;

dd) Chief Inspector of Ministry of Agriculture and Rural Development shall have the power to impose penalties for the administrative violations specified in Article 8, Article 10 through 19, Article 21 through 23, Article 32 through 44 hereof;

e) Director of the National Agro-Forestry-Fisheries Quality Assurance Department (NAFIQAD) shall have the power to impose penalties for the administrative violations specified in Article 41, Article 42 and Clause 1 Article 44 hereof;

g) Director of Department of Animal Health shall have the power to impose penalties for the administrative violations specified in Article 42 and Clause 1 Article 44 hereof.

9. Power to impose administrative penalties of fisheries surveillance force:

a) Fisheries resources surveillance officials shall have the power to impose penalties for the administrative violations specified in Clause 1 Article 38 hereof;

b) Heads of fisheries resources surveillance stations affiliated to regional sub-departments of fisheries resources surveillance shall have the power to impose penalties for the administrative violations specified in Point a Clause 1 Article 6, Points a, b Clause 2 Article 8, Clause 1 Article 21, Clause 1 Article 25, Clauses 1, 2 and 3 Article 27, Clause 1 Article 28, Clauses 1, 2 Article 30, Clause 1 Article 33, Clause 1 Article 35, Article 36, Article 37, Clauses 1, 2, 3 and Points a, b Clause 4 Article 38, Clauses 1, 2 Article 39, Clauses 1, 2 Article 40 and Clause 1, Point a Clause 2 Article 43 hereof;

c) Directors of regional sub-departments of fisheries resources surveillance shall have the power to impose penalties for the administrative violations specified in Points a, b Clause 1 Article 6, Article 7, Article 8, Clauses 1, 2 Article 9, Article 21, Article 23, Article 25, Clause 1 Article 26, Article 27 through 30, Article 33, Article 35 through 41, Clause 1, Point a Clause 2 Article 43 and Clause 1 Article 44 hereof;

d) Director of Department of fisheries resource surveillance shall have the power to impose penalties for the administrative violations specified in Article 6 through 9, Article 21, Article 23 through 30, Article 33, Article 35 through 39, Article 41, Clause 1 and Point b Clause 2 Article 43 and Clause 1 Article 44 hereof.

Article 55. Implementation of preventive measures and enforcement of administrative penalties

1. In cases where only fine is imposed upon the violator, the person authorized to impose penalties for administrative violations against regulations on fisheries is entitled o impound waterway vehicle-related documents and/or professional certificates until the decision on penalty implementation is implemented. If the abovementioned documents are not available, the person authorized to impose penalties is entitled to request the violator to operate the waterway vehicle to shore or to the office of his/her working authority for handling or impound the exhibits and/or instrumentalities within his/her competence.

In case the additional penalty which is confiscation of exhibits/instrumentalities of the violation is imposed for an administrative violation as regulated in this Decree, the person authorized to impose penalties is entitled to request the violator to operate the waterway vehicle to shore or to the office of his/her working authority for handling or impound the waterway vehicle within his/her competence.

2. The implementation of preventive measures and enforcement of administrative penalties shall comply with the authority and procedures specified in the Law on penalties for administrative violations.

Chapter IV

IMPLEMENTATION PROVISIONS

Article 56. Effect

1. This Decree comes into force from July 05, 2019 and supersedes the Government's Decree No. 103/2013/ND-CP dated September 12, 2013.

2. The phrase "thủy sản nuôi" ("cultured aquatic species") is added after the phrase "vật nuôi" ("domestic animals") in Point a Clause 6 Article 17, Clause 5 Article 18, Clause 6 Article 19 and Clause 9 Article 20 of the Government's Decree No. 119/2017/ND-CP dated November 01, 2017.

3. This Decree abrogates the following:

a) Regulations on aquatic breeds, aquatic feeds and aqua environmental remediation products in the Government's Decree No. 64/2018/ND-CP dated May 07, 2018;

b) Regulations on fishery operations in the Government's Decree No. 41/2017/ND-CP dated April 05, 2017.

Article 57. Transition

1. Violations against regulations on fisheries committed before this Decree takes effect and discovered afterwards or under consideration shall be handled in accordance with regulations that are advantageous to the organizations and individuals at fault.

2. In case where a violator files a complaint against a decision on penalty imposition which is issued or implemented before this Decree takes effect, regulations of the Government's Decree No. 103/2013/ND-CP dated September 12, 2013, the Government's Decree No. 41/2017/ND-CP dated April 05, 2017 and the Government's Decree No. 64/2018/ND-CP dated May 07, 2018 shall apply.

3. In case an administrative violation against regulations on fisheries is discovered after the effective date of this Decree and subject to the transition clause specified in the Law on fisheries or its instructional documents, regulations of the Government's Decree No. 103/2013/ND-CP dated September 12, 2013, the Government's Decree No. 41/2017/ND-CP dated April 05, 2017 and the Government's Decree No. 64/2018/ND-CP dated May 07, 2018 shall apply until the transition clause expires.

Article 58. Responsibility for guidance and implementation

1. The Minister of Agriculture and Rural Development shall instruct, organize and inspect the implementation of this Decree.

2. Ministers, heads of ministerial agencies, heads of Governmental agencies and Chairpersons of People's Committees of provinces shall be responsible for the implementation of this Decree./.

ON BEHALF OF THE GOVERNMENT
THE PRIME MINISTER

Nguyen Xuan Phuc

Country – VIET NAM
Original language – English

Non-detriment finding for Tree Fern- Cyathea spp. in Viet Nam

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Date Report: 25June , 2019

I. Background information on the taxa

1. Biological data

1.1-Scientific and common names

Scientific names: Both species *Cyathea gigantea* (Wall. ex Hook.) Holtt. and *Cyathea contaminans* (Hook.) Copel belongs to CYATHEACEAE

Comon names: Tree fern, Dương xỉ mộc, RángTiên tọa bẩn. Ráng Tiên tọa khổng lồ (for *Cyathe gigantea* and *C. contaminans*); Blue tree fern (Engl.),Giant fern (Engl.) Mountain tree fern (Engl.), Bong reng, Ngepi (India), Pakothiang, Pakopohon (Indonesia), Pakugajah, Pakugajahgunung (Malaysia), Hua ai pet (Thailand) for *Cyathea contaminans*

Distribution

Cyathea comprises 600-650 species and is distributed in the warmer parts of the world, including the tropics and subtropics, but not in the north-temperate zone or in dry areas. The greatest variety is found on tropical mountains. In South-East Asia about 200 *Cyathea* species are known. *C. amboinensis* is a native of Indonesia (Sulawesi, Moluccas). *C. contaminans* occurs naturally from northern India throughout South-East Asia. *C. junghuhniana* is confined to Indonesia (Sumatra, Java). *C. lurida* occurs in Indonesia (Sumatra, Java), Peninsular Malaysia and the Philippines. *C. moluccana* occurs naturally in Malaysia (Peninsular Malaysia, Sarawak, Sabah), Brunei and Indonesia (Sumatra, Kalimantan, Sulawesi, Moluccas). Numerous species are also cultivated as ornamentals (Winter de. W.P. & V.B. Amoroso, 2003). In Vietnam, 7 native species are recorgnized (Pham Hoang Ho, 1999).Among of them two *Cyathea gigantea* and *Cyathea contaminans* can be harvested for orchid media.

Cyathea gigantea is mainly distributed in the tropical and subtropical regions of Asia including northeastern to southern India, Sri Lanka, Nepal to Myanmar, Thailand, Laos, Vietnam, the Malay Peninsula, as well as central Sumatra and western Java. It grows in moist open areas at an altitude of 600–1000 m.

In Vietnam, this plant is widely distributed unevenly in mountainous provinces, including Hoa Binh: Đa Bac district (dist.): (Phu Canh Nature Preserve (NR..);Tan Lac and Lac Sondist.(Ngoc Son - Ngo Luong NR..); Lào Cai: Van Ban dist. (Hoang Lien – Van Ban NR..); Ha Giang: Hoang Su Phi dist. (Chieu Lau Thi mountain, Tay Con Linh NR..); Bac Me dist. (Phieng Luong Commune); Quản Bạ dist. (Tung Vai commune); Yen Bai:Tram Tau, and Mu Cang Chai dist.;Cao Bang: Nguyên Bình dist. (Phia Oăc National Park); Tuyen Quang: Na Hang, Yen Son and Chiem Hoa dist.; Phu Tho: Thanh Son, Tam Son dist. (Xuan Son NP.; Vinh Phuc (Tam Dao NP..); Lạng Sơn: Loc Binh (Mau Son mountain); Hà Nội (Ba Vi NP.);Quàng Trị; Lam Đong (Bi Dup – Nui Ba NP.), …

Cyathea contaminans N India and Malesia including NE India, Malaysia, Thailand, Laos, Campuchia, Vietnam, Papua New Guinea,Philippine, Trung Quốc.

In Viet Nam, this plant is widely distributed unevenly in mountainous provinces, including Đak Nong: Dak Song dist., Gia Lai: Kbang dist. (Kon Cho Rang NR..); Kon Tum:Kon Plong, Tu Mo Rong and Dak Glei dist. (Ngoc Linh NR..); Quang Nam:Phuoc Son and Nam Tra My dist. (Ngoc Linh moutain);Quảngtrị: Đa Krong and Huong Hoa dist. (Bac Huong Hoa NR..); Đa Nang: Hoa Vang dist. (Ba Na – Nui Chua and Son Tra NR..); Phu Yen, Khanh Hoa (Hon Ba NR..), …

1.1 Biological characteristics

1.1.1 Provide a summary of general biological and life history characteristics of the species (e.g. reproduction, recruitment, survival rate, migration, sex ratio, regeneration or reproductive strategies, tolerance toward humans)

1.1.2 Cyathea spp. Large to very large tree ferns with small to tall, slender to robust caudex; caudex usually erect, seldom climbing or prostrate, from less than 5 cm up to 15(-20) m tall, 2-24 cm in diameter, the apex covered with scales, the surface often bearing a cover of densely matted adventitious roots and prominent leaf scars. Leaves forming a rosette at the top of the stem, essentially monomorphous, pinnately compound; petiole stout

C*yathea contaminans* . Caudex 5-15 m tall and 10-15 cm in diameter, upper part densely covered with scales of the remaining petiole-bases (*only in old trees do leaf scars become visible*), much thickened by adventitious roots at base. Petiole up to 1 m long, stout, usually strongly spiny, glaucous, purplish towards the scaly base; scales up to 4.5 cm × 3 mm, very thin, pale brown, with dark setae at margin; lamina 1-2 m × 1-1.5 m, green above, glaucous-green beneath, 2-3-pinnate; pinnae up to 80 cm × 30 cm, pinnules about 2.5 cm apart, lanceolate, up to 15 cm × 3 cm but usually smaller, deeply lobed almost to costa, segments oblique, falcate, up to 1.5 cm × 4.5 mm, 5-6 mm

apart, crenate at margin. Sori globose, near costules in a double row on the underside of pinnules in older leaves, brown, lacking indusia; paraphyses pale, not longer than the sporangia. *C. contaminans* is easily recognized by the glaucous, purplish and thorny stipe bases. (Fig. 1 &2)

Fig. 1 & 2 –*Cyathea contaminans*

Cyathea gigantea The trunk of this species is erect and may be as tall as 5 m or more. Fronds are bi- or tripinnate and usually 2–3 m long. The rachis is long, dark to black in colouration and rough in appearance after the fall of scales. These scales are dark brown, glossy and have a narrow paler margin and fragile edges. Sori are round and indusia absent.(Fig. 3& 4)

Fig. 3 & 4 –*Cyathea gigantea*

1.1.3 Habitat types.

Cyathea gigantea and C*yathea contaminans* are common in rather open locations at 200-1600 m altitude of Semi-evergreen annd evergreen forests. often abundant in forest edges along roads; it needs sun on its crown and moisture at its roots The species can be found in valleys, forest edges, along stream-banks together with other plants. It adapts to warm and humid climatic conditions.

1.1.4 Role of the species in its ecosystem

When *Cyathea spp.* forms a very dense population or dominates in community, it plays an important role in covering free land, beauty landscaping, preventing the erosion and keeping the humidity of the soil..

1.2 Population

1.2.1 Global Population size (Population size may be estimated by reference to population density, having due regard to habitat type and other methodological considerations, or simply inferred from anecdotic data)

1.2.2 In Vietnam, *Cyathea gigantea* and C*yathea. contaminans* are distributed scatteredtly in the at least 19 mountainous provinces (Hoa Binh, Lao Cai, Ha Giang, Yen Bai, Cao Bang, Tuyen Quang,Phu Tho,,Vinh Phuc, Lạng Sơn, Ha Noi (Ba Vi), Quang Trị, Lam Đong, Đak Nong, Gia Lai, Kon Tum, Quang Nam, Đa Nang,Phu Yen, Khanh Hoa). But there is no data about the population size of this species. In addition, there is no information on this species in India, Nepal ,Myanma, Thailand, Laos, Philippines, Malaysia and Indonesia. Sri Lanka, Papua New Guinea, China.

1.2.3 Current global population trends for***Cyathea gigantea*** **and C*yathea contaminans***

___increasing ___√_decreasing ____ stable
____unknown

1.3 Conservation status

1.3.1 Global conservation status(according to IUCN Red List)

___Critically endangered
___Endangered
___Vulnerable
___Near Threatened
_√__Least concern (*for C. contaminans*)
_√__ Data deficient (*for C. gigantea)*

Least Concern (LC). Although *Cyathea* species are often exploited for the horticultural industry (mainly for their trunks as a base for epiphytic orchids Fibrous trunk used for orchid media.) this species is widespread and not noticeably being adversely impacted. Monitoring is necessary.

1.3.2 National conservation status for the case study country

2007: Red Data Book of Viet Nam (2007)

Status: NE (NotEvalution)

Main threats: - Habitat loss / Degradation

- Harvesting

Present: Althrough both these species is curently not included in Red Data Book of Viet Nam (2007),but in 2019, they had been quoted in Appendix IIA of the Government DecreeNo.06/2019/ND-CP dated January 22, 2019 on management of endangered, rare and precious species of forest fauna and flora and observation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora..

Cyathea spp. are not in danger of extinction but at the risk of extinction without rigid management and restriction from exploitation or use for commercial purposes, and species listed in Appendix II to CITES that are naturally distributed in Vietnam

1.3.3 Main threats within the case study country

___No Threats

_√_Habitat Loss/Degradation (human induced)

___Invasive alien species (directly affecting the species)

_√_Harvesting [hunting/gathering]

___Accidental mortality (e.g. By catch)

___Persecution (e.g. Pest control)

___Pollution (affecting habitat and/or species)

___Other_____

___Unknown

2. Species management within the country for which case study is being presented

2.1 Management measures

2.1.1 Management history

Before 2019, All *Cyatheaspp*. were not quoted in either in the Red Data Book of Viet Nam (Part II – Plant) as an officially protected plant or in the Government Decree 32/2006/ND-CPDated 30th March 2006 on Management of Endangered, Precious, and rare Species of WildPlants and Animals. However, in 2019, all tree fern- *Cyathea spp*. species had been quoted in

Appendix IIA of the Government Decree No.06/2019/ND-CP dated January 22, 2019 on management of endangered, rare and precious species of forest fauna and flora and observation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora.(Appendix IIA stipulated: *Forest animals and plants not in danger of extinction but at the risk of extinction without rigid management and restriction from exploitation or use for commercial purposes, and species listed in Appendix II to CITES that are naturally distributed in Vietnam*)

2.1.2 Purpose of the management plan in place

To achieve sustainable use of the natural resources of these species, and to ensure that the export will not be detrimental to the survival of this species in Viet Nam.

2.1.3 General elements of the management plan

Constrain the annual export from Viet Nam, as well as domestic use by Fibrous trunk used for orchid media.

2.1.4 Restoration or alleviation measures

In National Park and Nature Reserve, watershed, protected forest collecting of *Cyathea* is prohibited. In addition, collection permit must be obtained from Forestry branch or local authorityin province prior to collecting plant from the wild.

2.1.Monitoring system

2.1.1. Methods used to monitor harvest ---- No.

2.1.2. Confidence in the use of monitoring ---- No.

2.2 Legal framework and law enforcement (Provide details of national and international legislation relating to the conservation of the species)

Cyathea was included in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1975, which means that no export is allowed (except for spores and seedling or tissue cultures obtained in vitro) without prior permit issued by the CITES committee.

In the past, Vietnam not exported fern stems to abroad.Fern stems exploited using for national purpose only. At present the trade is better controlled because a special CITES export permit is needed.

According to our survey in Vietnam from 05/05/2019 to 12/06/2019 in provinces of Northern Vietnam: Hoa Binh (Da Bac distr.); Son La (Moc Chau, Thuan Chau, Mai Sơn, Quynh Nhai distr.); Đien Bien (Tuan Giao, Muong Ang and Tua Chua distr.); Lai Chau (Phong Tho, Tam Duong,Than Uyen distr.); Lào Cai (Van Ban distr.); Yen Bai (Mu Cang Chai, Van Chan, Nghia Lo,Trạm Tau distr.); Ha Giang (Quan Ba, Yen Minh, Bac Me, Hoang Su Phi distr.); Cao Bang (Bao Lam, Bao Lac, Nguyen Binh distr.); Bac Kạn (Ngan Son, Na Ri

distr.); Tuyen Quang (Na Hang, ChiemHoa distr.); Thai Nguyen (Phu Luong distr.); Lạng Sơn (Bac Son, LocBinh distr.); Bac Giang (Son Dong distr.). And some provincesin Southern Vietnam: Dak Nong (Dak Song), Đak Lak (Krong Bong, Buon Ho, Ea Hleo distr.); Gia Lai (Kbang distr.); Kon Tum (Kon Plong, Tu Mo Rong, Dak Gley distr.); Quang Nam (Phuoc Son, Tay Giang, Dai Loc distr.); Đa Nang (HoaVang, Son Tra).

In North Vietnam, Tree fern- *Cyathea gigantea* and *Cyathea contaminans* larg distributed in 20 provinces and city as: Hoa Binh,Son La, Đien Bien,Lai Chau, Lao Cai, Yen Bai, Ha Giang, Cao Bang,Bac Kan, Tuyen Quang, Thai Nguyen, Lang Son, Bac Giang, Lam Dong, Dak Nong, Dak Lak, Gia Lai, Kon Tum, Quang Nam and Đa Nang. Particularly in Protected area, watershed forest.

Two family and companies (Mr. Hoang Chi Cong- San Thang commune on Lai Chau city and Company Ha Que at Km 4 Ha Yen, Ha Giang City.) received permit fromlocal People authority Committee to exploit non-timber forest products (including tree fern). Quantity of exploitation averaged **200- 300** tones per year. In Southern Vietnam, populations of Tree fern - *Cyathea* had been exploited for domestic trade market only.

3. Utilization and trade for range State for which case study is being presented

3.1 Type of use (origin) and destinations (purposes) (e.g. commercial, medicinal, subsistence hunting, sport hunting, trophies, pet, food). Specify the types and extent of all known uses of the species. Indicate the extent to which utilization is from captive-bred, artificially propagated, or wild specimens.

Young leaves of most tree ferns – *Cyathea spp*. are edible. Tree ferns are grown in gardens as ornamentals and *C. contaminans* is the largest and most handsome one but many other species are also attractive. The fibrous root-encrusted trunks of tree ferns are a source of fern-fibre. The trunks with larger amounts of fibre are cut down, planted upside down in decorative gardens (mostly in the urban areas) or used as a substrate for certain types of epiphytic ferns and orchids. Often the fibre is cut off in slabs and used for a similar purpose. Crushed fibre is also used as a growing medium, pure or in mixtures with other material. The mass of adventitious roots at the base of the trunk of several species has a pot-like shape and is often used for potting orchids. In some countries a regular industry has been established around the supply of tree fern fibre to horticulturists.In Viet Nam Fibrous trunk of *Cyathea gigantea* and *C. contaminans*used for orchid media.

3.2 Harvest

3.2.1 Harvesting regime (extractive versus non extractive harvesting, demographic segment harvested, harvesting effort, harvesting method, harvest season)

Cyathea ferns - Tree ferne are slow-growing plants and take many years to reach maximum height.. Tree ferns usually have a solitary growth habit but

are commonly found in association with numerous plants within a small area. Sometimes they grow gregariously. For most species, little is known about the age of individual plants and the longevity of leaves. For young plants of *C. contaminans* the following data from West Java are available: average number of leaves on a plant 6-10; average time between the development of successive leaves 25-28 days; life of a single leaf 165-200 days; time taken for a complete renewal of the whole crown of leaves: 182-243 days; an old tree, 10 m tall, bore 12 leaves and the mean time between unfolding new leaves was 21 days.

The fibrous root-encrusted trunks of tree ferns are a source of fern-fibre. The trunks with larger amounts of fibre are cut down.

In Viet Nam, the trunk is usually collected in dry seasons (autumn or winter). During that time, the trunk have a low water level and it will be easy to transport

Harvesting method:

Leaves are removed first, then trunk is dug up, removed from the soil, hold trunk have been transported to the processing area and trunks is cuted into transetion piece with size 40 – 100cm long (or more) by sawmill machine (Fig. 5-6)

Fig. 5 & 6- Fresh trunks before processing.

There are threeways in processing of fresh trunks to make product . The first way, Cutting trunks is maked into rectangular piece (trunk table) by longitudinal trunk with size 40- 50 – 60 cm in length x 20- 25 cm in width and 2 cm in thick (It is depend on trunk diametre) or trunk pots by sawmill machine or specialized knife (Fig. 7 & 8).

The second way: Cutting trunks is maked in to trunk pot.

The thirth way: Sawdust or small pieces of trunkhad been pulverized by specialized machine to produce substrate for certain types of epiphytic ferns and orchids (Fig. 9).

Fig. 7 & 8-Tree fern Pruduct for trade : Rectangular trunk piece and trunk pots used for orchid media

Fig. 9-Tree fern Pruduct for trade: substrate for certain types of epiphytic ferns and orchids

3.2.2 Harvest management/ control

In the pass, Vietnamese CITES office has not officially set quota for exporting any tree ferns. But since 2019 , when all tree fern- Cyathea spp. species had been quoted in Appendix IIA of the Government DecreeNo.06/2019/ND-CP dated January 22, 2019 on management of endangered, rare and precious species of forest fauna and flora and observation of the Convention on International Trade in Endangered Species of Wild

Fauna and Flora. In future, the trade is better controlled because a special CITES export permit is needed. Forestry branch in province has responsibility for controlling localities and exploitation amount and issuing collection permits. Collecting the populations inside Nature reserves and National parks is prohibited. The export quota of **40-50** tones per year reasonable within five (5) years from 2019.

3.3 Legal and illegal trade levels (To the possible extent, quantify the level of legal and illegal use nationally and export and describe its nature).

Last ten years,tree fern exploitation served for Orchid cultivation in Vietnam. So far, no illegal trade has been found in Viet Nam.

II. Non-detrimental Finding procedure (NDFs)

Provide detailed information on the procedure used to make the non-detriment finding for the species evaluated.

1. Is the methodology used based on the IUCN checklist for NDFs?

_√__**yes** ___no

2. Criteria, parameters and/or indicators used

There are several ways to estimate the deposit of natural resources of the trunk of *Cyathea* such as field plot-survey method, field observations, field descriptions of plant communities and kinds of vegetation. To complete our estimation, we also referred to collect other information and data from the State-owned companies or private companies and the collectors in 19 provinces where Cyathea distributed such as Hoa Binh, Lao Cai, Ha Giang, Yen Bai , Cao Bang, Tuyen Quang, Phu Tho, Vinh Phuc, Lạng Sơn, Ha Noi (Ba Vi), Quang Tri, Lam Đong,Đak Nong, Gia Lai, Kon Tum, Quang Nam, Đa Nang, Phu Yen, Khanh Hoa Provinces.

3. Main sources of data, including field evaluation or sampling methodologiesand analysis used

The distribution of *Cyathea* in Viet Nam is uneven. Almost tree ferns – Cyathea distributes in Protected areas and watershed forest. *C. contaminans* is common in rather open locations at 200-1600 m altitude, often abundant in forest edges along roads; it needs sun on its crown and moisture at its roots

Through observation and investigation (Plot study), In Ngoc Linh NR (area from Ngoc Linh NR head qauater to Dak Chong - Muong Hoong communes). From latitude coordinate 15^0 10’ 25.0’’N to $15^0$09’ 31.4’’N and longitude coordinate 107^0 42’ 24..0’’ E to $107^0$51’ 56.0’’ E at elevation from 1.131 to 869 m.a.s.l.- *Cyathea* distribute in densly and abundantly in six point sites. There are 20- 40 *Cyathea* individuals which grown in one hectar (Plot= one hectar), estimated 200- 400 kg to 300- 600 kg of trunk for on hectar (each trunk weight around 10- 15 kg).Estimated 400-500 kg trunk deposite of tree fern for one hectar in Ngoc Linh NR. Fortunately, populations of *Cyathea*

contaminans has not been exploited in locations mentioned above. These populations will be reserved to serve demand in future

4. Evaluation of data quantity and quality for the assessment

Cyathea ferns are slow-growing plants and take many years to reach maximum height. Young leaves are produced regularly but overharvesting of young leaves for food will affect growth. Unlike ordinary trees, tree ferns cannot increase the thickness of their trunk as they grow taller and so in time they outgrow their strength. However, the trunk does increase in effective thickness, especially near the base, as a result of the growth of a dense entangled mass of stiff black roots which completely cover the original trunk, sometimes increasing its thickness several times. Tree ferns usually have a solitary growth habit but are commonly found in association with numerous plants within a small area. Sometimes they grow gregariously. For most species, little is known about the age of individual plants and the longevity of leaves. For young plants of *C. contaminans* the following data from West Java are available: average number of leaves on a plant 6-10; average time between the development of successive leaves 25-28 days; life of a single leaf 165-200 days; time taken for a complete renewal of the whole crown of leaves: 182-243 days; an old tree, 10 m tall, bore 12 leaves and the mean time between unfolding new leaves was 21 days. Case study Plot in Ngoc Linh NR shows that 400-500 kg trunk deposite of tree fern for one hectar. Other case study in Ha Giang province shows that each year can be exploite **300 – 400** tones). Trunk deposite of tree fern from three districts (Quan Ba, Yen Minh, Hoang Su Phi) of Ha Giang province. Any way, It is difficult to estimate the deposit of natural resources accurately because of the difficulty of field survey and the limitation of sampled populations in its vast distribution areas.

5. Main problems, challenges or difficulties found on the elaboration of NDF

The plants are widely and unevenly distributed in mountainous areas from the North to the South of Viet Nam, thus, our field survey is still very limited. In other hand, informations on exploitation and trade of tree fern from local Forest Protection Department are lacking.

6. Recommendations

To ensure the long-term survival of wild populations and their associated habitats, management plans for collection should provide a framework for setting sustainable harvest levels and describe appropriate collection practices that are suitable for Tree fern - *Cyathea* through following actions:

i) Only the populations outside nature reserves can be collected under the permission and strict control of local authority governments and Provincial Forest Protection Department.

ii) It is also need of raising management efficiency to prevent any illegal foreign trade (to China from other provinces of Noth-East Viet Nam as Đien Bien, Lai Chau, Ha Giang, Cao Bang, Bac Can, TuyenQuang and Lang Sơn Provinces) which is not controlled by quota). Exportation of *tree fern- Cyathea* should be limited by strict quota at **40-50** tones tones per year within 5 years from 2019 for sustainable use;

iii) Develop guidelines on good collection practice for tree fern- *Cyahtea* The guidelines should be concerned to:

- Appropriate seasons or time period for collection (to ensure the best possible quality of materials).
- Standards of plants for collection: only plant of which trunk weight is over 10 kg should be collected.
- Collection levels and collection practices to encourage the regeneration of source Orchid mediasubstrate (Ex: leaving the nurslings, small plants and spore-bearing plants for reproduction and regeneration of maintaining their populations).
- Minimum frequency of collection: Duration time for the next collecting should be 10 years.

These guidelines will serve as training materials for individuals and businesses on collecting and buying tree fern - *Cyathea*. It also guides provincial forestry branches to have responsibilities for supervision and inspection of performing its.

In future, export of final products rather than raw materials should be encouraged. It is hoped that researches on propagation through spore will be carried out for artificial cultivation and techniques for cultivating this plant in suitable areas. It will be help to reduce the pressure on wild resources of this much exploited species.Vegetative propagation by tissue culture should be utilised to minimise the destruction of wild stocks.

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Country – VIET NAM
Original language – English

Non-detriment finding for Cibotium barometz in Viet Nam

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Dated report: 25 June , 2019

I. Background information on the taxa

1. Biological data

1.1 Scientific and common names

Scientific names: ***Cibotium barometz*** (L.) J. Sm. It belongs to DICKSONIACEAE

Common names: Cau tich (Dog's spinal column - Vietnamese Chinese), Long cu ly (Culy hair), Long khi (Monkey hair), Kim mao (Golden hair - Vietnamese Chinese), Cu lan (Do Tat Loi, 1999; NIMM-WHO, 1990; NIMM, 1999), Cut bang (Tay Ethnic), Co cut pa (Thai Ethnic), Nhai cu viang (Dao Ethnic), Dang pam (K'Ho Ethnic), Golden moss golden chicken fern, woolly fern (English), pitchawar, agneau de scythie, cibotie (French).

Distribution

Cibotium barometz is mainly distributed in the tropical and subtropical regions of Asia including North – East India, Myanma, western Malay Peninsula, Indonesia (from Java to Sumatra), Philippines, Thailand, Laos, Viet Nam, Japan (Zhanget al.,2008; Wu et al.,2010), Taiwan (van Steenis and Holttum, 1982) and South China. In Viet Nam, this plant is widely distributed unevenly in mountainous provinces in the North, including Cao Bang (Ha Quang, Nguyen Binh, Thach An districts); Lang Son (Huu Lung, Loc Binh dist.); Quang Ninh (Ba Che, Hoanh Bo, Van Don dist.); Lai Chau (Phong Tho, Than Uyen dist.); Lao Cai (Bat Xat, Muong Khuong, Bao Thang, Van Ban); Yen Bai (Mu Cang Chai, Tram Tau dist.); Dien Bien (Dien Bien Dong, Tua Chua, Tuan Giao dist.); Son La (Quynh Nhai, Song Ma, Thuan Chau, Mai Son dist.); Hoa Binh (Mai Chau, Da Bac, Tan Lac dist.), Tuyen Quang (Na Hang, Yen Son, Chiem Hoa dist.); Bac Kan (Ba Be, Na Ri, Bach Thong dist.), Thai Nguyen (Phu Luong, Dai Tu, Dinh Hoa dist.); Phu Tho (Thanh Son, Tam Son dist.); Vinh Phuc (Tam Dao dist.); Thanh Hoa (Quan Hoa, Ba Thuoc, Cam Thuy dist.); Nghe An (Ky Son, Tuong Duong, Con Cuong dist.)... and some high mountainous areas in the South such as Ngoc Linh (Dak Gley, Dak Ha, Tu Mo Rong, Kon Plong dist.) in Kon Tum province, Quang Nam province (Tra My, Nam Giang, Tay Giang dist.); Chu Yang Sin in Dak Lak provine and Bi Dup in Lam Dong province (Do Tat Loi, 1999;

NIMM & WHO, 1990; Nguyen Tien Ban et al., 1996; Nguyen Tap in NIMM, 1999; Nguyen Tap in Do Huy Bich et al., 2004).

1.2 Biological characteristics

1.2.1 Provide a summary of general biological and life history characteristics of the species (e.g. reproduction, recruitment, survival rate, migration, sex ratio, regeneration or reproductive strategies, tolerance toward humans)

Cibotium barometz is recognized as a tree fern and hygrophilous and slight shad enduring especially when young. Rhizome stout, prostrate, are densely covered with shining brown long hairs. Fronds close; stipes thick, up to 1 m long or more, triangular in transverse section at base, densely bearing caducous adpressed hairs, stipe and rachis green, turning purplish beneath with age; with a continuous or broken row of linear aerophores on each side of stipe, base of stipe with a mass of long (1-1.5 cm) hairs, upper part of stipe and rachis covered with small, appressed flaccid hairs becoming glabrescent; laminae 2-pinnate-pinnatifid, 1.5-3 m long; medial pinnae 40-80 x 15-30 cm, lower pinnae shortened, deflexed; pinnae many, alternate, stalked, pinnules short stalked, usually of about equal length on either side of rachilla; pinnule-segments slight falcate, apiculate, margins crenulate to serrulate-serrate; veins free, fertile ones simple, sterile simple or forked; laminae subcoriaceous, upper surface deep green, lower surface glaucous, glabrous on both sides, except the hairy midrib; venation visible on both surface, free, lateral veins simple or forked. Sori 1-5 pairs on pinnule-segments; indusia bivalvate, outer indusia round, inner ones more or less oblong; outer valve of indusium usually large; paraphyses dark reddish brown. Spores pale yellowish, with equatorial flange within September – January

Reproduction of the plant normally occurs through spores in sexual propagation. Plants can produce large quantity of spores. Spore-bearing period lasts from August to December. It is observed that old rhizomes can spout some lateral buds, which grow into large rhizome. By spore propagation, the populations increase quickly and become large and dense in valleys and forest edges. However, it takes several years (over 4 years) for an individual grow into a mature spore-bearing plant. It also takes time to reach an exploitable plant of which rhizome is over 1.5 kg in weight.

1.2.2 Habitat types.

Cibotium barometz is common in tropical and subtropical regions and in Viet Nam. The species can be found in valleys, forest edges, along stream-banks together with other plants or under canopy of the Pine forests (in Kon Tum, Dak Lak and Lam Dong provinces) ranging from 300 to 1.000 m (in the North) and 800 to 1.500 m (in the South) (

Fig.1). It adapts to warm and humid climatic conditions. Optimum average temperature varies between 20 and 23ºC, the rainfall ranges from 1.800 to 2.600 mm every year. It prefers red-brown ferralitic and acid soils (Nguyen Tap in NIMM, 1999 and in Do Huy Bich et al., 2004).

1.2.3.Role of the species in its ecosystem

When *Cibotium barometz* forms a very dense population or dominates in community, it plays an important role in covering free land, preventing the erosion and keeping the humidity of the soil, especially when it grows under the canopy of Pine forests and along the stream-banks.

1.3 Population

1.3.1 Global Population size (Population size may be estimated by reference to population density, having due regard to habitat type and other methodological considerations, or simply inferred from anecdotic data)

In China, *Cibotium barometz* is distributed mainly in the South (Guangdong, Hainan, Guangxi and Yunnan), but there is no data about the population size of this species (Xian-Chun Zhang et al., 2008). In addition, there is no information on this species in India, Myanma, Thailand, Laos, the Philippines, and Indonesia.

1.3.2 Current global population trends

___increasing ___√_decreasing ____ stable
____unknown

1.4 Conservation status

1.4.1 Global conservation status (according to IUCN Red List)

___Critically endangered ___Near Threatened
___Endangered ___Least concern
___Vulnerable _√__ Data deficient

1.4.2 National conservation status for the case study country

1996:

Status: Threatened (T) – (In Red Data Book of Viet Nam, 1996)
Main threats: - Habitat loss / Degradation
- Harvesting

Present: This species is curently not included in neither Red Data Book of Viet Nam (2007) nor the Red List of Medicinal Plant in Viet

Nam (2001 & 2006). It can be understand that *Cibotium barometz* largely and densly distributed in 18 provinces, at least. Native production approximately reaches several thousands of tons.

1.4.3 Main threats within the case study country

___No Threats
_√_Habitat Loss/Degradation (human induced)
___Invasive alien species (directly affecting the species)
_√_Harvesting [hunting/gathering]
___Accidental mortality (e.g. By catch)
___Persecution (e.g. Pest control)
___Pollution (affecting habitat and/or species)
___Other_____
___Unknown

2. Species management within the country for which case study is being presented

2.1 Management measures

2.1.1 Management history

In 1996, *Cibotium barometz* was included in the Red Data Book of Viet Nam (Part II – Plant) as an officially protected plant. However, this species is currently not included in the Red Data Book of Viet Nam (2007) and in the Red list of Medicinal Plants in Viet Nam (2001 & 2006). But In 2019, *Cibotium barometz* quoted in Appendix IIA of the Government Decree No.06/2019/ND-CP dated January 22, 2019 on management of endangered, rare and precious species of forest fauna and flora and observation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora.(Appendix IIA stipulated: *Forest animals and plants not in danger of extinction but at the risk of extinction without rigid management and restriction from exploitation or use for commercial purposes, and species listed in Appendix II to CITES that are naturally distributed in Vietnam*)

2.1.2 Purpose of the management plan in place

To achieve sustainable use of the natural resources of this herb medicine, and to ensure that the export will not be detrimental to the survival of this species in Viet Nam.

2.1.3 General elements of the management plan

Constrain the annual export from Viet Nam, as well as domestic use by medicinal factories.

2.1.4 Restoration or alleviation measures

In National Park and Nature Reserve and watershed forest, collecting of *Cibotium barometz* is prohibited. In addition, collection permit must be obtained from Forestry branch in province prior to collecting plant from the wild.

2.1.Monitoring system

2.1.1. Methods used to monitor harvest ---- No.

2.1.2. Confidence in the use of monitoring ---- No.

2.2 Legal framework and law enforcement (Provide details of national and international legislation relating to the conservation of the species)

Since 1996, *Cibotium barometz* had been listed in CITES Appendix II, this plant was restrictively exploited mainly for domestic use in traditional medicine. However in 2001, more data of natural resources have been collected as well as the urgent need to exploit this plant in the area belong to Son La hydroelectric project, During of 15 yeaars from 2002 to 2017, Vietnamese CITES office licenced quota of 1,260.651 tones to export from Viet Nam . The export amount is showed in Table 1

1- Year	Export amount/ tone	2-Year	Export amount/ tone
2002	84	2013	148.3
2003	66	2014	130.0
2004	38.5	2015	109.5
2005	111	2016	110.351
2006	61	2017	97.0
2007	55		
2009 & 2010	250		
Subtotal	**665.5**		**595.151**
Total 1+2	**1,260.651**		

Table 1. Export amount of *Cibotium barometz* from 2002 to 2017

Control on sustainable exploitation of *Cibotium barometz*, from 2006 up to now, local authority in Son La and Dien Bien provinces have issued permit of collecting populations in the area where will become a reservoir and some other areas outside NP. and NR. (in Thuan Chau dist., Son La prov. and Muong Lay dist., Dien Bien prov.). Permit document set includes 4 documents below:

1. Exploitation permits from commune autority People Committee- Giấy phép khai thác lâm sản

2. Sustainable technical exploitative project – Phương án khai thác bềnvững thực vật hoang dã nguy cấp thuộc phụ lục CITES
3. Trade Contrat between local exploiters with trade company – Hợp đồng mua bán (Fig.4))
4. Oficial exploitative acceptance agreement – Biên bản kiểm tra nghiệm thu khai thác.
According to our survey in Vietnam from 05/05/2019 to 12/06/2019 in Vietnam: Provinces. Hòa Bình prov. (Da Bac District), Son La (Moc Chau, Thuan Chau, Mai Sơn, Quynh Nhai district), Điện Biên (Tuan Giao, Mương Ang and Tua Chua district),Lai Châu (Phong Tho, Than Uyen distr.), Lào Cai (Van Ban distr.), Yên Bái (Mu Cang Chai, Văn Chấn, Nghia Lo,Trạm Tấu district), Hà Giang (Quan Ba, Yen Minh, Bac Me district), Cao Bằng (Bao Lam, Bao Lac, Nguyen Binh), Bắc Cạn (Na Ri), Tuyên Quang, Thái Nguyên, Lạng Sơn, Bắc Giang (Son Dong) (Northern Vietnam). And provinces: Dak Nông (Dak Song), Đắc Lác (Buon Ho, Ea Hleo), Gia Lai (Kbang), Kon Tum (Kon Plong, Tu Mo Rong, Dak Gley), Quảng Nam (Phuoc Son, Dai Loc, Hoa Vang (Southern Vietnam).
Field surveys shows that *Cimbotium barometz* largely distributed in 18 provinces, at least as: Hòa Bình,, Son La , Điện Biên, Lai Châu, Lào Cai, Yên Bái , Hà Giang, Cao Bằng, Bắc Cạn, Tuyên Quang, Thái Nguyên, Lạng Sơn, Bắc Giang, Lam Dong, Dak Nong, Dak Lak, Gia Lai, Kon Tum, Quang Nam. Particularly in Protected area, watershed forest it is growing densely. Cimbotium Yield estimated 752 kg per one hectar. Certainly this area will become to Cimbotium reserver sources for trade and traditional medicine demand.

In survey area, At least, there are 16 local trade companies and families which purchases, collecte raw *Cimbotium* materials and process it in to dried products for domestic demand and international trade. Quantity of exploitation averaged 400-600 dried tones per year. In Southern Vietnam, populations of *Cibotium barometz* has not been exploited.

3. Utilization and trade for range State for which case study is being presented

3.1 Type of use (origin) and destinations (purposes) (e.g. commercial, medicinal, subsistence hunting, sport hunting, trophies, pet, food). Specify the types and extent of all known uses of the species. Indicate the extent to which utilization is from captive-bred, artificially propagated, or wild specimens.

Cibotium barometz is well valued as a medicinal herb. In traditional medicine, is is believed that the rhizome replenishes the liver and the kidney, strengthens the tendons and bones and relieves rheumatism conditions. Thus, it is widely used to cure rheumatism, limb-ache, lumbago, neuralgia and

pollakiuria in aged humans and leucorrhoea. It also cures sciatica, micturition, enuresis and body-ache in pregnant women. The golden hair covering the rhizome is used for poulticing the wounds and cuts in the limbs to stop bleeding. According to literature, *C. barometz*'s rhizome is also employed as a tonic and vermifuge. The hair, in suitable application, can arrest capillary bleeding by mechanical action. Up to now, there is no artificial cultivation of *C. barometz* in Viet Nam; all the materials used are collected from wild populations.

3.2 Harvest

3.2.1 Harvesting regime (extractive versus non extractive harvesting, demographic segment harvested, harvesting effort, harvesting method, harvest season)

In Viet Nam, the rhizome of *Cibotium barometz* is usually collected in dry seasons (autumn or winter). During that time, the rhizome have a low water level and it will be easy to be dried and lose less weight compared to fresh materials. The evidence shows that the ratio between dried and fresh rhizome ranging from 67 to 70%. It means the fresh rhizome will lose 30 to 33% its dried weight.

Harvesting method:

Leaves are removed first, then rhizome is dug up, removed from the soil, hard fibrous roots, petioles, golden hairs and transported to the processing area.

There are two ways in processing of fresh rizhome. The first way, rhizome is cut into slices by cutting machine or specialized knife.

The second way is that rhizomes can be cleaned and steamed or boiled quickly in hot water before they are thinly sliced. In this way, raw materials turn to brown-yellow. After being cut, materials are dried under sun or in the oven (Fig.8). Moisture content in dried materials must be below 13% (Vietnamese Pharmacopoeia III).

After preliminary processing, materials are packed in bag or sack (about 50 kg per bag or sack) and preserved in dry and cool place.

3.2.2 Harvest management/control

Since 2001, Vietnamese CITES office has officially set quota for exporting *Cibotium barometz*. Appropriate seasons for exploitation are autumn and winter. Forestry branch in province has responsibility for controlling localities and exploitation amount and issuing collection permits. Collecting the populations inside Nature reserves and National parks is

prohibited. The export quota of **150-250** tones per year is reasonable within five (5) years from 2019.

3.3 Legal and illegal trade levels (To the possible extent, quantify the level of legal and illegal use nationally and export and describe its nature)

The dry sliced rhizomes of *Cibotium barometz* called "Cau tich". Approximately 200 tones of "Cau tich" is used widely in traditional medicine every year in Viet Nam. State-owned companies and private companies started to commercialize this medicinal material many years ago. In 1996, this plant was listed in CITES Appendix II; therefore, it was restrictively exploited mainly for domestic use in traditional medicine. So far, no illegal trade has been found in Viet Nam.

Since 2002, Vietnamese CITES office provided officially set export quotas about **1260.651**tones of "Cau tich" and the main import country is China, Japan, Republic of Korea and Singapore..

From 2014 to December 2018, Son La Pharmaceutical Joint-Stock Company has processed about **800** tons of dryied rhizome of *Cibotium barometz* that was collected in Mai Son, Thuan Chau and Quynh Nhai district of Son La province. At present, field survey shows that Son La province (Mai Son, Thuan Chau, Quynh Nhai district), Yen Bai province (Tram Tau, Nghia Lo districts), Bac Can, Cao Bang provinces will become national reservoir of *Cimbitium barometz*. This quantity will serve for traditional medicine in Viet Nam and export demand for present and future.

II. Non-detrimental Finding procedure (NDFs)

Provide detailed information on the procedure used to make the non-detriment finding for the species evaluated.

1. Is the methodology used based on the IUCN checklist for NDFs?

_√__**yes** ___no

2. Criteria, parameters and/or indicators used

There are several ways to estimate the deposit of natural resources of the rhizomes of *Cibotium barometz* such as field plot-survey method, field observations, field descriptions of plant communities and kinds of vegetation. To complete our estimation, we also referred to collect other information and data from the State-owned companies or private companies and the collectors in Son La, Dien Bien, Lai Chau and Ha Noi.

3. Main sources of data, including field evaluation or sampling methodologies and analysis used

The distribution of *Cibotium barometz* in Viet Nam is uneven. Therefore, we selected sample plots from some provinces in which a few counties were selected. For example, local collector in Son La said that in richest areas (unexploited) has about 12 - 16 kg fresh rhizomes of *C. baometz* can be collected each field plot in 2 x 2 meter. In Kontum province, *C. baometz* densely distributed under shad of Pine and mixed forests belong to 4 districts: Dak Glei, Dak Ha, Tu Mo Rong and Kon Plong. According to our field plot survey carried out in areas belong to "Dak Glei Investment and Development of Agriculture, Forestry and Service Company", there are about 1.600 ha of forest where the species is found in here. The maximum fresh rhizomes can be collected in field plot (rich areas) are 20 - 25 kg in weight, and the minimum are 10 – 12 kg. The biggest rhizome reaches 13 kg in weight. These provinces are examples of the most abundant with this species. Based on all results of field plot-surveys and data gathered from other sources we can estimate the biomass of rhizomes of *Cibotium barometz* in provinces and districts, about 10.000 tones of deposits of "Cau tich" in Viet Nam. Fortunately, populations of *Cibotium barometz* has not been exploited in locations mentioned above. These populations will be reserved to serve demand in future

4. Evaluation of data quantity and quality for the assessment

It is difficult to estimate the deposit of natural resources accurately because of the difficulty of field survey and the limitation of sampled populations in its vast distribution areas. The annual sustained yield should be estimated at about 400 – 500 tones making up 5% of the standing stocks.

5. Main problems, challenges or difficulties found on the elaboration of NDF

The plants are widely and unevenly distributed in mountainous areas from the North to the South of Viet Nam, thus, our field survey is still very limited.

6. Recommendations

To ensure the long-term survival of wild populations and their associated habitats, management plans for collection should provide a framework for setting sustainable harvest levels and describe appropriate collection practices that are suitable for *Cibotium barometz* through following actions:

i) Only the populations outside nature reserves can be collected under the permission and strict control of local authority governments and Provincial Forest Protection Department. In addition, it should be focus on

collecting in area of new reservoir belonging to Son La, Dien Bien, Lai Chau and Yen Bai provinces.

ii)It is also need of raising management efficiency to prevent any illegal foreign trade (to China from other provinces of Noth-East Viet Nam as Ha Giang, Cao Bang, Bac Can, Tuyen Quang and Lang Sơn Provinces) which is not controlled by quota). Exportation of *Cibotium barometz* should be limited by strict quota at **150-250** tones per year within FIVE (5) years from 2019 for sustainable use;

iii) Develop guidelines on good collection practice for *Cibotium barometz*. The guidelines should be concerned to:

- Appropriate seasons or time period for collection (to ensure the best possible quality of materials).
- Standards of plants for collection: only plant of which rhizome weight is over 1,5 kg should be collected.
- Collection levels and collection practices to encourage the regeneration of source medicinal plant materials (Ex: leaving the nurslings, small plants and spore-bearing plants for reproduction and regeneration of maintaining their populations).
- Minimum frequency of collection: Duration time for the next collecting should be 10 years.

These guidelines will serve as training materials for individuals and businesses on collecting and buying *Cibotium barometz*. It also guides provincial forestry branches to have responsibilities for supervision and inspection of performing its.

In future, export of final products rather than raw materials should be encouraged. It is hoped that researches on propagation through spore will be carried out for artificial cultivation and techniques for cultivating this plant in suitable areas. It will be help to reduce the pressure on wild resources of this much exploited species.

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