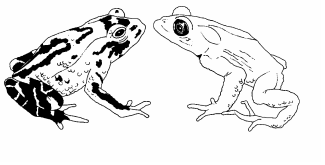
CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA



Eighteenth meeting of the Animals Committee
San José (Costa Rica), 8-12 April 2002

Implementation of Resolution Conf. 8.9 (Rev.)
(Decision 11.106)

PROGRESS ON THE IMPLEMENTATION OF THE REVIEW OF SIGNIFICANT TRADE (PHASES IV AND V)

This document has been prepared by the Secretariat.

Acipenseriformes (Phase IV)

1. The document in Annex 1 and the translations into French and Spanish have been prepared by TRAFFIC International in cooperation with IUCN and UNEP-WCMC, under contract to the CITES Secretariat.

2. Annex 1 consists of a review of four species of Acipenseriformes that are in commercial trade, and that were selected pursuant to Decision 11.95 directing the Animals Committee to include the Acipenseriformes in its Review of Significant Trade. The document deals with the following species of Acipenseriformes:

Acipenser oxyrinchus p. 3

Acipenser persicus p. 19

Acipenser transmontanus p. 37

Scaphirhynchus platorynchus p. 57

3. The relevant parts of Annex 1 have been sent to all range States of the species concerned, but comments from the range States have either not yet been received or not yet been incorporated in the document.

Testudinata (Phase IV)

4. The document in Annex 2 and the translations into French and Spanish have been prepared by IUCN, in cooperation with TRAFFIC and UNEP-WCMC, under contract to the CITES Secretariat.

5. It consists of a review of five species of testudines that were selected pursuant to Decision 11.93 requiring the Animals Committee to consider trade in specimens of CITES-listed freshwater turtles and tortoises in the context of the Review of Significant Trade. These five species are the following:

   Cuora amboinensis p. 71

   Cuora flavomarginata p. 95

   Cuora galbinifrons p. 109

   Lissemys punctata p. 121

   Pyxis planicauda p. 137

6. The relevant sections of Annex 2 have been sent to all range States of the species concerned, but comments from the range States have either not yet been received or not yet been incorporated in the document.

Strombus gigas (Phase V)

7. At its 17th meeting (July 2001, Hanoi, Viet Nam), the Animals Committee decided to include *Strombus gigas* in Phase V of the Review of Significant Trade pursuant to Resolution Conf. 8.9 (Rev.). This species was also reviewed in Phase III of the Review of Significant Trade (initiated in September 1995). A consultant has been appointed by the Secretariat, and it is expected that a draft report on the results of the review will be available at the next meeting of the Animals Committee.

Acipenser oxyrinchus Mitchill, 1814

Atlantic Sturgeon
Esturgeon de l'Atlantique
Esturion del Atlantico

Order: ACIPENSERIFORMES **Family: ACIPENSERIDAE**

SUMMARY

The Atlantic sturgeon *Acipenser oxyrinchus* is native to Canada and the United States of America (hereafter referred to as the USA). The species comprises two subspecies; the Atlantic sturgeon *Acipenser oxyrinchus oxyrinchus* which occurs in both range States, and the Gulf sturgeon *Acipenser oxyrinchus desotoi* which is endemic to the USA. All further references to Atlantic sturgeon refer to the subspecies *A. o. oxyrinchus* and not the full species. The historical range of the Atlantic sturgeon covered most of the eastern seaboard of North America, from Hamilton Inlet in Labrador, Canada to the St. Johns River in Florida. Gulf sturgeon are believed to have inhabited most major river systems from the Mississippi River to the Suwanee River, Florida, and marine waters of the central and eastern Gulf of Mexico south to Florida Bay. The overall range of both the Atlantic sturgeon and Gulf sturgeon remains relatively constant in comparison with their historic ranges. However, over the past century or more, habitat alterations and other factors have reduced the spawning range to a distinct subset of rivers. Populations of both subspecies are reduced from historic levels due to over-exploitation, but the present level of abundance throughout the range is uncertain. Current threats to the species include habitat alteration (e.g. construction, agriculture and industry), as well as bycatch.

Adult Atlantic sturgeon inhabit mainly marine and brackish waters, ascending into fresh water for spawning only. Adults reach a size of up to 2 m and 60 kg, with a maximum lifespan of approximately 60 years. Sexual maturity varies: northern females mature at 24-28 years and males at 20-24 years, while southern females mature at 9-15 years and males at 7-9 years. Unlike Atlantic sturgeon, adult Gulf sturgeon spend 8-9 months each year in rivers. They grow to a length of up to 2.4-2.7 m and a weight of up to 200-225 kg, with a lifespan of around 42 years. Timing, location, and habitat requirements for Gulf sturgeon spawning are poorly known, but females may mature at 7-17 years old.

In the USA, the Gulf sturgeon is included in the Endangered Species Act as a "threatened" species and is fully protected from commercial harvest, but in 1998 it was decided that the Atlantic sturgeon should not be included under this legislation. Nonetheless, the Atlantic States of the USA have instituted a moratorium on all harvest of the Atlantic sturgeon that is likely to be in place for around 30 years. Harvest of the Atlantic sturgeon is restricted in Canada. No international trade in the species was reported from 1990-1995. During 1996-2000, trade has been composed mainly of meat and live specimens; Canada exported a total of 70 t of meat (all from wild sources), 18 110 live specimens and 4 000 fertilised eggs (all from captive-bred sources). Although annual export volumes show no consistent trend, it appears that, very generally, exports of meat are decreasing, and those of live specimens are increasing. The USA has been the largest importer of both Canada's meat and live specimens. Canada sets annual harvest quotas for its commerical Atlantic sturgeon fisheries and has also suggested export levels for 2001.

Captive propagation of Gulf Surgeon is underway and restocking is considered necessary for the recovery of this threatened subspecies. Canada has produced hatchery-reared Atlantic sturgeon for scientific purposes for a number of years, and using captive bred stock from Canada, the USA plans to initiate its own facilities for research and for consumption within the USA.

The species is recommended under Decision 11.106 for inclusion in category 2/3.

DISTRIBUTION AND POPULATION

Also known as the black sturgeon, common sturgeon, Gulf of Mexico sturgeon, and the sea sturgeon, the CITES-listed species database gives the distribution of *Acipenser oxyrinchus* as: Bermuda; Canada; Mexico; and the USA (Anon., 2001a). However, the given distribution of Bermuda and Mexico is misleading and recent

literature does not consider these countries to be range States, although it is conceivable that transient specimens will occasionally be found within the jurisdiction of these countries (J. Waldman, Hudson River Foundation for Science and Environmental Research, *in litt.* to IUCN/SSC Wildlife Trade Programme 24 October 2001; Dr M.R. Collins, Marine Resources Research Institute, *in litt.* to IUCN/SSC Wildlife Trade Programme 5 October 2001). Bermuda and Mexico are therefore not considered further as range States for *A. oxyrinchus*.

Note that although the *CITES Checklists* (Anon., 2001b; c) cite the spelling of the scientific name of Atlantic sturgeon as *Acipenser oxyrhynchus*, the correct spelling is actually *Acipenser oxyrinchus* (Anon., 2001a) and this spelling error will be corrected in subsequent editions.

IUCN categorises *A. oxyrinchus* and its subspecies as (Anon., 1996):

> *A. oxyrinchus* Lower Risk Near Threatened (LR/nt) Canada, Mexico, USA [Atlantic (northwest, western central], based on the species not being Conservation Dependant, but almost qualifying for Vulnerable.
>
> *A. o. desotoi* Vulnerable (VU A1c) Mexico, USA [Atlantic (western central)], based on an estimated, inferred or observed 20% population reduction over the last three generations as a result of a decline in area of occupancy, extent of occurrence and/or quality of habitat.
>
> *A. o. oxyrinchus* Lower Risk Near Threatened (LR/nt) Canada, USA [Atlantic (northwest, western central)]

The IUCN/SSC Sturgeon Specialist Group is currently reassessing the global Red List status of North American species and stocks of sturgeon and paddlefish. These reassessments will be submitted to the IUCN Red List Authority for sturgeon, to be evaluated for inclusion in the 2003 IUCN Red List of Threatened Species. The proposed categories are as follows:

Acipenser oxyrinchus oxyrinchus Atlantic sturgeon - Near Threatened (R. St. Pierre, IUCN/SSC Sturgeon Specialist Group *in litt.* to IUCN/SSC Wildlife Trade Programme 28 September 2001).

Acipenser oxyrinchus desotoi Gulf sturgeon - Vulnerable (F.M. Parauka, Gulf Sturgeon Recovery Team Member, USFWS cited in R. St. Pierre, IUCN/SSC Sturgeon Specialist Group *in litt.* to IUCN/SSC Wildlife Trade Programme 28 September 2001).

The historical distribution of *A. oxyrinchus* is divided between that of two subspecies. The range of the Atlantic sturgeon (*A. o. oxyrinchus*) covered most of the eastern seaboard of North America, from Hamilton Inlet in Labrador, Canada to the St. Johns River in Florida. The other subspecies, the Gulf sturgeon (*Acipenser o. desotoi*), is believed to have occurred historically in most major river systems from the Mississippi River to the Suwanee River, Florida, and in marine waters of the central and eastern Gulf of Mexico south to Florida Bay (Wooley and Crateau, 1985).

The overall range of both the Atlantic sturgeon and Gulf sturgeon remains relatively constant. However, over the past century or more, human-caused habitat alterations and other factors have reduced spawning range to a distinct subset of rivers. The population of *A. oxyrinchus* is believed to be reduced from historic levels, but present abundance is uncertain throughout its range (Anon., 1995; Anon., 1998a). For management purposes, the USA authorities treat the two subspecies separately; all further references to Atlantic sturgeon therefore refer to the subspecies *A. o. oxyrinchus* and not the full species.

Atlantic sturgeon: Comprehensive information on current or historic abundance of *A. o. oxyrinchus* is lacking for most river systems. Overfishing, habitat degradation, and other factors believed to have affected the abundance of the Atlantic sturgeon took place in the absence of concrete scientific baseline data, making it difficult to quantify precisely the extent of its decline (Anon., 1998a).

Canada

A. o. oxyrinchus has historically been reported as far north as the lower George River in Ungava Bay and Hamilton Inlet in Labrador. The Atlantic sturgeon is currently found in Quebec in the Gulf of St. Lawrence from the Blanc Sablon on the Quebec side of the Strait Belle Isle, and in the St. Lawrence River up to Trois Rivières, and occasionally further upriver. Atlantic sturgeon have also been captured on the Gulf of St. Lawrence shore in

Newfoundland; in the Mirimichi River, New Brunswick; and at Cheticamp, Aspy Bay, Canso Straits, and Halifax in Nova Scotia. In the Bay of Fundy, Atlantic sturgeon were found in studies in the 1960s to be abundant in the New Brunswick's Saint John River, and were reported in the Minas basin and the Avon River. It is likely that Atlantic sturgeon once spawned in the Mirimichi, Shubenacadie, and La Have rivers. It is also believed that *A. o. oxyrinchus* probably spawned historically in the Annapolis River in Nova Scotia, but it is not known whether the population was extirpated following construction of a tidal power project (Anon., 1998a).

USA

A. o. oxyrinchus is believed to have been present historically in approximately 34 rivers, from the Penobscot in Maine to the St. Johns in Florida. The current range has contracted slightly, and reaches from the Kennebec River, Maine to the Satilla River, Georgia (absence from the Penobscot River is uncertain). Available information shows continuing uncertainty about the abundance or even presence of the Atlantic sturgeon in some river systems, while extensive research and monitoring work is done in others (Anon., 1998a).

Maine: The historic northern limit of the USA population is believed to be Maine's Penobscot River. In the late 1990s, the only river system within New England with a confirmed spawning population was the estuarial complex of Maine's Kennebec, Androscoggin, and Sheepscot rivers. Atlantic sturgeon may also use the estuaries of smaller Maine rivers during summer months, although most of these coastal rivers are not suitable for spawning (Anon., 1998a).

New Hampshire, Massachusetts, Rhode Island, and Connecticut: *A. o. oxyrinchus* are believed to inhabit several rivers in these states, but during the late 1990s there was no evidence of spawning populations. While a few Atlantic sturgeon have been captured in the Piscataqua River/Great Bay Estuary system in New Hampshire, these appear to be isolated events. There are historic and recent reports of adult Atlantic sturgeon in the Merrimack River (New Hampshire and Massachusetts). While there is no indication of spawning, there is evidence that the river is used as a nursery ground by sub-adults. In the Taunton River (Massachusetts and Rhode Island), Connecticut River (Massachusetts and Connecticut), Thames River (Connecticut), and Housatonic River (Connecticut), there are historic reports of spawning populations dating to the 1700s. However, in recent times there is no evidence of spawning, and stocks of Atlantic sturgeon native to these river systems are believed to be extirpated (Anon., 1998a).

New York: New York's Hudson River is believed to have been a historically important spawning river for *A. o. oxyrinchus*. The Hudson River supported spawning as recently as 1997, although efforts to confirm the presence of mature Atlantic sturgeon in that year resulted in the capture of only males (Anon., 1998a).

New Jersey, Delaware, Pennsylvania: The Delaware River may have supported the largest historical stock of Atlantic sturgeon of any coastal river system. Possible spawning grounds were reported as far north as Bordentown, New Jersey, just below Trenton. The continued presence of juveniles one-year old or less and adult sturgeon indicate that the Delaware River and Bay continue to serve as a spawning ground (Anon., 1998a).

The Chesapeake Bay and tributaries in Pennsylvania, Maryland, and Virginia: This system comprises another complex of rivers and estuaries where *A. o. oxyrinchus* was historically common. Important rivers with historical and some modern reports of sturgeon spawning grounds or presence include the Potomac, Rappahannock, York, James, Susquehanna, and Nanticoke (Anon., 1998a).

North Carolina: *A. o. oxyrinchus* was historically abundant in most of North Carolina's coastal rivers and estuaries, including the Roanoke, Tar-Pamlico, Neuse, Cape Fear, and Brunswick rivers and the Albemarle Sound system. Data indicate that spawning continues to occur in the Roanoke River/Albemarle Sound system and the Cape Fear River, and is also thought to have occurred recently in the Neuse and Tar-Pamlico rivers (Anon., 1998a).

South Carolina: *A. o. oxyrinchus* was present historically in many South Carolina rivers/estuaries, although it is not certain where spawning occurred. A NMFS-coordinated study concluded from sampling conducted within the last two decades that Atlantic sturgeon were present in the Great PeeDee, Waccamaw, and Sampit rivers, all of which are tributaries to Winyah Bay; the Santee River, Lake Moultrie, Cooper River, Ashley River, South Edisto River, Ashepoo River, and Combahee River, all of which are tributaries to St. Helena Sound; the Broad/Coosawhatchie River; and, the Savannah River. Based on the collection of juveniles, it is believed that

spawning occurs in the Santee River, one or more of the Ashepoo-Combahee-Edisto Basin tributaries, the Savannah, and possibly the Cooper, Great PeeDee, and Waccamaw rivers (Anon., 1998a).

Georgia and Florida: The Altamaha River in Georgia is believed to support one of the largest *A. o. oxyrinchus* populations in the southeast, based on the presence of more than 2 000 juveniles found in a sample using trammel nets. Another population of Atlantic sturgeon also exists in Georgia's Ogeechee River, although recent sampling efforts suggest that juveniles are scarce or absent in some years, indicating spawning or recruitment failure. Similarly, it is believed that a population of Atlantic sturgeon persists in the Satilla River in Georgia. Recent sampling indicates that the Atlantic sturgeon has been extirpated from some rivers at the southern extent of its range. These include the St. Marys River in Georgia and Florida, and possibly Florida's St. Johns, St. Augustine, and St. Lucie rivers. It is unknown whether these rivers were ever used for spawning or merely by migrating populations.

Gulf sturgeon: A. o. desotoi is endemic to the USA. States within its range include:

Louisiana: Along with very occasional captures offshore, *A. o. desotoi* has been recorded in the Mermantau River Basin and in the Mississippi River and its Basin. In the Lake Pontchartrain Basin, Gulf sturgeon have been collected by Louisiana state researchers and commercial and recreational fishermen in Lake Pontchartrain, Lake Borgne, and the Rigolets. Incidental catches of Gulf sturgeon have also been reported in the Tchefuncte, Tickfaw, Tangipahoa, Amite, Pearl, Middle Pearl, Bogue Chitto, and East Pearl rivers. Incidental catches and Gulf sturgeon collected in research studies have been similarly reported in the Mississippi Sound, as well as at least one incidentally taken fish in Biloxi Bay (Anon., 1995).

Mississippi: *A. o. desotoi* has been recorded in both Pascagoula Bay and the Pascagoula River. Also in this basin, Gulf sturgeon have been reported in the Chickasawhay, Leaf, and West Pascagoula rivers, which are tributaries of the Pascagoula River (Anon, 1995).

Alabama: *A. o. desotoi* are reported to be present in the Mobile River Basin, which includes Mobile Bay, the Mobile River, and tributaries such as the Tensaw, Blakely, Tombigbee, and Alabama rivers. Incidental catches of Gulf sturgeon have occurred in the Tombigbee River in the remaining riverine habitat below Coffeeville Dam and in the Alabama River in remaining habitat below Claiborne Dam (Anon., 1995).

Florida: A Gulf sturgeon was collected in Pensacola Bay in 1978, and the subspecies has been recorded in the Escambia River by the U.S. Fish and Wildlife Service (USFWS) as recently as 1994. Incidental catches of sturgeon have also been reported in that river, but recreational anglers have said that sightings are far less common when compared to the period prior to 1980. Annual sightings are also reported on the Conecuh River, a tributary of the Escambia. Other rivers in this system in which Gulf sturgeon have been captured and released during the 1990s by either the Florida Game and Freshwater Fish Commission or the USFWS include the Blackwater and Yellow rivers (Anon., 1995).

A. o. desotoi have been collected by federal, state, or university researchers in the Florida's Choctawhatchee Bay Basin. By far the greatest number were found in the Choctawhatchee River during tagging and release studies in the first half of the 1990s, and annual sightings are reported from the river below its confluence with the Pea River in south-central Alabama, as well as in the Pea River tributary itself (Anon., 1995). A population estimate published in 2000 for Gulf sturgeon older than age 2 in the Choctawhatchee River indicated a range of 1 700-3 000 fish (Lorio, 2000 cited in R. St. Pierre, IUCN/SSC Sturgeon Specialist Group, *in litt.* to IUCN/SSC Wildlife Trade Programme 28 September 2001).

The Apalachicola River contains a monitored Gulf sturgeon population. From 1984 to 1993, the estimated annual number of adult fish ranged from 96-131, with a mean of 115. Gulf sturgeon have also been caught by commercial gillnet fishermen and shrimp trawlers in Apalachicola Bay, and in the Brothers River, a tributary of the Apalachicola River. There was also a report of a large Gulf sturgeon (207 kg) in the Flint River near Albany, Georgia prior to the completion of the Jim Woodruff Lock and Dam in 1957. Juvenile fish have been recorded in the Ochlockonee River, part of the Ochlockonee River Basin (Anon., 1995).

Farther east and south, the Suwanee River Basin is believed to support the most viable Gulf sturgeon population in the region. Mark and release efforts by the Caribbean Conservation Corporation from 1986 to 1995 recorded 1 670 spring-migrating sturgeon at the mouth of the Suwanee River. The 1995 U. S. Fish and Wildlife Service

(USFWS)/Gulf States Marine Fisheries Commission (GSMFC) Gulf Sturgeon Recovery/Management Plan estimated that the annual population size ranged between 2 250-3 300 Gulf sturgeon, with an average weight of approximately 18 kg (Anon., 1995). A 1999 report estimated that the population included 7650 individuals older than 2 years (Sulak and Clugston, 1999 cited in R. St. Pierre, IUCN/SSC Sturgeon Specialist Group, *in litt*. to IUCN/SSC Wildlife Trade Programme 28 September 2001).

Tampa Bay has been the site of occasional captures of Gulf sturgeon. Charlotte Harbor Basin has also produced recorded specimens of juvenile and adult fish (Anon., 1995).

HABITAT AND ECOLOGY

Atlantic sturgeon: Adult *A. o. oxyrinchus* are anadromous, primarily inhabiting marine and brackish waters, and ascending into fresh water for spawning only. Feeding migrations of up to 3 000 km have been reported. The largest specimen ever recorded was approximately 4.2 m long and weighed 370 kg, but today the Atlantic sturgeon is believed to rarely attain more than approximately 2 m and 60 kg. The maximum lifespan is reported to be 60 years (Anon., 2001d; Hochleithner and Gessner, 1999).

The spawning season occurs between April and July and actual timing varies with water temperatures. Spawning occurs at water temperatures between 13-22° C over rocky or gravel substrate, with a preferable current of 0.5-0.8 m/second. *A. o. oxyrinchus* exhibits clinal variation in sexual maturity , with northern populations maturing much later than southern populations. In the far northern part of the range in the St. Lawrence River, females reach sexual maturity at 24-28 years and males at 20-24 years, while in the south females may reach maturity at 9-15 years and males at 7-9 years. Intervals between spawning also vary according to distribution, and vary from 1-4 years for males and 3-5 years for females (Chapman 1999; Hochleithner and Gessner, 1999).

Egg size is reported to be 2.3-2.8 mm in diameter, with fecundity varying from 16 000 to 24 000 eggs/kg of body weight, or an average of 20 000 eggs/kg of body weight (Chapman 1999; Hochleithner and Gessner, 1999). The ripe ovaries may account for as much as 25% of the total fish weight. Based on the weight of the fish, some sources estimate that a female may carry 400 000 to 2.6 million eggs (Anon., 1998a). Hochleithner and Gessner (1999) estimated a figure of 600 000 to 2 million eggs. Hatching is believed to occur at water temperatures between 16-19° C after 120-140 hours. Juvenile sturgeon are thought to remain in riverine or estuarine habitats for 1-6 years (Anon., 1998a). Adults descend the rivers immediately after spawning (Hochleithner and Gessner, 1999).

Despite its highly migratory nature, it is believed that the coastal movements of Atlantic sturgeon are largely confined to biogeographic provinces associated with their natal rivers. A 1996 study and 1997 analysis (Waldman *et al*., 1996; Wirgin *et al*., 1997) of the stock structures of populations of Atlantic sturgeon showed three highly differentiated stocks: Canadian (St. Lawrence and Saint John rivers); Hudson River; and southeastern rivers (Edisto, Savannah, Ogeechee, Altahama, and Satilla). Furthermore, despite the geographic proximity of the southern rivers, mitochondrial DNA analysis showed that stocks generally exchange less than one female per generation. These low gene flows were cited as evidence that natural recolonization of extinct or extirpated populations of Atlantic sturgeon will proceed slowly, complicating conservation and recovery efforts (Waldman and Wirgin, 1998).

The diet of *A. o. oxyrinchus* consists primarily of benthic invertebrates. Fish and mussels are also occasionally consumed (Hochleithner and Gessner, 1999).

Gulf sturgeon: A. o. desotoi is also anadromous. However, unlike *A. o. oxyrinchus*, which spends much of its life in marine and near-shore waters, adult and sub-adult Gulf sturgeon are believed to spend eight to nine months of each year in rivers and three to four months in estuaries or the Gulf of Mexico, usually during winter. Juvenile Gulf sturgeon less than two years old remain in riverine habitats and estuaries year-round (Anon., 1995).

Many Gulf sturgeon are believed to spend the summer months near the mouths of springs and cool-water rivers. In these rivers, sturgeon are often found congregated near deep water holes or in areas of deeper water with sand and gravel substrates. Due to the scarcity of historical biological data, it is impossible to determine if these areas represent preferred historic habitat or are what remains following the damming of rivers (Anon., 1995).

A. o. desotoi is believed to grow to a length of up to 2.4-2.7 m and a weight of up to 200-225 kg based on some historical examples (Anon., 1995). Chapman (1999) estimates longevity at 42 years.

Studies of *A. o. desotoi* migration in various rivers indicate that sub-adult and adult fish generally begin to migrate into rivers from the Gulf when temperatures increase to 16-23°C. They remain in the river systems until late fall, when water temperatures begin to drop, and most return to estuaries or the Gulf of Mexico by mid-November or early December. Analysis of mitochondrial DNA indicates that there are significant differences among sturgeon stocks in various rivers. These data suggest region-specific stocks and that Gulf sturgeon may have river-specific fidelity (Anon., 1995).

Timing, location, and habitat requirements for spawning are not well known or documented for this subspecies. A study by Huff (1975) in the Suwanee River found that sexually mature females ranged from 8-17 years old. Chapman (1999) notes the age at maturity at 7-12 years. Fecundity is estimated at 9 000-21 000 eggs/kg of female body weight, and spawning is estimated to take place for both males and females at intervals from 1-3 years. Egg size is estimated at 2.3-2.8 mm, with eggs varying in color from gray to brown to black (Anon., 1995; Chapman, 1999).

The subspecies' diet is believed to include crabs, amphipods, isopods, midge larvae, mud shrimp, and plant material. Sub-adult and adult fish apparently do not feed in their freshwater riverine habitats. Why the subspecies feeds for three to four months and then does not feed for the following eight or nine months is unclear (Anon., 1995).

THREATS TO SURVIVAL AND DOMESTIC USE

Atlantic sturgeon: Commercial over-harvest is often cited as a significant cause of the decline of *A. o. oxyrinchus* from historical times to the present. Papers dating as far back as 1888 expressed concern about unsustainable commercial exploitation of Atlantic sturgeon, and a cycle of "boom-and-bust" fisheries over the past century or more along the eastern seaboard is generally believed to have contributed significantly to depletion of the subspecies (Anon., 1998a; Waldman, 1999).

Although harvest of *A. o. oxyrinchus* is presently banned in the USA and restricted in Canada, the Atlantic sturgeon continues to face a number of conservation challenges through inhabiting rivers, estuaries, bays, and the ocean at various times during their long lifespans. This reliance on multiple habitats, plus the late age at maturation, leaves *A. o. oxyrinchus* vulnerable to a variety of forms of habitat degradation (Anon., 1998a). In addition, mortality resulting from bycatch in other fisheries may be an important factor affecting the Atlantic sturgeon's rate of recovery (Anon., 1998b). Finally, accidental or intentional introduction of exotic sturgeon species also poses a potential threat.

Over the last century and more, dams for hydroelectric power and flood control have affected rivers and habitat important to *A. o. oxyrinchus* in a number of rivers in both Canada and the USA. Dams affect anadromous species like the Atlantic sturgeon by blocking access to spawning grounds, changing free-flowing rivers to reservoirs, and altering downstream flows and water temperatures (Anon., 1998a). Hydroelectric power plants also have numerous potential impacts on habitat and water quality conditions important to the Atlantic sturgeon, including altered dissolved oxygen concentrations and temperature, artificial destratification, water withdrawal, changes in sediment load and channel morphology, accelerated eutrophication and change in nutrient cycling, and contamination of water and sediment (Hill, 1996).

Dredging of riverine, nearshore, and offshore areas for commercial shipping, recreational boating, construction, and marine mining significantly impacts aquatic ecosystems by removing, disturbing, and re-suspending bottom sediments. Impacts include direct removal or burial of organisms, turbidity/siltation effects, contaminant release and uptake, noise/disturbance, alterations to the hydrodynamic regime and physical habitat, and loss of riparian habitat (Chytalo, 1996). For example, these activities can disturb or eliminate benthic fauna on which *A. o. oxyrinchus* feed. They may also eliminate deep holes and alter rock substrates, which are important habitat features for the Atlantic sturgeon (Smith and Clugston, 1997).

Industrial activities, forestry and agriculture practices, coastal development and urbanization, and other human activities affect water quality in riparian systems in the watershed directly and indirectly in nearshore and offshore areas. Industrial activities can discharge pollutants, change water temperature and levels of dissolved

oxygen, and add nutrients. Forestry and agriculture practices often produce erosion, introduce fertilizers, herbicides, insecticides and other chemicals in water systems through run-off, and promote nutrient enrichment and alteration of water flow. Coastal development and urbanization result in storm water discharges, non-point source pollution, and erosion. *A. o. oxyrinchus* may be particularly vulnerable to such contamination because they are benthic feeders and because their long lifespans allow for the accumulation of heavy metals and organochlorine compounds in their fatty tissue (Anon., 1998a).

Bycatch of Atlantic sturgeon occurs in commercial fisheries along the entire USA Atlantic coast. Fisheries in which *A. o. oxyrinchus* have been captured include the American shad (gill nets), Atlantic cod (gill nets, incidental hook and line), Bluefish (gill nets, trawl), Groundfish (trawl), Horseshoe crabs (trawl), Monkfish (gill nets), River herring (gill nets), Southern shrimp (trawls), Spiny dogfish (gill nets), Striped bass (gill nets, pound nets), Summer flounder (trawl, perhaps gill nets in North Carolina), Weakfish (gill nets), and Northeastern and Southeastern whelk (trawls). Limited bycatch of juvenile Atlantic sturgeon has also been documented in lobster, crab, and fish pots. Since any level of bycatch is likely to delay recovery of the Atlantic sturgeon, there is a clear need to better document its extent, mortality in various gears, and population level impact (Anon., 1998b).

Concern that non-indigenous sturgeon pathogens could be introduced, most likely through aquaculture operations, has led the Atlantic States Marine Fisheries Commission (ASMFC) to impose restrictions on the aquaculture, importation, and international and interstate trade of live Atlantic sturgeon (Anon., 2001b). There is also some concern that the aquarium industry could possibly be a source for transfer of non-indigenous pathogens or competitive non-indigenous species from one geographic area to another, primarily through release of aquaria fish into public waters (Anon., 1998a).

Gulf sturgeon: Heavy commercialization in the late 19th century, which often went undocumented, is also believed to have contributed to the decline of *A. o. desotoi*. Some commercialization continued into the 1980s, but the only consistent Gulf sturgeon fishery occurred in western Florida (Anon., 1995; Waldman, 1999). As in other sturgeon fisheries, periods of significant harvest appear to have been followed by years of few captures. In addition to commercial harvest, "snatch-hook" recreational fisheries in Florida continued into the 1980s, and incidental take in other fisheries by commercial shrimpers, gillnet fishermen, and in the industrial bottomfish fishery (for the pet food industry) has been documented. As the USA no longer allows any targeted commercial fishing operations or recreational fishing for the subspecies, the major current threat from exploitation is likely to come from incidental catch (Anon., 1995).

The Gulf sturgeon *A. o. destoi* is effected by human activities such as dam construction, dredging, channel maintenance, urban development, land management, and other activities therefore affect Gulf sturgeon habitat as they do other sturgeon species. Navigation activities other than dam construction can also affect sturgeon habitat. In the Apalachicola River, a deep, rocky area at Rock Bluff at river mile 92.5 (river kilometer 148.8) frequented by Gulf sturgeon was filled with dredge spoil material from a disposal site upstream. Observations indicate that this activity apparently caused Gulf sturgeon to stop using the area as a regular habitat. Deepening channels, removing river bends, and repeated dredging for channel maintenance have further eliminated important habitat in some river systems. As the essential habitats of young-of-the-year Gulf sturgeon are poorly understood it is difficult to assess the impacts of such dredging on early life stages (Anon., 1995).

Another source of environmental stress may be the loss of cool water habitats important to Gulf sturgeon during summer months. Pumping or climate-induced groundwater-level declines can reduce the springflow that provides these cool water habitats. Loss of cool water habitats and water sources at critical times during the summer could subject Gulf sturgeon and their habitat to increased stress (Anon., 1995).

Pollution and contaminants may also impact *A. o. desotoi*. Studies of Gulf sturgeon in various rivers in the 1980s and early 1990s found concentrations of arsenic, mercury, DDT metabolites, toxaphene, polycyclic aromatic hydrocarbons (PAH), and aliphatic hydrocarbons high enough to warrant concern. The overall impact of these contaminants is difficult to determine, and likely varies by river system (Anon., 1995).

Accidental introduction of non-endemic species is considered a threat to ecosystems where wild populations of *A. o. desotoi* exist or where the subspecies may be re-introduced. Accidental and intentional releases of exotic species has been a frequent occurrence in the range of the Gulf sturgeon, even where laws or regulations prohibit it (Anon., 1995). Finally, since Gulf sturgeon appear to exhibit river fidelity, natural re-population rates may be very low or non-existent in systems where the subspecies is extirpated or significantly reduced. While

immature sturgeon occasionally move between river systems, the long period they require to reach sexual maturity and an intermittent spawning cycle make it unlikely that the subspecies can establish breeding populations quickly (Anon., 1995).

The harvest of *A. o. desotoi* and *A. o. oxyrinchus* is currently banned in the USA so there is no domestic use of the species. Within Canada, the volume and trend of domestic consumption of *A. o. oxyrinchus* is unknown.

INTERNATIONAL TRADE

A. oxyrinchus was first included in the CITES Appendices with effect from 1 July 1975 when the species was listed in Appendix I. Canada entered a reservation to the listing, which was withdrawn on 26 June 1979, when the species was transferred to Appendix II (Anon., 2001a).

The only current commercial trade in *A. o. oxyrinchus* comes from Canadian fisheries. Historically, it is believed that sustaining a caviar industry in Canada's Atlantic sturgeon fishery was difficult because of the uncertainty of spawning runs (Anon., 1998a). According to CITES data obtained from UNEP-WCMC, no international trade in specimens of *A. oxyrinchus* took place from 1990-1995; gross trade and a comparative tabulation of CITES reported trade in *A. oxyrinchus* for 1996-1999 is given in Annex 1 (Table 1). Canada has not submitted annual reports since 1997, and hence UNEP-WCMC data for 1998-1999 relies on data provided by Parties importing *A. oxyrinchus* from Canada. Data provided for this study by the Canadian Management Authority are therefore more accurate in terms of export composition and destination than compiled CITES annual report data obtained from UNEP-WCMC.

A summary of Canada's exports of commercial "product" (whole fish, meat or caviar) for 1996-2000 is given in Annex 2 (Table 2). According to these data, exports of "product" for commercial purposes totaled approximately 70 t: 22.4 t in 1996; 18.5 t in 1997; 8 t in 1998; 15.7 t in 1999; and 5.4 t in 2000. All of these exports were sourced from the wild, with the largest importer of Canadian *A. o. oxyrinchus* products being the USA (CITES Management Authority of Canada, *in litt.* to TRAFFIC International, 26 November 2001). Note that the export data for 1996 obtained from the CITES Management Authority of Canada (22.4 t) differ significantly with that of the UNEP-WCMC data (2.2 t). This discrepancy requires clarification by the CITES Management Authority of Canada and importing Parties.

No live specimens were exported from Canada in 1996. Canada's live exports for 1997-2000 comprised only of captive bred specimens exported for scientific purposes. During the period 1997-2000, exports totaled 18 110 live specimens and 4 000 fertilised eggs: 1 000 fingerlings in 1997; 710 fingerlings and 4 500 one month-old specimens in 1998; 4 000 eggs, 6 000 sack fry and 2 800 two-month old specimens in 1999; and 3 100 larvae in 2000. These specimens were exported to the following countries in decreasing order of volume: USA; Germany; Austria; and Italy. All live exports originated from New Brunswick, and the non-detriment findings were based on the fact that they originated from "live-capture" breeding operations and do not represent harvest from wild stocks. All live exports originated from the Canadian Sturgeon Conservation Centre (previously known as the Canadian Caviar Company), in New Brunswick (CITES Management Authority of Canada, *in litt.* to TRAFFIC International, 26 November 2001).

CITES annual report data show that a total of four eggs (unit unspecified) exported from the Russian Federation and Australia, were seized by New Zealand authorities in 1999.

According to data obtained from USFWS and UNEP-WCMC, the USA has not reported importing any *A. oxyrinchus* meat from Canada during the years 1996-1997. It is therefore likely that the meat reportedly exported by Canada to the USA during this period (approximately 20.7 t) has not been reported upon import into the USA. This therefore indicates a potentially significant problem regarding implementation of CITES import procedures within the USA during this period.

In response to CITES Notification to the Parties No. 2001/005 concerning "Catch and Export Quotas for Acipenseriformes for 2001," the Canadian Management Authorities noted that the country has catch quotas and other regulations for *A. o. oxyrinchus*, and that non-detriment findings for wild-caught sturgeon products are based on their being within sustainable harvest limits (i.e. catches are within the catch quotas) (CITES Management Authority of Canada, *in litt.* to TRAFFIC International, 24 December 2001). The figures suggested by Canada for the CITES Secretariat to use as export quotas for wild specimens exported in 2001 are 58 000 kg

of meat and 500 kg of caviar. Canada also indicated possible export levels of captive bred live specimens as 1 000 kg of Atlantic sturgeon in this year (L. Maltby, Canadian Wildlife Service, *in litt.* to CITES Secretariat, 2001). These figures are included in Notifications 2001/041 and 2001/042.

CONSERVATION MEASURES IN PLACE

Canada

Federal and provincial fishery managers have mandated harvest quotas and other conservation measures related to *A. o. oxyrinchus*. Quebec imposed a total harvest quota of 145 502 kg and a Total Allowable Catch (TAC) of 6 015 fish in 1997, along with a maximum size limit of 1.5 m. Monitoring of captures, conducted in collaboration with commercial fishermen, has enabled provincial government agencies to measure the effectiveness of the regulations. The season runs from May 1 to September 30, and all fishing zones are in brackish areas of the estuary (Anon., 1998a; CITES Management Authority of Canada, *in litt.* to TRAFFIC International, 24 December 2001). Total harvest quotas and TACs for 1998-2000 are as follows: 108 024 kg quota with a TAC of 5 297 fish in 1998; 103 615 kg quota with a TAC of 5 297 fish in 1999; and 116 843 kg quota with a TAC of 4 767 fish in 2000 (CITES Management Authority of Canada, *in litt.* to TRAFFIC International, 24 December 2001).

There are nine licensed fishermen for Atlantic sturgeon in the Saint John River, New Brunswick. There are no sturgeon licenses for the Gulf of St. Lawrence areas of New Brunswick, Nova Scotia, or Prince Edward Island, although small amounts of bycatch (less than 0.3 t/year) were reported in the decade up to 1997. This is a "sunset" commercial fishery, with non-transferable licenses that terminate with the death of the existing licensee, and no new licenses are available. Each license authorizes specific amounts of gear, and the season is closed for the entire month of June to protect spawning fish. Retention of bycatch has been prohibited in the Maritime provinces since 1995 (Anon., 1998a; CITES Management Authority of Canada, *in litt.* to TRAFFIC International, 24 December 2001).

USA

Federal and state authorities in the USA have undertaken measures to enhance the conservation and management of both *A. o. oxyrinchus* and *A. o. desotoi*. Since these measures differ for the two subspecies, they are described separately below.

Atlantic sturgeon. In 1988, the National Marine Fisheries Service (NMFS) announced the creation of a list of candidate species being considered by the Secretary of the Department of Commerce (of which NMFS is a part) for listing as threatened or endangered species under the USA Endangered Species Act of 1973 (ESA). NMFS added *A. o. oxyrinchus* to this list in 1991, and it remained on the revised list published in 1997 (Anon., 1998a). In late 1998 the USA Department of Commerce decided that listing as threatened or endangered under the ESA was not warranted at that time (Field *et al*., 1999).

Several interstate and federal laws and authorities oversee Atlantic sturgeon management. Perhaps the most important of these is the Atlantic States Marine Fisheries Commission (ASMFC). Authorized under the terms of the Atlantic States Marine Fisheries Compact, and joining the fifteen coastal states from Maine to Florida, the purpose of ASMFC is to promote better utilization of the fisheries of the Atlantic seaboard "by the development of a joint program for the promotion and protection of such fisheries, and by the prevention of the physical waste of the fisheries from any cause" (Anon., 1998a).

A 1993 amendment empowered the Secretary of Commerce to enforce mandatory compliance with approved ASMFC management measures by declaring a moratorium on fishing of the applicable species within the waters of any non-complying state. In July, 1998, ASMFC imposed a complete moratorium on harvest, sale, and possession of *A. o. oxyrinchus* as a mandatory compliance measure in all ASMFC jurisdictions. The moratorium cannot be lifted for a spawning stock until 20 protected year classes of females are established. Atlantic sturgeon reach maturity at an average age of 18 years, so it is therefore anticipated that the moratorium will be in effect until at least until 2039 (41 years from implementation, although consideration of lifting the moratorium could be given in areas where fish reach maturity at younger ages or where state moratoria had been in effect for some time before 1998). The moratorium also included:

A complete ban on possession of wild Atlantic sturgeon or their parts;

A request to the Secretary of Commerce to ban harvest and possession of Atlantic sturgeon in the Exclusive Economic Zone (EEZ);

Requirements that states assess and annually report capture and mortality of Atlantic sturgeon caught as bycatch in other fisheries, with the potential for closing those fisheries if bycatch is a significant threat to recovery;

Requirements that states authorizing culture of sturgeons (Atlantic or non-indigenous) require permittees to take appropriate measures to prevent escape or disease transmission;

Requirements that states report annually to ASMFC on their habitat protection and enforcement measures; and,

Requirements that states conduct periodic monitoring of populations (Anon., 1998a; Anon., 1998b).

All USA coastal states have now instituted a moratorium on possession of *A. o. oxyrinchus*, which eliminates the threat from directed commercial fishing as well as the incentive to keep sturgeon obtained as bycatch.

Gulf sturgeon: Unlike the Atlantic sturgeon, the Gulf sturgeon is listed as threatened under the ESA. Section 6(a) of the ESA provides for cooperation with affected states for the purpose of conserving threatened and endangered species. The Departments of Interior and Commerce can enter into cooperative agreements with a state, provided the state has an established a program for the conservation of the species. All four states in the range of the Gulf sturgeon (Florida, Alabama, Mississippi, and Louisiana) have entered into Section 6 agreements with USFWS (Anon., 1995).

In addition, in 1994 fourteen federal agencies, including the U.S. Army Corps of Engineers, the National Marine Fisheries Service, USFWS, the Department of Defense, the Minerals Management Service, the National Park Service, the Coast Guard, and the Environmental Protection Agency signed a Memorandum of Understanding (MOU) to establish a general framework for cooperation and participation in accordance with responsibilities under the ESA. The MOU called on the agencies to work together along with the public, states, Indian Tribal governments, and local governments to protect and manage species listed under the ESA and the ecosystems upon which those populations depend (i.e. it applies to inter-agency cooperation in recovery of the Gulf sturgeon) (Anon., 1995).

In 1995, USFWS and the GSMFC published the "Gulf Sturgeon Recovery/Management Plan," from which much of this information has been taken. The plan includes one short-term and two long-term objectives. The short-term objective is, primarily, "…to prevent further reduction of existing wild populations of Gulf sturgeon within the range of the subspecies." The first long-term objective is "…to establish population levels that would allow delisting of the Gulf sturgeon by management units. Management units could be delisted by 2023 if the required criteria are met. While this objective will be sought for all management units, it is recognized that it may not be achievable for all management units." The second long-term objective is, principally, "…to establish, following delisting, a self-sustaining population that could withstand directed fishing pressure within management units. Note that the objective is not necessarily the opening of a management unit to fishing, but rather, the development of a population that can sustain a fishery." The Plan goes on to outline recommendations for specific recovery actions to address threats to the subspecies (Anon., 1995).

As with the Atlantic sturgeon, states within the range of *A. o. desotoi* have also taken legal and regulatory steps (as well as implementing conservation programs) to manage the Gulf sturgeon towards recovery. Florida, Alabama, Mississippi, and Louisiana all prohibit any directed commercial or sport harvest of Gulf sturgeon (Anon., 1995).

Other USA federal laws which impact the management of *A. o. oxyrinchus* and *A. o. desotoi* in the USA include the Magnuson-Stevens Act (16 U.S.C. 1801 *et. seq.*), the Lacey Act of 1981 (16 U.S.C. 3371-3378), the Federal Power Act (16 U.S.C 791-828), the Anadromous Fish Conservation Act (16 U.S.C. 757a-757f), the Fish and Wildlife Coordination Act (16 U.S.C. 661-666), the Federal Water Pollution Control Act (33 U.S.C. 1251-1376 – "Clean Water Act"), the Rivers and Harbors Act of 1899, the National Environmental Policy Act (42 U.S.C. 4321-

4347), the Coastal Zone Management Act (16 U.S.C. 1451-1464) and Estuarine Areas Act, the Marine Protection, Research and Sanctuaries Act of 1972 and the Shore Protection Act of 1988 (Anon., 1998a).

CAPTIVE BREEDING

USFWS is currently engaged in research regarding captive propagation of *A. o. oxyrinchus and A. o. desotoi*. Studies are ongoing in Florida facilities to test reformulated feeds that support high levels of growth and survival of both Atlantic and Gulf sturgeon. Food is produced at the Bozeman Fish Technology Center (FTC) in Montana and shipped to cooperators for use in agreed upon studies. Work has also been underway at the Lamar FTC in Pennsylvania to develop culture technology and determine growth and survival of fry and fingerling Atlantic sturgeon reared at various stocking densities and fed various diets (Anon., 2001f). Any work on captive rearing of *A. o. oxyrinchus* in the USA must be conducted in compliance with the requirements of the 1998 ASMFC terms.

Facilities for hatchery-reared *A. o. oxyrinchus* in Canada are concentrated in New Brunswick. In 2001, ASFMC approved an exemption to allow the importation of non-indigenous Atlantic sturgeon fingerlings from Canada into the state of Florida. The sale of live fingerlings, cultured from eggs taken from wild Atlantic sturgeon broodfish populations in the Saint John River system in New Brunswick, will involve a joint initiative between the Canadian Sturgeon Conservation Centre (previously known as the Canadian Caviar Company), academic researchers, and several private aquaculturalists. Production of Atlantic sturgeon as domestic foodfish and caviar for the USA is the primary intent. There is potential for international sales of the aquacultured foodfish and caviar as long as such transactions are accompanied by CITES export permits (Anon., 2001f; CITES Management Authority of Canada, *in litt.* to TRAFFIC International, 24 December 2001).

According to Anon. (2001e), captive propagation of *A. o. desotoi* and development of hatchery broodstock are necessary for the recovery of this subspecies. The Welaka National Fish Hatchery (NFH) in Florida is holding 1 200 Gulf sturgeon of two year classes for future broodstock, captive propagation, and research needs. Efforts are underway to determine migration patterns and habitat preference types for the Suwanee River wild population. To accomplish this, sonic and radio tags are placed on sturgeon that are captured and then released, and tag retention is a major concern. To address it, 10 sturgeon of the 1995 year class are being used in a tag retention study in cooperation with the Panama City Fisheries Resource Office. These fish have been tagged with various fasteners placed on different body parts and retention rates are being monitored. Length and weight differences between tagged and untagged fish are also being recorded. In addition, 45 fish from the 1995 year class are being raised to determine the rate of sexual maturation in a hatchery environment (Anon., 2001e).

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Table 1

Comparative tabulation and gross trade data for all trade in *A. oxyrinchus*, 1996-1999

				Imports reported				Exports reported					
Year	**Imp.**	**Exp.**	**Origin**	**Quantity**	**Units**	**Term**	**Purpose**	**Source**	**Quantity**	**Units**	**Term**	**Purpose**	**Source**
1996	US	CA							2 161	kg	Meat	T	W
1997	AT	CA		1 000		Live	S	C	1 000		Live	S	C
1997	US	CA							18 548	kg	Meat	T	W
1998	DE	CA		500		Live	B	C					
1998	US	CA		60		Live		C					
1999	IT	US	CA	1		Bodies	T	W					
1999	NZ	AU		2		Eggs		I					
1999	NZ	RU		1		Eggs		I					
1999	US	CA		6 509	kg	Meat	T	W					
1999	DE	US							6		Specimens		W

Year	**Term**	**Unit**	**Country**	**Gross exports**	**Gross imports**
1996	Meat	kg	CA	2 161	0
1996	Meat	kg	US	0	2 161
1997	Live		AT	0	1000
1997	Live		CA	1 000	0
1997	Meat	kg	CA	18 548	0
1997	Meat	kg	US	0	18 548
1998	Live		CA	560	0
1998	Live		DE	0	500
1998	Live		US	0	60
1999	Bodies		IT	0	1
1999	Bodies		US	1	0
1999	Eggs		AU	2	0
1999	Eggs		NZ	0	2
1999	Eggs		NZ	0	1
1999	Eggs		RU	1	0
1999	Meat	kg	CA	6 509	0
1999	Meat	kg	US	0	6 509
1999	Specimens		DE	0	6
1999	Specimens		US	6	0

Source: CITES annual report data compiled by UNEP-WCMC.

Table 2

SUMMARY OF CANADIAN COMMERCIAL EXPORTS (PRODUCT ONLY) AND CATCH QUOTAS / TOTAL ALLOWABLE CATCHES FOR *A. OXYRINCHUS*, 1996-2000

	Cumulative weight of commercial export	**Provincial catch quota and / or total allowable catch (TAC)**
1996	22 442 kg (49 477 lb)[1]	Data unavailable
1997		
Quebec	18 545 kg	145 502 kg quota/TAC 6 015 fish
Nova Scotia-New Brunswick	0 kg	No quota or TAC set by province*
1998		
Quebec	7 959 kg	108 024 kg quota / TAC 5 297 fish
Nova Scotia-New Brunswick	42.67 kg	No quota or TAC set by province*
1999		
Quebec	6 508 kg	103 615 kg quota / TAC 5 297 fish
Nova Scotia-New Brunswick	9 160 kg	No quota or TAC set by province*
2000		
Quebec	0 kg	116 843 quota / TAC 4 767 fish
Nova Scotia-New Brunswick	5 432 kg	No quota or TAC set by province*

Source: CITES Management Authority of Canada, *in litt.* to TRAFFIC International, 24 December 2001
[1]CITES Management Authority of Canada, *in litt.* to TRAFFIC International, 26 November 2001

*Commercial fisheries in New Brunswick are regulated through permits, gear restrictions, size restrictions and seasonal closures (see **Conservation Measures in Place**).

Acipenser persicus Borodin, 1897

Persian Sturgeon
Ossetra/Asetra

Order: ACIPENSERIFORMES **Family: ACIPENSERIDAE**

SUMMARY

The Persian sturgeon *A. persicus* has a wide distribution occurring in the Caspian Sea and the Black Sea and in many of the tributaries of these seas. However, the construction of dams on virtually all these rivers has significantly reduced the available spawning area for all species of sturgeon. The majority of the population is now thought to occur in the southern parts of Caspian Sea, originating mainly from restocking programmes carried out by the Islamic Republic of Iran, (hereafter referred to as Iran). *A. persicus* develops sexual maturity between eight and 15 years of age and may live up to 40 years and weigh up to 86 kg. In addition to loss of habitat, *A. persicus* has been subject to overfishing.

It is difficult to distinguish *A. persicus* from *A. gueldenstaedtii* (Russian sturgeon) morphologically and for the last decade, the annual catch data for *A. persicus* and *A. gueldenstaedtii* have been combined for Azerbaijan. However, Iran started to issue separate quotas for these species in 2001. Information on the domestic markets for Persian sturgeon products is not available for the Russian Federation, but Iran estimated its domestic consumption to be 5% of the country's total caviar production and 65% of its sturgeon meat production. Iran records that annual catches of *A. persicus* have increased after a low period in the mid 1990s. It now seems, particularly in Iranian waters that the status of *A. gueldenstaedti* is declining whist the status of *A. persicus* is improving.

In 1998-1999, reported range State gross exports of *A. persicus* caviar totalled 61.2 t, with Iran (61 t) being the main exporter; Turkey was also reported as an exporter and the Russian Federation as a country of origin. Iran apparently exceeded its caviar export quota for 1998 of 10 t (but caviar exports of *A. gueldenstaedtii* and *A. persicus* may have been combined in the Iranian CITES annual report for 1998). The total caviar export quota for 2001 has decreased from the 2000 quota of 56.350 t to 51 t, but the export quota for meat increased significantly, from 43.5 t to 140 t.

Iran is carrying out a large restocking programme for *A. persicus.*

Since the break-up of the former USSR, Iran is currently the only country that allows the legal acquisition of sturgeon from the waters of the Caspian, all other range states require that fish be caught in the rivers, though the situation in Azerbaijan is unclear.

The species is recommended under Decision 11.106 for inclusion in category 1/2.

SPECIES IDENTIFICATION

The Persian sturgeon, *A. persicus* was for a period considered to be synonymous with *A. gueldenstaedtii*, the Russian sturgeon but is now considered a valid species (Artyukhin, 1995; Bemis *et al*., 1997; Coad, 1995; Reshetnikov *et al*., 1997, Sokolov, 1998 all cited in Eshmeyer, 1998). However, Vlasenko *et al.* (1989 cited in Anon., 1997) contend that *A. gueldenstaedtii* was not distinguishable from *A. persicus*, where their ranges overlap in the southern and southeastern Caspian. Indeed, the two species are combined in the catch statistics of Azerbaijan, and were combined for Iran's 2000 caviar export quota. However,. Pourkazemi (Chair IUCN/SSC Sturgeon Specialist Group *in litt.* to IUCN/SSC Wildlife Trade Programme, 25 September 2000) notes that *A. gueldenstaedtii* can be distinguished from *A. persicus* in the Iranian coasts on the basis of 22 morphological differences (Nazari Chari, 1993, cited in Dr M Pourkazemi *in litt.* to IUCN/SSC Wildlife Trade Programme, 25 September 2000). As the range of measurements from the two species overlap and neither the sample size nor the standard deviation of the measurements are included in the data presented, it is not clear if there is a statistical difference. These two species can also apparently be differentiated on the basis of immuno-biochemical characteristics (Pourkazemi *in litt.* to IUCN/SSC Wildlife Trade Programme, 26 October 2001).

Whilst the CITES Management Authority of Azerbaijan (*in litt*. to CITES Secretariat, 23 November 2001) recognise that there are morphological differences between these two species, they state that a generic

description of *A. persicus* is not available, consequently, the trade data do not differentiate *A. persicus* specifically. The DNA test developed by the United States Fish and Wildlife Service to identify sturgeon products in trade cannot distinguish between the two species (Fain, 2001). The catch and export quotas provided to the CITES Secretariat by Iran for 2001 are separate for the two species (Notification to the Parties No. 2001/042).

Further taxonomic confusion also exists concerning the subspecies *colchicus*, which has been assigned variously to *A. gueldenstaedtii colchicus* (e.g. Dr N. Patriche *in litt.* to IUCN/SSC Wildlife Trade Programme, 2 November 2000), or to *A. persicus colchicus* (e.g. Zarkua and Tsuladze, 1999).

DISTRIBUTION AND POPULATION

The CITES database lists the current distribution of *A. persicus* as: Azerbaijan; Georgia; Iran (Islamic Republic of); Kazakhstan; Russian Federation; Turkey (Anon., 2001a).

The 1996 IUCN Red List classifies A. persicus as: Endangered (EN - A2d) based on a population reduction of at least 50% over the next three generations caused by actual or potential levels of exploitation.

Black Sea Stock: Endangered (EN - A1ac) Georgia, Russian Federation, Turkey, based on a directly observed population reduction of at least 50% over the last three generations caused by a decline in area of occupancy, extent of occurrence and/or quality of habitat.

Caspian Sea Stock: Vulnerable (VU - A1acde) Azerbaijan, Iran (Islamic Republic of), Russian Federation, based on a population reduction of 20% over three generations which has been directly observed and caused by levels of exploitation and the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites. A decline in area of occupancy/extent of occurrence and/or quality of habitat has also occurred.

Lelek (1987 cited in Anon., 1997) classified the status of *A. persicus* in the Caspian Sea as Endangered.

Pavlov *et al.* (1994 cited in Birstein *et al*., 1997) considered the Black Sea population of this species to be 'R'.

In the Caspian Sea the species is widely distributed throughout the sea, but it feeds and spends the winter mainly in the southern regions (Vlasenko *et al*., 1989 cited in Anon., 1997). Most of the populations remain near the southern coasts (Kazancheev, 1981 cited in Anon., 1999) but long distance migrations between the northern and southern areas have also been reported (Anon., 1999). The main spawning population concentrates in the southern Caspian Sea and ascends the rivers on the Azerbaijan (Kura), Dagestan (Sulak and Samur) (Vlasenko *et al*., 1989 cited in Anon., 1997), and Iranian coasts (the Gorgan Chaii River). On the basis of a stock assessment conducted throughout the Caspian Sea in August and September 2001, *A. persicus* occur more abundantly in Iranian waters than elsewhere as no specimens were observed in the northern part of this Sea according to Moghim and Valinsab, 2001 (cited in Pourkazemi *in litt*. to IUCN/SSC Wildlife Trade Programme, 26 October 2001).

The Black Sea Stocks enter the Rioni River, Georgia and the Don River, Russian Federation to spawn (Artyukhin and Vecsei, 2001). Detailed information on populations, spawning grounds and migration patterns in the Black Sea is not available (Anon, 1999).

Azerbaijan

The species enters the Kura River to spawn (Vlasenko *et al*., 1989 cited in Anon., 1997), but no information is available on the recent incidence of spawning in this river.

Dagestan

Small spawning populations enter the Sulak and Samur Rivers (Vlasenko *et al*., 1989 cited in Anon., 1997) but no information is available on the recent incidence of spawning in this river.

Georgia

The population of the Rioni River was estimated at 17 000 specimens in the early 1980s (Pavlov *et al*., 1994, cited in Anon., 1997).

The southeast coast of the Black Sea is an important feeding and wintering area for sturgeon (*Huso huso*, *A. stellatus*, *A. nudiventris*, *A. persicus colchicus* and *A. sturio*) which migrate upstream to a number of rivers for spawning. The main rivers involved are the Supsa, Inguri, Chorokhi and particularly the Rioni. *A. persicus colchicus* is still the most abundant sturgeon species in Georgian waters (Zarkua and Tsuladze, 1999).

Iran (Islamic Republic of)

The main spawning grounds of the species on the Iranian coast are located in the Sefidrud River. The Gorganrud, Tajan and Babulrud Rivers are also used for spawning (Nasri Chari, 1992 cited in Pourkazemi *in litt*. to IUCN/SSC Wildlife Trade Programme, 26 October 2001). A long term objective of the Iranian management programme for sturgeon is to achieve and sustain 25% natural reproduction in all five sturgeon species occurring in their waters, to help maintain genetic diversity (Jenkins, 2001).

Kazakhstan

The species enters the Ural River to spawn (Levin, 1995) but no information is available on the recent incidence of spawning in this river.

Russian Federation

In the northern part of the Caspian Sea a small spawning population migrates into the Volga (Astrakhan) (Hureau, 1991 cited in Froese and Pauly, 2001) and Terek Rivers (Anon., 1999). No recent information is available on spawning activity in the Russian Federation.

Turkey

The southeastern coast of the Black Sea is an important feeding and wintering area for five sturgeon species (Zarkua and Tsuladze, 1999). The CITES Management Authority of Turkey question the occurrence of *A. persicus* in Turkey (*in litt*. to TRAFFIC International, 11 November 2001).

Turkmenistan

No information available. The CITES Management Authority of Turkey question the occurrence of A. persicus in Turkmenistan (in litt. to TRAFFIC International, 11 November 2001).

Elsewhere

Occurrences have also been recorded in Romania (the Danube) (Hureau, 1991 cited in Froese and Pauly, 2001).

HABITAT AND ECOLOGY

A. persicus may reach a total length of 2.28 m and a weight of 70 kg, and in the Volga River specimens have been reported up to 1.70 m (total length - TL) and 30 kg in weight Vlasenko *et al*., 1989 cited in Anon., 1997). In another source, maximum size is quoted as 157.5 cm TL (male/unsexed); 176.1 cm (female) (Froese and Pauly, 2001).

In the southern Caspian the species reaches a maximum length of 2.98 m (TL) in females and 2.22 m in males. The maximum weight recorded is 86 kg in females and 81 kg in males. The maximum longevity is given as 40 years in females and 36 years in males (Tavakolli and Moghim, 2001 cited in Pourkazemi *in litt.* to IUCN/SSC Wildlife Trade Programme, 26 October 2001). Sexual maturity is attained at eight to nine years in males and 10-14 years in females (Azari Takami, 1974 cited in Pourkazemi *in litt*. to IUCN/SSC Wildlife Trade Programme, 26 October 2001), whereas in the Black Sea basin Persian sturgeon males reach sexual maturity at 8-12 years and females at 13-15 years (Holcik, 1989 cited in Pourkazemi *in litt*. to IUCN/SSC Wildlife Trade Programme, 26 October 2001).

The diet for young individuals consists of a wide variety of mainly benthic invertebrates such as molluscs, insect larvae and crustaceans, while adult fish are mainly piscivorous. Predation of *A. persicus* is not reported (Anon., 1997). Annual food consumption by this species is about 3.4 times its body weight (Froese and Pauly, 2001).

Two races of the species are recognised, namely a spring and a winter race according to the time of the migration (Vladiykov, 1964 cited in Anon., 1999).

In the southern Caspian, the spring race of *A. persicus* migrates to the Sefidrud River in early April to June and the autumn race migrates during October and November (Rostami, 1961 cited in Pourkazemi *in litt.* to IUCN/SSC Wildlife Trade Programme, 26 October 2001). When in the rivers, the species remains close to the bottom and in the main channel of the river at normal to low water levels and fast flowing mountain rivers are preferred for spawning (Artyukhin and Zarkua, 1986 cited in Pourkazemi *in litt*. to IUCN/SSC Wildlife Trade Programme, 26 October 2001).

The migration routes of the spawning populations in the Black Sea are not described in recent studies (Anon., 1999).

THREATS TO SURVIVAL AND DOMESTIC USE

The main threats to *A. persicus* have been overfishing, poaching, construction of dams and pollution.

Construction of hydroelectric power stations and water reservoirs in almost all spawning rivers has led to a sharp reduction of available spawning grounds for all sturgeon species. Dams and subsequent water flow regulation have decreased the ranges of sturgeon by 100 to 200 km in all rivers (mostly South Caspian Sea) (Anon., 1997).

It is estimated that 80% of spawning grounds have been depleted in the Caspian Sea Basin (Barannikova *et al*., 1995 cited in Anon., 1999). Detailed reductions in spawning area due to dam construction have been reported: by Vlasenko, 1994 (cited in Anon., 1999) in the Russian Federation, Azerbaijan and the Autonomous Republic of Dagestan, Russian Federation (hereafter referred to as Dagestan). In the Volga River only 4.3 km^2 of the total 36 km^2 remained after the construction of the Volgograd Dam, whilst in the Terek River 1.3 km^2 of spawning habitat remain. In Azerbaijan, the Kura River spawning grounds have been reduced to about 1.6 km^2, and in Dagestan the Sulak River spawning grounds available are about 2.016 km^2. These reductions in available spawning grounds led to a reduction of the natural reproduction of several sturgeon species (Barannikova *et al*., 1995; Khodorevskaya *et al*., 1997 both cited in Anon., 1999). Although a reduction in natural reproduction due to reduced spawning ground availability has not been documented specifically for *A. persicus*, the species may be similarly affected (Anon., 1999).

Holcik (*in litt.* to IUCN/SSC Wildlife Trade Programme, September 2000) notes that access to the spawning grounds in the Sefidrud has been prevented by the Mangil Dam construction, water extraction and pollution. However, according to Pourkazemi (*in litt.* to IUCN/SSC Wildlife Trade Programme, 25 September 2000), between the Mangil Dam and other dams constructed on the Sefidrud River, there remains a distance of 45 km from the sea to the dam closest to the estuary, and sturgeon are still observed entering the river to spawn.

There is a high level of pollution in almost all rivers within the species' range. From 1978 to 1993 the level of pollution increased drastically in almost all rivers entering the Caspian Sea, the main sources being oil and other industrial sewage (Vlasenko, 1994 cited in Anon., 1999). The Kura River (Azerbaijan) is one of the major sources of the pollution due to draining, mining and industrial sewage from the upper part of the river (Georgia and Armenia) where the river water carries high concentrations of heavy metals such as copper and molybdenum (Dumont, 1995 cited in Anon., 1999).

A new threat is posed by the alien ctenophore: *Mnemiopsis leidyi* now established in the Caspian Sea. This species depletes zooplankton levels, the natural food of pelagic fish, and also consumes their eggs and larvae (IUCN/SSC Sturgeon Specialist Group, 2001). In 1997, *Beroe ovata*, a comb jelly which preys on *M. leidyi* appeared in the Black Sea and there has been a decline in *M. leidyi* populations while some prey species of zooplankton have begun to increase (Ivanov and Ruban, 2001).

Azerbaijan

Waters of this region represent important winter feeding grounds, but lakes of deposited oil and pollutants lie on the shore lines of the Caspian and the number of these polluting the sea is expected to increase as the sea level rises (Dumont, 1995 cited in Anon., 1999).

Along the northern and southern coast of Azerbaijan, within its coastal waters, *A. persicus* [and *A. gueldenstaedtii*] is caught as by-catch in stationary nets and *kilka* (Clupeidae) fishing devices (CITES Management Authority of Azerbaijan *in litt.* to TRAFFIC Europe, 18 September 2000). Both young and adult sturgeon are caught by coastal fisheries during the migration, when the water temperatures change. Young sturgeon make up to 17.7% of the by-catch.

Species composition of the catch and by-catch of sturgeon species in the late 1990s

	A. persicus* and *A. gueldenstaedtii	***A. stellatus***	***H. huso***	***A. nudiventris***
Catch	63.47%	30.77%		5.76%
By-catch	78.50%	16.80%	3.70%	1%

Source: CITES Management Authority of Azerbaijan *in litt.* to TRAFFIC Europe, 18 September 2000.

Annual recorded landings (catch and by-catch) of *A. persicus* and *A. gueldenstaedtii* (tonnes)

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
A. guelenstaedtii.* and *A. persicus	26.00	40.20	37.00	72.60	100.30	101.20	51.30	79.20	48.60	55.00
Total sturgeon catch	**74.00**	**88.20**	**111.00**	**240.10**	**201.20**	**162.50**	**120.30**	**128.60**	**82.40**	**108.90**

Source: CITES Management Authority of Azerbaijan *in litt.* to TRAFFIC Europe, 18 September 2000.

In the late 1990s, for the first time in the history of the *kilka* fishery, the by-catch of *A. persicus [and A. gueldenstaedtii*] dropped to almost zero. For instance, in 1992 364 specimens were caught, but these incidental catches were reduced to few anecdotal specimens in more recent years (CITES Management Authority of Azerbaijan *in litt.* to TRAFFIC Europe, 18 September 2000).

Azerbaijan set a catch quota for 2001 of 37 700 kg (total) for *A. gueldenstaedtii*, presumably this includes a proportion of *A. persicus*, with which its catch statistics are combined.

Georgia

Sturgeon have always been an important part of Georgian fisheries and played a significant role in the fish supply to the local population.

During the fishing seasons, particularly for coastal anchovy fisheries, numerous sturgeon juveniles are caught as by-catch. The estimated catch of all species of sturgeon declined from 77 000 individuals in 1977, to 57 000 in 1980 and 27 000 in 1986. During the 1990s, illegal fishing in Georgia expanded rapidly due to poor control (Zarkua and Tsuladze, 1999). No information is available regarding current catch volumes.

Iran (Islamic Republic of)

Recent investigations indicate that there is no serious pollution in Iranian waters in contrast to the middle and northern parts of the Caspian basin (Abdolhay, 2001).

Iran is currently the only Caspian country to harvest from the open waters of the Caspian Sea; commercial netting in rivers is prohibited (Jenkins, 2001). *A. persicus* is considered by the Iranian Authorities to be endemic to the southern Caspian Sea Basin and rarely migrates to the central and northern parts of the sea (CITES Management Authority of Iran *in litt*. to TRAFFIC Europe, 24 September 2000). The stocks for this species are mainly managed through restocking and conservation programmes of the Iranian Fisheries (Pourkazemi *in litt*. to IUCN/SSC Wildlife Trade Programme, 26 October 2001).

The results of the monitoring of catch and stocks of *A. persicus* suggest that the wild population does not follow the same trends as the other commercially caught sturgeon. Since 1991, catch data show that the annual catch of *A. gueldenstaedtii* has declined fairly steadily until 1999. In contrast, data suggest that whilst catches of *A. persicus* peaked in 1991 and declined to a low in 1995, but then rose somewhat and fluctuated around and annual mean of 475 t. Therefore the status of the *A. persicus* population appears to be improving while the stocks of *A. gueldenstaedtii*, *A. stellatus*, *A. nudiventris* and *H. huso* seem to be decreasing. In the near future, the status of *A. persicus* is expected to be better than that of other species. In the past, *A. persicus* comprised 20% of the annual Iranian sturgeon catch, while at present, it comprises more than 55-60% (CITES Management Authority of Iran *in litt*. to TRAFFIC Europe, 24 September 2000).

Annual catch of *A. gueldenstaedtii* and *A. persicus* (tonnes)

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
A. persicus	538.3	601.1	559.6	415.0	408.9	386.5	488.3	448.2	547.3	439.9	448.5
A. guelden-staedtii	384.7	422.7	363.1	212.7	142.1	114.3	130.9	86.3	75.3	56.7	
Total	**2 296.3**	**2 315.1**	**2 058.0**	**1 462.1**	**1 380.9**	**1 216.3**	**1 310.0**	**1 043.5**	**1 127.9**	**923.3**	

Source: CITES Management Authority of Iran *in litt*. to TRAFFIC Europe, 24 September 2000; Pourkazemi *in litt* to IUCN/SSC Wildlife Trade Programme, 26 October 2001.

***A. persicus* catch (individuals in thousands) during 1992-2000**

1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
23.2	17.2	17.5	15.3	21.1	19.7	23.3	19.8	19.9

Source: Pourkazemi, *in litt*, to IUCN/SSC Wildlife Trade Programme, 26 October 2001.

About 19 900 specimens of adult sturgeon were caught in 2000, yielding about 53 t of caviar. For the past 5 years, the Iranian domestic market of caviar and sturgeon meat is estimated at 5% and 65% of the country's production respectively (CITES Management Authority of Iran *in litt*. to TRAFFIC Europe, 24 September 2000). The revenue gained from sturgeon products plays a relatively minor role in the national economy of the country, but it has an important effect on fisheries management especially in terms of supporting research, rehabilitation of stocks, anti-poaching and catch operations (Abdolhay, 2001).

Production of *A. gueldenstaedtii* and *A. persicus* in 1992 and 2000 (tonnes)

	1992				**2000**			
	Meat	**% ***	**Caviar**	**% ***	**Meat**	**% ***	**Caviar**	**% ***
A. persicus	451.9	*28.2*	62.6	*23.9*	344.9	53.8	53.2	*57.6*
A. gueldenstaedtii.	279.7	*17.4*	38.6	*14.7*				
Total	**1 604.2**		**262.3**					

* Percentages relate to the share of *A. persicus* products of the total Iranian sturgeon fisheries.

Source: Pourkazemi *in litt.* to IUCN/SSC Wildlife Trade Programme, September 2000 and Pourkazemi *in litt.* to IUCN/SSC Wildlife Trade Programme, 26 October 2001.

The first artificial breeding programme for *A. persicus* in Iran began in the Sefidrud in 1924. Several species of sturgeon have been bred for restocking programmes since then. There are now five hatcheries located in the southern shores of the Caspian Sea and the fingerlings produced are released into the main rivers located in the north of Iran. Restocking success for *A. persicus* has apparently been better than for other species (Pourkazemi *in litt.* to IUCN/SSC Wildlife Trade Programme, 26 October 2001). Reports from Iranian fisheries for the year 2000 (cited in Pourkazemi *in litt.* to IUCN/SSC Wildlife Trade Programme, 26 October 2001) show that almost 11 million *A. persicus* fingerlings have been released since 1992.

Kazakhstan

No information available.

Russian Federation

No information available.

Turkey

Turkey does not catch or trade *A. persicus* (CITES Management Authority of Turkey in litt, to CITES Secretariat, 11 December 2001).

Turkmenistan

Sturgeon fisheries and processing are a state monopoly in Turkmenistan (Anon., 2000a).

INTERNATIONAL TRADE

The listing of *A. persicus* in CITES Appendix II entered into effect on 1 April 1998. The reported trade data for this species were therefore limited to two years of trade (April 1998 - December 1999).

Eggs of *A. persicus* processed as caviar are sold under the commercial names “Ossetra”, and “Asetra”, names also used for the caviar of other sturgeon occuring in the Russian Federation. The eggs are large and vary in colour from dark to golden brown with a distinctive taste.

The United States Fish and Wildlife Service’s (USFWS) Forensic Laboratory has obtained reference material for 19 of the 27 species of sturgeon and paddlefish (including *A. persicus*) and are in the process of developing reliable genetic markers in order to distinguish between different types of caviar. The USFWS DNA test is designed to detect informative differences between species of sturgeon. To date, the test cannot distinguish *A. persicus* (Fain, 2001).

At the 11th meeting of the Conference of the Parties a decision was made regarding Acipenseriformes, which determined that range States (starting from 1 January 2001) should declare coordinated intergovernmental level annual export and catch quotas per basin, or biogeographical region where appropriate, for all commercial trade in specimens of Acipenseriformes. Parties not informing the Secretariat of such quotas prior to 31 December of the preceding year would be automatically treated as having a zero quota for the following year (Decision 11.58). Endemic species/populations/stocks exploited by a single country within its territorial waters are not covered by Decision 11.58. The Islamic Republic of Iran considers *A. persicus* to be endemic to its waters (CITES Management Authority of Iran *in litt*. to TRAFFIC Europe, 24 September 2000) but other references cited above in the distribution section do not appear to support this interpretation of species’ distribution.

CITES Annual Report data reveal that the predominant species reported on the international caviar market in 1998, were *Acipenser stellatus* (46% of reported trade) and *Acipenser gueldenstaedtii* (31% of reported trade) followed by *Huso huso, Acipenser persicus, Huso dauricus* and *Acipenser schrencki* (making up the remaining 23% of reported trade). In 1998, *A. persicus* caviar formed 3% of the exports reported that year. The main

destinations for caviar in 1998 were France, Germany, Switzerland and the United States of America (hereafter referred to as the USA) (Raymakers, 2001).

Gross exports and the comparative tabulation of trade in *A. persicus* are given in the Annex. According to 1998-1999 CITES data, gross exports of *A. persicus* caviar from range States totalled 61 180 kg, with all but 200 kg originating in, or exported by Iran; the remaining 200 kg was exported by Turkey and the country of origin reported as the Russian Federation. The comparative tabulation shows two further transactions with the Russian Federation reported as the country of origin and the United Arab Emirates as the exporter, exporting 2 kg of eggs to the USA and 546kg of eggs to Hong Kong. However, in Notification No. 2001/079 November, 2001, the CITES Standing Committee recommended that trade with the UAE be suspended until that country can demonstrate that the Convention is adequately implemented. Eight Parties (re)exported *A. persicus* caviar, Belgium, Denmark, France, Germany, China (Hong Kong Special Administrative Region), Iran, Switzerland, Turkey and the United Arab Emirates.

Based on gross import statistics, the largest importers of *A. persicus* caviar were France (39 t); Switzerland (14.5 t); Japan (5.2 t); Spain (4 t); Denmark (2.8 t); Germany (2.7 t); UK (2.1 t). A total of 70.3 t of caviar was imported during 1998 and 1999.

CITES gross export data show that Iran also exported 28.3 t of meat, 26.1 t of which was imported by Spain in the 1998-1999 period.

Azerbaijan

Although Azerbaijan had an export quota for *A. gueldenstaedtii* in 1999 (for both meat and caviar) there are no reported exports from this country in the data available for this period. CITES did not enter into force in Azerbaijan until February 1999.

As noted in the species identification section, the CITES Management Authority of Azerbaijan (*in litt.* to the CITES Secretariat, 23 November 2001) does not differentiate *A. persicus* from *A. gueldenstaedtii* in catch data due to identification difficulties. The caviar export quota of 3 450 kg for 2001 for *A. gueldenstaedtii* caviar therefore will presumably include some *A. persicus* caviar (although this is not specified).

Note on A. gueldenstaedtii: In response to concerns raised at the 45th CITES Standing Committee Meeting (19-22 July, 2001), Azerbaijan, Kazakhstan and the Russian Federation agreed to halt sturgeon fishing in the Caspian Sea for the remainder of the year. These range States also agreed to provide the CITES Secretariat with a detailed inventory of the caviar they currently have in storage (from their last harvest) and to allow only this to be exported. The Caspian States must also have carried out a comprehensive range of enforcement and sturgeon management measures by the end of 2001. These include facilitation of on-site inspections by CITES of the sturgeon management activities and the joint setting of catch and export quotas for 2002.

Iran (Islamic Republic of)

Export quotas for *A. persicus* (kilogrammes)

		1998	1999		2000		
		Caviar	**Caviar**	**Meat**	**Caviar**	**Meat**	**Fert. eggs**
Azerbaijan			5 900	50 000	4 350	43 500	
Iran	*(A. gueldenstaedtii)*	(10 000)	(14 000)		52 000 including *A. gueldenstaedtii*		
	A. persicus	45 000	53 000				

Source: CITES Notification No.s 1998/35-36-61, 1999/21-47-53-68 and 2000/053-056.

In 1998 and 1999 Iran had separate quotas for *A. gueldenstaedtii* and *A. persicus*. However, a total combined export quota of 52 000 kg for caviar of *A. gueldenstaedtii* and *A. persicus* was established for 2000. This could be a result of the difficulty in differentiating between these two species (see Species Identification). However, Hosseini (pers. comm. to Pourkazemi *in litt*. to IUCN/SSC Wildlife Trade Programme, 26 October 2001)

confirmed that separate catch statistics are available for the 2000 catch. Separate quotas for the two species have been established for 2001.

2001 Catch and Export quotas for *A. persicus* (kilogrammes)

	Catch quota		Export quota	
Iran	**Caviar**	**Meat**	**Caviar**	**Meat**
(A. gueldenstaedtii)	3 640	27 300	3 460	11 000
A. persicus	52 900	349 000	51 000	140 000

Source: Notification to the Parties No. 2001/042.

Georgia

During the fishing seasons, particularly for the coastal anchovy fisheries, numerous sturgeon juveniles are caught as by-catch. The estimated catch of all species of sturgeon declined from 77 000 individuals in 1977, to 57 000 in 1980 and 27 000 in 1986. During the 1990s, illegal fishing in Georgia expanded rapidly due to poor control (Zarkua and Tsuladze, 1999). No information is available to determine if any of the catch is destined for the international market.

Kazakhstan

No information available.

Russian Federation

No information available.

Turkey

There is no catch nor international trade of *A. persicus* (Management Authority of Turkey *in litt*. to CITES Secretariat 6 November 2001).

Turkmenistan

Sturgeon fisheries and processing are a state monopoly (Anon., 2000).

Note: The use of the term “eggs” and the unit “kg”, “g” or no unit (see # in Appendix and table on export quotas, above) to describe shipments of both caviar and fertilised eggs complicates the analysis of trade data. Similar difficulties arise from the unit used for export quotas of fertilised eggs, which is kilogrammes (“kg”) instead of “number of specimens”. Kilogrammes do not directly correspond to the number of specimens, and hence does not allow the effective evaluation of quotas. This confusion is also a source of mis-interpretation of data and is an obstacle to the proper monitoring of international trade, e.g. underestimation of live specimens in trade.

The level of illegal trade of *A. persicus* is unknown, however, illegal trade of *A. gueldenstaedtii* caviar has increased since the collapse of the former USSR and it might be supposed that there is also an illegal trade of caviar made from the roe of *A. persicus* (De Meulenaer and Raymakers, 1996).

CONSERVATION MEASURES

In 1998, the Caspian Environment Programme was established. Supported by the European Union (EU) and Global Environment Facility (GEF) and including all Caspian range States as official partners, one of the activities it undertook is to establish a common management scheme for sturgeon for all Caspian States.

Despite the fact that the five range States of the Caspian Sea have set up a *Committee for the Conservation and Use of the Biological Resources in the Caspian Sea* during recent years, the proposed international agreement governing Caspian sturgeon catch and drawn up by this Committee has not been signed so far (end of 2000).

Before the fragmentation of the USSR, there was strict management of the sturgeon fishery in the Caspian Sea, including a quota system, maximum and minimum size restrictions, closed seasons and a complete ban on the sea fishery. Since the collapse of the USSR, five States (Russian Federation, Iran, Azerbaijan, Kazakhstan and Turkmenistan) and the two Autonomous Republics of Dagestan and Kalmykia are fishing for sturgeon in the Caspian Sea (Anon., 1997).

The meeting on the Protection and Sustainable Management of Sturgeon Populations in the Black Sea Basin, Sofia, Bulgaria, 23-26 October, 2001, agreed upon 21 conclusions for the attention of national CITES Authorities and relevant government agencies including implementation of adaptive management as an interim measure, establishing a management group and development of a regional strategy and action plan.

Azerbaijan

No clear regulations (TRAFFIC Europe *in litt*. to TRAFFIC International, 1997).

Georgia

No clear regulations (TRAFFIC Europe *in litt*. to TRAFFIC International, 1997). However, in the 1970s a 360 km^2 conservation zone, along the coastline up to 60-100 m water depth, was established in the area between Poti-Ochamchira. This area has always been an important feeding and wintering ground for sturgeon (Zarkua and Tsuladze, 1999). However, anchovy fisheries have been allowed in the conservation zone and many sturgeon fingerlings have been caught as by-catch.

Iran (Islamic Republic of)

Annual catch quotas for sturgeon are determined by the senior authorities and sturgeon experts of the Iranian Fisheries and are established on the basis of stock assessments, catch per unit effort (CPUE), and caviar harvest data from previous years. The maximum allowable catch limit for each sturgeon species is estimated and after approval is communicated to each province and catch station (Abdolhay, 2001).

At all sturgeon catch stations the age, length, sex and weight of fish landed are recorded for each species. The population structure is estimated on the basis of age groups. As a result of ten years of study the number of catch stations has been halved, different catch methods have been adopted, and lower export quotas have been set for the past five years (CITES Management Authority of Iran *in litt*. to TRAFFIC Europe, 24 September 2000).

Fishermen targeting *Rutilus frisii kutum* with nets used to catch a substantial number of young sturgeon as by-catch, this led to declining sturgeon stocks. From the 1994 to 1998 the Iranian Fisheries bought fishing permits from 7 000 fishermen, and assisted them to carry out alternative fisheries activities. The positive impacts of this were evident in the increase in the sturgeon catch during the following three to four years. Increasing sustainability, particularly of Persian sturgeon stocks of the southern Caspian can apparently be attributed to proper management of sturgeon stocks in Iran (Abdolhay, 2001).

A caviar labelling system is in place, where each tin of caviar holds a sign or mark that indicates at least the date and place of catch, the name of the catch station, name of processor and the species.

Considerable resources are used to enforce regulations, and although poaching for sturgeon occurs occasionally it does not appear to be a major problem in Iran (Jenkins, 2001).

Kazakhstan

No clear regulations (TRAFFIC Europe *in litt*. to TRAFFIC International, 1997).

Russian Federation

No clear regulations (TRAFFIC Europe *in litt*. to TRAFFIC International, 1997).

Turkey

All sturgeon species are under strict protection, fishing, domestic and international trade is banned (Management Authority of Turkey *in litt*. to CITES Secretariat, 6 November 2001).

Turkmenistan

No specific information on regulations is available (Anon., 1997) though sturgeon fisheries and processing are a state monopoly in Turkmenistan (Anon., 2000a).

CAPTIVE BREEDING

Azerbaijan

During the past year, Azerbaijan has produced 5.82 million *A. persicus* fingerlings (CITES Management Authority of Azerbaijan *in litt*. to CITES Secretariat, 23 November 2001).

Georgia

A sturgeon production plant built in 1983 was in operation on the Rioni River until the 1990s obtaining fingerlings imported from the Volga and Dnieper River for growth in ponds, results are uncertain (Zarkua and Tsuladze, 1999).

Iran (Islamic Republic of)

The construction of hatchery centres began with the aim of producing 14 million sturgeon fingerlings. By 1997, the sturgeon hatchery area had increased from 0.72 km^2 in 1981 to 7.42 km^2. Shilat, the Fisheries Company aims to enhance annual sturgeon fingerling production to 50 million and increase their weight (up to 30 g), there is a special emphasis on Persian sturgeon. Annually, several million sturgeon fingerlings (species not specified) are produced for release into the rivers entering the Caspian Sea (Abdolhay, 2001).

Annual release of ***A. gueldenstaedtii*** and ***A. persicus*** fry (million fingerlings)

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
A. persicus	4.06	5.92	2.93	3.57	4.66	8.05	11.02	18.75	22.59	17.30	18.5
A. gueldenstaedtii	?	0.04	?	?	0.30	0.52	0.67	0.92	0.42	0.96	?
Total	**4.06**	**6.60**	**2.93**	**3.57**	**5.91**	**9.13**	**12.35**	**21.63**	**24.56**	**19.10**	**18.5**

Source: CITES Management Authority of Iran *in litt*. to TRAFFIC Europe, 24 September 2000; Pourkazemi *in litt*. to IUCN/SSC Wildlife Trade Programme, 26 October 2001.

After fingerling release, a 3% return after maturity is assumed (Pourkazemi *in litt*. to IUCN/SSC Wildlife Trade Programme, 26 October 2001)

Although Jenkins (2001) states that it is clear that Iranian Fisheries are able to monitor trends in the population and evaluate the impact of annual harvests, it is not clear under the present system of stock assessment by what means they determine the quantities of fingerlings of each species to be produced for the restocking programme each year.

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Annex

Gross exports* of *A. persicus,* 1998-1999

Year	Taxon	Term	Unit	Country	Gross exports
1998	*Acipenser persicus*	Eggs	kg	FR	1.4
1998	*Acipenser persicus*	Eggs	kg	**IR**	**0.5**
1998	*Acipenser persicus*	Eggs	kg	AE	1520
1998	*Acipenser persicus*	Eggs	kg	DE	669
1998	*Acipenser persicus*	Eggs	kg	FR	254
1998	*Acipenser persicus*	Eggs	kg	**IR**	**8766**
1998	*Acipenser persicus*	Meat	kg	**IR**	**10**
1999	*Acipenser persicus*	Bodies		**IR**	**1**
1999	*Acipenser persicus*	Eggs	kg	CH	0.36
1999	*Acipenser persicus*	Eggs	kg	DK	0.19
1999	*Acipenser persicus*	Eggs	kg	ES	0.54
1999	*Acipenser persicus*	Eggs	kg	FR	24.165
1999	*Acipenser persicus*	Eggs	kg	GB	0.5
1999	*Acipenser persicus*	Eggs	kg	HK	0.625
1999	*Acipenser persicus*	Eggs	kg	**IR**	**0.6**
1999	*Acipenser persicus*	Eggs	kg	AE	233
1999	*Acipenser persicus*	Eggs	kg	BE	11
1999	*Acipenser persicus*	Eggs	kg	CH	7354
1999	*Acipenser persicus*	Eggs	kg	DK	1176
1999	*Acipenser persicus*	Eggs	kg	ES	1
1999	*Acipenser persicus*	Eggs	kg	FR	3811
1999	*Acipenser persicus*	Eggs	kg	HK	9
1999	*Acipenser persicus*	Eggs	kg	**IR**	**52213**
1999	*Acipenser persicus*	Eggs	kg	**TR**	**200**
1999	*Acipenser persicus*	Meat	kg	**IR**	**28268**

* **Definition:** "**Gross exports** are the sum of all reported exports and re-exports in a particular commodity or species in a particular year or series of years;... Gross trade is thus a simple measure of the total number of items recorded in international trade. However, gross trade may be an overestimate of the total number of actual specimens in trade as re-exports are not deducted from the total" (Anon., 2000c). This is particularly applicable to caviar of which shipments are often exported, re-packaged and re-exported. For instance, in the mid-1990s, Germany re-exported as much as 45% of its annual caviar imports (De Meulenaer and Raymakers, 1996).

Comparative tabulation of all trade in *A. persicus*, 1998-1999

				Imports reported					Exports reported				
Year	Imp.	Exp.	Origin	Quantity	Units	Term	Purpose	Source	Quantity	Units	Term	Purpose	Source
1998	AD	FR	IR						21	kg	Eggs	T	W
1998	AR	DE	IR						10	kg	Eggs	T	O
1998	BR	FR	IR						4	kg	Eggs	T	O
1998	CA	AE	IR						35	kg	Eggs	T	O
1998	CA	AE	IR						19	kg	Eggs	T	W
1998	CA	IR							12	kg	Eggs	T	W
1998	CH	AE	IR						183	kg	Eggs	T	W
1998	CH	FR	IR						151	kg	Eggs	T	W
1998	CI	FR	IR						8	kg	Eggs	T	W
1998	CM	FR	IR						2	kg	Eggs	T	W
1998	CY	FR	IR						1	kg	Eggs	T	W
1998	DE	IR		786	kg	Eggs	T	W	2	kg	Eggs	T	W
1998	DK	AE	IR	58	kg	Eggs	T	W	90	kg	Eggs	T	W
1998	DK	IR							340	kg	Eggs	T	W
1998	ES	IR		1 000	kg	Eggs	T	W					
1998	FR	AE	IR	330	kg	Eggs	T	W					
1998	FR	IR		6 127	kg	Eggs	T	W	1 415	kg	Eggs	T	W
1998	GA	FR	IR						2	kg	Eggs	T	W
1998	HK	AE	IR						277	kg	Eggs	T	W
1998	HK	AE	RU						546	kg	Eggs	T	W
1998	HK	FR	IR						23	kg	Eggs	T	W
1998	HK	FR	IR						2	kg	Eggs	T	O
1998	JP	AE	IR						9	kg	Eggs	T	W
1998	JP	IR							500	kg	Eggs	T	W
1998	LB	FR	IR						2	kg	Eggs	T	W
1998	LC	FR	IR						2	kg	Eggs	T	W
1998	MC	FR	IR						3	kg	Eggs	T	W
1998	MX	FR	IR						15	kg	Eggs	T	W
1998	MX	FR	IR						3	kg	Eggs	T	O
1998	NC	FR	IR						3	kg	Eggs	T	W
1998	NO	AE	IR						18	kg	Eggs	T	W
1998	NO	AE	IR	12	kg	Eggs	T	O	11	kg	Eggs	T	O
1998	PF	FR	IR	500	g	Eggs	T	W	500	g	Eggs	T	W
1998	SA	FR	IR						2	kg	Eggs	T	W
1998	SG	DE	IR	659	kg	Eggs	T	O	659	kg	Eggs	T	O
1998	SG	FR	IR						340	g	Eggs	T	O
1998	SG	FR	IR	4	kg	Eggs	T	W	10	kg	Eggs	T	W
1998	SG	FR	XX	360	g	Eggs	T	O					
1998	SN	FR	IR						240	g	Eggs	T	W
1998	US	AE	RU						2	kg	Eggs	T	W
1998	US	IR		500	g	Eggs	P	I					
1998	ZA	FR	IR						300	g	Eggs	T	W
1998	GB	IR							10	kg	Meat	T	W
1999	JP	IR							1		Body	T	W
1999	AD	ES	IR						540	g	Eggs	T	W
1999	AD	ES	IR						1	kg	Eggs	T	W

				Imports reported					Exports reported				
Year	Imp.	Exp.	Origin	Quantity	Units	Term	Purpose	Source	Quantity	Units	Term	Purpose	Source
1999	AD	FR	IR						1 600	g	Eggs	T	W
1999	AD	FR	IR						15	kg	Eggs	T	W
1999	AE	IR							250	kg	Eggs	T	W
1999	AN	CH	IR						8	kg	Eggs		W
1999	AR	FR	IR						2	kg	Eggs	T	W
1999	BN	HK	IR						625	g	Eggs	T	W
1999	BR	DK	IR						120	kg	Eggs	T	W
1999	BS	FR	IR						360	g	Eggs	T	W
1999	CA	IR							25	kg	Eggs	T	W
1999	CH	DK	IR	964	kg	Eggs	T	W	1 014	kg	Eggs	T	W
1999	CH	FR	IR	733	kg	Eggs	T	W	849	kg	Eggs	T	W
1999	CH	IR		12 289	kg	Eggs	T	W	12 332	kg	Eggs	T	W
1999	CI	AE		6	kg	Eggs							
1999	CI	FR	IR						460	g	Eggs	T	W
1999	CI	FR	IR						386	kg	Eggs	T	W
1999	CM	FR	IR						540	g	Eggs	T	W
1999	CN	CH	IR						8	kg	Eggs		W
1999	CN	GB	IR						500	g	Eggs	T	W
1999	CZ	CH	IR						9	kg	Eggs		W
1999	CZ	CH	IR	9	kg	Eggs	T	W					
1999	CZ	DK	IR	30	g	Eggs	T	W	100	g	Eggs	T	W
1999	DE	CH	IR	186	kg	Eggs	T	W					
1999	DE	CH	IR						185	kg	Eggs		W
1999	DE	IR		1 338	kg	Eggs	T	W	1 682	kg	Eggs	T	W
1999	DE	IR							14	kg	Eggs	P	W
1999	DK	CH	IR	130	kg	Eggs	T	W					
1999	DK	CH	IR						130	kg	Eggs		W
1999	DK	IR		2 255	kg	Eggs	T	W	2 255	kg	Eggs	T	W
1999	ES	IR		3 055	kg	Eggs	T	W	3 055	kg	Eggs	T	W
1999	FR	CH	IR						5 105	kg	Eggs		W
1999	FR	CH	IR	5 091	kg	Eggs	T	W					
1999	FR	FR	IR	2 175	kg	Eggs	T	W					
1999	FR	IR		25 640	kg	Eggs	T	W	17 807	kg	Eggs	T	W
1999	GA	FR	IR						605	g	Eggs	T	W
1999	GA	FR	IR						6	kg	Eggs	T	W
1999	GB	IR		1150	kg	Eggs	T	W	2 115	kg	Eggs	T	W
1999	GB	IR							600	g	Eggs	P	W
1999	GL	DK	IR						90	g	Eggs	T	W
1999	HK	AE	IR	228	kg	Eggs	T	W					
1999	HK	CH	IR						163	kg	Eggs		W
1999	HK	CH	IR	124	kg	Eggs	T	W					
1999	HK	FR	IR						7 130	g	Eggs	T	W
1999	HK	FR	IR	6	kg	Eggs	T	W	6	kg	Eggs	T	W
1999	HK	IR		200	kg	Eggs	T	W	200	kg	Eggs	T	W
1999	ID	CH	IR						2	kg	Eggs		W
1999	JP	FR	IR						250	g	Eggs	T	W
1999	JP	FR	IR						47	kg	Eggs	T	W
1999	JP	IR							4 622	kg	Eggs	T	W
1999	KE	FR	IR						550	g	Eggs	T	W
1999	KR	FR	IR	375	g	Eggs	T	W	2 220	g	Eggs	T	W
1999	KR	FR	IR						9	kg	Eggs	T	W

				Imports reported					Exports reported				
Year	Imp.	Exp.	Origin	Quantity	Units	Term	Purpose	Source	Quantity	Units	Term	Purpose	Source
1999	LB	FR	IR						2	kg	Eggs	T	W
1999	LU	CH	IR						1 728	kg	Eggs		W
1999	LU	CH	IR	1 728	kg	Eggs	T	W					
1999	MA	FR	IR						360	g	Eggs	T	W
1999	MC	FR	IR						1	kg	Eggs	T	W
1999	MU	FR	IR						1 000	g	Eggs	T	W
1999	MU	FR	IR						6	kg	Eggs	T	W
1999	MX	FR	IR						14	kg	Eggs	T	W
1999	MY	CH	IR						360	g	Eggs		W
1999	NC	BE	IR						1	kg	Eggs	T	W
1999	NC	DK	IR						5	kg	Eggs	T	W
1999	NC	FR	IR						810	g	Eggs	T	W
1999	NC	FR	IR						1	kg	Eggs	T	W
1999	NL	IR							3	kg	Eggs	P	W
1999	OM	FR	IR						7	kg	Eggs	T	W
1999	PF	FR	IR						1 310	g	Eggs	T	W
1999	PF	FR	IR						3	kg	Eggs	T	W
1999	SA	CH	IR						2	kg	Eggs		W
1999	SA	FR	IR						12	kg	Eggs	T	W
1999	SG	CH	IR						13	kg	Eggs		W
1999	SG	CH	IR	10	kg	Eggs	T	W					
1999	SG	DK	IR						11	kg	Eggs	T	W
1999	SG	FR	IR						5 600	g	Eggs	T	W
1999	SG	FR	IR	6	kg	Eggs	T	W	40	kg	Eggs	T	W
1999	SG	HK	IR	9	kg	Eggs	T	W	9	kg	Eggs	T	W
1999	SN	FR	IR						330	g	Eggs	T	W
1999	SN	FR	IR						208	kg	Eggs	T	W
1999	TW	DK	IR						23	kg	Eggs	T	W
1999	TW	FR	IR						4	kg	Eggs	T	W
1999	TW	IR							20	kg	Eggs	T	W
1999	US	FR	IR						540	g	Eggs	T	W
1999	US	TR	RU						200	kg	Eggs	T	O
1999	XX	FR	IR						8	kg	Eggs	T	W
1999	ZA	FR	IR						500	g	Eggs	T	W
1999	ZA	FR	IR						10	kg	Eggs	T	W
1999	CH	IR		450	kg	Meat	T	W	750	kg	Meat	T	W
1999	DE	IR		1 000	kg	Meat	T	W	1 070	kg	Meat	T	W
1999	ES	IR		26 100	kg	Meat	T	W	26 100	kg	Meat	T	W
1999	HK	IR							140	kg	Meat	T	W
1999	IT	IR							120	kg	Meat	T	W
1999	JP	IR							18	kg	Meat	T	W
1999	SE	IR							70	kg	Meat	T	W

Source: CITES annual report data compiled by UNEP-WCMC.

Acipenser transmontanus

Richardson, 1836 **White Sturgeon**
Esturgeon Blanc
Esturión Blanco

Order: ACIPENSERIFORMES **Family: ACIPENSERIDAE**

SUMMARY

White sturgeon *Acipenser transmontanus* is native to North America's Pacific coast. The historic distribution of the species covered coastal waters and major river systems from Mexico to Alaska, with this overall distribution remaining fairly intact today. However, spawning populations exist in only a few major river systems between the Fraser River in British Columbia, Canada, and the Sacramento-San Joaquin rivers in California, United States of America (hereafter referred to as the USA). *A. transmontanus* is the largest North American sturgeon species, as well as the largest freshwater fish in North America. It reaches lengths of 6 m, weights approaching 907 kg, and has an average lifespan of at least 80 years. Males reach sexual maturity at 10-20 years and spawn every 1-2 years, and females mature at 15-30 years and spawn every 2-6 years.

Overharvest of *A. transmontanus* towards the end of the 19th century, and into the beginning of the 20th century, left the species seriously depleted throughout major range rivers in Canada and the USA. *A. transmontanus* populations also face other challenges; habitat fragmentation caused by the construction of dams and water impoundments have segmented once free-flowing rivers into isolated pockets of habitat of varying suitability, which has resulted in the creation of several subpopulations. The heavy manipulation of river flows can affect spawning and migration runs, and the reduction in water quality through land-use practices such as forestry and industry are also believed to have had negative impacts on the species.

Today, harvest of the species is prohibited in Canada and either banned or carefully regulated in different areas of the USA. Use and trade of *A. transmontanus* in the USA currently centres on meat and caviar for domestic sale and export, with many of these products deriving from farmed sources rather than wild sturgeon. Only the states of Oregon and Washington permit commercial harvest of *A. transmontantus* in the USA, and this is concentrated within the Columbia River system. These states jointly manage the commercial harvest throughout the Columbia River, including the setting of annual catch quotas for legally harvestable specimens. During 2000-2002 the overall annual harvest limit for the lower Columbia River is 50 000 fish, with only 20% of this being allocated to commercial fishers. Commercial catches for this area have generally increased since 1991, from 3 800 fish harvested in 1991 to 10 700 fish harvested in 2000, peaking at 13 894 fish in 1998. Along with the Oregon/Washington fisheries, the other primary sources of *A. transmontanus* specimens are commercial aquaculture operations in California, which produce both meat and caviar.

Exports of meat from the USA totaled 457 kg in 1998, rising to 3 816 kg in 1999, however, only 41% of these combined volumes were sourced from the wild. Canada, followed by the United Kingdom, were the main consumers of these exports. During this two-year period, the USA also reported exporting a total of 80 000 eggs and 155 live specimens from wild sources, and 24 kg of first generation live eggs, all of which were destined primarily for Canada.

For 2001, the USA anticipated exports of wild specimens as 0 kg of caviar and 3 000 kg of meat, and for captive bred specimens as 3 500 kg caviar and 22 000 kg meat. The total commercial catch quota for 2001 is 9 300 fish.

The species is recommended under Decision 11.106 for inclusion in category 3.

DISTRIBUTION AND POPULATION

Also known as the Columbia sturgeon, Pacific sturgeon, Oregon sturgeon, and the Sacramento sturgeon, the CITES-listed species database gives the distribution of *Acipenser transmontanus* white sturgeon as Canada and the USA (Anon., 2001a).

IUCN (Anon., 1996a) categorizes *A. transmontanus* as Lower Risk Near Threatened (LR/nt) Canada, USA [Pacific-northeast]), based on the species not qualifying for Conservation Dependant, but is close to qualifying for Vulnerable.

The *A. transmontanus* River Kootenai Population is classified as Endangered (EN A1a, B1+2ce) USA [River Kootenai]. This is based on a directly observed population reduction of at least 50% over the last three generations, an extent of occurrence or area of occupancy estimated to be less than 5 000 km^2 with the population being severely fragmented or known to exist at less than five locations, and a continuing decline in the area, extent and/or quality of habitat, and the number of mature individuals.

The IUCN/SSC Sturgeon Specialist Group is currently reassessing the global Red List status of North American species and stocks of sturgeon and paddlefish. These reassessments will be submitted to the IUCN Red List Authority for sturgeon, to be evaluated for inclusion in the *2003 IUCN Red List of Threatened Species*. The proposed categories are as follows:

USA regional population: Least Concern (LC) USA.

River Kootenai population: Endangered (EN) USA (S. Duke, USFWS cited in R. St. Pierre, IUCN/SSC Sturgeon Specialist Group *in litt*. to IUCN/SSC Wildlife Trade Programme 28 September 2001).

Upper Columbia River subpopulation: Critically Endangered (CR) Canada, USA (J. Hammond and C. Spence, Ministry of Water, Land and Air Protection cited in R. St. Pierre, IUCN/SSC Sturgeon Specialist Group *in litt*. to IUCN/SSC Wildlife Trade Programme 28 September 2001).

Fraser regional subpopulation: Vulnerable (VU) Canada [Fraser River].

Upper Fraser subpopulation: Endangered (EN) Canada [Fraser River].

Nechako River subpopulation: Critically Endangered (CR) Canada [Fraser River] (T. Down and J. Ptolemy, Ministry of Water, Land and Air Protection cited in R. St. Pierre, IUCN/SSC Sturgeon Specialist Group *in litt*. to IUCN/SSC Wildlife Trade Programme 28 September 2001).

Acipenser transmontanus, the white sturgeon, is native to North America's Pacific coast. The historic distribution of the white sturgeon covered coastal waters and major river systems from Mexico to Alaska. The overall distribution of the species remains fairly intact. It is believed that the species may occur in Pacific coastal waters (to a depth of approximately 30 m) as far north and west as Alaska's Aleutian Islands and as far south as Ensanada, Mexico in Baja California. However, known spawning populations exist in only a few major river systems between the Sacramento-San Joaquin rivers in California and the Fraser River in British Columbia. Smaller, non-spawning populations may be found in other river systems from California to Alaska (Anon., 1996b; Anon., 2001b; Anon., 2001c).

Canada

A. transmontanus is limited to waters in British Columbia. Historically, spawning populations are believed to have been concentrated in three river systems: the Columbia, Fraser/Nechako, and Kootenay rivers.

Fraser/Nechako Rivers: Canada's Fraser River is a non-regulated river that originates in the Rocky Mountains near Jasper and follows a winding course for some 1 375 km before emptying into the Strait of Georgia near Vancouver. The river and its tributaries drain a major portion of British Columbia. In 1995, British Columbia initiated a five-year assessment program to gather biological and stock status information for white sturgeon that would assist management and conservation efforts in the Fraser River system (Anon., 2000a).

The study indicated that natural barriers have created at least five putative stocks of white sturgeon within the Fraser River watershed. One stock, the lower Fraser Mainstem population, was identified in the lower Fraser River between Mission at river km 78 (river mile 47) and Bristol Island at river km 153 (river mile 92). The second identified stock was the lower Fraser Canyon population, located primarily in three areas of the lower Canyon section of the lower Fraser River, from approximately river km 154 (river mile 92.5) to river km 211 (river mile 126.5). White sturgeon concentrations in this river segment stretch from the vicinity of Hope, including the confluence area of the Coquihalla River at river km 159 (river mile 95.4), to between Alexandra Bridge and Blackwater Canyon, downstream of Hell's Gate at river km 200-208 (river miles 120-125). The third identified stock was the Middle Fraser River population, whose boundaries were demarcated from river km 212 (river mile 127) to river km 790 (river mile 474). White sturgeon in this population were broadly distributed between Boston

Bar, at river km 220 (river mile 132), and Prince George at river km 790 (river mile 474). The fourth identified population inhabits the upper Fraser River above Prince George, where white sturgeon are most commonly found near the confluence of major tributaries (Anon., 2000a).

The fifth identified stock has been found to be distinct from all other Fraser River populations, and consists of white sturgeon populations in the Nechako River and its tributaries, most notably the Stuart River (Anon., 2000a). The Nechako River flows into the mainstem Fraser River from the west, in the vicinity of Prince George. Movement studies using conventional tag-recapture techniques and radio-telemetry suggest that fish from this population do not migrate to the Fraser River. It is believed that this unique Nechako River population is at greater risk than other Fraser River stocks. The Nechako River stock is dominated by larger and older fish than those of the other stocks. A large percentage of this population are over 30 years old, suggesting that the population suffers from either poor spawning success or high juvenile mortality (Anon., 2001d).

Overall, the British Columbia assessment program found that white sturgeon density was highest in the lower sections of the Fraser River, with population abundance generally declining as the stocks approached the northern limits of their range. Population estimates published in the study included 17 259 sturgeon in the lower Fraser Mainstem stock, with a density of 230.1 fish/km (368.2 fish/mile); 976 sturgeon in the lower Fraser Canyon stock, with a density of 17.1 fish/km (27.4 fish/mile); 3 745 sturgeon in the Middle Fraser River stock, with a density of 6.5 fish/km (10.4 fish/mile); and 571 sturgeon in the Nechako River stock, with a density of 1.5 fish/km (2.4 fish/mile). Data were not collected to determine the population size and distribution of white sturgeon in the tidal zone of the lower Fraser River below Mission. If data had been collected for this stretch of river, the population estimate of the lower river stock (the stock of the lower Fraser River below Mission plus the lower Fraser Mainstem stock) is assumed to be higher based on the other stock estimates. Estimates were not made for the Upper Fraser stock because of insufficient data collected. However, the information that was collected suggests that this area is mainly used by juveniles and sub-adults, and that densities are low (Anon., 2000a).

It is believed that the northern populations exhibit a slower growth rate and consequently reach sexual maturity later than the southern stocks. The study noted that localized movements were common for all of the stocks, although larger-scale movements were also observed for feeding, overwintering, and spawning. Evidence of white sturgeon movements from the middle to lower Fraser River through Hell's Gate suggested genetic mixing between these stocks (Anon., 2000a).

Columbia/Kootenay Rivers: Two additional distinct white sturgeon populations are found in the upper Columbia River and Kootenay rivers in British Columbia. Historically, white sturgeon were likely distributed within the mainstems of both of these rivers in Canada, as well as in the larger tributaries and lakes located within their drainages. At one time, these populations had free access to the Pacific Ocean, although it is likely that resident subpopulations were also present. However, the last glaciation approximately 10 000 years ago formed a natural barrier at Bonnington Falls on the lower Kootenay River, effectively isolating white sturgeon in Kootenay Lake and the Kootenay River from Columbia River populations (Anon., 2000a).

Canada's Kootenay River white sturgeon population is contiguous with the USA's Kootenai River population. In the British Columbia portion of the Columbia River system, dam construction resulted in additional fragmentation and isolation of white sturgeon populations. Three additional dams have been constructed since the ratification of the Columbia River Treaty between Canada and the USA in 1968. Two of the dams, the Hugh L. Keenleyside Dam (HLK) and the Mica Dam, ensure that adequate water storage is available to provide hydro-generation potential and flood control as required by the Treaty. Revelstoke Dam, a non-treaty dam, was constructed by BC Power for hydroelectric power generation (Anon., 2000a; Anon., 2001d).

HLK Dam, a flow regulation facility commissioned in 1968, is the furthest downstream of the dams, and is located at the south end of Arrow Reservoir in British Columbia. The Columbia River downstream from HLK to Lake Roosevelt is one of the few remaining free-flowing segments of the Columbia River. This area supports a small population of white sturgeon that is considered highly threatened by recruitment failures that are likely related to the effects of river regulation and industrial development (Anon., 2000a; 2001b).

There may also be remnant white sturgeon populations trapped behind or between dams on the Columbia River in British Columbia, and in larger lakes and tributaries within this system. For example, reconnaissance surveys in 1995 and 1997 recorded the presence of a possible remnant white sturgeon population in Arrow Reservoir, between HLK and Revelstoke dams. Studies conducted in 1999 confirmed a white sturgeon spawning area

below Revelstoke Dam. The only other known spawning area noted in the Columbia River in Canada is found below HLK at the confluence of the Pend d'Oreille and Columbia rivers (Anon., 2000a; Anon., 2000d).

Other Systems: Outside these river systems, white sturgeon have been observed in the mouth of the Cowichan and Somass rivers on Vancouver Island; however, it is believed that they are migratory fish from the mainland systems, rather than separate spawning populations (Anon., 2001c).

USA

Spawning anadromous populations of *A. transmontanus* are believed to occur only in the lower Columbia, Rogue, Sacramento-San Joaquin, and possibly Klamath river systems in the USA. Resident freshwater populations are present in the upper Columbia River Basin, including the Kootenai and Snake rivers (Anon., 2001b). Distinct *A. transmontanus* populations within this range include:

The Columbia River Basin: The Columbia River Basin system spans seven states in the USA as well as the portion of British Columbia described above, and contains several white sturgeon populations. At one time, virtually all of this population had access to the Pacific Ocean, and may have used both freshwater and saltwater habitats. However, a series of major hydroelectric, flood control, irrigation water storage, navigation, and diversion projects, beginning downstream with the Bonneville Dam, have effectively segmented the Columbia River Basin population into three separate groups: the lower Columbia River stock below the lowest dam, with ocean access; fish isolated (functionally but not genetically) between dams; and fish located in several large tributaries (Miller *et al.*, 2001).

The Columbia River comprises a significant portion of the boundary between Oregon and Washington, and the two states manage white sturgeon populations cooperatively in these waters. The largest, most productive white sturgeon population in all of the species' range is found within the 233 km (145 miles) stretch of the lower Columbia River downstream from Bonneville Dam. A 1999 draft stock status update indicated, however, that the abundance of legal harvest-sized 1.05 m-1.5 m (42-60 in) white sturgeon declined between 1995 and 1997. Abundance of this size class was estimated to be 227 700 fish in 1995, which fell to an estimated 157 100 fish in 1997. DeVore *et al*. (1999) reported that it appeared that the decline was not a result of over-harvest in the lower Columbia River, but was due to a decrease in recruitment to the legal-sized population and a mass emigration from the Columbia River system. In 1998, the harvestable stock was estimated to have been 186 300 fish, less than that of 1995 but larger than the 1996 and 1997 estimates (Anon., 2000b). Although the 1999 estimate is not yet available, anecdotal information indicates that the range of estimates are generally less than the 1998 figures and closer to the 1996 and 1997 estimates (Anon., 2001e). These stock figures are discussed in more detail under **Conservation Measures**

Upstream from Bonneville Dam, inland populations of white sturgeon are effectively isolated in reservoir pools and river stretches between the mainstem Columbia and Snake river dams that form barriers to sturgeon migration. *A. transmontanus* abundance is evaluated every three years in some reservoirs, or "pools," to monitor the effects of hydro-system mitigation activities. Pool specific abundance of white sturgeon approximately 0.91-1.83 m (3-6 ft) in total length have been estimated using mark-recapture techniques, yielding estimates of 48 600 fish in Bonneville Pool in 1999, 48 600 fish in The Dalles Pool in 1997, and 23 400 fish in John Day Pool in 1996. Projected abundances for sturgeon of the same length in 2000, based on observed growth and mortality rates, were 59 300, 57 700, and 26 700 fish respectively for these reservoirs (Anon., 2001e).

While the historic population structure in the Columbia River Basin system is unknown, and seasonal migration barriers may have occurred on the mainstem rivers, it is likely that gene flow occurred because individuals probably moved freely throughout the Columbia and Snake rivers. Today, such movement is impossible, and individual population fragments may not contain gene pools that are representative of larger historical populations. For example, dams have isolated inland white sturgeon, and formed resident population segments in areas between upstream impoundments. Reproductive success is believed to be low in many of these populations (Anon., 2001b). As an example, the Snake River has 12 dams from its mouth moving upstream to Shoshone Falls in Idaho. Many of the populations in Snake River segments have been extirpated, or consist of only a few trapped adults without significant juvenile recruitment (R. Beamesderfer, S. P. Cramer & Associates *in litt.* to TRAFFIC North America, August 2001). White sturgeon are more abundant in regions where free-flowing river habitat exists, such as between the Lower Granite Dam and Hells Canyon Dam, where some 75% of the river remains free-flowing (Miller *et al.*, 2001). In the upper reaches of the Snake River in Idaho, white sturgeon

are extant, as they also are in the Salmon River. However, these populations are considered significantly depleted (Anon., 2000c). Individual based life history models to determine the risk of extinction for the nine populations between Shoshone Falls and Lower Granite dam on the Middle Snake River are being prepared (H. Jaeger, Oak Ridge National Laboratory *in litt.* to TRAFFIC International 10 December 2001). Research is also ongoing to describe the genetic structure of white sturgeon within the Columbia River Basin (T.A. Rien, Oregon Department of USFWS *in litt*. to IUCN/SSC Wildlife Trade Programme 31 October 2001).

Kootenai River: The officially termed and listed "Kootenai River population of white sturgeon" is limited to approximately 270 km (168 miles) of the Kootenai River in Idaho and Montana, and Kootenay Lake in British Columbia, primarily upstream from Cora Linn Dam at the lake's outflow. While the population inhabits this area and migrates freely from Kootenai Falls in Montana downstream to Kootenay Lake, a natural barrier at Bonnington Falls, downstream of Kootenay Lake, has isolated the Kootenai River white sturgeon population from other white sturgeon populations in the Columbia River Basin since the last glacial age approximately 10 000 years ago. This geological separation has produced a genetically distinct subpopulation. In 1997, the population was estimated at approximately 1 468 wild fish, with few individuals younger than 25 years of age (Anon., 2000d).

Sacramento-San Joaquin Rivers: The Sacramento-San Joaquin River Basin drains about 153 000 km^2 (59 000 $miles^2$) of California's Central Valley, and contains a reproducing population of white sturgeon, primarily found in the larger Sacramento River as far upstream as Shasta Dam. white sturgeon are also believed to spawn in the San Joaquin River (Kohlhorst *et al.*, 1991), and the species may also use the Feather River as a spawning ground (Anon., 2001f). The confluence of the Sacramento and San Joaquin rivers forms a large tidal estuary containing a network of more than 1 100 km (683 miles) of tidal sloughs and channels. White sturgeon inhabit the estuary year-round, including San Francisco, San Pablo, and Suisin bays and the Sacramento-San Joaquin Delta (Anon., 2001f). Contemporary estimates of stock size are not available.

Other Systems: White sturgeon are also believed to spawn in Oregon's Rogue River basin and are present in the mainstem up to Savage Rapids Dam, and in the Illinois River up to Illinois Falls. White sturgeon are also believed to spawn in the Willamette River in Oregon. Along the Oregon coast, white sturgeon are found in numerous estuaries, including the Nehalem River and Bay, Tillamook Basin, Nestucca River and Bay, Siletz River and Bay, Yaquina River and Bay, Alsea River and Bay, Suislaw River and Bay, Umpqua Basin, Coos River Basin, Coquille River Basin, and Chetco River and Bay. These aggregations are not considered spawning populations; white sturgeon found in these estuaries are believed to originate from populations of the Fraser, Columbia, Rogue, and Sacramento-San Joaquin systems (Anon., 2001b). White sturgeon are also believed to be present in bays, estuaries, and the nearshore ocean along the Washington coast including Gray's Harbor, Willapa Bay, the Straits of Juan De Fuca, and the San Juan Islands. It is unusual to find white sturgeon in Puget Sound or the Hood Canal (Anon, 1996b; Anon., 2001g). White sturgeon are also known to enter or inhabit the Klamath/Trinity River Basin system, but it is uncertain whether this is a spawning population or originates elsewhere (Anon., 2001b). The Klamath River is not thought to sustain a stable population of white sturgeon (M. Parsley, US Geological Survey, *in litt*. to IUCN/SSC Wildlife Trade Programme 18 October 2001).

HABITAT AND ECOLOGY

The white sturgeon is the largest North American sturgeon species, as well as the largest freshwater fish in North America, reaching lengths of nearly 6 m and weights approaching 907 kg. A very long-lived fish, Chapman (1999) estimated average white sturgeon longevity at greater than 82 years. One female caught in Oregon in 1991 was aged at 104 years. Most fish caught in recent times, however, have been much smaller and younger (National Paddlefish and Sturgeon Steering Committee, 1993; Hochleithner and Gessner, 1999).

The age of sexual maturity for *A. transmontanus* is estimated to range from 10-20 years for males and 15-30 years for females. The male spawning interval is 1-2 years, while females spawn every 2-6 years (Hochleithner and Gessner, 1999). Spawning occurs between March and June when water temperatures reach between 10-17°C (National Paddlefish and Sturgeon Steering Committee, 1993). Spawning in the Columbia River Basin occurs between April and July (M. Parsley, US Geological Survey, *in litt*. to IUCN/SSC Wildlife Trade Programme 18 October 2001). Since 1993, the first recorded annual spawning in the Columbia River has consistently occurred once mean daily water temperatures reach 14°C, with subsequent events occurring up until peak water temperatures of 21°C (Hildebrand *et al.*, 1999 cited in CITES Management Authority of Canada *in litt.* to TRAFFIC International, 29 November, 2001). Other environmental factors such as day length, water

current and habitat quality are also important spawning cues (CITES Management Authority of Canada *in litt.* to TRAFFIC International, 29 November, 2001). The species prefers areas of pebble and rock substrates in deep pools and behind ripples in swift current, and adults are "broadcast" spawners. Eggs and sperm are released into rapidly flowing water, which serves to disperse the eggs and prevents them from clumping together and smothering one another, and from siltation that could bury the eggs. The semi-buoyant, adhesive eggs may drift considerable distances downstream before sinking and adhering to the substrate (National Paddlefish and Sturgeon Steering Committee, 1993). Female fecundity is estimated to range from 5 000-23 000 eggs/kg of body weight (Chapman, 1999), averaging approximately 5 600 eggs/kg of body weight (Hochleithner and Gessner, 1999). Eggs measure 2.6-4.0 cm in diameter (Chapman, 1999).

Kootenai River white sturgeon and other landlocked or freshwater populations tend to be smaller than the anadromous fish of the lower Columbia River. The largest specimen reported from the Kootenai River basin was a 159 kg individual, estimated at 85-90 years of age, captured in Kootenay Lake in 1995 (Anon., 2000d). While the size or age at sexual maturity for wild white sturgeon is variable, Kootenai River females have been documented to mature as early as age 22 and males at age 16. Many adults are believed to spend much of their life in the depths of Kootenay Lake and may migrate as much as 114 km up the Kootenai River. Other members of the population inhabit the upper reaches of the Kootenai River (Anon., 2000d).

The diet of *A. transmontanus* consists of benthic invertebrates such as crustaceans, insects, molluscs, and fish, including lamprey, smelt, anchovies, and salmonids. Juveniles feed primarily on mysid shrimp, amphipods, and molluscs (National Paddlefish and Sturgeon Steering Committee, 1993; Hochleithner and Gessner, 1999). Information collected in the Columbia River indicate that white sturgeon are opportunistic carnivores that feed upon whatever fish or invertebrates are seasonally or locally available (Hildebrand *et al*., 1999 cited in CITES Management Authority of Canada *in litt.* to TRAFFIC International, 29 November, 2001). In the lower Columbia River, specimens with total lengths of 1.5-29 cm were found to feed primarily on gammarid amphipods (*Corophium* spp.). Copepods, Ceratopogonidae larvae, and Diptera pupae and larvae were also consumed, primarily at the onset of exogenous feeding. Diets of larval and young-of-the-year white sturgeon from impounded and unimpounded sections of the Columbia River were similar (Muir *et al*., 2000 cited in M. Parsley, US Geological Survey, *in litt*. to IUCN/SSC Wildlife Trade Programme 18 October 2001).

Several freshwater species of fish are known to prey on white sturgeon eggs in the Columbia River basin; *Catostomus macrocheilus* Largescale Sucker, *Cottus asper* Prickly Sculpin, *Cyprinus carpio* Common Carp, and *Ptychocheilus oregonensis* Northern pikeminnow (Miller and Beckman, 1996 cited in M. Parsley, US Geological Survey, *in litt*. to IUCN/SSC Wildlife Trade Programme 18 October 2001). The U.S. Geological Survey, Columbia River Research Laboratory, Cook, Washington, USA is currently investigating predation on juvenile white sturgeon by native and introduced piscivores. Also, river otters are known to prey on adult white sturgeon foraging in the lower reaches of tributaries to Puget Sound located on the Olympic Peninsula, Washington (M. Parsley, US Geological Survey, *in litt*. to IUCN/SSC Wildlife Trade Programme 18 October 2001).

THREATS TO SURVIVAL AND DOMESTIC USE

Overharvest of *A. transmontanus* towards the end of the 19th century, and into the beginning of the 20th century, left the species seriously depleted throughout major range rivers in Canada and the USA, as indicated by the collapse of harvest rates (Beamesderfer, 1999; Miller *et al*., 2001; Waldman, 1999). Today, harvest of white sturgeon is prohibited in Canada and either banned or carefully regulated by management agreements in the USA (Anon., 2000b; Anon., 2001c; Miller *et al*., 2001). However, species recovery has occurred during the 20th century, co-inciding with an insignificant demand for white sturgeon roe throughout much of this period. Therefore, because a single large adult female can produce up to 90 kg of roe (Waldman, 1999), there is concern that if demand increases and conservation measures are relaxed in Canada and the USA, wild populations could again face non-sustainable harvest pressure. This is because if roe prices are high and demand is not met by legal methods, this could present an incentive for illegal harvest of gravid females.

A. transmontanus populations also face other challenges and threats, many of which are specific to individual river systems and populations. Habitat fragmentation caused by the construction of dams and water impoundments for hydroelectric power, irrigation, and water diversion have segmented once free-flowing rivers into isolated pockets of habitat of varying suitability. Demand for water for power generation, irrigation, and urban populations means that natural river flows are heavily manipulated by state and regional authorities, which can affect spawning and migration runs (Anon., 2001b; Anon., 2001c). Migration patterns will play a significant role in

determining the viability of white sturgeon in river systems fragmented by dams (Jager *et al*., 2001 cited in M. Parsley, US Geological Survey, *in litt*. to IUCN/SSC Wildlife Trade Programme 18 October 2001). One U.S. Geological Survey provisionally accepted manuscript describes how power-peaking operations at dams have caused scouring of white sturgeon eggs and embryos from the substrate, potentially reducing survival at these early life stages. Counihan *et al*. (1998) believe that white sturgeon embryos may also be susceptible to gas bubble trauma associated with high dissolved gas supersaturation caused by spill at dams (cited in M. Parsley, US Geological Survey, *in litt*. to IUCN/SSC Wildlife Trade Programme 18 October 2001).

The effects of such activities can be especially severe on small or isolated populations. For example, alteration of the natural flow regime of the Kootenai River is believed to have affected that subpopulation's spawning, egg incubation, nursery, and rearing habitats, and has reduced the overall productivity of the Kootenai River and Kootenay Lake. The operation of Libby Dam since 1974 is considered to be one of the primary causes of the decline of the subpopulation during the 1980s and 1990s. When the dam began operations regulating the Kootenai River, average spring peak flows were reduced by more than 50%, and winter flows increased by almost 300%. Natural high spring flows, necessary as a cue for reproduction, now occur only rarely during the spawning season. As a result, since 1974 there has been an almost complete lack of juvenile recruitment (Anon., 1994; Anon., 2000d).

Populations *of A. transmontanus* are believed to be impacted by reductions in water quality associated with land-use practices, such as forestry, and loss of habitat from dredging, gravel mining and other industries (Anon., 2001c). Industrial pollutants and contaminants, such as chemical run-off from farms, forests, urban, and residential lands pose additional threats. High concentrations of contaminants have been found in the fishes' organs and flesh. Bioaccumulation of PCBs and other contaminants are believed to inhibit sturgeon growth and decrease egg and larval survival (Anon., 1996b). Oregon State University is currently conducting research to describe the effect of contaminants on the productivity of white sturgeon (T.A. Rien Oregon Department of USFWS *in litt*. to IUCN/SSC Wildlife Trade Programme 31 October 2001).

In addition to environmental hazards, other threats to *A. transmontanus* include: lack of recruitment among isolated populations that could result in extinction, stress from multiple recaptures in catch-and-release fisheries and the potential for accidental mortality, and invasive species that threaten native species through introduction of non-native diseases, competition, and predation (Anon., 2001c; Anon., 2001d; Miller *et al*., 2001).

In 1994, Canada closed the Fraser River fishery and banned the possession or retention of *A. transmontanus* in British Columbia (Anon., 2001d). Although Canada imports various white sturgeon products from the USA, there is no harvest or trade from domestic sources. The only remaining "use" of white sturgeon in British Columbia has been in catch-and-release sport fisheries. Data from the Department of Fisheries and Oceans document the capture and release of 1 430 white sturgeon in 1998 and 255 white sturgeon in 1999 in the Harrison, Chehalis, Nicomen-Norrish, Stave and Vedder-Chilliwack sport fisheries. A significant majority of these fish were taken and released in the Harrison River (Anon., 2001h).

In the USA, the majority of use and trade of *A. transmontanus* is in specimens derived from farmed sources rather than wild sturgeon. The trade currently centers on fresh or processed meat and caviar for domestic sale and export.

In Oregon and Washington, commercial harvest of wild white sturgeon is concentrated within the Columbia River system. However, the vast majority of the Columbia River harvest of *A. transmontanus* is allocated to sport fisheries (Beamesderfer, 1999; DeVore *et al*., 1999). In some segments of the river, only catch-and-release fishing is permitted, and in other areas retention is prohibited after the annual catch quota is reached (Anon., 2001b). In addition, egg sales from lower Columbia River commercial and sport-caught sturgeon are currently prohibited (R. Beamesderfer, *in litt.* to TRAFFIC North America, September 2001). There is some directed commercial fishing for white sturgeon in coastal marine waters. Washington scheduled a fishery for white sturgeon from 6 November to 30 November 2001 in Willapa Bay, subject to an overall quota of 1 037 fish, including catches during earlier salmon fisheries (Anon., 2001i; 2001j). California, Idaho, and Montana do not allow commercial harvest of white sturgeon (Anon., 2001k; Miller *et al.*, 2001).

Along with the Oregon/Washington fisheries, the other primary sources of white sturgeon product for the market are commercial aquaculture operations in California, which produce meat and also caviar under labels such as Sterling Caviar and Tsar Nicoulai. The largest of these operations is Stolt Sea Farm, a multinational corporation

with white sturgeon farming, based in the USA in Elverta, California. Stolt Sea Farm produces caviar under the Sterling label, and also sells whole white sturgeon averaging 7 kg. Products also include Sterling Classic Caviar (USD30/oz or USD 1 058/kg), Sterling Premium Caviar (USD36/oz or USD 1 270/kg), Sterling Royal Black Caviar and Sterling Imperial Caviar (both at USD 45/oz or USD 1 587/kg) (Anon., 2001l). Tsar Nicoulai, based in San Francisco, markets white sturgeon caviar as Tsar Nicoulai Estate Osetra (USD 51/oz or USD 1 799/kg) and American sturgeon (USD 24/oz or USD 846/kg) (Anon., 2001m).

These operations have been working to build both domestic and international markets for their white sturgeon products as alternatives to Caspian Sea caviar. White sturgeon caviar is advertised as being similar to Caspian Sea varieties. For example, Stolt's Sterling Classic Caviar is marketed as "comparable to the best Osetra caviar," and Sterling Premium Caviar is said, by the company, to be "similar to premium Beluga" (Anon., 2001l).

Documented illegal activities regarding white sturgeon involve mostly fisheries violations in both Canada and the USA, although some activities relate to trade. In California, there has been evidence of poachers targeting gravid females in the Sacramento-San Joaquin Basin. As far back as the mid-1980s, enforcement officers noted the take of oversized white sturgeon from Bonneville Pool, presumably for roe. In 1993, two Washington state fishermen were indicted for illegally harvesting 1 451 kg of Columbia River white sturgeon caviar over a 5 year period and selling it to a distributor in New Jersey. Charges were eventually dropped against one fisherman, but the other pled guilty to a violation of the Lacey Act and received a sentence of 8 months in prison and a USD 2 500 fine. The owner of the distributing company was found guilty of obstruction of justice and misdemeanor violations of the Lacey Act and was sentenced to 18 months in prison and a USD 4 000 fine (Hoover, 1996).

In Canada, recent press reports have noted several cases of illegal trade and/or possession. In one case, a restaurant received a fine of CAD 7 000 (USD 4 690) for illegally buying sturgeon. In another case, two people were charged with illegal possession of three white sturgeon; the largest fish was almost 1.83 m long and weighed 45 kg (The Vancouver Sun, 28 April 2000). In a third case, a Vancouver resident paid a fine of CAD 5 000 (USD 3 350) for illegally possessing sturgeon. This case resulted from a joint investigation of sturgeon poaching on the Fraser River by local district conservation officers and the Department of Fisheries and Oceans. On 13 September 2000, night surveillance in the Fraser River resulted in the seizure of six live specimens (Anon., 2001o). Overall, while illegal trade does not appear to have posed a significant threat to the species in the wild in recent decades, the increase in demand for North American sturgeon species as an alternative to imported caviar is likely to target all North American species, and must be monitored closely.

INTERNATIONAL TRADE

As with all other Acipenseriformes species not already listed on the Appendices, *A. transmontanus* was included in CITES Appendix II with effect from 1 April 1998 (Anon., 2001a), and therefore available CITES data are limited to two years of trade (April 1998 - December 1999).

Canada does not allow commercial exports of wild-caught *A. transmontanus*. However, Canada does permit the export of wild live individuals (typically eggs, fry and fingerlings) for captive breeding and re-introduction programmes. For example, permits have been issued for shipments of hatchery-reared yearlings and larvae for research purposes related to a federal re-introduction program in the USA (see **Conservation Measures**) (CITES Management Authority of Canada *in litt.* to TRAFFIC International, 29 November, 2001). One example of this type of export occurred in 2000, where Canada re-exported 1 500 live wild yearlings and 50 000 live wild larvae to the USA, their country of origin (P. Hall, Department of Fisheries and Oceans (DFO) cited in CITES Management Authority of Canada *in litt.* to TRAFFIC International, 29 November, 2001).

Little data are available regarding exports of *A. transmontanus* meat or caviar from the USA prior to 1998 when the species was listed in Appendix II. Several USA exports reported in 1996 involved live specimens, and a review of USA export data for 1997 showed a total of 3 684 live sturgeon in this year, mostly to Taiwan, Province of China.

Gross trade and a comparative tabulation of CITES reported trade in *A. transmontantus* for 1998-1999 is given in the Annex. According to these data, meat comprised the majority of *A. transmontanus* exports during 1998 and 1999 in terms of weight, although eggs, live specimens, specimens, and unspecified specimens were also exported. In 1998, the USA reported exporting 457 kg of meat from captive bred and first generation sources. The USA's reported meat exports rose to 3 816 kg in 1999, of which 1 762 kg was reported to be from wild

sources, with the remainder again comprising captive bred and first generation sources. Of the total meat exports from the USA for 1998-1999, Canada was the main consumer (2 314 kg), followed by the United Kingdom (1 691 kg) and Taiwan, Province of China (268 kg). During this two-year period, the USA also reported exporting a total of 155 live wild specimens to Canada and Mexico, 80 000 eggs from wild sources to Canada, 24 kg of first generation live eggs to Sweden and Canada, and 12 (mostly pre-Convention) specimens to Germany and Russia.

It is not known whether commercial exports represented new markets or continuations of business relationships that did not require reporting prior to 1998. After 1999, the export of live *A. transmontanus* products was prohibited by the USFWS, Division of Scientific Authority, because of disease transmission concerns. The export of 80 000 wild eggs exported to Canada in 1999 were Kootenai River stock being exported for conservation and research purposes, and therefore, exports of this nature fall outside of the USA ban on the export of live white sturgeon.

Italy has reported exports of *A. transmontanus* with the source as "ranched"; exports for 1998 and 1999 total 3 390 kg of meat and 10 kg of eggs, primarily destined for Switzerland.

In 2001, the USA anticipates exports of captive bred specimens of *A. transmontantus* as follows: 3 500 kg caviar; 22 000 kg meat (CITES Notification 2001/041). In accordance with Decision 11.58, the USA anticipates exports of wild specimens of *A. transmontanus* for 2001 as follows: 0 kg of caviar; 3 000 kg of meat (CITES Notification No. 2001/042). The export of live *A. transmontanus* specimens remains prohibited by the USFWS due to concerns regarding disease transmission.

CONSERVATION MEASURES

A. transmontanus receives no federal designation in the USA, with the exception of the Kootenai River population, which was listed as endangered in the USA on 6 September 1994 (Anon., 1994). The Canadian government listed the white sturgeon as Vulnerable in 1990, based on its limited distribution in Canada (Lane, 1991). Conservation measures in place vary at the provincial and state levels in Canada and the USA.

Canada

British Columbia: Subsequent to its classification of Vulnerable by Canadian government authorities, the B.C. Conservation Data Centre listed *A. transmontanus* as Imperiled, placing it on the province's Red List. Three populations (Nechako, upper Columbia, and Kootenay), are classified under the province's highest possible threat ranking of Critically Imperiled (Anon., 2001c). All commercial and sport harvest, and retention, of white sturgeon is prohibited. While catch-and-release fisheries are still allowed in some segments and tributaries of the Fraser River, this practice is increasingly restricted. As of 7 September 2000, angling for sturgeon is no longer permitted in the Nechako River or its tributaries, including the Stuart River. Similar action was previously taken on behalf of the Kootenay/upper Columbia River populations (Anon., 2001d).

USA

California: California has prohibited the commercial harvest of wild *A. transmontanus* since 1917. The state also prohibits the purchase, sale, and possession of a whole sturgeon or any parts thereof, including eggs, in any place where fish are sold (Anon., 2001k). There is an exception to this prohibition in the case of *A. transmontanus* reared in approved and permitted aquaculture facilities in the state.

In freshwater fisheries, sport fishermen may take *A. transmontanus* year-round, except for closures listed under special regulations. Closures currently encompass the Special North Coast District Sturgeon Closure (Humboldt, Del Norte, Trinity, and Siskiyou counties). It is illegal to take any sturgeon in the North Coast District at any time. Sport anglers in the permitted sport fishery may keep one fish between 1.15-1.83 m (46-72 in) per day. The sturgeon must voluntarily take the bait or lure in its mouth. No sturgeon can be taken by trolling, snagging, or the use of firearms. In addition, a gaff or any type of firearm cannot be used to land a sturgeon (Anon., 2000e). Definitions of these terms vary by State, but for example, a gaff refers to a metal hook with a handle for landing large fish, snagging refers to angling using a hand-held pole with unbaited single or multiple hooks attached to the line, and trolling refers to angling from mechanically powered boat.

Marine sport fisheries are open all year, with the same size restriction, daily bag limit, and methods of take that apply to the freshwater sport fishery. Sturgeon may not be taken between 1 January and 15 March in the portion of San Francisco Bay that includes the following boundaries: a direct line between Point Chauncy (National Marine Fisheries Laboratory) and Point Richmond, the San Francisco-Oakland Bay Bridge and a direct line between Point Lobos and Point Bonita (Anon., 2000f).

Oregon/Washington: Oregon and Washington manage commercial harvest of *A. transmontanus* in fishing zones along their common boundary through the Columbia River Compact, which is charged by congressional and statutory authority to adopt commercial fishing seasons and regulations. The Compact membership includes the Oregon and Washington fish and wildlife agency directors, acting on behalf of the Oregon Fish and Wildlife Commission (OFWC) and the Washington Fish and Wildlife Commission (WFWC). In addition, the Columbia River treaty tribes have authority to regulate treaty Indian fisheries. When addressing commercial seasons for species under its jurisdiction, including sturgeon, the Compact must consider the effects of the commercial fishery on escapement, treaty rights, and sport fisheries, as well as the potential impact on species listed on the Endangered Species Act (ESA). While the Compact has no authority to adopt sport fishing rules or seasons, it has an inherent responsibility to consider the equitable allocation of limited resources among users (Anon., 2001e).

In addition to the framework of the Compact, sturgeon fisheries located between the mouth of the Columbia River and Bonneville Dam are guided during 2000-2002 by a joint management plan signed by the directors of the Oregon Department of Fish and Wildlife and Washington Department of Fish and Wildlife in March, 2000. Conservation measures in the "Joint State Agreement on Sturgeon Fishery Management" include management for "optimum sustainable yield" of *A. transmontanus*, establishment of an overall annual harvest limit, allocation of this harvestable limit between commercial and sport fishers, and the setting of commercial and sport seasons. The commercial size limit allowed for *A. transmontanus* in the 2000-2002 sturgeon fishery management plan is 1.2-1.5 m (48-60 in). Sport fishery regulations allot a size limit of 1.05-1.5 m (42-60 in) (Anon., 2001e).

Authorities designated under the agreement monitor stocks of harvestable *A. transmontanus* in the lower Columbia River system. The table below shows the estimated abundance of *A. transmontanus* in the lower Columbia River from 1989-1998. It is not known if these estimates are based on actual catch data. As mentioned above (see **Distribution and Population**) there have also been periodic stock assessments in some reservoirs above Bonneville Dam. In addition, general indices of abundance of sublegal (less than 1.05 m [42 in]) and oversized (greater than 1.5 m [60 in]) sturgeon are believed to be good as of 2001 (Anon., 2001e). It is unknown whether there are confidence limits associated with this size class information.

Estimated Abundance of Harvestable White Sturgeon in the Lower Columbia River, 1989-1998			
	Total Length Interval		
Year	**1.05-1.2 m / 42-48 in**	**1.2 –1.5 m / 48-60 in**	**Total (i.e.1.05-1.5 m / 42-60 in)**
1989	32 500	16 800	49 300
1990	26 100	12 000	38 100
1991	32 900	11 700	44 600
1992	59 900	8 700	68 600
1993	85 000	14 200	99 200
1994	N/A	N/A	N/A
1995	143 200	59 000	202 200
1996	131 700	33 500	165 200
1997	123 700	33 400	157 100
1998	161 600	24 700	186 300

Source: Anon., 2000b

Under the Joint State Agreement, during 2000-2002 the overall annual harvest limit for white sturgeon between the mouth of the Columbia River and Bonneville Dam is 50 000 fish. Numerical limits were also established in previous years. Current annual harvest is allocated as follows: 20% commercial (10 000 total fish), and 80% sport (40 000 total fish). This quota may be adjusted if there is a significant population change, a new analytical/theoretical approach, or a substantial change in harvest impacts outside of the Columbia River system. Sport and commercial seasons can also be modified as necessary to ensure that the average catch during the

three-year period does not exceed the fishery-specific harvestable number (Anon., 2001e). Actual catch data in numbers of fish for the years 1991-2000 are provided below.

Lower Columbia River Commercial White Sturgeon Harvest, 1991-2000					
		Commercial			
Year	Sport	Winter	Early Fall	Late Fall	Commercial Total
1991	22 700	840	530	2 430	3 800
1992	40 100	1 210	790	4 240	6 240
1993	37 900	1 020	--	7 050	8 070
1994	33 500	3 030	--	3 380	6 410
1995	45 100	110	--	6 040	6 150
1996	42 800	1 380	330	6 670	8 380
1997	38 200	3 064	1 971	7 792	12 828
1998	41 600	2 675	2 634	8 585	13 894
1999	39 800	2 303	2 854	4 336	9 493
2000	40 500	2 795	2 970	4 560	10 700

Source: Anon., 2001e

CITES Notification No. 2001/042 states that the USA's total commercial catch quota for 2001 is 13 460 fish (this quota applies to legally harvestable commercial catch between the mouth of the Columbia River and Bonneville Dam). However, according to the Joint Columbia River Management Staff (Anon., 2001e), the actual figure that should have been communicated to the Secretariat for 2001 was 9 300 fish. As mentioned below, this is calculated by deducting the 2000 commercial overage (the actual number of commercial fish caught in 2000 in excess of the commercial limit for 2000 - i.e. an overage of 700 fish) from the 2001 limit of 10 000 fish, to give a commercial catch limit of 9 300 fish for 2001.

Beyond length limits, sport fishery regulations allow the catch of one sturgeon per day and a total of ten sturgeon per person per year. Mandatory use of barbless hooks is required (Anon., 2000b). Regulators anticipate that mesh size restrictions will be adopted to ensure that Select Area fisheries target salmon rather than *A. transmontanus* (Anon., 2001e).

These conservation measures reflect the planned management of the sturgeon fishery in the Columbia River states. Reviews of population monitoring by designated, competent authorities have resulted in periodic adjustments to the plan. For example, as noted above, the Joint Columbia River Management Staff is requiring that any overages (number of fish caught in excess of the limit) from the 2000 white sturgeon fisheries be applied to the 2001 catch limit guidelines. This has resulted in adjustments, with a 39 500 catch limit for sport fisheries and a 9 300 catch limit for commercial fisheries in 2001. Changes to the plan also include implementation of temporary rules that prohibit retention of sturgeon in some management zones, and more restrictive legal size limitations for specific sport fisheries. Finally, data gathered during 2001 indicated that an overall quota of 50 000 white sturgeon may not be appropriate for future fisheries, and additional catch reductions may be required for both sport and commercial fisheries beginning in 2002 (Anon., 2001e; Anon., 2001q).

Idaho: Commercial harvest is prohibited in the state (Miller *et al.*, 2001). Catch-and-release angling restrictions have been in place for white sturgeon on the Snake River in Idaho since 1984 (Miller *et al.*, 2001). There is no harvest season for white sturgeon. Any white sturgeon that is caught may not be removed from the water and must be released immediately. Barbless hooks are required at all times (Anon., 2000c; Anon., 2001p).

Montana: Montana has prohibited commercial and sport fishing for white sturgeon since 1979 (Miller *et al.*, 2001). Take and/or possession of white sturgeon is illegal in Montana (Anon., 2000g).

Canada / USA

Kootenai River Population: International cooperation between Canada and the USA to protect and conserve the Kootenai River white sturgeon population began in June 1992 with the formation of the Kootenai River white sturgeon Technical Committee. The Committee, composed of individuals representing several state, tribal, federal, and Canadian agencies, was formed to identify factors affecting Kootenai River white sturgeon and develop a regional pre-listing recovery strategy. After the species' listing as endangered on the ESA, a recovery team composed of two Canadians and eight Americans was formed in January 1995. The team completed a final recovery plan for the Kootenai River white sturgeon in 1998; the plan was approved by the U.S. Fish and Wildlife Service in late 1999. Recovery objectives include reestablishment of successful reproduction in the wild by increasing Kootenai River flows during spawning runs, and production (and stocking) of hatchery-reared juveniles over the next decade to prevent extinction. Since 1997, the wild population has been augmented with the release of nearly 2 800 juvenile white sturgeon, reared in the Kootenai Tribal Fish Hatchery in Bonner's Ferry, Idaho (Anon., 2000d).

Canada continues to implement transboundary recovery actions on behalf of the Kootenai River white sturgeon population. B.C. Environment and the Canadian Department of Fisheries and Oceans participate actively in recovery implementation and coordination activities associated with regulating flows at Kootenai River hydroelectric projects to benefit Kootenai River white sturgeon. B.C. Environment also conducts white sturgeon monitoring and assessment work in Kootenay Lake. These studies are complementary to those continuing in Idaho by the Idaho Department of Fish and Game and the Kootenai Tribe of Idaho. B.C. Environment has approved the use of the Kootenay Trout Hatchery near Fort Steele, British Columbia as a back-up or fail-safe white sturgeon facility. Fertilized eggs are transported from the Kootenai Tribe Hatchery in Idaho to the Kootenay hatchery to ensure that at least some juvenile sturgeon will survive in the event of catastrophe at the primary hatcheries (Anon., 2000d).

CAPTIVE BREEDING

Canada

Provincial authorities in British Columbia became involved in captive propagation of *A. transmontanus* fairly recently. Traditionally, the primary role of the provincial Fish Culture Section was production of salmonid species for recreational fisheries. However, there are now two projects underway to support species recovery for the white sturgeon: the Kootenay River Sturgeon Conservation Hatchery (see **USA** below), and the Columbia River Sturgeon Conservation Hatchery. In addition, the Nechako River white sturgeon Recovery initiative is considering a conservation fish culture component to assist in recovery efforts (Anon., 2001r).

Commercial aquaculture of white sturgeon remains in the very initial stages in British Columbia. In 2000, two companies obtained government permits to raise white sturgeon commercially (Anon., 2000h). It is too early to predict the future viability of these endeavors. B.C. government data record that white sturgeon are being cultured in limited or experimental quantities only (Anon., 2001s).

Italy

Reported exports of *A. transmontanus* "ranched" in Italy for commercial international trade probably refer to specimens produced by a captive breeding operation.

Taiwan, Province of China

In 1993, a farm in the northeast of Taiwan, Province of China was reported to have imported an unknown quantity of *A. transmontanus* of lengths of 5cm from the USA. By 2001, more than 300 of these fish had reached maturity, producing eggs for the first time in the summer of 2001. This farm has reportedly produced a total of 2.7 kg of eggs, of which 0.3 kg will be used as breeding stock and the remaining 2.4 kg will be sold domestically as caviar at a price of NTD 1 800/300 g (USD 174/kg) (United Evening News 25/7/2001, Liberty Times 26/7/2001 and China Times 9/8/2001, cited in TRAFFIC East Asia–Taipei *in litt*. to TRAFFIC International 31 October 2001).

USA

At the federal level, Abernathy National Salmon Technical Center took wild adult Columbia River sturgeon for use as broodstock in 2000; the adults were released after spawning. Fish that are produced will be used to restore declining Columbia River populations. In FY 2000, the Idaho Fish Health Center (FHC) successfully spawned 5 female and 11 male Kootenai River white sturgeon and assisted in the release of 8 healthy family groups to promote recovery efforts (Anon., 2001t).

The Idaho FHC is a cooperating partner in a Bonneville Power Administration (BPA) funded program to prevent the extinction, preserve the remaining genetic variability, and rebuild the natural age class structure of the Kootenai River white sturgeon population. Idaho FHC is working with the Kootenai Tribe of Idaho to collect samples from spawning adult sturgeon, as well as monitoring and taking pre-release samples on juvenile sturgeon. Idaho FHC played a significant role in the release of brood-year 1995 juveniles (the first release in the Kootenai River) and the transfer of half of the brood-year 1999 eggs to a back-up hatchery located in Canada (Anon., 2001u). These eggs were imported from the USA into the Kootenay River White Sturgeon Conservation Hatchery at Fort Steele, British Columbia, for short-term culture through the partnership between the Kootenai Tribe of Idaho and the B.C. Ministry of Environment. These were re-exported (1 500 live yearlings and 50 000 live larvae) to the USA in 2000 for subsequent release in Idaho (CITES Management Authority of Canada *in litt.* to TRAFFIC International, 29 November 2001). Idaho FHC extensively sampled wild fish within the drainage as well as captive fish for disease, to satisfy Canadian concerns and requirements for the release and transfer of disease-free sturgeon (Anon., 2001u).

Commercial aquaculture of white sturgeon is at its most advanced state in California. Several large commercial operations produce roe and meat at a number of grow-out facilities, although the exact level of production is unknown and difficult to obtain. An article published in 1999 estimated that Stolt Sea Farm produced 1.35 metric tonnes of caviar that year, and aspired to increase production to at least 10 tons (9 metric tonnes) within five years. Tsar Nicoulai's estimated production in 1999 was about 225 kg according to the same article (Anon., 1999). Stolt Sea Farm reported production of 182 tons (163.8 metric tonnes) of white sturgeon overall (this includes meat) in the year 2000 (Anon., 2001v).

Until recently, Oregon provided a very limited amount of broodstock for the California operations. However, these operations are now considered self-sustaining by the operators (R. Beamesderfer, S. P. Cramer & Associates, *in litt.* to TRAFFIC North America, September 2001).

Currently, Oregon has one legal operator who is permitted to take up to six females per year and a number of males. Fertilized eggs are surgically removed for growing out, and the fish are then returned to the wild. Offspring, which at one time provided broodstock to California, now go to aquariums or for ornamental pond use. Prior to legislative action in the late 1980s which placed a moratorium on further permits, there were two such operations, but one has since ceased (C. Melcher, ODFW, pers. comm., June 2001; R. Beamesderfer, S. P. Cramer & Associates, *in litt.* to TRAFFIC North America, September 2001).

Other white sturgeon aquaculture activities in the Pacific Northwest include a College of Southern Idaho research program in cooperation with the state of Idaho, and an aquaculture feasibility research program implemented by the Columbia River Inter-Tribal Fish Commission working with Abernathy Hatchery (R. Beamesderfer, S. P. Cramer & Associates, *in litt.* to TRAFFIC North America, September 2001).

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Annex

Comparative tabulation and gross trade data for all trade in *A. transmontanus*, 1998-1999

Year	Term	Unit	Country	Gross exports	Gross imports
1998	Eggs	kg	RU	88	0
1998	Eggs	kg	IT	10	0
1998	Eggs	kg	US	3	88
1998	Eggs	kg	CH	0	10
1998	Eggs	kg	DE	0	2
1998	Eggs	kg	SE	0	1
1998	Live		US	340	0
1998	Live		CA	0	225
1998	Live		MX	0	115
1998	Meat	kg	US	457	421
1998	Meat	kg	GB	240	0
1998	Meat	kg	CA	181	367
1998	Meat	kg	IT	90	0
1998	Meat	kg	NL	45	0
1998	Meat	kg	CH	0	135
1998	Meat	kg	TW	0	90
1998	Meat		CA	68	0
1998	Meat		US	0	68
1998	Specimens		US	9	0
1998	Specimens		DE	0	6
1998	Specimens		RU	0	3
1998	Unspecified	kg	US	18	0
1998	Unspecified	kg	TW	0	18
1999	Eggs	kg	US	23	1
1999	Eggs	kg	GB	1	0
1999	Eggs	kg	IT	0.2	0
1999	Eggs	kg	US	0	0.2
1999	Eggs	kg	CA	0	23
1999	Eggs		US	80 000	0
1999	Eggs		CA	0	80 000
1999	Meat	kg	US	3 816	0
1999	Meat	kg	IT	3 300	0
1999	Meat	kg	NL	176	0
1999	Meat	kg	CA	0	1 947
1999	Meat	kg	CH	0	3 476
1999	Meat	kg	GB	0	1 691
1999	Meat	kg	TW	0	178
1999	Specimens		US	3	0
1999	Specimens		DE	0	3

Source: CITES annual report data compiled by UNEP-WCMC.

				Imports reported					Exports reported				
Year	Imp.	Exp.	Origin	Quantity	Units	Term	Purpose	Source	Quantity	Units	Term	Purpose	Source
1998	US	CA	US	181	kg	Meat	T	F					
1998	US	CA	US	68		Meat	T	F					
1998	US	GB	US	173	kg	Meat	T	W					
1998	US	GB		67	kg	Meat	T	W					
1998	CH	IT		90	kg	Meat	T	R					
1998	CH	IT		10	kg	Eggs	T	R					
1998	CH	NL	IT	45	kg	Meat	T	C					
1998	US	RU	US	88	kg	Eggs	T	U					
1998	DE	US		6		Specimens	S	O					
1998	DE	US	RU						2	kg	Eggs	T	W
1998	SE	US							1	kg	Eggs		F
1998	CA	US							125		Live	T	W
1998	CA	US	XX						100		Live	T	W
1998	MX	US							30		Live	T	W
1998	MX	US	XX						85		Live	T	W
1998	CA	US							277	kg	Meat	T	F
1998	CA	US							90	kg	Meat	T	C
1998	TW	US							90	kg	Meat	T	F
1998	DE	US							6		Specimens		O
1998	RU	US							3		Specimens		O
1998	TW	US							18	kg	Unspecified	T	F
1999	US	GB	US	1	kg	Eggs	T	W					
1999	CH	IT		3 300	kg	Meat	T	R					
1999	US	IT		0.2	kg	Eggs	T	R					
1999	CH	NL	IT	176	kg	Meat	T	C					
1999	CA	US							80 000		Eggs		W
1999	CA	US							23	kg	Eggs	T	F
1999	CA	US							1 766	kg	Meat	T	F
1999	CA	US							181	kg	Meat	T	C
1999	GB	US							1 691	kg	Meat	T	W
1999	TW	US							107	kg	Meat	T	F
1999	TW	US							71	kg	Meat	T	W
1999	DE	US							3		Specimens		W

Source: CITES annual report data compiled by UNEP-WCMC.

Scaphirhynchus platorynchus Rafinesque, 1820 **Shovelnose Sturgeon**

Order: ACIPENSERIFORMES **Family: ACIPENSERIDAE**

SUMMARY

Shovelnose sturgeon *Scaphirhynchus platorynchus* is endemic to the United States of America (hereafter referred to as the USA). This species is distributed in the Mississippi and Missouri Rivers basins of central USA. The species is estimated to be absent from 15 of the 59 rivers where it is believed to have once been abundant largely due to dam construction and river channelisation. The species reaches sexual maturity between 5-7 years of age and may live up to 27 years and reach a weight of 2.5-4.5 kg. In 1993, the Missouri Interstate Cooperative Resource Association (MICRA) was designated as the focal group to coordinate management of sturgeon and paddlefish. Little funding has been made available to undertake the recommendations proposed in the management framework.

Commercial catch of *S. platorynchus* is permitted in eight states: Arkansas, Illinois, Indiana, Iowa, Kentucky, Missouri, Tennessee and Wisconsin. Shovelnose meat can be smoked and sold like paddlefish and white sturgeon, but most consumption appears to be local rather than interstate or international. Many states have not required the reporting of catch and this makes it difficult to get an accurate picture of the scope of the domestic market and trade in recent years, and has also complicated the task of USA CITES permitting authorities in making findings of scientific non-detriment and legal acquisition.

In 1999, Illinois commercially harvested 21 256 kg of flesh and 1 588 kg of eggs of *S. platorynchus*, quantities have increased steadily over the ten year period 1990-1999. Harvest in Tennessee during 1999, the first year of statewide mandatory reporting, was recorded as 106 kg whole fish and 1.8 kg of eggs, reported harvest grew to 468 kg of fish and 173 kg of eggs in 2001. In 1998, Missouri estimated its ten-year annual average commercial harvest of shovelnose sturgeon at 7 925 kg, but no figures are available for roe harvest. Iowa reported an annual average harvest of 8000 kg of fish, but eggs cannot be legally harvested and sold. Wisconsin reported an annual commercial harvest of some 850 kg of fish; no information on egg harvest is available. Arkansas, Indiana, and Kentucky also permit commercial harvest of shovelnose sturgeon, but do not require reporting.

Prior to 1998, and the CITES listing of all previously unlisted sturgeon species, there are very few data available for exports of *S. platorynchus* roe or meat. Non-CITES listed (or otherwise federally protected) fish imported or exported for human or animal consumption, does not have to be declared to the USFWS, therefore, it is likely that there was pre-Convention trade for which there are no export data. CITES data available since the species was included in Appendix II in 1998 (April 1998-December 1999) do not specify any units, the majority of transactions were reported to be for scientific purposes. CITES permit applications in 2000 and 2001 indicate that dealers are beginning to apply for export permits for shovelnose sturgeon caviar.

The species is recommended under Decision 11.106 for inclusion in category 1/2.

SPECIES IDENTIFICATION

Hybridisation between the shovelnose (*Scaphirhynchus platorynchus*) and pallid sturgeon (*Scaphirhynchus albus)* occurs in the Mississippi and Missouri Rivers (Carlson *et al.*, 1985). Distinguishing between smaller individuals of these two species based on morphometric differences may be very difficult (Graham and Rasmussen, 1998).

Keenlyne *et al*. (1994) found significant morphometric differences between upper Missouri River fish compared with those sampled in the down river populations, indicating that a different strain of shovelnose sturgeon may exist (Keenlyne, 1997).

DISTRIBUTION AND POPULATION

Also known as the flathead sturgeon, hackleback sturgeon, sand sturgeon and the switchtail sturgeon, the CITES database lists the distribution of *Scaphirhynchus platorynchus* as USA, Missouri and Mississippi River systems (Anon., 2001a).

The 1996 IUCN Red List classifies *S. platorynchus* as Vulnerable: VU A1acd+2d based on a population reduction of at least 20% over the three generations which has been directly observed and a projected reduction of at least 20% over the next three generations and caused by past and projected levels of exploitation. A decline in area of occupancy/extent of occurrence and/or quality of habitat has also occurred.

The IUCN/SSC Sturgeon Specialist Group is currently reassessing the global Red List status of North American species and stocks of sturgeon and paddlefish. These reassessments will be submitted to the IUCN Red List Authority for Sturgeon, to be evaluated for inclusion in the *2003 IUCN Red List of Threatened Species*. The proposed category for *S. platorynchus* is Vulnerable (R. St Pierre, IUCN/SSC Sturgeon Specialist Group *in litt*. to IUCN/SSC Wildlife Trade Programme, 20 November 2001).

The historic range of *S. platorynchus*, a species endemic to the USA, covered most of the Mississippi and Missouri River basins, from Montana in the north to Louisiana in the south, and from Pennsylvania in the east to New Mexico in the west. States that have reported historic shovelnose sturgeon populations include Alabama, Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Mexico, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, South Dakota, Tennessee, Texas, West Virginia, Wisconsin, and Wyoming (Hesse and Carreiro, 1997). Major river systems in the Mississippi-Missouri drainage system with recorded shovelnose sturgeon populations include the Yellowstone, Powder, Little Sioux, Platte, Minnesota, Chippewa, Illinois, Ohio (with Wabash), Cumberland, Nishnabotna, St. Francis, White, Arkansas, Red, and Atchafalaya Rivers (Hochleithner and Gessner, 1999).

Although the range of *S. platorynchus* has not been reduced to the same extent as that of the lake sturgeon (*Acipenser fulvescens*) and pallid sturgeon which share portions of the shovelnose sturgeon's range, it is no longer present in New Mexico and Pennsylvania. The species is also absent from large portions of Kansas, Kentucky, and Tennessee where it is believed to have once been abundant (Anon., 1993; Propst, 1999). Hesse and Carreiro (1997) estimated that the shovelnose sturgeon is now absent from 25.4% of the (15 of the 59) rivers and streams where it once occurred.

It has been reported that the shovelnose sturgeon is declining throughout the Nebraska Reach region of the Missouri River (Hesse, 1993 cited in Rasmussen, in press). In addition, as of 2001, the species is no longer reproducing throughout much of the Missouri River system because of river modification, impoundments and water release regulation (K. Keenlyne, IUCN/SSC Sturgeon Specialist Group *in litt*. to IUCN SSC/Wildlife Trade Programme, 30 October 2001). Reproduction only occurs in the uppermost reach of the Missouri River above Fort Peck Reservoir in Montana, on the lower reaches of the Yellowstone River which flows into the Missouri River in eastern Montana, and down river from the lowermost dam on the Missouri River near the southern border of South Dakota (Keenlyne *in litt*. to IUCN/SSC Wildlife Trade Programme, 30 October 2001).

Summary of Sturgeon Status

		Keenlyne (1997)				Management regimes/ conservation measures (2001)
State	**Miller (1972)**	**Status since 1990**	**Classification 1997**	**Hesse and Carreiro (1997)**	**Andreasen (1998)**	
Alabama	depleted	extinct	extirpated	decreasing	critically imperilled	no sport, no commercial
Arkansas		unknown	commercial		vulnerable	commercial
Illinois		unknown	sport-commercial		imperilled	commercial
Indiana		unknown	none	stable	vulnerable	commercial
Iowa		stable	sport-commercial	decreasing? Stable?		commercial
Kansas		unknown	sport	stable	vulnerable	sport
Kentucky	endangered	unknown	sport	stable		commercial
Louisiana		unknown	special concern			no sport, no commercial
Minnesota		stable	sport-concern	stable		sport

State	Miller (1972)	Keenlyne (1997)		Hesse and Carreiro (1997)	Andreasen (1998)	Management regimes/ conservation measures (2001)
		Status since 1990	Classification 1997			
Mississippi	depleted	unknown	rare			no sport, no commercial
Missouri		unknown	sport-commercial	decreasing		commercial
Montana		stable	sport	stable		sport
Nebraska		stable	sport	stable		sport
New Mexico		extinct	extirpated			
North Dakota		stable	protected	decreasing? stable?		no sport, no commercial
Ohio		unknown	endangered			endangered. No sport, no commercial
Oklahoma	endangered	unknown	special concern	decreasing	critically imperilled	sport
Pennsylvania		unknown	extirpated	extirpated		
South Dakota	depleted	unknown	protected	stable		no sport, no commercial
Tennessee		unknown	Extirpated			
Texas		unknown	endangered		imperilled	endangered. no sport, no commercial
West Virginia	rare to depleted	extinct	extirpated			
Wisconsin		unknown	sport-commercial			commercial
Wyoming	endangered	stable	sport-commercial		critically imperilled	no sport

Source: Miller (1972) basinwide assessment, see paper Keenlyne (1997) status since 1990 information compiled from a literature review - see paper; classification in 1997 based on results of a questionnaire sent by the author to 24 range states.
Hesse and Carreiro (1997) information gathered by authors in a survey of state fishery managers
Andreasen (1998) state status as assigned by an individual State Natural Heritage Programme or Conservation Data Centre, if existing, otherwise by the Nature Conservancy Management regimes/ conservation measures (2001) based on current state management regimes and conservation measures for shovelnose sturgeon – see **Conservation Measures** section at end of this review

The table provides a summary of status information from states over time. However, as Keenlyne (1997) notes some states have dual classification systems and classify the species differently in different waters. Monitoring of status over time is therefore difficult. Differences in opinion as to the status of the species in the various states clearly point toward a need for further assessment of shovelnose sturgeon populations basinwide (Hesse and Carreiro, 1997).

The abundance of shovelnose sturgeon has been estimated for rivers of several sizes with a variety of habitats and varying degrees of modification: Schmulbach (1974) estimated 2 500 fish/km for the Missouri River prior to channelisation, Helms (1972) estimated 1 030 fish/km for the navigation-altered Mississippi River, Christenson (1975) estimated 100 fish/km for the small Red Cedar River in Wisconsin, Elser *et al.* (1977) estimated 403 to 537 fish/km for the Tongue River in Montana (cited in Keenlyne, 1997) and Christenson, (1975 cited in Rasmussen, in press) estimated 94-100 fish/km for the Chippewa River, Wisconsin.

HABITAT AND ECOLOGY

S. platorynchus is a small sturgeon, generally reaching maximum lengths of just over one meter and a weight of approximately 2.5-4.5 kg (Chapman, 1999; Hochleithner and Gessner, 1999). Maximum longevity for the species is estimated at 27 years (Chapman, 1999). It is estimated that sexual maturity is reached at 5-7 years of age, at lengths of 500-630 mm for males and females, respectively, at this age their weight averages 0.9-1.3 kg (Anon., 1993; Chapman, 1999). Spawning normally occurs from April through July with adults migrating upriver to spawn over rocky substrates in rapidly flowing water with temperatures between 19 and 21°C. The spawning interval is not well known (Chapman, 1999; Hochleithner and Gessner, 1999). Female fecundity is believed to be 6 000 to 17 000 eggs/kg, with egg diameters of 2.8-3.5 mm (Chapman, 1999).

S. platorynchus prefers water with current velocities between 0.2-1.5 m/second, and prefers high turbidities. The species is usually found within the strong currents of main river channels, often over sand and gravel substrates where they feed. In the Mississippi and other rivers, shovelnose sturgeon are also commonly found frequenting the tailwaters below wing dams and other structures that accelerate current flow in channels that are otherwise impeded by man-made structures (Anon., 1993; Hochleithner and Gessner, 1999).

S. platorynchus prefers a diet that consists largely of insect larvae, mussels, worms, and crustaceans, although plant matter is also consumed (Anon, 1993).

The status of the mussel species for which the shovelnose serves as a host species, is of concern in many of the river systems. However the implications of the loss of the shovelnose sturgeon for other species has not been assessed by biologists, and this ecological problem is not being addressed anywhere throughout the range of the shovelnose sturgeon (Keenlyne, 1997; Keenlyne *in litt*. to IUCN/SSC Wildlife Trade Programme, 20 November 2001).

THREATS TO SURVIVAL AND DOMESTIC USE

Shovelnose sturgeon are now extirpated from large portions of former habitat in states such as Tennessee, Kentucky, and Kansas, largely due to dam construction and river channelisation which have made much of their former habitat unavailable for migration or spawning (Anon., 1993). In addition, Boreman (1997 cited in St Pierre *in litt*. to IUCN/SSC Wildlife Trade Programme, 20 November 2001) noted that sturgeon life history and habitat use attributes make the species highly vulnerable to fishing pressure.

In the early 1990s, approximately 51% of the large river habitat of the Missouri and Mississippi Rivers had been channelised, 27% was in reservoirs, and the remaining 21% had been affected by reservoir dam discharges (Dryer and Latka, 1994 cited in Anon., 1997). Results of a questionnaire developed by Keenlyne (1997), showed that in 19 states habitat alteration was of concern in relation to the conservation of shovelnose sturgeon, 6 states mentioned that pollution was a concern, one state mentioned overharvest, another hybridisation with the pallid sturgeon and three states expressed no issues of concern.

Alterations of stream flow can affect both food availability and the species' foraging ability (Keenlyne, 1997). The resulting shortage of food may delay sexual maturity, but more likely, it prolongs the amount of time necessary to develop a full complement of eggs, resulting in unnaturally extended periods between egg production and therefore reduced population productivity (Keenlyne *in litt*. to IUCN/SSC Wildlife Trade Programme, 20 November 2001). In the past, several authors have identified reproductive problems such as massive follicular degeneration and high levels of hermaphroditism (from 2.1-3%) (Carlson *et al.,* 1985 cited in Anon., 1997; June, 1977).

Pollution is also likely to be a threat to the species over much of its range (Dryer and Latka, 1994 cited in Anon., 1999). Ruelle and Henry (1994 cited in Anon., 1994) found that fish and eggs (whole body) accumulate elevated concentrations of contaminants. In the early 1990s, the eggs of female shovelnose sturgeon from Montana had mean selenium concentrations of 10.62 mkg/g, enough to cause reproductive failure in eggs. The concentration of organochlorines in the tissues was also high (up to 199 mkg/g) causing the state of Missouri to issue a human health consumption advisory for Missouri and Mississippi River Sturgeon egg and flesh (Birstein 1993b cited in Anon., 1997). In addition, the states of Illinois, Indiana, Kansas, Kentucky and North Dakota have in the past issued consumption advisories for paddlefish and/or sturgeon caviar caught in certain water bodies because of PCB, chlordane, and mercury contamination (Anon., 2001b).

Hybridisation of the shovelnose sturgeon with the pallid sturgeon was described by Carlson *et al*., (1985). All the hybrids studied were females, which may have indicated an imbalanced sex ratio, as has been reported in some other fish hybrids. Hybrids with *S. albus* were just as prevalent in the examined samples, suggesting that hybridisation between the species may occur frequently (Anon., 1997). Keenlyne *et al*. (1994 cited in Rasmussen, in press) concluded that hybridisation may now be occurring in half of the Missouri and lower Mississippi River reaches.

In the past, commercial and recreational fishing pressure were not considered a threat to *S. platorynchus*. This may have been due to the greater value placed on the larger Acipenseriformes such as the lake sturgeon (*Acipenser fulvescens*) and paddlefish (*Polyodon spathula)* which are found throughout the range of the shovelnose sturgeon. The relatively small shovelnose sturgeon produces far less roe per fish than the larger species, even though this roe yields commercially acceptable caviar (Anon., 1993). Historically, the shovelnose sturgeon were destroyed as a by-catch whilst the larger Paddlefish and lake sturgeon were sought for their eggs. However, despite this low level of production, the species was harvested commercially in all states on the Missouri and Mississippi Rivers (Helms, 1974 cited in Rasmussen, in press) and in 1950, commercial harvest accounted for 1.5% of the total catch. During the 50-year period (1947-1996) the highest annual total catch of shovelnose sturgeon from the Upper Mississippi River (Illinois, Iowa Minnesota, Missouri and Wisconsin) was 54 503 kg taken in 1956, the lowest 4 284 kg, taken in 1952 and the 50 year annual average was 21 536 kg (UMRCC Annually, cited in Rasmussen in press). Helms (1972, cited in Rasmussen, in press) considers this data to be conservative.

Shovelnose meat can be smoked and sold like paddlefish and white sturgeon, but most consumption appears to be local rather than interstate or international (Williamson, in press). Caviar from the roe of *S. platorynchus* is generally produced alongside paddlefish caviar in several states of the USA, but usually in far smaller quantities. A female shovelnose sturgeon may be expected to produce at the most 0.23-0.45 kg of roe per fish. As of the spring of 2001, fishermen were receiving 88-100 USD/kg for meat in Tennessee, and processed caviar retailed for around 352 USD/kg (Williamson, in press).

Many of the USA states in which *S. platorynchus* roe is harvested have not regulated the harvest (commercial and sport) of shovelnose sturgeon as closely as they have the harvest of other species such as paddlefish or lake sturgeon. Lack of harvest reporting makes it difficult to get an accurate picture of the scope of the domestic market and trade in recent years, and has also complicated the task of U. S. Fish and Wildlife Service (USFWS) CITES permitting authorities in making findings of non-detriment and legal acquisition (TRAFFIC North America *in litt.* to TRAFFIC International, 4 December 2001).

The amount of *S. platorynchus* commercially harvested in 1999 in Illinois was 21 256 kg of flesh and 1 588 kg of eggs in Illinois (M. Conlin, Chief, Division of Fisheries, Illinois Department of Natural Resources *in litt.* to T. Saito, Office of Management Authority, USFWS, 23 August 2000). The table below shows commercial harvest of shovelnose sturgeon flesh and eggs 1990-1999.

Commercial shovelnose sturgeon harvest in Illinois, 1990-1999.

Year	Flesh (kg)	Eggs (kg)
1990	4 016	21
1991	6 381	70
1992	4 594	69
1993	8 916	100
1994	13 582	0
1995	10 242	57
1996	8 041	113
1997	12 691	106
1998	15 160	355
1999	21 426	1 601
Total:	**104 988**	**2 492**

Source: M. Conlin, Chief, Division of Fisheries, Illinois Department of Natural Resources *in litt.* to T. Saito, Office of Management Authority, USFWS, 23August 2000.

Shovelnose sturgeon harvest in Tennessee during 1999, the first year of statewide mandatory reporting, was recorded as 106 kg (whole fish) and 1.8 kg of eggs. In 2000, reported harvest grew to 468 kg of fish and 173 kg of eggs (Anon., 2001c). In 1998, Missouri estimated its ten-year annual average commercial harvest of shovelnose sturgeon at 7 925 kg, but no figures are available for roe harvest (Todd, 1999). Iowa reported an annual average harvest of 8 000 kg of fish, but eggs cannot be legally harvested and sold (Todd, 1999). Wisconsin reported an annual commercial harvest of some 850 kg of fish; no information on egg harvest is available (Todd, 1999). Arkansas, Indiana, and Kentucky also permit commercial harvest of shovelnose sturgeon, but none require reporting (Todd, 1999). Using this information, it is impossible to track how much caviar is being produced in aggregate, or where it is being marketed and sold domestically (TRAFFIC North America *in litt.* to TRAFFIC International, 4 December 2001).

Keenlyne (*in litt.* 20 November 2001) states that as there are no comprehensive or coordinated efforts to manage this species, there is insufficient data to use in determining an acceptable harvest level for this relatively late maturing fish in its drastically modified remaining habitats.

There has been some concern about illegal take and trade of *S. platorynchus*, often in conjunction with poaching related to paddlefish. When responding to the 2000 Significant Trade Review for paddlefish, Kansas reported that it is likely that illegal harvest does take place, although the state is not aware of major poaching activities (T. Mosher, Fisheries Research Coordinator, Kansas Department of Wildlife and Parks *in litt*. to T. Saito, Office of Management Authority, USFWS, 17 August 2000). Illinois reported that suspected illegal activities focus on the under-reporting of commercial harvest, particularly with caviar, and that the state is exploring options to address the situation (M. Conlin, Chief, Division of Fisheries, Illinois Department of Natural Resources *in litt.* to T. Saito, Office of Management Authority, USFWS, 23 August 2000).

Iowa law enforcement personnel recently participated in an investigation on illegal practices related to the selling of fish and game along the Missouri River, and this may involve sturgeon or paddlefish, (M. Conover, Chief, Fisheries Bureau, Iowa Department of Natural Resources *in litt.* to T. Saito, Office of Management Authority, USFWS, 14 August 2000). Nebraska also reported paddlefish and sturgeon poaching activities on the Missouri River (D. Gabelhouse, Administrator, Fisheries Division, Nebraska Game and Parks Commission *in litt*. to T. Saito, Office of Management Authority, USFWS, 21 August 2000). There is also ongoing concern that illegal harvest of sturgeon might seriously impact recovery efforts for the endangered pallid sturgeon (Omaha World Herald, 20 July 2000).

Mis-labeling of paddlefish and shovelnose caviar continue to raise serious concerns among state and federal wildlife managers, law enforcement officials, and conservationists. One such incident involved caviar originating in the Mississippi River basin being labelled as Russian caviar (TRAFFIC North America *in litt*. to TRAFFIC International, 4 December 2001).

INTERNATIONAL TRADE

The listing of *S. platorynchus* in CITES Appendix II entered into effect on 1 April 1998. Data for this species were therefore limited to two years of trade (April 1998 - December 1999).

Year	Taxon	**Term**	**Unit**	**Country**	**Gross exports**	**Gross imports**	**Net exports**	**Net imports**
1998	*Scaphirhynchus platorynchus*	Scientific specimen	None specified	DE	0	6	0	6
1998	*Scaphirhynchus. Platorynchus*	Scientific specimen	None specified	RU	0	3	0	3
1998	*Scaphirhynchus platorynchus*	Scientific specimen	None specified	US	9	0	9	0
1999	*Scaphirhynchus platorynchus*	Eggs	None specified	PF	0	1	0	1
1999	*Scaphirhynchus platorynchus*	Eggs	None specified	US	1	0	1	0
1999	*Scaphirhynchus platorynchus*	Scientific specimen	None specified	DE	0	3	0	3

1999	*Scaphirhynchus platorynchus*	Scientific specimen	None specified	US	3	0	3	0

Source: CITES annual report data compiled by UNEP-WCMC.

Prior to 1998, and the inclusion in the Appendices of all previously unlisted sturgeon species, there are very few data available for exports of *S. platorynchus* roe or meat. Non-CITES listed (or otherwise federally protected) fish imported or exported for human or animal consumption, does not have to be declared to the USFWS, therefore, it is likely that there was pre-Convention trade for which there are no export data (C. Hoover, TRAFFIC North America pers. comm., 2001).

In 1996, there was one recorded shipment involving 10 specimens of live, wild caught shovelnose sturgeon, valued at USD 10, shipped to the Solomon Islands. One 1997 transaction involved 80 live, wild-caught specimens, valued at USD 200, which were shipped to Japan. In 1998 there were two shipments, one involved three biological specimens exported to the Russian Federation, and the other involved six biological specimens exported to Germany. In 1999, there was one recorded shipment of shovelnose sturgeon biological specimens to Germany (TRAFFIC analysis of USFWS LEMIS data cited in TRAFFIC North America *in litt*. to TRAFFIC International, 4 December 2001).

CITES permit applications in 2000 and 2001 indicate that caviar dealers are beginning to apply for export permits for shovelnose sturgeon caviar. If this trade continues, state managers will need to monitor exports very carefully to ensure that they fall within sustainable harvest levels, which will be difficult to ascertain given the lack of rigid oversight of the species and lack of information regarding domestic consumption (TRAFFIC North America *in litt*. to TRAFFIC International, 4 December 2001).

CONSERVATION MEASURES

The USA federal government does not list the shovelnose sturgeon as threatened or endangered under the Endangered Species Act.

In the USA, *S. platorynchus* populations are managed by state wildlife authorities rather than federal authorities. State management regimes and conservation measures for shovelnose sturgeon vary between states. Some allow no harvest, others allow sport fishing but no commercial harvest, and some allow commercial and sport fisheries, subject to individual state regulations and reporting requirements (TRAFFIC North America *in litt.* to TRAFFIC International, 4 December 2001).

States allowing commercial fishing

Arkansas: Commercial fishing data were not collected from 1982 to 2000 in Arkansas, so little information is available to determine if commercial fisheries are sustainable (A. Layher, Biologist, Fisheries Division, Arkansas Game and Fish Commission *in litt.* to T. Saito, Office of Management Authority, USFWS, 18 August 2000). Recreational fishing is also legal, but little information is available concerning the extent of the harvest.

Illinois: The state allows commercial harvest but has no commercial catch quota for *S. platorynchus*. There is however, a restriction that makes it illegal to use trammel nets in the Ohio River with less than 10 cm bar mesh netting (Illinois Administrative Code, Section 810.20). The state also requires commercial fishermen that fish the Ohio River to report the undressed weight of their catch both annually and by the 10th of each month following harvest. Reports must be submitted whether or not they have taken any fish (Illinois Administrative Code, Section 830). There is no sport fishery for shovelnose sturgeon in the state (Mosher, 1999).

Indiana: The state allows both commercial and sport fishing for shovelnose sturgeon. There is no commercial catch quota, and the state has not kept harvest records of either fishery (Mosher, 1999; Todd, 1999).

Iowa: Iowa allows both commercial and sport fishing for *S. platorynchus.* There is no commercial catch quota. However, eggs cannot be legally harvested for the caviar trade (Todd, 1999). Few data are available regarding harvest levels in the state's year-round shovelnose sturgeon sport fishery (Mosher, 1999).

Kentucky: Commercial harvest of shovelnose sturgeon is permitted in Kentucky, but there is no commercial catch quota and there is no mandatory harvest reporting (Todd, 1999). Sport fishing is also permitted, but fishermen are not required to report their catch (Mosher, 1999).

Missouri: Missouri allows commercial fishing of shovelnose sturgeon (Todd, 1999). The state also permits year-round sport fishing for the species (Mosher, 1999).

There is no commercial catch quota for *S. platorhyncus*. Commercial fishermen must obtain a permit that costs USD 25 for residents and USD 200 for non-residents. In addition, each permittee must tag each net, seine, or group of 50 hooks for juglines, trotlines, bank lines, limb lines, or throwlines under a set fee schedule. These tags are not transferable, and tagged equipment must be attended personally by the permittee or by another licensed commercial fisherman authorized in writing by the permittee as an assistant. A licensed commercial fisherman must be present in each boat (Wildlife Code of Missouri, 3CSR10-10.720).

There are also restrictions designating which state waters may be fished, size limits, and gear restrictions. In the Missouri River, the part of the St. Francis River that forms the border between Missouri and Arkansas, and most of the state's portion of the Mississippi River, shovelnose sturgeon more than 76 cm in length (measured from tip of snout to fork of tail) may not be possessed or transported during commercial fishing operations or while possessing commercial fishing gear; such fish must be returned to the water unharmed immediately after being caught (Wildlife Code of Missouri, 3CSR10-10.725). Commercial fishing gear cannot be used or set within 274.2 m of any spillway, lock, dam, or the mouth of any tributary stream or ditch. In addition, the minimum bar measure for seines, gillnets, and trammel nets is 5 cm (when wet), the minimum bar measure for hoop nets and wings is 4 cm (when wet), and hooks attached to trotlines or throwlines must be at least 61 cm apart (Wildlife Code of Missouri, 3CSR10-10.725).

All commercial fishermen must submit a monthly report on a form provided by the Missouri Department of Conservation, noting the origin and the quantity and species of fish taken during the preceding month. The form must be filed even if no fish are taken, and permit renewal is conditioned on receipt of satisfactory monthly reports by the Department of Conservation (Wildlife Code of Missouri, 3CSR10-10.727).

Tennessee: Tennessee allows both commercial and sport fishing of *S. platorynchus*. There is no commercial catch quota, and prior to 1998 the state did not keep harvest records or impose any special regulations on this particular species. In 1998, Tennessee adopted new regulations covering both shovelnose sturgeon and paddlefish (Anon, 2000). Sport harvest of the species remains largely unregulated (Mosher, 1999; Anon, 2001?).

Wisconsin: Wisconsin allows commercial harvest of shovelnose sturgeon (Todd, 1999). There is no commercial catch quota. The state also permits a year-round sport fishery (Mosher, 1999).

States allowing sport fishing only

Kansas: There is no commercial fishery for shovelnose sturgeon in Kansas. Sport fishing is allowed year-round, but little data are available to determine harvest levels (Mosher, 1999).

Minnesota: There is no commercial harvest of shovelnose sturgeon in Minnesota. Sport fishing is permitted, with a creel limit of 10-fish per day (Mosher, 1999).

Montana: Montana does not permit commercial fishing for shovelnose sturgeon. It does permit sport fishing, with a creel limit of five fish per day (Mosher, 1999).

Nebraska: The shovelnose sturgeon is classified as a sport fish in Nebraska. There is no commercial catch allowed. Sport fishing is permitted in inland waters and waters of the Missouri River downstream from the mouth of the Big Sioux River. The state has established a daily bag limit of 10 fish, and a possession limit of 20 fish. Fishing is prohibited in the waters of the Missouri River upstream from the mouth of the Big Sioux River (Nebraska Fisheries Regulations, Chapter 2.006 "Sport Fishing Regulations").

Oklahoma: There is no commercial harvest of shovelnose sturgeon in Oklahoma (Todd, 1999). Sport fishing is permitted, but the size of the harvest is unknown (Mosher, 1999).

Wyoming: Wyoming permits sport fishing for shovelnose sturgeon year-round (Mosher, 1999).

States prohibiting commercial and sport fishing

Alabama: The state closed its waters to all harvest of any sturgeon species in 1972 (USFWS/GSMFC, 1995).

Louisiana: Harvest or possession of any native sturgeon species, or parts of any such sturgeon species, have been illegal in Louisiana since 1990 (USFWS/GSMFC, 1995; J. Roussel, Assistant Secretary, Office of Fisheries, Louisiana Department of Wildlife and Fisheries *in litt.* to T. Saito, Office of Management Authority, USFWS, 25 August, 2000).

Mississippi: Mississippi closed its waters to commercial harvest of all sturgeon species in 1974. There is no sport fishery (USFWS/GSMFC, 1995; Mosher, 1999; Mississippi Public Notice No. 2999.022).

North Dakota: There is no commercial or sport fishery for shovelnose sturgeon in North Dakota (Mosher, 1999; Todd, 1999).

Ohio: The shovelnose sturgeon is listed as an endangered species in the state of Ohio. Therefore, no take or trade is permitted (Ohio Code, Section 1501:31-23-01).

South Dakota: The state prohibits harvest of all sturgeon species by commercial or sport methods (C. Stone, Senior Wildlife Biologist, South Dakota Department of Game, Fish and Parks *in litt.* to R. Gnam, Office of Management Authority, USFWS, 25 August 2000).

Texas: The shovelnose sturgeon is listed as an endangered species in Texas. No commercial or sport harvest is permitted (Mosher, 1999; Todd, 1999).

In 1993, the Mississippi Interstate Cooperative Resource Association (MICRA) was designated as the focal group to coordinate work on a framework for management of sturgeon and paddlefish developed in the same year by the USFWS (Anon., 1993 cited in Rasmussen, in press). MICRA encompasses states in the Mid-Continent Region (Alabama, Arkansas, Colorado, Georgia, Iowa, Illinois, Indiana, Kansas, Kentucky, Louisiana, Michigan, Missouri, Minnesota, Mississippi, Montana, North Carolina, Nebraska, North Dakota, New Mexico, New York, Pennsylvania, Ohio, Oklahoma, South Dakota, Tennessee, Texas, Virginia, Vermont, Wisconsin, West Virginia, and Wyoming). However, little funding has been made available to undertake the recommendations in the management framework.

In 1998, Graham and Rasmussen (1998) noted that the MICRA Sturgeon and Paddlefish Committee recommended that commercial fishing for sturgeon species throughout the Mississippi basin be banned. Shovelnose sturgeon were included in this recommendation because of their similarity of appearance (at small sizes) to the pallid sturgeon.

Where a semi natural water flow had been maintained Hesse and Carreiro (1997 cited in Rasmussen, in press) observed that relatively healthy populations of sturgeon and paddlefish remained (e.g. areas of Arkansas and Louisiana).

CAPTIVE BREEDING

S. platorynchus is not a target species for government captive propagation and restocking efforts or commercial aquaculture. It is one of only two North American Acipenseriformes (the other is the Green sturgeon, *A. medirostris*) for which the USFWS has no direct captive propagation program (Anon, 2001d). Shovelnose sturgeon are used as a surrogate species for pallid sturgeon in efforts to detect iridovirus in free-ranging fish stocks. Approximately 200 free-ranging shovelnose sturgeon have been monitored for the virus and have also been used in experimental conditions to stress-test the species for viral expression (Anon., 2001d).

There is also no known aquaculture to produce of *S. platyrhynchus* meat or caviar for commercial trade purposes. There have however been some activities at the local level. Shovelnose sturgeon have been produced at three federal fish hatcheries (Hesse and Carreiro, 1997 cited in Rasmussen in press) for release in Wyoming rivers. Fish produced at The Garrison Dam National Fish Hatchery (NFH) from Missouri and

Yellowstone River brood stock were released in the Powder River; the Gavins Point NFH used brood stock from the Missouri River reach between the Yellowstone River confluence and Lewis and Clark Lake to produce fish for release in the Bighorn Rivers; the Natchitoches NFH produced fish from brood stock from the Mississippi River at the Old River Control Structure in Louisiana, but none were released (Rasmussen, in press).

West Virginia and New Mexico have also developed reintroduction plans to restock rivers where the shovelnose has been extirpated (Keenlyne, 1997), the species has not been present in New Mexico since 1875 (Anon., 1991 cited in Rasmussen in press). The Ohio Division of Wildlife reports a plan to reintroduce the shovelnose sturgeon in the Ohio River above Meldahl Lock and Dam at Ohio River kilometer 702 (S. Schell, pers. comm. to St Pierre *in litt*. to IUCN/SSC Wildlife Trade Programme, 20 November 2001).

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Cuora amboinensis Daudin, 1802

Malaysian Box Turtle
South Asian Box Turtle
Tortue boite d'Asie orientale

Order: **TESTUDINES** **Family: BATAGURIDAE**

SUMMARY

The Southeast Asian box turtle *Cuora amboinensis* is represented by four subspecies (*C. a. amboinensis, C. a. couro, C. a. kamaroma, C. a. lineata*). It is widely distributed throughout south and southeast Asia, from India to Viet Nam. Whilst individuals have been found at markets in China, it has not been recorded in the wild in that country. It is the largest species of the genus with a typical carapace of a large adult measuring 20 cm. Box turtles tend to have a low reproductive rate and *C. amboinensis* reaches sexual maturity at four or five years old. Although females are capable of laying several nests per year, each of two to three eggs, average fecundity is estimated at 4-6 eggs per mature female per year and life expectancy is between 25-30 years.

Despite being considered common throughout much of its range it is believed to be vulnerable to overharvest in many areas. The species is classified as Vulnerable by IUCN. As a habitat generalist, the species co-exists with humans in modified habitats, thus habitat loss and alteration is thought not to be such a problem. The major threat is reputedly collection for food for both local and international trade. In fact, *C. amboinensis* is one of the species most often encountered in the freshwater turtle consumption trade of the Southeast Asian sub-region. Hundreds of thousands of *C. amboinensis* have reportedly been imported to China through Hong Kong during the last decade. In the same time period, several thousand specimens have also apparently been exported for the European pet trade and although there are reports from 1998 that they may still be offered by the thousands, the import data is not yet available to support this view. A review of available literature shows the main exporting countries to be Cambodia, Malaysia, Myanmar, Indonesia and Viet Nam though there are no current CITES data available to substantiate this. Collection for food is often directed at larger adult specimens which are likely to be reproductively active, further impacting the populations affected. This species is also harvested for the medicinal trade, religious use, zoo exhibits and ornaments.

Although the species is either totally protected or harvest is regulated via a permit/quota system in the majority of range States, implementation of legislation and appropriate enforcement appear to be lacking in some regions. The inclusion of this species in Appendix II appears to be reducing imports to parts of Europe and encouraging captive breeding to supply this market. In June 2000, China restricted imports of this species and the effects of this regulation remain to be seen. However, the decreasing availability of this species in trade and a concurrent increase in prices suggest that this species may be declining as a result of over exploitation. Unfortunately there is no information available on population monitoring, habitat conservation measures or on the management of this species. Whilst, the species is thought to occur in a number of protected areas throughout the region, there is little firm evidence. Although conservation breeding programmes exist, little information is apparently available regarding efforts to breed *C. amboinensis* on a commercial scale.

The species is recommended under Decision 11.106 for inclusion in category 1.

DISTRIBUTION AND POPULATION

The CITES database lists the distribution of *C. amboinensis* as: Bangladesh; Brunei Darussalam; Cambodia; ?China; India; Indonesia: *Bali*, *Java*, *Kalimantan*, *Lesser Sunda Is*, *Moluccas*, *Sulawesi*, *Sumatra*; Lao People's Democratic Republic; Malaysia: *Peninsular Malaysia*, *Sabah*, *Sarawak*; Myanmar; Philippines; Singapore; Thailand and Viet Nam (Anon., 2001a).

C. amboinensis occurs from Bangladesh (Khan, 1982 cited in Ernst and Barbour, 1989), the Nicobar Islands and Assam in India (Moll and Vijaya, 1986 cited in Ernst and Barbour, 1989), south through Myanmar, Thailand, Cambodia, Viet Nam, and Malaysia, and east in Indonesia to Sulawesi and Amboina (the type locality). It also reaches the Philippines (Ernst and Barbour, 1989).

The 2000 IUCN Red List classifies this species as Vulnerable (VU A1d+2d) based on a population reduction of at least 20% over the three generations and a projected reduction over the next three generations and caused by actual or potential levels of exploitation. The IUCN/SSC Tortoise and Freshwater Turtle *Specialist* Group and Asian Turtle Working Group (Anon., 2000a) consider the species Endangered (EN) in Bangladesh, Cambodia, Lao PDR and Viet Nam; Vulnerable (VU) in Indonesia, India, Malaysia and Thailand. There is no information available for Myanmar; the species is presumed stable in Singapore (small population).

Bangladesh

C. a. kamaroma was first reported by Khan (1982a cited in Ernst and Barbour, 1989) from the Teknaf Peninsula, in southeastern Bangladesh. It was found later in the wetlands in Sylhet and Maulvi Bazaar districts in the northeast areas, adjoining forests and tea gardens (NERP, 1994 cited in Rashid and Khan, 2000). Rashid and Khan (2000) report the species to be uncommon and often used locally for food. The species is listed as Endangered in the Red Book of Threatened Amphibians and Reptiles of Bangladesh (Anon., 2000b).

Brunei Darussalam

The species occurs in Brunei according to the Natural History Section, Brunei Museum collection. No field studies have been undertaken (CITES Management Authority *in litt*. to IUCN/SSC Wildlife Trade Programme, 27 October 2001).

Cambodia

According to Iverson *et al.* (1998) Cambodia also forms part of the distribution range of *C .a. couro* (cited in Anon. 1999a). However, van Dijk believes that this subspecies does not occur in Cambodia, whilst C. a. *kamaroma* does (TRAFFIC Southeast Asia – Viet Nam, *in litt*. to TRAFFIC International, 29 November 2001). The importance of the Cambodian population of this species, in terms of its conservation value in the region, is suspected to be high compared to the populations of Thailand, Lao PDR and Viet Nam (Tana *et al.*, 2000). Cambodia has a large lowland area with a low density of people, and so may have the largest remaining population of this species in Indochina (Tana *et al.*, 2000).

China?

C. amboinensis has been reported from Guangdong and Guangxi provinces in Southern China (Zhang *et al*., 1998 cited in Lau and Shi, 2000). However, all records are based on market animals or shells retained by people. So far this species has not yet been found in the wild in China despite the fact that it is a lowland species that can live in man-made water bodies in other countries (Lau and Shi, 2000). Several authors believe that the species probably does not occur in China (Artner *in litt*. to IUCN/SSC Wildlife Trade Programme, 13 December 1999; de Bruin *in litt.* to IUCN/SSC Wildlife Trade Programme, 17 December 1999; Lau *in litt.* to IUCN/SSC Wildlife Trade Programme, 20 December 1999. Lau and Shi (2000) state that it is likely that earlier research would have recorded the species if it were present.

India

The species occurs in northeastern India, along the Brahmaputra floodplains of Assam, Arunachal Pradesh and Nagaland; also the Nicobar Islands (Choudury *et al*., 2000), Kaziranga National Park, Manas Tiger Reserve, and the Orang and D'Ering Wildlife Sanctuaries hold considerable populations of this species (Bhupathy *et al*., 1994 cited in Choudury *et al*., 2000). Of the two sub species present in India, *C.a. kamaroma* occurs on the Nicobar Islands, in Assam, and on the Andaman Islands (Anon, 1999a) whilst *C. a. couro* may occur in Eastern India (Jenkins, 1995), though van Dijk believes this unlikely (van Dijk *in litt*., 29 November 2001). It is possible that *C. a. lineata* occurs in India. There is no data available on population trends (Choudury *et al*., 2000).

Indonesia

Three subspecies of *C. amboinensis* are distributed in Sumatra, Java, Bali, Kalimantan, Sulawesi, Maluku, Sumbawa and Timor (Samedi and Iskandar, 2000). *C. a. amboinensis* can be found on the Indonesian Islands of Amboina which is the type locality, Buru, Ceram, Batjan, Halmahera and Sulawesi (Anon., 1999a). *C. a. couro* occurs on the Indonesian Islands of the type locality Java, also on Sumatra and their small offshore islands

(Rummler and Fritz, 1996 cited in Anon., 1999a) and *C. a. kamaroma* occurs on Kalimantan (Rummler and Fritz, 1991 cited in Anon., 1999a). The conservation status of these sub species is regarded as 'Common' in Indonesia (Samedi and Iskandar, 2000).

Lao PDR

The documented range of *C. amboinensis* is the south of the country (Duckworth *et al*., 1999). Some populations of *C. a. couro* may occur in Lao PDR (Anon., 1999a), however van Dijk believes this unlikely, though the subspecies *kamaroma* does occur in Lao PDR (van Dijk *in litt*., to TRAFFIC International, 29 November 2001). In 1993, Salter (cited in Anon., 1999a) stated that the populations of *C. amboinensis* had decreased and were now nearly extinct. The species is included in the "At Risk" category in Lao PDR legislation, for species with the highest level of threat (Stuart, 1998b cited in Duckworth *et al*., 1999).

Malaysia

Found in Peninsular Malaysia, Sarawak and Sabah (Jenkins, 1995), *C. amboinensis* is the most widespread of Peninsular Malaysian turtle species (Sharma and Tisen, 2000). *C. amboinensis* (*C. a. kamaroma*) appears to be abundant in most states that still have swamps and man-made wetland habitats such as rice fields, irrigation canals and ponds. However, it is believed that the capture of animals from the wild will undoubtedly contribute to population reduction, particularly in areas where harvesting is regular and in large quantities (Sharma and Tisen, 2000). The Management Authority of Malaysia (*in litt.* to the CITES Secretariat, 22 October 2001) stated that domestic consumption is not a threat to the species, whereas collection for commercial trade is having an impact, interviews with local collectors confirm this as they indicated that the species is not as abundant as in the past.

Myanmar

According to Artner (*in litt.* to IUCN/SSC Wildlife Trade Programme, 13 December, 2000) *C. a .couro* does not occur in Myanmar, but *C. a.* lineata and (probably) *C. a. kamaroma* do. *C .a. lineata* presumably occurs in the province Kachin in Northeast Myanmar (Anon., 1999a). The IUCN/SSC Tortoise and Freshwater Turtle Specialist Group and Asian Turtle Working Group consider the status and distribution of this species ill-defined in Myanmar and there are no recent records (Anon., 2000a).

Philippines

C. a. amboinensis can be found on practically all islands of the Philippines (Anon., 1999a). However, populations from the different Islands need further taxonomic investigation (Rummler and Fritz 1991, cited in Anon., 1999a), as they differ from the Moluccan and Sulawesi (Indonesian) form (Gaulke *in litt*. to IUCN/SSC Wildlife Trade Programme, 30 November 1999). *C. a. kamaroma* inhabits the Sulu Archipelago of the Philippine Islands (Anon., 1999a).
Alcala classified this *C. amboinensis* as "common" in 1986 (cited in Anon., 1999a). However, in 1999 he described this species as "not exactly a common turtle, an increased effort is required to gather a good number of specimens in any locality" (*in litt*. to the Ministry of Environment cited in Anon., 1999a). Hence, the populations in the Philippines appear to be in decline (Anon., 1999a).

Singapore

In 1999, *C. amboinensis* was described as a common resident and abundant in the region (the CITES Management Authority of Singapore *in litt.* 1999 cited in Anon., 1999a). However, in 2001 it was reported that any population that may be present would be extremely small and insufficient to sustain commercial harvesting (*in litt*. to IUCN/SSC Wildlife Trade Programme, 26 October 2001).

Thailand

C. amboinensis occurs throughout the country. Small populations are confirmed from protected areas. This species is believed to be uncommon and population trends are unknown (van Dijk and Palasuwan, 2000). The type locality for *C .a. kamaroma* is 50 km from Bangkok (van Dijk and Palasuwan, 2000). Nutaphand (1979 cited in Anon., 1999a) described the distribution as "numerous", however, in 1990 Manzke (1993 cited in Anon.,

1999a) did not observe a single specimen in a valley near Chumphon which was reported to be the habitat of this subspecies.

Viet Nam

C. amboinensis inhabits the central part of South Viet Nam. The species can be found in Dac Lac, Long An, Minh Hai (U Minh, Nam Can) (Duc and Broad, 1995), in addition, some populations of the subspecies *C .a. couro* may occur (Anon., 1999a). The species is now limited to remaining natural forests and wetlands within its range. However with agricultural conversion of wetlands and marshes into rice fields, an overall reduction of riparian forest habitat, and hunting pressures, few if any viable populations of *C. amboinensis* are thought likely to exist (Hendrie, 2000). The species' availability on markets in Viet Nam is also decreasing (Lehr 1996, 1997 cited in Anon., 1999a), which may indicate declining populations in the wild.

HABITAT AND ECOLOGY

Predicting the ecosystem effects of the disappearance of *Cuora* species is close to impossible since little more than the bare minimum of natural history is known for some species and nothing for others (van Dijk, 1999a).

C. amboinensis is the largest species of the genus (Anon., 1999a). Carapace lengths of adults may reach 22 cm and they may weigh around 1.5 kg (Jenkins, 1995). The life span is usually 25-30 years (Anon., 1999a).

Box turtles tend to have a low reproductive rate. In *C. amboinensis*, sexual maturity is reached at 4 or 5 years and mating occurs in *the* water and females find a moist, well-drained area for nesting (Ernst and Barbour, 1989). Reproduction appears timed to the seasons, so that nesting takes place during the dry warm season in January, February and April (Whitaker and Andrews, 1997 cited in Anon., 1999a) and the eggs hatch early in the rainy season (TRAFFIC, 1999). An output of 10 eggs per year is probably a maximum even for very large females; as an estimate of average fecundity, four to six eggs per mature female per year is considered more usual (TRAFFIC, 1999). The average egg size is 32 by 43 mm and incubation time is roughly 76 days between fertilisation and hatching (Moll, 1979).

C. amboinensis is found only in lowland tropical rainforest areas of Southeast Asia with a constant temperature between 24-32ºC (Ernst and Barbour*,* 1989). *C. amboinensis* is apparently equally at home on land or in water, and is often found on land far from water (Ernst and Barbour, 1989). However, Taylor (1920 in Ernst and Barbour, 1989 cited in Anon., 1999a) reported that juveniles are entirely aquatic. The species prefers warm, still water and is generally found in or near streams, ponds, marshes and rice paddies (Jenkins, 1995). Due to their tropical habitat, these turtles never hibernate and are active all year long (Ernst and Barbour, 1989). Primarily nocturnal they hide under piles of debris along banks of streams during the day (Anon., 1999a). Alcala (1986 cited in Anon., 1999a) reported this species to be found at altitudes up to 500 m in the Philippines.

This species has an omnivorous, if primarily vegetarian diet (Rogner, 1996 cited in Anon., 1999a) and according to Nutaphand (1979 cited in Anon., 1999a) it feeds on plants, molluscs and shrimps as well as fungi and worms. *C. amboinensis* does not require food on a daily basis and can feed twice per week without detrimental effects (Ernst and Barbour, 1989). *C. amboinensis* eggs as well as a significant proportion of hatchlings are an important source of food for monitor lizards, herons and some small mammalian predators such as viverrids (R. Wirth, *pers. comm.* 1998 cited in Anon., 1999a). Although information on the scale of predation on hatchlings is not available for *Cuora* species, hatchling survival of other turtles is reported to be low (Smith, 1997 cited in Anon., 1999a).

THREATS TO SURVIVAL AND DOMESTIC USE

The low reproductive rate, low nesting numbers and small clutch sizes of the genus *Cuora*, makes them very sensitive to over collection (Das, 1997 cited in Anon., 1997). Collection for food is directed at larger adult specimens, further impacting the populations affected (Anon., 1999b). *C. amboinensis* is one of the primary native species in the food trade , by number of individuals (van Dijk *et al*., 2000).

As *C. amboinensis* is considered a generalist that can live in altered environments, it is probably less affected by the ongoing deforestation throughout Southeast Asia than many other species. *C .a. amboinensis* has been observed in small dirty waterholes used by water buffalos on Masbate, Phillipines, and *C. a. kamaroma* has

been found hidden under stones on an airport runway on Sanga Sanga, Philippines (Gaulke *in litt*. to IUCN/SSC Wildlife Trade Programme, 30 November 1999).

However, as a consequence of living close to human settlements, the threats to the taxon through pollutants (insecticides, herbicides, fertilisers, and others) need to be investigated as negative effects on fertility, incubation success, or hatchling development cannot be ruled out (Gaulke *in litt*. to IUCN/SSC Wildlife Trade Programme, 30 November 1999). It is conceivable that some specimens become entangled and drown in gill nets set to catch fish (van Dijk, 1999b).

Whilst van Dijk in 1992, (*in litt*. to F. Lambert, IUCN Species Survival Commission, 23 November 1992) considered *C. amboinensis* to be a human-tolerant species able to survive in modified habitats such as ponds, canals, ditches and rice paddies and apparently capable of sustaining the relatively low level of exploitation observed in the early 1980s, Lau *et al*., (2000) report that for many widespread and presumably common Asian turtles e.g. *C. amboinensis,* the large-scale exploitation for the food trade is most likely unsustainable and efforts should be directed towards detailed *in situ* conservation measures and ecological studies of such species.

Bangladesh

C. amboinensis is a primary source of meat protein for some low-income non-Muslims, and for tribal peoples living in or near remote forested areas. As demand and local prices have increased, subsistence consumption is now mostly directed towards local trade. Urbanisation, water pollution and loss of wetlands have also contributed to the decline of turtles in general (Rashid and Khan, 2000).

Cambodia

Cambodia probably contains the largest population of the species in Indochina (Tana *et al*., 2000), but local subsistence use of turtles is widespread in Cambodia, and probably not species specific. The domestic trade in turtles is considered minor when compared with the much larger international trade (Tana *et al*., 2000).

China?

Although there are still numerous suitable habitats in China (Lau and Shi, 2000), it is not clear whether the species occurs there.

India

There is a suspected pet trade in *C. amboinensis.* This species is also collected for food (A. Choudhury pers. comm.) and in Arunachal Pradesh and Assam, the species is a target for subsistence hunting (Choudury and Bhupathy, 1993 cited in Anon., 1999a and Bhupathy *et al*., 2000). It is believed that specimens collected for trade are only destined for local markets (Bhupathy *et al*., 2000). Habitat availability for the species is good in the Brahmaputra flood plains (Choudury *et al.*, 2000).

Indonesia

The local market for this species is very small, and most animals are directed to the markets in Hong Kong and China (Saputra *in litt.,* 1999 cited in Anon., 1999a). However, Fritz and Gaulke (1997 cited in Anon., 1999a) reported *C. amboinensis* to be the most common turtle species observed during a survey on local dealers in Sumatra Utara. The habitat of this species has probably decreased as a result of extensive programmes to relocate people from Java to Sumatra, which constitutes one of the main distribution ranges of *C. amboinensis*. These developments specifically affect the subspecies *C. a. couro* and *C. a. amboinensis* in Sulawesi (Anon., 1999a).

Lao PDR

Records of collection by local people suggest that every species of turtle in Lao PDR has a value as a food or trade commodity (Stuart and Timmins, 2000). The susceptibility of *C. amboinensis* to exploitation is increased because the species is associated with habitat that is heavily used by humans (Stuart and Timmins, 2000).

Malaysia

C. amboinensis is known to be collected for the pet trade, as a meat source, as zoo exhibits and for religious and medicinal use. This extensive collection and trade is likely to be reducing populations in several locations. In particular, the species is intensively captured for the local meat trade. Traders in Kelantan and Perlis reportedly buy hundreds of individuals from trappers weekly. Five trappers working for a Chinese middleman in Perlis were observed bringing in approximately 50-70 animals from rice fields in a single days' effort. This is the most common semi-aquatic species sold in wet markets and Chinese "pet stores" in Kuala Lumpur, Ipoh and Melaka. In September 1999, one exporter in Perak reported buying more than 800 turtles per day from middlemen for export to Shenzen, China (Sharma and Tisen, 2000). The Management Authority of Malaysia (*in litt*. to the CITES Secretariat, 22 October 2001) reported that collectors have to venture to new areas to obtain these turtles as previous collection sites have been depleted.

Myanmar

C. amboinensis is used mainly for traditional medicine and is sold in specialist shops primarily to Asian and predominantly Chinese tourists. In 1995, shells of tortoise (species unspecified), which are used to treat some nephrological problems, were sold for USD 0.80 each (Martin 1997 cited in Anon., 1999a). Due to a marked rise in the number of tourists, demand for these products is thought to have increased dramatically during recent years. In Myanmar itself, the use of medicines made from turtles is negligible (Anon., 1999a). *C. amboinensis* is also likely to be impacted by deforestation in Myanmar (van Dijk, 1997, cited in Anon., 1999a)

Philippines

In the Philippines, this species is used for food and as a traditional medicine e.g. as rheuma remedy. On Luzon and the West Visayan Islands especially, unknown numbers of stuffed turtles are sold in souvenir shops and markets (Gaulke *in litt*. to IUCN/SSC Wildlife Trade Programme, 30 November 1999). According to the Ministry of the Environment of the Philippines (*in litt.,* 1999 cited in Anon., 1999a) the country's populations are threatened by the demand of local people as food, particularly in the Central Visayas, but maybe also in other parts of the country.

Singapore

In 1999, less than 10% of the animals in trade were for local consumption (the CITES Management Authority of Singapore *in litt.* 1999 cited in Anon., 1999a). However, harvesting is now prohibited as the species is protected (Management Authority of Singapore *in litt*. to IUCN/SSC Wildlife Trade Programme, 26 October 2001).

Thailand

This species is collected for the pet trade and also sold for release at temple ponds (van Dijk and Palasuwan, 2000), but the consumption of adults does not seem to have ever been a major feature in Thailand (van Dijk, 1999b).
In a survey of markets in Northern Thailand Malayan box turtles were observed in very small numbers (Puginier, 1994 cited in Jenkins, 1995). Although vast areas of potential habitat remain, it is unclear how secure these are from incidental collection, risk of accidental capture by fishermen, entanglement in discarded nets, habitat degradation, habitat loss and pollution (van Dijk and Palasuwan, 2000). Small populations occur in protected areas, these are well to very well protected (van Dijk and Palasuwan, 2000).

Viet Nam

The main threats to this species in Viet Nam are habitat loss and hunting for the wildlife trade (Hendrie, 2000). The extent of national utilisation is unknown, though Duc and Broad (1995) documented this species for sale in Ho Chi Minh in large numbers and in smaller numbers in northern markets. In 1993, Lehr (1997 cited in Anon., 1999a) reported *C. amboinensis* as the third most common species to be offered at markets in South Viet Nam, but the number on offer had reportedly decreased considerably by 1996. Market prices were in the range of 2 USD/kg, variation in price was often apparently as much to do with the location of the market as with the species involved (Anon., 1999a). This species may have been consumed locally in some rural areas in the past (Hendrie, 2000) and juveniles are often used as a release animals by Buddhists (Duc and Broad, 1995).

INTERNATIONAL TRADE

C. amboinensis was listed in CITES Appendix II in 2000, consequently the CITES trade data that are available may be incomplete. Trade data for *C. amboinensis* are provided in the Annex. According to the 2000 CITES reported exports data, trade in *C. amboinensis* from range States totalled 282 959 live specimens, all except 8 300 reported as of captive origin in Malaysia, were reported to be wild collected. Malaysia accounted for the majority of these exports (277 190). Indonesia exported 5 767 individuals and Viet Nam 2.

Based on trade data reported by exporting countries, the largest importers of live specimens of *C. amboinensis* were China (262 740); Hong Kong (6 850); USA (8 450) and Singapore (2 000). In addition eight European countries imported a total of 1 619 live specimens, the large majority of these were exported by Indonesia, and 1 292 were imported by three Asian countries.

During the last decade, hundreds of thousands of *C. amboinensis* have reportedly been imported to China and Hong Kong for food and medicinal purposes (Collins, 1998; Lau *et al.,* both cited in Anon., 1999a; Jenkins, 1995). Several thousand specimens have apparently also been exported for the Western pet trade (Smart and Bride, 1993) and they are still offered by the thousands (Yuwono, 1998), mostly originating from Indonesia. The sustainability of these high export numbers cannot be substantiated (Anon., 1999a).

Recently, the main trade in *C. amboinensis* has apparently taken place between Indonesia and China. Thousands of *C. amboinensis* were reported in the Qing Ping market in Guangzhou in June 1999 (Artner and Strauss, 1999 cited in H. Artner *in litt.* to IUCN/SSC Wildlife Trade Programme, 13 December 1999). However, fluctuating numbers of *C. amboinensis* in trade probably reflect the exploitation of new sources of the species rather than a population effect as the trade volumes show boom-and-bust cycles at individual sites (Samedi, Shepherd, presentations at Phnom Penh workshop 1-4 December 1999) (van Dijk, 1999a).

Bangladesh

The species is consumed locally and also exported (Bhupathy *et al*., 2000). During the 1980s Bangladesh earned about USD 600 000 per annum from turtle exports (species not specified). However, in the early 1990s, the magnitude of trade decreased to some extent before increasing again during the later part of the decade (Rashid and Khan, 2000).

Brunei Darussalem

The CITES Management Authority (2001 *in litt.* to IUCN SSC Wildlife Trade Programme, 27 October 2001) stated that they have no records of export or import for this species.

Cambodia

The level of domestic trade is considered minor when compared to the reportedly much larger international trade (Tana *et al*., 2000). Although there is virtually no direct information on exploitation and trade in emydids in Cambodia, a notable proportion of specimens in trade in Viet Nam, including *C. amboinensis*, originated in Cambodia (Duc and Broad, 1995).

A number of species of freshwater turtle and tortoise including *C. amboinensis* were found in a market at Stung Treng, on the Mekong River, Cambodia, (Mundkur *et al*. 1995 cited in Duc and Broad, 1995). Live turtles were reported to be sent from Stung Treng, to Phnom Penh, but mainly sold across the border in Viet Nam. Live turtles, which presumably include *C. amboinensis* were on sale for in Cambodia for USD 2.2 per kilogramme, the end market was documented to be Phnom Penh, Thailand or Viet Nam (Martin and Phipps, 1996).

Little data exists on illegal trade of turtles to Thailand, although without further information it is presumed to be much less significant than the trade to Vietnam (Tana *et al*., 2000).

China (export)

C. amboinensis may not occur in China, however, if it is present it is currently included in the export suspension of all Testudinata for commercial purposes (except *Chinemys reevsii* and *Trionyx sinensis*) which began in June 2000 (CITES Management of China *in litt.* to CITES Secretariat, 16 October 2001).

India

This species is collected for local markets only (Bhupathy *et al*., 2000). There is no legal international trade. Illegal trade has yet to be assessed (Choudury *et al*., 2000).

Indonesia

C. amboinensis is exported in "huge" numbers from Indonesia to East Asia (Samedi and Iskandar, 2000) and Indonesia is reportedly one of the main exporters of *C. amboinensis* to mainland China (Artner and Hofer, 2000) and Taiwan POC (Chen *et al*., 2000). The IUCN/SSC Tortoise and Freshwater Turtle Specialist Group and Asian Turtle Trade Working Group note that "Boom-and-bust collection cycles" for *C. amboinensis* have been occurred at particular locations in Indonesia (Anon., 2000a). These involve a recurring pattern of turtle exploitation operations becoming established at a particular location, and collecting turtles through an extensive network of trappers, hunters and middlemen. the collection efforts and both capture and export volumes increase rapidly, reach a peak and then decline as accessible populations become depleted and collectors need to venture into new, more distant areas. The average size of animals that are traded also declines correspondingly, as areas are over-collected. Annual exports of this species from Indonesia are estimated at about 800 tons or one million individuals (van Dijk, 1999).

According to official figures, 147 344 *C. amboinensis* turtles were exported from Indonesia into Hong Kong between November 1993 and October, 1994. Between 80-90% of these animals were re-exported from Hong Kong into China (Lau *et. al.* 1995 cited in Anon., 1999a). These figures may indicate illegal trade as the total export quota for *C. amboinensis* from Indonesia in 1994 was only 10 000 animals (van Dijk, 1999).

Although Saputra (*in litt.,* 1999 cited in Anon., 1999a) claims that exports from Indonesia for the pet trade are relatively small, one single wholesale animal trader reported *C. amboinensis* to be available "by thousands if needed" for export as pets (Yuwono, 1998 cited in Anon., 1999a). Yuwono lists Java, Sumatra and Kalimantan as the animals' place of origin.

The official annual export quota from 1991-1994 was 10 000 individuals (Jenkins, 1995). By 1998 the annual export quota set by the CITES Management Authority for this species had risen to 90 000 individuals (Directorate General of Nature Protection and Conservation cited in Samedi and Iskandar, 2000). In 2000, this quota was revised and decreased to 6 000 live animals (Notification to the Parties No. 2001/053 31/08/00, but the quota for 2001 has increased to 18 000 live specimens (Notification to the Parties No. 2001/041 09/07/01).

Sumatra: Official exports of 37 000 Southeast Asian box turtles from Sumatra in 1988 were reported by van de Bunt (1990, cited in Jenkins, 1995). Reportedly, exports of *C. amboinensis* were sent on a weekly basis from Sumatra's capital Medan not only to Hong Kong but also to Singapore (Auliya in prep. cited in Anon., 1999a).

The high numbers of *C. amboinensis* found even on the property of small scale dealers on Sumatra (which every few days are sold to large dealers in Medan and from there are exported) indicate strongly that the actual trade numbers may be much higher than the official numbers according to Gaulke (*in litt.* to IUCN/SSC Wildlife Trade Programme, 30 November 1999). During a two-months survey in the southeastern part of the province of Sumatra Utara *C. amboinensis* was reportedly the most abundant species available from two traders (Fritz and Gaulke, 1997 cited in Anon., 1999a).

Exporters in Medan and Tembilahan stated that the most numerous species received are *C. amboinensis* and *Orlitia borneensis,* approximately 1 350 individuals were observed at an exporting company in Medan, Sumatra on 24 September, 1999 (Shepherd, 2000). A large collection and export business located in Palembang, often sells some of their turtles to a dealer in Tembilahan, particularly when prices are high. According to various dealers in Riau, the business in Palembang is very large, exporting approximately 40 tonnes of turtles per month. In Tembilahan, *C. amboinensis* is the most numerous species bought into this operation. Prices have dropped considerably over the past year, prices paid for *C. amboinensis* in 1997 ranged from IDR 17 000-18 000 per kg,

(USD 1.6 to 1.7/kg) compared to the current price of IDR 11 000 -12 000/kg (USD 1.03 to 1.13/kg) (Shepherd, 2000).

Middlemen and exporter purchasing prices in September 1999 in Sumatra Indonesia (from Shepherd, 2000):

	Middlemen purchasing prices per kg			**Exporter purchasing prices per kg**		
Area	Medan	Pekan Baru	Duri	Kandis	Medan	Tembilahan
Rupiah	10 000	7 000	6 000	7 500-10 000	17 000	12 000
USD	0.94	0.66	0.56	0.71-0.94	1.6	1.13

Turtles of all sizes were observed in the Medan holding centre, including hatchlings of at least three species including *C. amboinensis*. Eggs are often laid in the holding pens and crates, but staff report that there have never been any requests for the eggs, and so they are discarded (Shepherd, 2000).

Sulawesi: In the early 1990's an even larger export trade existed for this species from Sulawesi (Jenkins, 1995). Annual exports to Hong Kong of up to 13 tonnes of Southeast Asian box turtle plastron from Ujung Pandang were reported by Giessen *et al*. (1991 cited in Jenkins, 1995). This was estimated to represent up to 200 000 individuals of animals of all age and sex classes and it seemed likely that the trade was not sustainable.

Irian Jaya: This Province had reportedly been allocated a quota in 1997 for *C. amboinensis* as well as other reptile species that do not occur in Irian Jaya (Iskandar, pers. obs. cited in Samedi and Iskandar, 2000).

Lao PDR

Lao PDR is not a Party to CITES. There is reportedly a small scale export of this species from Champasak to Thailand. An estimated 60-70 live specimens annually, most originating in Salavan Province east of Champasak and smuggled via Ban Mai (Jenkins, 1995). The species is considered 'At Risk' in Lao PDR legislation. Unknown quantities of specimens are caught in southern Lao PDR and transported to Viet Nam (via Savannakhet/Danang Highway) and Cambodia (Anon., 1999a). The international borders of Viet Nam and China with Lao PDR are reportedly porous, so transboundary wildlife trading and poaching is thought to continue, mostly unchecked (Stuart and Timmins, 2000).

Malaysia

Malaysia regularly exports turtles, including *C. amboinensis* to Viet Nam, which for the majority of these animals, acts as a through-route into China and Hong Kong (Jenkins, 1995). The Government reports extensive unregulated exports of *C. amboinensis* to China (Ministry of Science, Technology and Environment of Malaysia, *in litt.* 1999 cited in Anon., 1999a). A quota of 50 000 live specimens has been set for 2001 (Notification to the Parties No. 2001/041).

In more recent months there appear to have been large numbers of the species trapped locally and exported. In September 1999, one exporter in Perak reported buying more than 800 turtles per day from middlemen for export to Shenzhen, China. Records from the Department of Wildlife and National Parks [the CITES Management Authority of Malaysia] show that between January to October 1999, a total of 456 541 individuals were exported (Sharma and Tisen, 2000). Figures, based on permits issued until 22 October 2001, record 45 360 live specimens from the wild have been exported from Peninsular Malaysia (Management Authority of Malaysia *in litt*. to CITES Secretariat, 22 October 2001).

Enforcement experience shows that traders have shipped *C. amboinensis* in consignments mixed with other species (Management Authority of Malaysia *in litt*. to CITES Secretariat, 22 October 2001). As the majority of trade in this species is destined for China, a bilateral agreement has been established between the CITES Management Authorities of China and Malaysia (Management Authority of Malaysia *in litt*. to CITES Secretariat, 22 October 2001).

Myanmar

Although all native turtle species are protected against commercial trade by domestic law, Myanmar is reportedly one of the main exporters of *C. amboinensis* to China (Artner and Hofer, 2000). The trade route is sometimes via Thailand for both live animals and traditional medicine products (Anon., 1999a). Forty seven specimens of the subspecies *C. a. lineata* reported to have originated in Myanmar were found on sale in Yunnan Province, China (Fritz and Obst, 1998 cited in Anon., 1999a).

Philippines

According to the Ministry of Environment (*in litt.* 1999 cited in Anon., 1999a) there was a small scale export to Korea and Hong Kong in 1995 and 1996, but only of captive-bred specimens. However, the Management Authority of the Philippines (*in litt*. to IUCN/SSC Wildlife Trade Programme, 6 November 2001) reported that the breeding operation ceased in 1996. It may be assumed that these specimens were destined for food markets, Traditional Chinese Medicine markets or the USA pet market. Some illegal trade was recorded in the local market (Ministry of Environment *in litt.* 1999 cited in Anon., 1999a).

Singapore

The CITES Management Authority recorded a substantial trade in this species. "In the last four years, Singapore has imported quantities of this species but less than 10% are for local consumption. More than 90% of the specimens are either re-exported or trans-shipped to other Asian countries" (CITES Management Authority of Singapore, *in litt.* 1999 cited in Anon., 1999a). Chen *et al*., (2000) note that *C. amboinensis* is one of the most common species exported from Singapore to Taiwan, POC. In 2001 the CITES Management Authority (*in litt*. to IUCN/SSC Wildlife Trade Programme, 26 October 2001) reported that it had not issued any permits for this species in the last 14 months. However, a shipment said to originate from Singapore via Macao that was confiscated in Hong Kong on 12 December 2001 contained about 1800 individuals of *C. amboinensis* (Haig, 2001).

Thailand

There is no legal international trade in *C. amboinensis* from Thailand (Management Authority of Thailand *in litt*. to IUCN/SSC Wildlife Trade Programme, 13 November 2001). Illegal trade consists of a modest domestic trade, and small numbers of animals in the pet trade allegedly imported from other countries (van Dijk and Palasuwan, 2000). Two seizures in Thailand in 1999 involved turtles. One seizure included 154 *C. amboinensis* among 311 turtles sold to gain Buddhist merit by releasing the purchased animals (49.5%). The other seizure involved 17 *C. amboinensis* among 479 turtles believed to be destined for export for food, or for domestic consumption (Source: Wildlife Protection Section, Royal Forest Department cited in van Dijk, 1999). Potential trade impacts are modest in comparison to habitat effects (van Dijk and Palasuwan, 2000).

Viet Nam

C. amboinensis is one of the most abundant species of box turtle in trade, it is commonly recorded on sale in markets in Ho Chi Minh City and in smaller numbers in northern markets, where it was presumably destined for export to China (Jenkins, 1995). According to Lehr (1997 cited in Anon., 1999a) 90% of all turtles on Vietnamese markets are destined for export to China. The numbers of *C. amboinensis* specimens observed for sale in Southern Viet Nam during 1993 have since decreased by more than half and at the same time the price per kilogramme has doubled from USD 10-20 (Lehr 1997 cited in Anon., 1999a). Other figures for the value of *C. amboinensis* on the domestic market in Viet Nam between 1993 and 1994 put the price at 13 000-86 000 d/kg (USD 0.9 –6). Whilst, the value at export point for the same period was 100 000 d/kg (7 USD/kg (Duc and Broad, 1995).

In 1996, virtually no legally protected species could be found in official public markets in Viet Nam, reportedly because most of the trade in these animals was now conducted from the traders' private residences. However, species not available for sale immediately could be procured at short notice, indicating that traders are well co-ordinated and organised (Lehr 1997 cited in Anon., 1999a). Every day between 3-30 tonnes of wild animals, 61.4% of which are turtles, are thought to be exported to China through the three border towns of Dong Xing, Longyao and Shuikou alone. A significant proportion of this trade, including *C.amboinensis* is reportedly illegal (Li and Li 1998; Anon., 1999a). In addition, Viet Nam is reported to export specimens for the European and American pet trade (Anon., 1999b cited in Anon., 1999a).

International trade in certain turtle species is permitted under certain conditions in Viet Nam, which includes licensing of exports. These export data are compiled by the CITES office in the Forest Protection Department, even though many traded species are not listed in the CITES Appendices (Hendrie, 2000).

The origin of these turtles (in the table below) is unknown and may apparently include Cambodia (Hendrie, 2000).

Number of *C. amboinensis* legally exported from Viet Nam during the period 1994-99.

1994	1995	1996	1997	1998	1999	Total
550	3 330	2 390	2 540	3 760	870	13 440

Source: FPD CITES office (in Hendrie, 2000).

Importers

China

China suspended the import of species of Testudinata for commercial purposes from Indonesia, Thailand and Cambodia in June 2001 (CITES Management Authority of China 2001 *in litt.* to IUCN/SSC Wildlife Trade Programme, 16 October 2001).

C. amboinensis is consumed in South China where it is a primary species in the food trade (Ades *et al*., 2000). Observations in the Qing Ping Free Market in Guangzhou, China in November 2000 reported that live *C. amboinensis* were being sold in higher quantities than previously observed, the majority reportedly originating in Myanmar, Malaysia, Indonesia (mainly Sumatra) and Viet Nam (Artner and Hofer, 2000). At a recent survey at Qing Ping market in August 2001, after the import suspension, more than 1 000 live specimens of *C. amboinensis* were recorded (E. Even, *in litt*. to TRAFFIC Europe, November 2001). At Qing Ping market, Guangzhou, in October 2001, about a dozen traders each had several hundred to perhaps a thousand specimens of *C. amboinensis* on display, with a total of several thousand specimens observed in the market (van Dijk and Parry-Jones, *in litt*. to TRAFFIC International, 12 November 2001).

Hong Kong: In 1993, 680 582 kg of unspecified turtle species were imported into Hong Kong, and within the first ten months of 1994 a record level of 1.8 million kg had been recorded. As the second most abundant species in trade *C. amboinensis* accounted for a large proportion of imports (Lau *et al.* 1995 in Anon., 1999a). According to Barzyk (cited in Anon., 1999a) by 1999 imports of food turtles to Hong Kong reached more than 3 million specimens.

The species is reportedly consistently present in the food trade in Hong Kong and there are small numbers of yearlings of *C. amboinensis* for sale in pet shops. Although the yearlings are thought to be a result of opportunistic hatching of eggs laid by gravid females held in stock and dealers may be aware of the financial benefits of captive breeding (Lau *et al*., 2000).

In October 2001, 29 live specimens were observed for sale in markets and other outlets in Hong Kong, prices per specimen as advertised were between HKD 44-56 (USD 9-12) (van Dijk and Parry-Jones *in litt*. to TRAFFIC International, November 2001). Although there are no records of trade to Hong Kong, the Agriculture Fisheries and Conservation Department (*in litt*., to TRAFFIC East Asia, 16 November 2001) believe there are significant levels of trade in *C. amboinensis*. (See note above on confiscation of 1800 *C. amboinensis* on 12 December 2001 (Haig, 2001)).

Taiwan, POC: In 1997, at least 20 species of turtles were found in trade (Chang, 1997 cited in Chen *et al*., 2000) for medicinal products, of these, *C. amboinensis, Malayemys subtrijuga* and *Siebenrockiella crassicollis* usually represented more than 75% of the total amount. Between 1992 and 1998, *C. amboinensis* and *Malayemys subtrijuga* were the most common species in trade, originating from Indonesia and Singapore (Chen *et al*., 2000). *C. amboinensis* is a primary species for the plastron trade (Ades *et al*., 2000), but there is some demand for the species for aquaria in Taiwan, POC (Chang, 1996), and according to TRAFFIC up to 200 animals were available for immediate sale from pet shops (TRAFFIC, quoted in Chang 1996 cited in Anon., 1999a).

Europe

In 1991 Bringsoe (cited in Anon., 1999a) reported that *C. amboinensis* plays a significant role in the European specialist pet market, and Pro Wildlife (in prep. cited in Anon., 1999a) noted that following European Union import restrictions on North American box turtles, European enthusiasts had apparently discovered Asian box turtles as an attractive alternative. Allegedly, during the 1990s tens of thousands of animals were imported into Europe, although the majority of animals kept as pets did not survive for long (Meier, *pers. comm.* 1999 cited in Anon., 1999a).

Great Britain alone reportedly imported 3 833 individuals between 1986 and 1990 (Smart and Bride, 1993 cited in Anon., 1999a). In 1998, *C. amboinensis* was on sale in the Netherlands on an internet site for USD 35 and in 1999 in the United Kingdom for USD 25 each (Maas *in litt*. 1999), while a wholesaler asked as little as USD 3 per animal (Anon, 1999b cited in Anon., 1999a). Traders from Switzerland reportedly sold Malaysian specimens of this species for USD 45 (Theiler, 1998) to USD 69 (Auliya *in prep.* cited in Anon., 1999a). A recent survey of 27 wholesalers and specialist reptile shops carried out by Pro Wildlife in Germany revealed that 44.5% of businesses questioned held stocks of this species available for immediate sale. A further third stated that they were able to obtain the species on request. The animals were offered for between USD 7.5 and 32 each and reportedly originated primarily from Indonesia and Hong Kong (Anon., 1999a).

Compared with other species of the genus *Cuora*, *C. amboinensis* is of moderate popularity among European hobbyists and is offered at relatively low prices of around 15 – 30 Euro (USD 13.5-27) (T. Vinke, Chair of the Chelonian Working Group of the German Herpetological Society (DGHT), pers. comm. to TRAFFIC Europe, October 2001; M. Auliya, in prep. cited in TRAFFIC Europe *in litt*. to TRAFFIC International, 8 October 2001). Imports of live *C amboinensis* are reported by Spain where 550 individuals were imported in 2000. In 2001 the Management Authority of Spain issued import permits for a total of 750 live specimens of *C. amboinensis* originating from Indonesia and Malaysia (Mercedes Nunez, CITES Management Authority of Spain, *in litt*. to TRAFFIC Europe, 8. October 2001 cited in TRAFFIC Europe *in litt*. to TRAFFIC International, 8 October 2001). Germany imported 140 live specimens of *C. amboinensis* originating from Indonesia in 2001 (M Sterz, Management Authority of Germany, *in litt*. to TRAFFIC Europe, October 2001 cited in TRAFFIC Europe *in litt*., to TRAFFIC International).

According to the DGHT Chelonian Working Group the species availability on the European market has decreased since the listing of the species in CITES Appendix II in 2000 and consequently, captive bred specimens are now increasingly in demand (T Vinke, pers. comm. to TRAFFIC Europe, October 2001 cited in TRAFFIC Europe *in litt*., to TRAFFIC International). It is estimated that some thousand specimens are currently kept in the EU (T Vinke, pers. comm. to TRAFFIC Europe, October 2001 cited in TRAFFIC Europe *in litt*., to TRAFFIC International).

USA

In 1981, the recorded price for this species was around USD 38 (Hoover, 1998) but specimens can now be bought from pet shops for approximately USD 10-25 (Lucas 1999; Central Florida Reptile Farm 1999). Between 1993 and 1995 a total of 14 476 specimens were imported into the USA with 464 specimens in 1993, 5 066 in 1994, and 8 946 in 1995 (Hoover, 1998). However, according to the US Fish and Wildlife Service (*in litt.* 1999 cited in Anon., 1999a) in 1995, 6 683 live animals were imported into the USA. The figures for 1996 and 1997 are 5 982 and 6279 respectively. In 1997, an additional 65 shell-products were also imported (US Fish and Wildlife Service *in litt.* 1999 cited in Anon., 1999a). The USA exported 749 animals in 1995, 85 in 1996, and 80 in 1997.

CONSERVATION MEASURES

There is no information available on population monitoring and despite the creation of wildlife and nature reserves throughout the species range, there are no habitat conservation measures specifically directed towards *C. amboinensis.*

Bangladesh

The species is listed as Endangered in the IUCN-Bangladesh 1999 Red Data Book (Anon., 2000b). Capture, trade and killing of specifically listed wild fauna is prohibited through Annex III of the Bangladesh Wildlife Preservation Amendment (BWPA) (Rashid and Swingland, 1997 cited in Anon., 1999a). *C. amboinensis* is not

specifically noted in any annex, meaning that it is neither specifically protected (Annex III) nor open to hunting (Annex I); rather its legal state is undetermined. Under the Act, the Forest Department (under the Ministry of Environment and Forest) is responsible for the deployment and enforcement of the Act. Other offices such as the Customs, Police, Bangladesh Rifles, and other authorities will render all assistance to the Forest Department for enforcement (Rashid and Munjural Hannan Khan, 2000). However, according to S.M.A. Rashid (CARINAM, *in litt*. to IUCN/SSC Wildlife Trade Programme, 7 September 2001), there is very little evidence of the enforcement of punitive measures as prescribed in the BWPA for collectors and traders involved in illegal collection or trade.

Cambodia

Current regulations and controls concerning tortoises and freshwater turtles in Cambodia are:

Law No. 33 (Department of Fisheries): main law on use of aquatic animals; Law No. 35 (Department of Forestry): main law on use of land animals; Joint Declaration (Ministry of Agriculture, Forestry and Fisheries and Ministry of Environment) No. 1563: wild animals cannot be hunted with traps, explosive materials, or poison, nor can wild animals or their products be sold, commercialised, exploited or transported, nor can wild animals or their products be sold in restaurants; Government Decision 01 (Department of Forestry): to end illegal trade in land animals; Government Decision 02 (Department of Fisheries): to end illegal trade in aquatic animals (Tana *et al*., 2000).

India

The species inhabits 5 or 6 protected areas in north-eastern India and protected areas legislation is extended to *C. amboinensis* (TRAFFIC Europe *in litt*. to TRAFFIC International, 28 November 2001). However, there are no specific management or control measures (Choudury *et al*., 2000). *C. amboinensis* is not covered by the Indian Wildlife Protection Act, 1972 (Anon., 1999a). However, all forms of wild animals including parts and products are prohibited from export under the Schedule 2, Export Policy under the Import and Export Policy of Government of India and the Customs Act, 1962.

Indonesia

C. amboinensis is not included in domestic species legislation, but is subject to management by virtue of its inclusion on CITES Appendix II. For CITES listed species, the Directorate General of Nature Protection and Conservation (DGNPC) as the CITES Management Authority sets annual capture quotas based on recommendations from the Scientific Authority, the Indonesian Institute of Sciences, for the whole country. This quota is then divided into provincial quotas and managed by the District Fishery Service in cooperation with the Local Officer of the DGNPC. The District Fishery Service sets the quotas between regions of their province (Samedi and Iskandar, 2000).

Lao PDR

Laos is not a Party to CITES. There are two wildlife management categories under Lao legislation. Salter (1993) reports that *C. amboinensis* falls under category I (Instructions on the execution of Council of Minister decree No. 118/CCM dated 5th October 1989 on the Management and Protection of aquatic animals, wildlife and on hunting and fishing). It is thus classified as a valuable and nearly extinct species for which hunting is banned in all seasons. (Salter, 1993 cited in Jenkins, 1995). However, Stuart and Timmins (2000) state that no turtles are truly protected in Lao PDR as only local names, which vary regionally and do not match scientific names, are listed in the legislation. Legislation designating National Biodiversity Conservation Areas (NBCA) is in place, but NBCA status does not prevent collection of turtles from an area. Harvest and trade are prohibited, but are not effectively regulated leading to poor controls (van Dijk *in litt*. to TRAFFIC International 29 November 2001).

Malaysia

Malaysian legislation governing freshwater turtles is complicated by its division of responsibilities between Federal and State authorities regulating Wildlife and Fisheries. State fisheries legislation in Johore, Kelantan and Negeri Sembilan can be interpreted to cover *C. amboinensis*; coverage under Malacca State legislation is unclear. Exports of freshwater turtles from Peninsular Malaysia comes under the remit of the Federal Department of Wildlife and National Parks of Peninsular Malaysia (Gregory and Sharma, 1997). In Sarawak, the

Wild Life Protection Ordinance 1998 includes *C. amboinensis* as a 'Protected Species'. In Sabah the species is not protected under the Wild Life Enactment 1997 (Sharma and Tisen, 2000).

Myanmar

The Burma Wildlife Protection Act, 1936, does not mention *C. amboinensis.* However blanket protection from commercial exploitation is extended to all wildlife species (Myanmar Forestry and Conservation Officials pers comm. to van Dijk, 1993, 1994 cited in van Dijk *in litt.*, to TRAFFIC International, 29 November 2000). Furthermore the Fisheries Department provides additional protection to all species of turtles. Enforcement of protective wildlife legislation is the responsibility of the Departments of Fisheries and Forestry. Although the collection of wild animals for personal use is permitted in Myanmar, wildlife is banned from commercial trade by the Forest Law of 1992 (van Dijk 1997 cited in Anon., 1999a). Violators face a USD 1 500 fine and up to two years in jail. Myanmar legislation prohibits the commercial exploitation including export of natural resources including tortoises and freshwater turtles, but allows collection for subsistence use.

Philippines

In the Philippines, trade of all terrestrial wildlife and wildlife products is prohibited, but enforcement is believed to be insufficient (Gaulke *in litt*. to IUCN/SSC Wildlife Trade Programme, 30 November 1999). Although there have been no studies on the distribution of this species in protected areas of the Philippines, it can be safely assumed that most protected terrestrial areas, which are situated in lowlands or enclose lowland areas, are inhabited by box turtles (Gaulke *in litt*. to IUCN/SSC Wildlife Trade Programme, 30 November 1999).

Singapore

Harvesting of the species is prohibited under the Wild Animals and Birds Act. Removal of any wildlife from national parks and nature reserves is also prohibited under the National Parks Act (CITES Management Authority of Singapore *in litt*. to IUCN/SSC Wildlife Trade Programme, 26 October 2001).

Thailand

All 26 species of turtle that are considered native to Thailand are protected from exploitation under the Wild Animals Reservation and Protection Act B.E. 2535 which was revised in 1992. This law controls hunting, trade, possession, import, export, and commercial breeding of wildlife. Thailand is a signatory to CITES, whose provisions are implemented through WARPA (van Dijk and Palasuwan, 2000). Under the Act, trade in protected animals is allowed only if derived from licensed captive-breeding operations and then only if the species is included in a list of species eligible for commercial breeding. To date, no chelonian species have been listed as eligible. Thai fisheries law also provides protection for some native chelonians (Jenkins, 1995). National Parks and Wildlife Sanctuaries are legally protected from all forms of removal, release, disturbance, or other impacts on all plants, animals, and the habitat as a whole (van Dijk and Palasuwan, 2000).

Hence there is no legal international trade.

Viet Nam

Circular 62/2001/TT-BNN issued on 05 of June 2001 by the Ministry of Agriculture and Rural Development to guide imports and exports of goods and commodities managed by the Ministry for the period of 2001-2005 stipulates that Viet Nam prohibits exports of all wild animals and rare and precious plants. Thus export of all native turtle species is prohibited. Hunting and collection for subsistence or any other purposes in National Parks and Protected Areas are restricted under forest protection laws (van Dijk *in litt.* to TRAFFIC International, 29 November 2001).

China

Article 18 of the Wild Animal Protection Law (1988) states that a hunting license is required to hunt or catch wildlife that is not under special state protection. Further, any sale or the species or product thereof should be regulated in domestic markets under Article 27 of the Enforcement Regulations for the Protection of Terrestrial Wildlife of the People's Republic of China (1992).

China suspended the export of native species of Testudinata for commercial purposes (except *Chinemys reevsii* and *Trionyx sinensis*) on 6 June 2000 (CITES Management Authority of China, *in litt.* to IUCN/SSC Wildlife Trade Programme, 2001).

A new regulation has recently been imposed in China controlling the import of turtles into the country. Notification No. [2000]51, concerning the Strengthening the Live Reptile Import and Export Management issued by the Management Authority of China on 13 June 2000, stipulates that:

Import of specimens listed in Appendix II of CITES are not allowed from those countries which have not established an annual export quota;

1. Commercial imports of all species from Indonesia, Cambodia and Thailand are suspended;

2. Imports into Guangdong and Hainan Provinces must arrive only in Guangzhou Baiyun Airport, Shenzhen Huangtian Airport and Haikou Meilan Airport. Imports into other provinces and municipalities are to be determined by the local administration. The import port should be indicated in the certificate of export/import.

USA

Import of *Cuora* into the USA is affected by the four-inch rule which came into effect in the USA in 1975. This rule was imposed by the USA Food and Drug Administration to prevent transmission of turtle-associated *Salmonella* to children. Having closed that supply, the trade now supplies other, wild-caught turtles more than 10 cm (4") long. The "four inch" rule makes commercial farming and raising financially unattractive and thus reputedly shifts the pet trade into wild-caught sources (A. Rhodin, pers. comm. December 1999 cited in van Dijk 1999 *in litt*. to IUCN/SSC Wildlife Trade Programme, 21 December 1999).

CAPTIVE BREEDING

Almost nothing is known regarding efforts to breed *C. amboinensis* on a commercial scale. Saputra mentions a breeding operation in Sumatra but no details on the breeding capacity are known (Saputra *in litt.* 1999 cited in Anon., 1999a).

According to the Management Authority of the Philippines (*in litt.* to IUCN to IUCN/SSC Wildlife Trade Programme, 6 November 2001) an export of a single captive-bred specimen by a holder of a wildlife farm permit took place in 1995, however, the captive operation ceased in 1996. TRAFFIC Southeast Asia is not aware of captive breeding of *C. amboinensis* for commercial purposes in Southeast Asia (van Dijk *in litt*. to TRAFFIC International, 29 November 2001).

Captive breeding occurs in at least one turtle farm in Guangdong province; this farm claims to produce several thousand hatchlings of *C. amboinensis* annually, destined for raising and subsequent sale into the consumption trade (van Dijk and Parry-Jones, *in litt.* to TRAFFIC International, 12 November 2001).

The species is kept in captivity in hobbyist circles in numbers exceeding thousands, and is regularly and consistently bred in modest numbers (probably in the order of a dozen hatchlings per year) (Grychta, 1988; Hofstra, 1998;Inskeep 1984a, 1984b; Mudde, 1987; 1994; Saxana, 1994 cited in van Dijk, 1999b).

In 1999, Artner (*in litt.* to IUCN/SSC Wildlife Trade Programme, 13 December 1999) reported that CHELONIA 2002, a newly founded conservation breeding programme in Austria, had bred all *Cuora* species except *Cuora zhoui.*

ECS (Erhaltungszuchtinitiative Chinesische Schildkröten), a conservation breeding initiative of Dutch, German, Swiss, Hungarian and Austrian turtle breeders specialised in Chinese turtle species has already bred all surviving *Cuora* species (H. Artner *in litt*. to IUCN/SSC Wildlife Trade Programme, 13 December 1999).

According to the International Species Information System ISIS (November 2001)17 males, 34 females and 71 specimens of unknown sex are kept in zoos, while seven hatchlings have been reported within the last six months (Anon., 2001b).

Currently, the American Zoological Association is finalising plans for a master studbook for the Genus *Cuora* and is considering including private breeders and collectors as suppliers of male turtles. Captive reproduction has been inconsistent; however, a few husbandry and breeding techniques have been developed. Currently, all subspecies have been bred successfully in captivity in zoos or private collections. Unfortunately, many of these are isolated instances and the future is uncertain (Barkzyk, 1999).

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Annex

All trade in *C. amboinensis*													
						Imports reported				Exports reported			
Year	**App.**	**Taxon**	**Imp.**	**Exp.**	**Origin**	**Quantity**	**Term**	**P**	**S**	**Quantity**	**Term**	**P**	**S**
2000	2	Cuora amboinensis	CZ	ID						10	live	T	W
2000	2	Cuora amboinensis	DE	ID						220	live	T	W
2000	2	Cuora amboinensis	ES	ID		50	live	T	W	235	live	T	W
2000	2	Cuora amboinensis	FR	ID						260	live	T	W
2000	2	Cuora amboinensis	HK	ID						50	live	T	W
2000	2	Cuora amboinensis	IT	ID						130	live	T	W
2000	2	Cuora amboinensis	IT	ID						1	live	P	W
2000	2	Cuora amboinensis	JP	ID						592	live	T	W
2000	2	Cuora amboinensis	NL	ID						113	live	T	W
2000	2	Cuora amboinensis	PH	ID						200	live	T	W
2000	2	Cuora amboinensis	US	ID		1044	live	T	W	3949	live	T	W
2000	2	Cuora amboinensis	US	ID		225	live	T	I				
2000	2	Cuora amboinensis	US	ID						7	live	P	W
2000	2	Cuora amboinensis	CN	MY		37100	live	T	W	258240	live	T	W
2000	2	Cuora amboinensis	CN	MY						4500	live	T	C
2000	2	Cuora amboinensis	DK	MY						150	live	T	W
2000	2	Cuora amboinensis	ES	MY		500	live	T	W	500	live	T	W
2000	2	Cuora amboinensis	HK	MY						3800	live	T	C
2000	2	Cuora amboinensis	HK	MY						3000	live	T	W
2000	2	Cuora amboinensis	MO	MY						500	live	T	W
2000	2	Cuora amboinensis	SG	MY		1500	live	T	W	2000	live	T	W
2000	2	Cuora amboinensis	US	MY		2681	live	T	W	4500	live	T	W
2000	2	Cuora amboinensis	DK	US	VN					2	live	T	W
2000	2	Cuora amboinensis	US	VN		27	live	T	W				

Source: Source: CITES annual report data compiled by UNEP-WCMC

Cuora flavomarginata Gray, 1863

Yellow-margined Box Turtle
Tortue-boite à bords jaune

Order: TESTUDINES **Family: BATAGURIDAE**

SUMMARY

The yellow-margined box turtle *Cuora flavomarginata* has been divided into three poorly defined subspecies. The type species *Cuora flavomarginata flavomarginata* is found in Taiwan, *C. f. sinensis* is known from mainland China and *C. f. evelynae* is found in the Ryukyu Islands of Japan. *C. flavomarginata* is categorised as Endangered according to IUCN. At the national level, the species is already considered Vulnerable in Japan and Endangered in China (including Taiwan), but it has recently been proposed that the mainland China population should be considered as Critically Endangered and the population of Taiwan considered as Vulnerable. Although there are no population estimates available, populations are thought to have declined in all range States, though the population in Taiwan is reported to be recovering to some extent.

The species is different to many *Cuora* species in that it is primarily terrestrial. It is found mainly in forested areas and relatively little is known of its ecology in the wild. The species grows up to a length of 20 cm and in captivity, it has exhibited a longevity of 19 years. Sexual maturity in the wild has been estimated at 13 years for males and 14 years for females, with a variable clutch size of 1-4 eggs, and an annual number of clutches also varying between 1 and 4.

The main threats to the species are habitat loss and degradation throughout its range, harvest for local food consumption, and collection for the international pet trade. There is very little data on the volume of domestic or international trade prior to or after the species was listed in Appendix II in 2000. Only partial data are available from the United States of America (hereafter referred to as the USA); 97 live specimens were (re)exported from Hong Kong to the USA in 2000, whilst the USA imported a total of 5 035 live *C. flavomarginata* specimens from 1992-1999, primarily from China and Hong Kong. The species has reportedly become more scarce in domestic trade and this has coincided with increased prices being demanded for the species. The species is protected to varying degrees throughout its range, however, implementation of legislation and appropriate enforcement have been reported to be inadequate. China imposed a moratorium on the export of this species in June 2000. However, this conservation measure does not address the domestic consumption of the species, which appears to remain significant and is probably unsustainable. Captive breeding has been undertaken for a number of years in the USA and in Europe, outside the species range, although it is unclear if the level of breeding is sufficient to meet the demand in the western pet market. Commercial captive breeding facilities in China are reportedly supplying an increasing number of hatchlings to the domestic pet market in China. The potential of these facilities to produce specimens for the food market is unknown.

The species is recommended under Decision 11.106 for inclusion in category 1/2.

TAXONOMY

Some herpetologists have classified *C. flavomarginata* as belonging to the genus *Cistoclemmys*, as the adults lead a less aquatic life than in other *Cuora* species (Bour, 1980; Hirayama, 1984 cited in Rogner 1996, all cited in Anon., 2000a). Furthermore, recent phylogenetic analyses suggest that species within the genus *Cistoclemmys* are clearly separated from those of *Cuora* (Yasukawa, 1997; Yasukawa and Ota, 1999 both cited in T.-H. Chen, National Museum of Marine Science and Technology, Taiwan Province of China, *in litt.* to IUCN/SSC Wildlife Trade Programme, 4 September 2001). Consequently, application of the generic name of *Cistoclemmys* to *flavomarginata* should be considered (Chen, *in litt.* to IUCN/SSC Wildlife Trade Programme, 4 September 2001).

The species has been divided into three poorly defined subspecies (McCord and Iverson, 1991):

The nominate taxon *Cuora flavomarginata flavomarginata* is found in Taiwan (Connor and Wheeler, 1998).

C. f. sinensis is a weakly distinguished taxon found in southern mainland China (Connor and Wheeler, 1998). This subspecies was considered to be identical to the nominate form by Fritz and Obst (1998 cited in Anon., 2000b).

C. f. evelynae is found in the Ryukyu Islands, Japan (Connor and Wheeler, 1998) and was described as a separate species by Ernst and Lovich (1990 cited in Anon., 2000a), which was later reduced to subspecies rank under *C. flavomarginata* by McCord and Iverson (1991 cited in Anon., 2000a).

DISTRIBUTION AND POPULATION

Also known as the black-bellied box turtle, Chinese box turtle, yellow-rimmed box turtle, snail eating box turtle and the Asian snail-eating box turtle, the CITES species database lists the distribution of *C. flavomarginata* as: China; Taiwan, Province of China and Japan (Anon., 2001a). *C. f. flavomarginata* may possibly also occur in Hong Kong (Bogadek and Lau, 1997 cited in Anon., 2000a).

According to the 2000 IUCN Red List, the species occurs in China, Taiwan, Province of China and Japan (Nansei-Shoto). The 2000 IUCN Red List classifies *C. flavomarginata* as Endangered (EN A1cd+2cd). This is based on a population reduction of at least 50% over the past three generations, and a projected 50% reduction within the next three generations, caused by actual or potential levels of exploitation, and a decline in the area of occupancy, extent of occurrence and /or quality of habitat (Hilton-Taylor, 2000).

Current information on population size is not available for wild populations (Anon., 2000a).

China

C. flavormarginata is widely distributed in the mainland provinces of Anhui, Fujian, Henan, Hubei, Hunan, Jiangsu, Shanghai, Zhejiang. Records from Guangdong and Guangxi provinces probably refer to animals brought in from the north for the food trade (Zhao, 1998). There are still numerous suitable habitats left in China (Lau and Shi, 2000).

Although no population estimates are available and no studies are planned to estimate population size (M.W.N. Lau and R. Parry-Jones *in litt.* to IUCN/SSC Wildlife Trade Programme, 31 October 2001), the population in China (including that of Taiwan) is considered to be endangered and in decline (Zhao, 1998). Anon. and Anon. (2000) suggested that the mainland population (*C. f. sinensis*) should probably be considered as Critically Endangered (CR). According to Lau and Shi (2000), population declines are indicated by fewer animals being observed in Chinese food markets.

Hong Kong Special Administrative Region

This species is known from three widely separated localities in the New Territories (central and north-eastern part) and Lantau Island. However, the few specimens found so far are almost certainly released animals and it is uncertain whether a breeding population exists in Hong Kong (Lau *et al*., 2000). Hong Kong is well away from the known mainland distribution of the species (TRAFFIC East Asia and South East Asia *in litt.* to TRAFFIC International, November 2001).

Taiwan, Province of China

C. flavomarginata is thought to be distributed through low altitude areas of the whole island in cultivated areas, orchards, vegetable farms, bamboo forests, broad-leaf forests, mixed forests, grasslands, streams, lakes and ditches (Anon., 2001b; Peng, 1996 cited in TRAFFIC East Asia-Taipei *in litt.* to TRAFFIC International, 5 November 2001). The population of *C. f. flavomarginata* has declined in recent decades due to expansion of agricultural lands, remnants are now stable or slightly recovering (Anon. and Anon., 2000). Some stable *C. flavomarginata* populations are reported to be found in northern Taiwan (Chen, 1998, cited in Chen, *in litt.* to IUCN/SSC Wildlife Trade Programme, 4 September 2001). Anon. and Anon. (2000) considered the species under the IUCN category of Vulnerable (VU A1c) in Taiwan, Province of China.

Japan

C. f. evelynae is known only from Ishigaki and Iriomote islands in the Yaeyama Island chain (Ryukyu Islands). The species is widely distributed on Iriomote Island with a range size of 250 km^2. However, due to deforestation of evergreen broadleaved forests and development activities, the range has clearly been reduced in the north and east of Ishigaki Island, leaving a range size of less that 30 km^2. The total population size is unknown,

however, it appears that at least on Ishigaki Island, the population is declining based on a reduction in the number of sightings (CITES Management Authority of Japan, *in litt.* to IUCN/SSC Wildlife Trade Programme, 9 November 2001). In 1999, the Environment Agency (Government of Japan *in litt.* 1999 cited in Anon., 2000a) cited habitat loss and illegal capture for the pet trade as a reason for this decline.

The CITES Management Authority of Japan (*in litt.* to IUCN/SSC Wildlife Trade Programme, 9 November 2001) report that a survey to estimate population density was conducted on Iriomote Island from 1982-1983. The results gave a population density of 0-128 individuals/hectare, but the population trend on the island is unknown. There is concern that road construction on Iriomote Island may break the habitat continuity between the ocean and the terrestrial areas, but the rate of such habitat fragmentation is unknown.

C. flavomarginata has been reported to be introduced into Okinawa Island (Ota, 1995 cited in Chen, *in litt.* to IUCN/SSC Wildlife Trade Programme, 4 September 2001).
C. flavomarginata is listed as Vulnerable in the Red Data Book of Japan (Ota, 2000 cited in TRAFFIC East Asia-Taipei *in litt.* to TRAFFIC International, 5 November 2001). The species is also listed as "Rare" in the Red Data Book of Okinawa prefecture (Anon., 1996 cited in TRAFFIC East Asia-Taipei *in litt.* to TRAFFIC International, 5 November 2001).

HABITAT AND ECOLOGY

The habitats of *C. flavomarginata* have not been thoroughly studied in the wild. *C. flavomarginata* has a highly omnivorous diet (Connor and Wheeler, 1998). With a maximum reported age of 19 years in captivity (Reckel, 1999 cited in Anon., 2000a), the carapace of *C. flavomarginata* grows to a length of 18-20 cm (Rogner, 1996 cited in Anon., 2000a).

Reproduction in captivity shows that the species matures at approximately 10 years of age. The clutch size varies from 1-4 eggs with an annual number of clutches of 1-4. So far, various captive breeding operations have not observed the species reproducing for more than 8 years after first maturing (Zwartepoorte and De Bruin, 2000 cited in H. Zwartepoorte, Rotterdam Zoo and European Studbook Foundation, *in litt*. to IUCN/SSC Wildlife Trade Programme, 11 September 2001). Incubation lasts for 68-90 days (Anon., 2000a) and hatchlings have carapaces of approximately 4 cm in length (Ernst and Barbour, 1989).

China

The species inhabits wet areas at the edges of forests and beside rivers and lakes. It is often active during periods of rainfall. In Anhui Province, it inhabits forest borders or grassy mountains with scattered shrubs close to aquatic areas. It is active in flowing streams during the dry season. In the summer months, it is nocturnal, and during the winter months, it moves to the southern slopes where there is thick grass and dead leaves for hibernation (Zhao, 1998).

Zhao (1998) recommends that surveys should be carried out to better understand the distribution, status and ecology etc. and to lead to realistic conservation measures.

Taiwan, Province of China

One study showed that adult individuals comprised 78.1% of the northern Taiwan population. Females are estimated to mature at 14 years old and males at 13 years (Chen and Lue, 1999 cited in Chen, *in litt.* to IUCN/SSC Wildlife Trade Programme, 4 September 2001). The clutch size ranges from 1-3 in the northern Taiwan population (Chen, 1998; Chen and Lue, 1999, cited in Chen, *in litt.* to IUCN/SSC Wildlife Trade Programme, 4 September 2001).

Gravid females usually stay near the border of evergreen forests during the nesting season and then move back into the forest's interior. Males tend to remain in the densely vegetated areas of the evergreen forest throughout the year. The home range of *C. flavomarginata* ranges from 0.07 to 6.39 ha in northern Taiwan, Province of China (Chen, 1998; Lue and Chen, 1999, both cited in Chen, *in litt.* to IUCN/SSC Wildlife Trade Programme, 4 September 2001).

In southern Taiwan, females have been observed to retain four eggs per clutch (Chen, *in litt.* to IUCN/SSC

Wildlife Trade Programme, 4 September 2001).

Japan

C. f. evelynae inhabits natural evergreen broadleaved forest and well-recovered secondary forests. It is rarely found in dry environments since it prefers land-water interfaces such as low wetlands, ponds and rivers. Forests with wet forest floors are considered necessary for its survival (CITES Management Authority of Japan, *in litt.* to IUCN/SSC Wildlife Trade Programme, 9 November 2001).

C. f. evelynae is less active in winter but is not believed to hibernate. Mating has been observed in late March, females are known to produce 1-3 eggs that are 40-51 mm long and 24-27 mm wide. These hatch in mid-late August, but the generation time is unknown. The subspecies is omnivorous; its diet ranging from plants to small animals (including insects, snails and the snake *Ramphotyphlops braminus*) and may include scavenging from the carcasses of large animals. Neither the social structure, genetic characteristics or other differences between the subspecies of *C. flavomarginata* are known (CITES Management Authority of Japan, *in litt.* to IUCN/SSC Wildlife Trade Programme, 9 November 2001).

THREATS TO SURVIVAL AND DOMESTIC USE

The main threats to this species are habitat loss and degradation in its East Asian range, collection for local consumption for its perceived medicinal benefits, and collection for the international pet trade (TRAFFIC South East Asia *in litt.* to TRAFFIC International, 29 November 2001). The genus *Cuora* spp., have a very low reproductive rate with low nesting numbers and small clutch sizes, making them very sensitive to over collection (Das, 1997 cited in Anon., 2000b). In view of its endangered status, illegal trade is likely to pose a serious threat to the survival of this species (Lau and Parry-Jones, *in litt.* to IUCN/SSC Wildlife Trade Programme, 31 October 2001).

China

The main threat to the species is through over-collection for the food trade (Lau and Shi, 2000; National Environmental Protection Agency of China, 1998 cited in Anon., 2000a). The species is also threatened by habitat destruction and degradation as a result of deforestation and urbanisation, although there are still thought to be numerous suitable habitats remaining in China (Lau and Shi, 2000). According to Connor and Wheeler (1998), there is continued harvest from the wild to satisfy the international pet trade. Meier (*in litt.* 1998a cited in Anon., 2000a) noted that the species had become scarce in food markets, reportedly causing a significant increase in price and in turn, allegedly raising the incentives for even more intensive collection from the wild.

The domestic trade in both South China and Hong Kong mainly involves live adults and subadults for the commercial food trade and small juveniles for the pet trade. Like other hard-shelled turtles, *C. flavomarginata* is consumed as a tonic and/or is cooked together with herbal ingredients as medicinal food (Lau and Parry-Jones, *in litt.* to IUCN/SSC Wildlife Trade Programme, 31 October 2001). The shell and meat of *C. flavomarginata* are particularly believed to be effective as a cure for cancer within China (Lu *et al*., 2000a;b, cited in Chen, *in litt.* to IUCN/SSC Wildlife Trade Programme, 4 September 2001). *C. flavomarginata* is used to make two drugs, Duan Ban Gui Pian and Duan Ban Zhu She Ye. The first is used to cure osseous tuberculosis of the joints and lymphatic glands. The second is injected to treat haemorrhoid bleeding, fistula and as a supplementary cancer drug (Zhang *et al.,* 1998 cited in CITES Management Authority of China, *in litt.* to CITES Secretariat, 17 November 2001).

A growing number of small juveniles have appeared in pet shops in South China and Hong Kong. These small juveniles are believed to have been bred in commercial breeding farms (Chan, in press cited in Lau and Parry-Jones *in litt.* to IUCN/SSC Wildlife Trade Programme, 31 October 2001). One Hong Kong based turtle trader reported in October 2001 that an estimated 60% of *C. flavomarginata* hatchlings in trade in China are wild-harvested from Anhui, Hubei and Hunan provinces, where the species was reported to "remain common" (TRAFFIC East Asia and South East Asia *in litt*. to TRAFFIC International, November 2001).

As with many freshwater turtle species, data on the volume of trade are not available.

There are different accounts as to how commonly the species is found in Chinese markets. According to Zhao

(1998) a few individuals are found in markets; and the individuals in Guangdong market were said to come from Hunan. Lau and Shi (2000) report that the fact that fewer animals are turning up in Chinese markets suggests that the population is declining, and Devaux (1999 cited in Anon., 2000a) reported this species to be rarely for sale at markets in China.

In contrast, at the markets in Guangdong and Guangxi in 1994, *C. flavomarginata* was described by Wenjun *et al.* (1996) as common. Five specimens were observed for sale in a single day in August 1995 at Qingping market Guangzhou Province (Meier, *in litt.* 1998a cited in Anon., 2000a). At the same market Valentin (*in litt*. to the German CITES Scientific Authority, 30 September 1999, cited in Anon., 2000a) observed about 50 specimens of *C. flavomarginata* for sale in November 1998 and in April 1999. Chen (*in litt.* to IUCN/SSC Wildlife Trade Programme, 4 September 2001) reports that the trade of *C. flavomarginata* is still common in southern China with more than 50 individuals observed for sale in Qingping market on 30 August, 2001. At any one time, up to 50 specimens were observed in each of Guangzhou's Qingping market and in Shenzhen's Dongmen market from 2000-2001 during the Kadoorie Farm & Botanic Garden's (KFBG) Wildlife Trade Monitoring studies (Lau and Parry-Jones *in litt*. to IUCN/SSC Wildlife Trade Programme, 31 October 2001).

Approximately 34 species of chelonia were observed in the Qingping market, Guangzhou in October 2001. Numbers of specimens were estimated on the basis of turtles on display in public view and therefore represent the minimum number available. A few traders had between 3 and 10 specimens of *C. flavomarginata* in stock, with a total of around 20-30 specimens observed in the market. Prices ranged from RMB 300–420/jin [1 jin = 500 g] (approximately USD 73–100/kg); the advertised prices varied considerably between adjacent vendors. New wildlife markets have also been opened in Guangzhou (TRAFFIC East Asia and South East Asia *in litt*. to TRAFFIC International, November 2001).

Surveys undertaken at one market in Shanghai during 2001 indicated that several hundred live specimens of *C. flavomarginata* were available (E. Even, Emmen Zoo *in litt*. to TRAFFIC Europe, November 2001 cited in TRAFFIC Europe *in litt.* to TRAFFIC International, 8 November 2001).

Hong Kong Special Administrative Region

C. flavomarginata is utilised for both food and for pets in Hong Kong. The vast majority of turtles in the food and the pet trade originate from outside Hong Kong. A year long survey of 12 representative market sites was conducted by TRAFFIC East Asia during 1998-1999. Of the 84 chelonian species encountered, *C. flavomarginata* was one of the top ten species traded in terms of volume. However, these may not necessarily be wild specimens (Lau *et al*., 2000). A growing number of small juveniles have appeared in pet shops in Hong Kong and are believed to have been captive bred (Chan, in press cited in Lau and Parry-Jones *in litt.* to IUCN/SSC Wildlife Trade Programme, 31 October 2001).

The price of individual *C. flavomarginata* has apparently risen continuously from about USD 5-8 in 1985, to between USD 10-12 in 1990, and USD 35-75 in 1997 depending on the animals' size (Meier *in litt*., 1998 cited in Anon. 2000a). In autumn 1998, *C. flavomarginata* were reportedly for sale in Hong Kong pet shops for USD 40 each (German CITES Scientific Authority pers. obs. 1998 cited in Anon. 2000a). One Hong Kong-based turtle trader reported in October 2001 that prices for *C. flavomarginata* continue to increase (TRAFFIC East Asia and South East Asia *in litt*. to TRAFFIC International, November 2001).

From 2000-2001, a maximum of 30 juveniles have been observed in pet shops and up to 20 adults in Hong Kong food markets during the KFBG's Wildlife Trade Monitoring studies (Lau and Parry-Jones *in litt*. to IUCN/SSC Wildlife Trade Programme, 31 October 2001). In October 2001, 17 adult *C. flavomarginata* were observed at one traditional Chinese medicine and supermarket shop in Jordan, Hong Kong. These specimens were selling for HKD 960 / catty [1 catty = 600 g] (approx USD 206/kg); it should be noted, however, that this shop is always about twice as expensive as street / market prices. A total of about 90 *C. flavomarginata*, mainly juveniles and hatchlings, were observed in six aquarium and pet shops in Hong Kong at prices (where indicated) ranging between HKD 300-560/animal (approx USD 40-70/animal) (TRAFFIC East Asia and South East Asia *in litt*. to TRAFFIC International, November 2001).

Taiwan, Province of China

Habitat loss and degradation caused by land development seem to be the primary factors that could cause population declines. Deforestation and habitat fragmentation in low altitude evergreen forests have deprived the species of many of its essential habitats. The extensive collection and release of native or exotic turtles is also thought likely to pose serious threats to natural populations (Chen *et al.*, 2000a).

According to the trade statistics on the web site of Ministry of Economic Affairs, there were at least 1 441 t of turtle shells of unspecified species imported from various countries and areas into Taiwan, Province of China from 1990-2000. The turtle shells came primarily from mainland China (589 t.) and Indonesia (540 t) (Chen, *in litt.* to IUCN/SSC Wildlife Trade Programme, 4 September 2001). Although this data is not species specific, it demonstrates the importance of Taiwan, Province of China as major consumer of turtle shells. However, according to TRAFFIC East Asia-Taipei, (*in litt.* to TRAFFIC International, 5 November 2001) *C. flavomarginata* is only found occasionally in the traditional Chinese medicine market.

The meat of *C. flavomarginata* is sometimes consumed by aboriginal peoples (Chen, *in litt.* to IUCN/SSC Wildlife Trade Programme, 4 September 2001).

C. flavomarginata are kept as pets in Taiwan. Prices from one outlet advertising on the web in 2000 were quoted as TWD 600/animal (approximately USD 17/animal), with 40 specimens reportedly available for sale (Anon., 2000c cited in TRAFFIC East Asia-Taipei in litt. to TRAFFIC International, 5 November 2001).

Japan

Since the 1970s, important habitats continue to be lost through large-scale deforestation. Many *C. flavomarginata* individuals are killed accidentally on the roads around its habitat. On Ishigaki Island, the Cane Toad *Bufo marinus* has been introduced and is an invasive species. The distribution of *B. marinus* is expanding and it is a potential food competitor with *C. f. evelynae*. *C. f. evelynae* is a popular pet and it is conceivable that an appreciable number of individuals are caught illegally for the pet trade. Subspecies of *C. flavomarginata* other than *C. f. evelynae* are imported and sold in pet shops, however, there are no data available as to the volume of this trade (CITES Management Authority of Japan, *in litt.* to IUCN/SSC Wildlife Trade Programme, 9 November 2001). In 1999, the Environment Agency (Government of Japan *in litt.* 1999 cited in Anon., 2000a) cited habitat loss and illegal capture for the pet trade as a reason for the decline in this species' population.

Rare or endemic species of Japan are listed as "National Monument" (See **Conservation Measures**) which provides for protection of the species and its habitat. Before its categorization as a National Monument, significant numbers of this species were taken from these islands as pets (Ota, 1995 cited in TRAFFIC East Asia-Japan *in litt.* to TRAFFIC International, 5 November 2001). Some individuals have been found in non-native habitats, such as on the mainland of Okinawa prefecture (Chigara, 1991 cited in TRAFFIC East Asia-Japan *in litt.* to TRAFFIC International, 5 November 2001).

Endemic to Japan, *Geoemyda japonica*, and also classified as a "National Monument", is distributed only on the mainland of Okinawa prefecture and its range does not overlap with that of *C. flavomarginata*. However, hybrid specimens of *C. flavomarginata* and *G. japonica* have been recorded and in future could significantly impact upon populations of *G. japonica* (Yasukawa, 1996 cited in TRAFFIC East Asia-Japan *in litt*. to TRAFFIC International, 5 November 2001).

INTERNATIONAL TRADE

The listing of *C. flavomarginata* in CITES Appendix II entered into effect on 19 July 2000. As of December 2001, only two instances of trade in *C. flavomarginata* had been reported. These consisted of two separate reports of imports into the US of wild specimens. One of these comprised 47 live specimens imported from, and originating in Hong Kong. The other transaction of 50 live individuals was imported from Hong Kong, with an unknown country of origin.

				Imports reported				**Exports reported**			
Year	**Imp.**	**Exp.**	**Origin**	**Quantity**	**Term**	**P**	**S**	**Quantity**	**Term**	**P**	**S**
2000	US	HK		47	Live	T	W				

2000	US	HK	XX	50	Live	T	W				

Source: CITES annual report data compiled by UNEP-WCMC.

China

China is thought to be the world's major consumer of freshwater turtles, the majority of which are now imported from other Asian Countries, and the overall trade has probably increased since the opening of borders with other Asian countries (Lau and Shi, 2000). Rare or restricted Asian species observed in Chinese food markets are particularly sought after (Lau and Shi, 2000).

It is difficult to separate international trade from the domestic trade (Lau and Parry-Jones *in litt.* to IUCN/SSC Wildlife Trade Programme, 31 October 2001) and to differentiate legal international trade from illegal trade (Lau and Shi, 2000). Most of the trade entering the Chinese food markets is alleged to be illegal, with serious consequences for wild populations (Zwartepoorte *in litt*. to IUCN/SSC Wildlife Trade Programme, 11 September 2001). However, the CITES Management Authority of China (*in litt.* to CITES Secretariat, 17 October 2001) does not have any data on illegal trade of *C. flavomarginata*.

China suspended the export of native species of Testudinata for commercial purposes (except *Chinemys reevsii* and *Trionyx sinensis*) on 6 June 2000 (CITES Management Authority of China, *in litt.* to CITES Secretariat, 17 November 2001).

A new regulation has recently been imposed in China controlling the import of turtles into the country. Notification No. [2000]51, concerning the Strengthening the Live Reptile Import and Export Management issued by the Management Authority of China on 13 June 2000, stipulates that:

> Import of specimens listed in Appendix II of CITES are not allowed from those countries which have not established an annual export quota;
>
> Commercial imports of all species from Indonesia, Cambodia and Thailand are suspended;
>
> Imports into Guangdong and Hainan Provinces must arrive only in Guangzhou Baiyun Airport, Shenzhen Huangtian Airport and Haikou Meilan Airport. Imports into other provinces and municipalities are to be determined by the local administration. The import port should be indicated in the certificate of export/import.

Fourteen specimens of *C. flavomarginata* were exported in 2001 for animal exchange between the Nan Jing Turtle Research Association and the Turtle and Tortoise Care Society in California, USA (CITES Management Authority of China *in litt.* to CITES Secretariat, 17 October 2001).

Hong Kong Special Administrative Region

Ongoing Wildlife Trade Monitoring studies conducted by Kadoorie Farm & Botanic Garden (KFBG) has found *C. flavomarginata* repeatedly in small numbers in both the pet and food markets in Hong Kong. Since this species is not thought native to Hong Kong and captive breeding for this species is not known locally, the specimens observed in the local pet and food markets have likely been imported (Lau and Parry-Jones *in litt.* to IUCN/SSC Wildlife Trade Programme, 31 October 2001). Connor and Wheeler (1998) note that specimens continue to enter the international pet trade via Hong Kong. There is reportedly a trend for the importation into Hong Kong of captive-bred hatchlings of several Asian species, some in large farm-scale numbers; these include *C. flavomarginata* (Lau *et al*., 2000).

The process to include this species in the Animals and Plants (Protection of Endangered Species) Ordinance (which implements CITES) is expected to be completed in early 2002 (C.S. Cheung, AFCD pers comm. to TRAFFIC East Asia, 29 October 01 cited in Lau and Parry-Jones *in litt.* to IUCN/SSC Wildlife Trade Programme, 31 October 2001). Therefore, the international trade in the species is not yet regulated in Hong Kong and trade data are not available.

Taiwan, Province of China

The species is reported to have been exported from Taiwan, Province of China to the USA in large numbers in the past (Connor and Wheeler, 1998). It is known that this species has been formerly intensively collected for the pet trade and for stuffed specimens, but no reliable data exist to enable the size of this trade to be estimated. Commercial exploitation of this species in Taiwan, Province of China is thought to have diminished, or has possibly even ceased due to population declines and protective legislation (Chen *et al*., 2000).

Japan

There are no recorded imports of this species into Japan in recent years; the Customs Tariff Schedule of Japan does not have a specific category for live turtles but includes all live turtles under "other live animals". TRAFFIC East Asia-Japan *in litt.* to TRAFFIC International, 5 November 2001). Japan has not imported *C. flavomarginata* during the period July 2000 to October 2001. No exports of the species have been made during this period without a CITES export permit (CITES Management Authority of Japan, *in litt.* to IUCN/SSC Wildlife Trade Programme, 9 November 2001).

Thailand

Specimens are occasionally sold in regional pet trade outlets, and have been occasionally observed for sale in Chatuchak market, Bangkok prior to January 2000 (TRAFFIC South East Asia *in litt*. to TRAFFIC International, 29 November 2001).

USA

Import of *Cuora* into the USA is affected by the four-inch (ten cm)-rule, which came into effect in 1975. This rule was imposed by the USA Food and Drug Administration to prevent transmission of turtle-associated *Salmonella* to children. Having closed that supply, the trade now supplies other, wild-caught turtles more than ten cm long. This rule makes commercial farming and raising financially unattractive and thus reportedly shifts the pet trade into wild-caught sources (Anders Rhodin, pers. comm. to van Dijk December 1999, cited in van Dijk *in litt*. to IUCN/SSC 1999).

Imports of *C. flavomarginata* into the USA, 1992-1999

Year	1992	1993	1994	1995	1996	1997	1998	1999
No. live	143	11	1 020	1 109	1 145	320	881	*406*

Sources: 1992-1995: Hoover, 1998.
1996-1999: LEMIS data cited in TRAFFIC North America *in litt*. to TRAFFIC International, December 2001.

The recorded number of *C. flavomarginata* imported into the USA has dropped substantially since the high level of 1996. The figures presented in the Table should be considered minimum import figures, as a certain percentage of the total imports were likely recorded either at the genus level only, or as non-CITES reptiles. The country of export for 1996-1999 has been recorded primarily as China or Hong Kong, however, in 1999, Vietnam appears as a country of origin (TRAFFIC North America *in litt*. to TRAFFIC International, December 2001).

Captive-bred hatchlings are apparently offered for USD 150-250 (Anon., 1999; McCord, *in litt.* to Weissgold 4 October 1999, both cited in Anon., 2000a). Wild-caught specimens are offered for sale by importers for USD 35-135 depending on the size of the animals (Weissgold, *in litt.* to the German CITES Scientific Authority 1999 cited in Anon., 2000a).

Europe

The species is relatively commonly sold and kept by hobbyist in Europe. Since the CITES listing of the species in 2000, the availability of the species decreased drastically and nowadays an increasing number of captive bred specimens is being offered (T. Vinke, Chair of the DGHT Chelonian Working Group, pers. comm. to TRAFFIC Europe, October 2001). Traders in the United Kingdom offered the live specimens of the species for around 115 Euro in 1998 (Auliya, in prep.). In 2000 and 2001, some specimens have been offered by Czech traders for

around 150 Euro but no imports have been recorded by the Czech Republic (Jan Kucera, CITES Management Authority of the Czech Republic, *in litt.* to TRAFFIC Europe, October 2001).

CONSERVATION MEASURES

C. flavomarginata is listed on Annex B of EC Regulation 338/97, with effect from 18 December 2000 (Anon., 2001a).

China

Although this species is not protected by the People's Republic of China Wild Animals Protection Law (Lau and Shi, 2000), it is included on the list of Beneficial, Scientific and Economic Terrestrial Animals under State Protection (2000). However, measures to protect the species are not clearly provided. Additionally, hunting and collection of animals inside nature reserves is prohibited (CITES Management Authority of China, *in litt.* to CITES Secretariat, 17 October 2001). However such protection needs to be better enforced (Lau and Parry-Jones *in litt.* to IUCN/SSC Wildlife Trade Programme, 31 October 2001).

Observations made at Qingping market, Guangzhou in October 2001 suggested that the market is now subject to stricter regulation than were observed in previous years. Traders are stationed in their shops and are not allowed onto the sidewalk or main road; and this regulation appears to be well enforced (TRAFFIC East Asia and South East Asia *in litt.* to TRAFFIC International November 2001).

Hong Kong, Special Administrative Region

All wild chelonians are legally protected in Hong Kong by the Wild Animals Protection Ordinance. This prevents the collection, removal, destruction, and possession of any wild turtle or possession of any hunting or trapping equipment and is enforced by the Agriculture, Fisheries and Conservation Department (AFCD) of the Hong Kong Special Administrative Region. The AFCD is also responsible for administering and enforcing the Animals and Plants (Protection of Endangered Species) Ordinance which implements CITES. Import, export, trade and possession of CITES-listed species, whether native or exotic, is only allowed with permission from the AFCD. The maximum penalty for breaking the Ordinance is HKD 5 million (approximately USD 62 500) and two years imprisonment, although much smaller fines are usually levied (Lau *et al.*, 2000). However, the process to include *C. flavomarginata* in the Animals and Plants (Protection of Endangered Species) Ordinance, has not yet been completed, but is expected to be completed in early 2002 (pers. comm., C.S. Cheung, AFCD to TRAFFIC East Asia, 29 October 01 cited in Lau and Parry-Jones *in litt.* to IUCN/SSC Wildlife Trade Programme, 31 October 2001).

Additionally, all animals inhabiting Country Parks are protected within these in accordance with the Country Parks Ordinance (Lau *et al.*, 2000).

Taiwan, Province of China

Under the Wildlife Conservation Law (WCL), all marine turtle species are designated as "endangered" and three freshwater turtle species, including *C. flavomarginata,* are classified as rare and valuable (Chen *et al.*, 2000). *C. flavomarginata* is listed as a second category protected species; specimens of *C. flavomarginata* may not be hunted, killed, traded, exhibited, owned, imported, exported, raised or bred, unless under special circumstances recognized in the WCL or related legislation (Article 16, WCL, 1994) (TRAFFIC East Asia-Taipei *in litt.* to TRAFFIC International, September 2001). The Division of Conservation, Council of Agriculture is the authority responsible for implementing the WCL. Although *C. flavomarginata* and other native turtles are protected through the WCL, this law is reportedly not effectively enforced in the field; exploitation of turtles, especially freshwater species, reportedly still occurs in considerable numbers. No effective action for the conservation of *C. flavomarginata* are reported to have been carried out as of 2000 (Chen *et al.*, 2000).

Four national parks protect some of the habitat that *C. flavomarginata* occupies (M. Lau, *in litt* to IUCN/SSC Wildlife Trade Programme 20 December 1999).

Japan

The habitat of *C. f. evelynae* is partially protected as National Sanctuaries and/or National Parks (Environment Agency, Government of Japan *in litt.* 1999 cited in Anon., 2000a). However, none of these measures act specifically for the protection of this subspecies (Anon., 2000a). Part of Ishigaki Island has been designated by the Minister of the Environment as a National Park and Wildlife Protection Area under the National Parks Law and the Wildlife Protection and Hunting Law. Development activities such as building structures and the felling of trees require permission from the Minister of the Environment or the govenor of the prefecture concerned (CITES Management Authority of Japan, *in litt.* to IUCN/SSC Wildlife Trade Programme, 9 November 2001).

C. f. evelynae was classified as a "National Monument" in 1972 under the Law for the Protection of Cultural Properties. This provides protection to the species and its habitat. According to Article 80, catching, injuring or killing this subspecies is prohibited. Activities which may affect its status or conservation require a permit issued by the director of the Agency for Cultural Affairs (CITES Management Authority of Japan, *in litt.* to IUCN/SSC Wildlife Trade Programme, 9 November 2001; TRAFFIC East Asia-Japan *in litt.* to TRAFFIC International, 5 November 2001).

According to the Law for the Humane Treatment and Management of Animals, pet shops which trade in reptiles are required to report their address, date of establishment and areas of their facility and the main animals they trade, to the prefectural government (TRAFFIC East Asia-Japan *in litt.* to TRAFFIC International, 5 November 2001).

CAPTIVE BREEDING

According to the International Species Information System, 9 males, 11 females and 17 specimens of unknown sex of *C. flavomarginata* are kept in zoos; no hatchlings have been reported within the last six months (Anon., 2001c).

China

Attempts at breeding *C. flavomarginata* have been made in Anhui and Jiangsu Provinces according to Zhao (1998). One adult specimen of *C. flavomarginata* was observed at the captive breeding facility of Tunchan Farm, Hainan Island in October 2001. According to an informed Hong Kong-based hobbyist / turtle trader encountered in Qing Ping market, captive breeding farms for *C. flavomarginata* exist in Hubei Province. These farms possess about 300-400 adults and produce about 200 hatchlings per year. It is not clear whether these figures refer to one prominent farm, the average size of several farms or the combined total of several small farms (TRAFFIC East Asia and South East Asia *in litt*. to TRAFFIC International, November 2001).

Taiwan, Province of China

The captive breeding of protected species such as *C. flavomarginata* for commercial purposes is prohibited under the Wildlife Conservation Law (TRAFFIC East Asia-Taipei *in litt.* to TRAFFIC International, September 2001).

USA

In 1999, J. Buskirk (*in litt.* to IUCN/SSC Wildlife Trade Programme 21 December 1999) noted that this species is the most widely reproduced member of the genus among private chelonian enthusiasts in California. McCord (*in litt.* to Weissgold 4 October 1999 cited in Anon., 2000a) estimates more than 1 000 specimens are kept in captivity in the USA, whilst according to Zwartepoorte (*in litt*. to IUCN/SSC Wildlife Trade Programme, 11 September 2001), *C. flavomarginata* is only bred in relatively small numbers in the USA.

Europe

The species is captive bred among hobbyist circles in Europe and captive bred specimens are increasingly offered on the European pet market (Vinke, pers. comm. to TRAFFIC Europe, October 2001 cited in TRAFFIC Europe *in litt.* to TRAFFIC International, 8 November 2001). The species is captive bred among hobbyist circles in EU Member States, especially in Austria, Germany, the Netherlands and Switzerland (TRAFFIC Europe *in litt.* to TRAFFIC International, 8 November 2001). According to Zwartepoorte (*in litt*. to IUCN/SSC Wildlife Trade Programme, 11 September 2001) approximately 180 specimens are listed in the studbook/breeding programme

for the species managed by the European Studbook Foundation. Studbooks/breeding programmes have been initiated with the aim of the establishment of *ex situ* populations.

In 1999, Artner (*in litt.* to IUCN/SSC Wildlife Trade Programme, 13 December 1999) reported that CHELONIA 2002, a then newly founded conservation breeding programme in Austria, had bred all *Cuora* species except *Cuora zhoui.* He also reports that ECS (Erhaltungszuchtinitiative Chinesische Schildkröten), a conservation breeding initiative of Dutch, German, Swiss, Hungarian and Austrian turtle breeders specialised in Chinese turtle species, has also bred all surviving *Cuora* species.

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Cuora galbinifrons Bourret, 1939 **Indochinese Box Turtle**

Order: **TESTUDINES** **Family: BATAGURIDAE**

SUMMARY

The Indochinese box turtle *Cuora galbinifrons* has a very restricted global distribution occurring in China, Viet Nam, Lao People's Democratic Republic and possibly Cambodia. There are four subspecies (C. g. *hainanensis* is regarded as a junior synonym [i.e. the most recently described synonym] of *Cuora g. galbinifrons*). Adults measure up to 19 cm (carapace length). Species of the genus *Cuora* reach maturity at about four to five years of age and have a life expectancy up to 30 years in their natural habitat. They have a low reproductive rate, a clutch comprises between one and three eggs with a maximum annual production believed to be six eggs.

Cuora galbinifrons is classified as Critically Endangered by IUCN. Although habitat loss may have negative impacts on populations of this species, the primary threat is from heavy harvesting, throughout its range, for the wildlife trade with and within China. A population decline is indicated by a decrease in the availability of this species at food markets in China as well as in southern, central and northern Viet Nam. This coincides with a doubling of price in some regions. A smaller number of animals is thought to be exported to supply the pet trade in the western world as well as hobbyists in Japan, Hong Kong, Thailand and elsewhere within Indochina. This species was only included in CITES Appendix II in 2000 and at present no CITES data are available. In addition, in June 2000, China restricted imports of this species depending on whether the exporting countries had an export quota in place. At present, China also requires imports to be channelled through designated entry-points.

There is no information available on the management of *C. galbinifrons* or on specific habitat conservation measures. The species is thought to occur within a number of protected areas within its range, but this is little guarantee against collection. However, the Cuc Phong Conservation Project in Ninh Binh Province,Viet Nam aims to establish practical solutions for dealing with the large numbers of confiscated turtles and to promote education in local communities regarding the conservation and protection of Vietnamese tortoise and freshwater turtle species. This species has a history of high mortality in captivity and there are, to date, very few captive propagation programmes. A few private hobbyists are breeding the species in captivity, but there does not appear to be any commercial breeding.

The species is recommended under Decision 11.106 for inclusion in category 1.

TAXONOMY

Synonynms: *Cistoclemmys galbinifrons, Cuora hainanensis, Cuora serrata* (Anon, 2001).

C. g. galbinifrons (Bourret, 1939), the Vietnamese box turtle, is found in northern Viet Nam (with Tam Dao, Bach-Ma and Linh-Cam as type locality [Iverson, 1992]), on Hainan and in Guangxi and possibly Yunnan provinces, China. *C. g. hainanensis* is regarded as a junior synonym of *C. g. galbinifrons* (Lehr *et al*. 1998b), with a type locality on Hainan Island.

The Hainan serrated box turtle *C. g. serrata* (Iverson and McCord, 1992) is a dark race from Tainhfien, central Hainan Island, although it may also occur in Viet Nam according to Shiu (cited in de Bruin and Artner, 1999). Some authors have proposed that this subspecies represents a separate species, viz. *C. serrata*, on the basis of a number of differences from (and a lack of intergrades with) the other galbinifrons subspecies, and similarities with *Pyxidea mouhotii* (by Fritz and Obst, 1997). Others consider that the *"serrata"* form is a hybrid between *C. galbinifrons* and *Pyxidea mouhotii* (Parham *et al*., 2001); van Dijk (*in litt.* to TRAFFIC International, 29 November 2001) recommends retention of the subspecies classification, whilst acknowledging the diverse views.

C. g. bourreti (Obst and Reimann, 1994), Bourett's box turtle, occurs in central Viet Nam (the type locality is Linh-Cam in the province Ha Tinh) (Obst and Reimann, 1994), southeast Lao PDR, and northeast Cambodia, (though records for Cambodia are unconfirmed and if present would be *C. g. picturata* which was previously included in *C. g. bouretti*) (van Dijk *in litt*. to TRAFFIC International, 29 November 2001). However, Ernst concluded that the characters used to differentiate *C. g. bourreti* fall within the normal variation of the Vietnamese population of *C. g. galbinifrons* (de Bruin, 1994).

C. g. picturata (Lehr *et al,.* 1998a) occurs in south Viet Nam, with Annam as type locality, and Cambodia (Lehr *et al*., 1998b).

DISTRIBUTION AND POPULATION

The CITES database lists the current distribution of *C. galbinifrons* as: China, Lao People's Democratic Republic (Lao PDR) and Viet Nam (Anon., 2001a).

The IUCN Red List 2000 classifies this species as Critically Endangered (CR A1d+2d) (Hilton Taylor, 2000) based on a population reduction of at least 80% over the three generations and a projected population reduction of 80% over the next three generations and caused by actual or potential levels of exploitation. The species is considered 'At Risk' in Lao PDR (Duckworth *et al*., 1999; their highest threat category), and Critically Endangered in Lao PDR and Viet Nam (IUCN/SSC Tortoise and Freshwater Turtle Specialist Group and Asian Turtle Working Group, 2000), Endangered (EN) in China (Hainan) (Zhao, 1998 cited in Lau and Shi, 2000).

On account of the diversity of subspecies, the conservation situation is very acute (IUCN/SSC Tortoise and Freshwater Turtle Specialist Group and Asian Turtle Working Group, 2000). Wild populations of this species are in decline probably throughout most of its range apparently due to the heavy harvesting for the wildlife trade with and within China (Anon., 1999). However, declines have not been documented objectively (van Dijk *in litt*. to TRAFFIC International, 29 November 2001).

Cambodia

C. galbinifrons is thought to occur in Cambodia, although specimens were not examined (Lehr *et al*., 1998b; Obst and Reimann, 1994). Specimens examined from a market in Viet Nam were thought to have originated from southern Viet Nam or Cambodia (Lehr *et al.*, 1998b). Specimens obtained from reliable pet dealers examined in Europe by Obst and Reimann were thought to have originated from Cambodia (B. Stuart, IUCN/SSC Tortoise and Freshwater Turtle Specialist Group, 2001, *in litt*. to IUCN/SSC Wildlife Trade Programme). However, the species has not been encountered in Cambodia, although Stuart (2001, *in litt.* to IUCN/SSC Wildlife Trade Programme) speculates that it probably does occur in the upland areas of extreme northeastern Cambodia in Ratanakiri Province, and perhaps in the uplands of extreme eastern Mondolkiri Province.

China

The subspecies *C. g. galbinifrons* is restricted to Guangxi and Hainan provinces in southern China (Lau and Shi, 2000). *C. g. hainanensis* (Li, 1958), which is generally considered a junior synonym of *C. g. galbinifrons*, typically occurs on Mt. Diaolou at an altitude of 200 m (Zhao and Adler, 1993 cited in Anon., 1999). It is still being collected and trapped in Hainan (de Bruin and Artner, 1999), reportedly even within protected areas. The population is believed to be in decline and is classified as "endangered" in the Chinese Red Data Book (Zhao, 1998).

Lao People's Democratic Republic

C. galbinifrons occurs in the North in the Annamite mountains and Nakai Plateau of the Central Region of Lao PDR (Stuart, 1999). A carapace was found from a consumed specimen in a village in the limestone region. This specimen was reported to have been found locally, which suggests the species may also be present at lower elevations. The species is included in the "At Risk"category - for species with the highest level of threat in Lao PDR (Stuart, 1999).

Viet Nam

Three subspecies occur in Viet Nam, *C. g. galbinifrons* in the north, *C. g. bourreti* in central and northern Viet Nam, and *C. g. picturata* occurs in the south (van Dijk *in litt*. to TRAFFIC International, 29 November 2001). *C. galbinifrons* is limited to the remaining forests, National Parks and Protected Areas, but wild populations are believed to be in decline due to heavy harvesting for the wildlife trade with China (Hendrie, 2000). This species was classified as "vulnerable" in the country's Red Data Book (Anon., 1992), and local people reported *C. g. bourreti* to be very rare and difficult to find. Only a few specimens of *C. g. picturata* have been observed in

Vietnamese markets although they are in high demand (Lehr *et al.,* 1998b in Anon., 1999). In 1993, Lehr (1997) observed more than 50 specimens per market in central and northern Viet Nam, but numbers had at least halved three years later. This, together with a doubling of the price over the same period and a decreased abundance of the species in the western pet trade has been taken to indicate that wild populations of this species are declining (Lehr, 1996; Lehr *et al.,* 1998a; Pro Wildlife, in prep. in Anon, 1999).

HABITAT AND ECOLOGY

C. galbinifrons reaches up to 19 cm (carapace length) in length and one to two kilogrammes in weight for a large adult (van Dijk *in litt.* to TRAFFIC International, 29 November 2001). In their natural habitat, *Cuora* spp. have a life expectancy of up to 30 years and reach sexual maturity from four to five years of age. The species has a low reproductive rate; in its natural habitat two clutches of a single egg may be laid each year (42 mm x 23 mm) (de Bruin, 1994). In captivity a clutch can comprise one to three eggs, with a maximum of six eggs per year (Fiebig and Lehr in prep. in Anon., 1999). Incubation of two successfully hatched young lasted 65 and 72 days (at 28-29ºC), the hatchlings measured 5.69 cm x 2.76 cm in plastron length and weighed 15 and 24 g respectively (de Bruin, 1994). The diet consists of slugs, snails, mushrooms, fruits, frogs, toads, newts, insects, worms, and animal carcasses (Anon., 1999). Although it readily enters water, it is probably one of the least aquatic species of *Cuora*. *C. galbinifrons* lives in submontane / mid-elevation forests dwelling on the forest floor protected by undergrowth (Barzyk, 2000). It tends to be a very shy species and withdraws into its shell when disturbed (Ernst and Barbour, 1989 cited in Anon, 1999).

Cambodia

The presence of the species is suspected but has not been confirmed (Stuart 2001 *in litt*. to IUCN/SSC Wildlife Trade Programme) and therefore details of its habitat and ecology in this country are unknown.

China

This species occupies forest streams, ponds, and the surrounding moist terrestrial habitats. Some suitable habitats remain (Lau and Shi, 2000).

Lao PDR

The species occurs at higher elevations in evergreen forest or closed forest (Stuart, 1999). It may also occur at lower elevations in dry evergreen mixed with deciduous forest (based on a carapace from a consumed specimen reportedly obtained locally) (Stuart, 1999).

Viet Nam

C. galbinifrons lives in evergreen forests on hillsides and in mountainous regions (Hendrie, 2000).

THREATS TO SURVIVAL AND DOMESTIC USE

IUCN considers this species to be Critically Endangered A1d+2d (Hilton Taylor, 2000), based on an observed, estimated, inferred or suspected reduction of at least 80% over the last three generations and a similar reduction during the next ten years or three generations based on actual or potential levels of exploitation (IUCN/SSC Tortoise and Freshwater Turtle Specialist Group and Asian Turtle Trade Working Group, 2000).

The low reproductive rate of the genus *Cuora* spp. makes them very sensitive to over-collection (Das, 1997 cited in Anon., 1999). *C. galbinifrons* is used both as food and for the pet trade (Lau and Shi, 2000). Larger adults are preferred for the food trade with a consequent heavy impact on the populations affected (Anon., 1999). *C. galbinifrons* has been found in food markets in China (McCord, 1998) and in southern, central and northern Viet Nam. In all these locations the availability of the species at markets has dropped (Lehr, 1997 cited in Anon., 1999). According to the National Environmental Protection Agency of China (1998 cited in Anon., 1999) collection for the food markets poses the greatest threat to this species, although habitat loss in the countries of origin must also have a negative impact on the species (Fiebig and Lehr, in prep. in Anon., 1999).

Cambodia

If this species does occur in Cambodia it is likely to be affected by large-scale forest clearing activities (Hardtke, 1997 cited in Anon., 1999) and to be collected by hunters (Stuart 2001, *in litt.* to IUCN/SSC Wildlife Trade Programme). Local subsistence use of turtles is widespread in Cambodia, and probably not species specific (Tana *et al.*, 2000). The domestic trade in turtles is considered minor in comparison with the international trade (Tana *et al.*, 2000).

China

The main threat to this species is over-collection for the food trade. Whilst it is difficult to differentiate the domestic trade from the international trade, it is possible that some of the animals traded at markets in China are captured in the country (Lau and Parry-Jones, *in litt.* 2001). However, it is believed that the majority of *C. galbinifrons* observed regularly in Guangzhou and Shenzhen markets during surveys undertaken by Kadoorie Farm and Botanic Garden (KFBG) originated in other southeast Asian countries (Lau and Parry-Jones, *in litt.* 2001), as this species appeared to be the most frequently observed species in the Viet Nam-China turtle trade (Hendrie, 2000).

The trade mainly involves live sub-adults for the commercial food trade, which are consumed in a tonic and/or cooked with herbal ingredients as a medicinal food. In addition it is possible that the plastron might be traded as an ingredient for traditional medicine (Lau and Parry-Jones *in litt.* 2001). *C. galbinifrons* was recorded in food markets in China's Guangxi Autonomous Region (McCord *in litt.* 1998; Meier *in litt.* 1998a both cited in Anon, 1999) and Hainan Province (Lau 1999 *in litt.* to the German CITES Scientific Authority) and the subspecies *C. g. galbinifrons* was for sale in Qing Ping Market in Guangzhou, Guangdong Province in August 1995 (Meier *in litt.*. 1998a). Valentin (1999 cited in Anon., 1999) reported about 30 specimens of *C. galbinifrons* on sale at the Qing Ping market in November 1998 as well as in April 1999. A very small number have also appeared in pet shops in South China (Lau and Parry-Jones *in litt.* 2001).

Deforestation, construction of small hydroelectric plants, and the liming of streams cause destruction and degradation of the habitat of this species (Lau and Shi, 2000). Lau and Parry-Jones (*in litt.* 2001) report that the species' habitat has been heavily logged in the past and the remaining habitats are now restricted to a few, isolated protected areas. Acid rain, fertilisers and pesticides in some areas may have further negative impacts on the species and/or its habitat (Maas, 1995 cited in Anon., 1999).

Lao PDR

Subsistence use of wild collected turtles is widespread throughout the country, and is not species specific. However, *C. galbinifrons* has been recorded as hunted by local people for subsistence purposes (Stuart 1999) The species is also reputedly taken by Vietnamese poachers (Robichaud, 1998a cited in Duckworth *et al.*, 1999). One villager interviewed in 1998 in Ban Maka-Neua predicted that the species would disappear as a result of over-harvesting within a few years (Duckworth *et al.*, 1999). On account of its restricted distribution within the country, coupled with the demand for the food trade, the species is thought to be subject to a high level of threat (Stuart and Timmins, 2000). It is also likely that populations are affected by habitat loss, which is described in Collins (1990), and Lehr (1996 cited in Anon., 1999).

Viet Nam

The major threats are habitat loss and collection. The species may have been consumed locally in the past but presently most turtles are likely to be sold to traders for export (Hendrie, 2000). Potential trade impacts are depletion of wild populations and compromised viability of surviving populations (Hendrie, 2000).

The value of *C. galbinifrons* in domestic markets in Viet Nam between 1993 and 1994 was 38 000-86 000d/kg (2.65-6 USD/kg). By 1996, the price paid for turtles had doubled (Fiebig and Lehr in prep., cited in Anon., 1999) and in Hue (a coastal city in central Viet Nam), the number of species on offer was significantly lower in 1996 than in 1993. During surveys from 1993 to 1996 *C. g. picturata* was regularly found in the Cau Mong food market in Ho-Chi-Minh City (Lehr *et al.,* 1998b). Such trade centres in Hanoi and Ho-Chi-Minh City are the main outlets for the species despite the fact that it is listed in the country's "Red Data Book" (Peter 1996, cited in Anon., 2000).

INTERNATIONAL TRADE

This species was included in CITES Appendix II as recently as 2000 and at present no CITES trade data are available. The species is traded internationally for food markets and this trade is considered to have the most serious impact on the species. Smaller numbers enter the pet trade. Numbers in trade as of 1999 were reportedly in decline (van Dijk, 1999). Most international trade concerns live animals.

Populations of *C. galbinifrons* have apparently decreased markedly in China as a result of commercial trade (National Environmental Protection Agency of China, 1998 cited in Anon., 1999). This is also reflected in Viet Nam by the species' reduced availability in food markets (Lehr, 1997 cited in Anon., 1999). Pro Wildlife (*in prep.* in Anon., 1999) reported that European importers also assume a population decline and inform of mounting difficulties in obtaining specimens. However, Anon. (1999) reported that the species was still commonly sold in the European and USA pet market at that time, intensifying the pressure to the populations in the wild.

Cambodia

If the species does occur in Cambodia, it is likely to be affected by the high level of international trade in unspecified turtle species. Legal international trade is administered by a government agency that ships turtles from Phnom Penh to Guangzhou or Hong Kong, China. The trade was restricted by an annual quota (though the quotas for 2000 and 2001 were apparently revoked (TRAFFIC Southeast Asia, *in litt.* to TRAFFIC International, 29 November 2001)) and by the size of individual turtles, which must be larger than one kilogramme to be exported legally. During 1998 and 1999 an estimated 100 tonnes of turtles (species unspecified) were exported from Cambodia. A quota for 100 tonnes of turtles of all species was approved for the 1999-2000 season (Tana *et al.*, 2000). However, the illegal international trade in turtles from Cambodia is thought to be much larger than the legal trade and most specimens are thought to be destined for Viet Nam, at least in the first instance (Tana *et al.,* 2000).

China (as an exporter)

In 1996, Chang (in Anon., 1999) noted that each year between 200 000-300 000 kg of turtle shells (species not specified) were reportedly transported from China to Taiwan. This weight equates to roughly one million animals, some of which are in all likelihood *Cuora* species.

Commercial exports from China of all but two species of Testudinata were suspended from 6 June 2000. According to the CITES Management Authority of China, (*in litt.* to IUCN/SSC Wildlife Trade Programme, 2001) ten specimens of this species were exported from China to the USA for research purposes in 2001.

China (as an importer)

China is thought to be the world's major consumer of freshwater turtles, the majority of these are now imported from other Asian Countries, and the overall trade has probably increased since the opening of borders with other Asian countries (Lau and Shi, 2000). Statistics on international trade are lacking, however, between 1993 and 1996 up to 19 tonnes of turtles passed through three border ports between Guangxi province and Viet Nam per day (Li and Li, 1997, 1998 cited in Lau and Shi, 2000). Rare or restricted Asian species observed in Chinese food markets are particularly sought after, and *C. galbinifrons* is one of these targeted species (Lau and Shi, 2000).

It is difficult to differentiate legal international trade from illegal trade (Lau and Shi, 2000) and to separate international trade from the domestic trade, (Lau and Parry-Jones *in litt.* 2001) but *C. galbinifrons* is believed to be imported into China (Lau and Shi, 2000). Surveys undertaken at Qing Ping market, Guangzhou and at a market in Shanghai in August 2001, recorded for sale more than 100 and several hundreds of live specimens of *C. galbinifrons* at each of the markets respectively (Even *in litt*. to TRAFFIC Europe, November 2001). At Qing Ping market, Guangzhou, in October 2001, a few traders each had on display five to ten specimens of *C. galbinifrons*, with a total of around 30-40 specimens observed in the market, making *C. galbinifrons* one of the least numerous species on offer (van Dijk and Parry-Jones, in litt. to TRAFFIC International, 12 November 2001).

Hong Kong (China Special Administrative Region)

Although this species has been listed in CITES Appendix II since 2000, the process to include it in the Animals and Plants (Protection of Endangered Species) Ordinance, which gives effect to CITES, has not yet been completed but is expected to be in effect in early 2002 (C.S. Cheung, pers. comm., AFCD, to TRAFFIC East Asia, 29 October 2001). Hence the international trade of this species is still not regulated in Hong Kong and trade figures are not available (Lau and Parry-Jones, *in litt.* 2001). As recently as October 2001, about 10 adult *C. galbinifrons* were observed at a traders in the Fresh Market at Nelson and Canton street intersection, at a price of HKD 120 /catty (approx USD 26 /kg), and a further 10 adult specimens were observed at the stall of another Hong Kong vendor on the opposite side of the street, but no price was advertised (van Dijk and Parry-Jones, *in litt*. to TRAFFIC International, 12 November 2001).

As the species is not native to Hong Kong and breeding of the species is not known, the small numbers observed in the local pet and food markets in Hong Kong are most likely to have been imported (Lau and Parry-Jones, *in litt.* 2001). From here specimens are destined for the international pet trade. They are apparently purchased from food markets or local villagers by Hong Kong pet dealers, transported to Hong Kong and then shipped to other countries such as the USA, Germany, and Japan (Lau and Shi, 2000).

This species was reportedly the fifth most traded chelonian species in Hong Kong during May 1998 to May 1999. In 1997 and 1998 there was an influx of neonate *C. galbinifrons* in the Mong Kok pet markets in Hong Kong (Barzyk *pers.obs*. cited in Barzyk, 1999). It was suggested that these might have been farm-raised (Barzyk, 1999), but van Dijk (*in litt.* 2001) states that captive breeding remains a rarity and nearly all of the animals in trade are wild-collected.

A small number of yearlings can be found for sale in pet shops in Hong Kong, some are thought to result from opportunistic hatching of eggs laid by gravid females held in stock. This observation suggests that it is likely that dealers are aware of the financial benefits of captive breeding (Lau and Shi, 2000). During 2000 and 2001 up to 20 adults and young at any one time were observed in food markets and pet shops respectively during the KFBG's Wildlife Trade Monitoring (Lau and Parry-Jones, *in litt.* 2001)

In 1998 according to the German CITES Scientific Authority (*pers. obs.* cited in Anon., 1999), specimens of *C. galbinifrons* were on sale at food markets as well as in pet shops in Hong Kong for about USD 17.

Lao PDR

Lao PDR is not a Party to CITES, and the legal status of *C. galbinfrons* is not clear (Stuart, 2001, *in litt.* to IUCN/SSC Wildlife Trade Programme). Despite being excluded from trade by law according to Lehr *et al.* (1998a in Anon., 1999) and Jenkins (1995) specimens of *C. g. bourreti* and *C. g. picturata* are exported from Lao PDR. These specimens are sent to Viet Nam via Lao Bao, and on to Hanoi through Dong Ha, from where they are exported to China and Hong Kong via Lang Son and Mong Cai. According to Stuart and Timmins (2000), the international borders of Viet Nam and China with Lao PDR are not well regulated and transboundary wildlife trading and poaching reportedly continues mostly unchecked. However, there are no data concerning the volume of international trade in this species (Anon., 1999).

Viet Nam

C.galbinifrons is one of three species of most commonly traded turtles in Viet Nam (Jenkins, 1995) and a recent report reveals that 41% of all turtles observed in trade are *C. galbinifrons* (Compton, 2000). Smaller individuals are commonly sold as pets. This species is most commonly observed in the trade during the late summer through to October (Hendrie, 2000). Specimens from Viet Nam are also on sale in the western pet market (Anon., 1999).

Official CITES office records indicate that 5 106 specimens of this species were legally exported between 1994 and late 1999 (Hendrie, 2000). In August 1993, 45 kg of live turtles were observed in Hanoi with a price of 86 000d/kg (6 USD/kg) (Le Dien Duc and Broad, 1995). The value of *C. galbinifrons* at export points, during 1993 and 1994 was 100 000d/kg (7 USD/kg) (Le Dien Duc and Broad, 1995).

In July 1999, a seized cargo included three full rice bags (87 kg) of *C. galbinifrons* (estimated 150 individuals). This is the largest number of *C. galbinifrons* observed in a single trade seizure (Hendrie, 1999). Another estimate, based on seizures in Ninh Binh Province, found the species appeared in 81% of all trade seizures where turtles

were present (Hendrie, 2000). The price per kilogramme doubled between 1993 and 1996 from USD 10 to USD 20. Yet, during the same period the number of animals on markets observed in central and northern Viet Nam dropped from more than 50 specimens per market to less than half this number (Lehr 1997, 1998 cited in Anon., 1999).

Potential trade impacts are depletion of wild populations and compromised viability of surviving populations (Hendrie, 2000).

Importing countries

Import of *Cuora* into the USA is affected by the four-inch (ten cm)-rule, which came into effect in the USA in 1975. This rule was imposed by the USA Food and Drug Administration to prevent transmission of turtle-associated *Salmonella* to children. Having closed that supply, the trade now supplies other, wild-caught turtles more than ten cm long. This rule makes commercial farming and raising financially unattractive and thus reportedly shifts the pet trade into wild-caught sources (Anders Rhodin, pers. comm. to van Dijk December 1999, cited in van Dijk *in litt.* 1999).

Meier estimated that thousands of *C. galbinifrons* were imported into the European Union during the last decade, often as substitutes for North American box turtles, which had become subject to import restrictions and zero export quotas (Meier 1999, pers. comm. to the German CITES Scientific Authority, March 1999 cited in Anon., 1999). According to various traders, specimens of *C. galbinifrons* are no longer acquired easily, and prices have increased (Anon., 1999).

Lehr *et al.* (1998a) state that the species was "abundantly" available in the USA. According to Hoover (1998) between 1993 and 1995 a total number of 1 179 specimens were imported to the USA (39 specimens in 1993, 481 in 1994 and 659 in 1995). In 1999 specimens were on sale for USD 50 -100 in the United Kingdom (Maas *in litt.* 1999 cited in Anon., 1999). Pairs of *C. g. bourreti* and *C. g . galbinifrons* were traded amongst European turtle enthusiasts for USD 245 (Advertisements in "Schildkröten-Fachmagazin, 2/98 and 4/98; Theiler, 1998).

Most of the specimens in German pet shops are exported from Hong Kong. A recent survey of 27 pet trading businesses revealed that 44.5% had stocks available for immediate sale, while 7.5% said they would be able to obtain specimens if required (Anon., 1999).

However in 2001, Vinke (pers. comm. to TRAFFIC Europe cited in TRAFFIC Europe *in litt*. to TRAFFIC International) stated that the species is kept by only a few hobbyists in Europe and it is not commonly available.

The decrease of this species in the European pet trade is as likely to be an effect of reduced demand (there is a very limited market for an expensive, stress-sensitive species that quickly gained a reputation for being difficult to keep alive) as of reduced supply. Indeed, as the species disappeared from the western European pet trade it appeared in the East European pet trade in even larger numbers (Ron de Bruin, *pers.comm* to van Dijk in van Dijk, *in litt.* 1999). In 2000 and 2001, specimens were offered by Czech traders for around 150 EUR (133 USD) but no imports have been recorded by the Czech Republic (J. Kucera, CITES Management Authority of the Czech Republic, *in litt.* to TRAFFIC Europe, October 2001 cited in TRAFFIC Europe *in litt*. to TRAFFIC International, 8 October 2001).

A web search to determine availability of the species in Japan was conducted in August 2001, two shops recorded 'Indochinese box turtle to be available'. One specifically mentioned *C. galbinifrons* for sale at 10 000 JPY (84 USD). (TRAFFIC East Asia Japan, in litt. to TRAFFIC International, 5 November 2001).
In September 2001, an illegal shipment including 15 live specimens of *C. galbinifrons* originating from Singapore and destined for Sweden, were intercepted at Schipol Airport in Amsterdam (D. Birtwhistle, Dutch Inspection Service, *in litt*. to TRAFFIC Europe, October 2001 cited in TRAFFIC Europe *in litt*. to TRAFFIC International 8 October, 2001).

CONSERVATION MEASURES

Cambodia

Hunting and export of native wildlife is illegal (Martin and Phipps 1996).

China

C. galbinifrons (*Cistoclemmys galbinifrons*) is listed in the China Red Data Book (Zhao, 1998) as "endangered" as populations are declining (Lau and Shi, 2000). Although the species occurs in forested nature reserves, illegal collecting still occurs in these protected areas (Lau and Parry-Jones, *in litt.* 2001). Article 18 of the Wild Animal Protection Law (1988) states that a hunting license is required to hunt or catch wildlife that is not under special state protection. Further, any sale of the species or product thereof should be regulated in domestic markets under Article 27 of the Enforcement Regulations for the Protection of Terrestrial Wildlife of the People's Republic of China (1992).

A new regulation has recently been imposed in China controlling the import of turtles into the country. Notification No. [2000]51, concerning the Strengthening the Live Reptile Import and Export Management issued by the China CITES Management Authority in June 2000, stipulates that:

3. Import of specimens listed in Appendix II of CITES are not allowed from those countries which have not established an annual export quota;

4. Commercial imports of all species from Indonesia, Cambodia and Thailand are suspended;

5. Imports into Guangdong and Hainan Provinces must arrive only in Guangzhou Baiyun Airport, Shenzhen Huangtian Airport and Haikou Meilan Airport. Imports into other provinces and municipalities are to be determined by the local administration. The port of entry should be indicated in the certificate of export/import.

China suspended the export of native species of Testudinata for commercial purposes (except *Chinemys reevsii* and *Trionyx sinensis*) on 6 June 2000 (CITES Management Authority of China, *in litt* to IUCN/SSC Wildlife Trade Programme, 2001).

China's National Environmental Protection Agency (1998) recommends surveys in order to obtain information on population size and distribution. Despite the establishment of nature reserves and scenic areas in parts of the species range, none of these measures act specifically for this species (Anon., 1999).

Lao PDR

This species is strictly protected in Lao PDR, where its capture is prohibited throughout the year (Jenkins 1995). However, Stuart and Timmins (2000) claim that no turtles are truly protected in Lao PDR as only local names, which have regional variations and do not match scientific names, are listed in the legislation. The species occurs in some protected areas within Lao PDR but there is evidence of hunting within them (Stuart, 2001 *in litt.* to IUCN/SSC Wildlife Trade Programme). Most National Biodiversity Conservation Areas were designated on the basis of forest cover, and include approximately 12.5% of the country's surface.

Viet Nam

This species is listed in the Vietnamese Red Book of rare and endangered species (Anon.,Ministry of Science, Technology and Environment of Vietnam, 1992). Due to its listing as "vulnerable" in the Red Data Book of Viet Nam in 1992, this species was thought to be excluded from legal trade (Red Data Book Viet Nam, Ministry of Science, Technology and Environment cited in Anon., 1999). However, Hendrie (2000) reports that specimens were exported legally from Viet Nam between 1994 and 1996 and that enforcement of national wildlife protection laws is generally marginal and inconsistent.

The Cuc Phuong Conservation Project, Ninh Binh Province, works in co-operation with authorities from the National Park, and provincial and national Forest Protection Department officials and aims to establish practical solutions for dealing with the vast numbers of illegally traded turtles that are seized. The programme has received several turtles from previous confiscations, and intends to develop guidelines for effective quarantine, habitat assessment, release and monitoring of specimens for the purposes of reintroduction, as well as focus on raising the level of awareness and education in local communities about the need to conserve and protect Viet Nam's tortoise and freshwater turtle species.

Since 1962, Viet Nam has created 87 reserves (Collins 1990). However, none of these reserves act specifically for the protection of turtles (Anon., 1999).

CAPTIVE BREEDING

Captive breeding of this species is being attempted in Shanghai (Zhao, 1998 cited in CITES Management Authority of China, *in litt.* to IUCN/SSC Wildlife Trade Programme 2001). This species is bred in very small numbers in captivity - probably less than 50/year worldwide by hobby breeders – and therefore it is concluded that all trade concerns wild caught animals (de Bruin *in litt*., 2001).

This species has a history of high mortality in captivity and despite being relatively common in the United States of America (hereafter referred to as the USA), there are to date very few captive propagation programmes (Barzyk, 1999), although, it is bred in small numbers in captivity by private breeders (Meier, *pers. comm.* 1999a; pers. comm. to the German CITES Scientific Authority, March 1999 cited in Anon., 1999). According to Nietzke (1998) de Bruin was the first to successfully breed this species in captivity in 1993. Incidental captive breeding producing only three to five hatchlings per year, with production of an additional single hatchling of *C. g. serrata,* has been reported by McCord (*in litt.* to Weissgold 4 October 1999). The first successful captive breeding of the subspecies *C. g. bourreti* occurred in 1998 (Fiebig and Lehr in prep.). Breeding efforts on a commercial scale are not reported for this species (Anon., 1999).

CHELONIA 2002, a conservation breeding programme in Austria, has managed to breed all *Cuora* species, except *C. zhoui* (Artner 1999 *in litt.* to the IUCN/SSC Wildlife Trade Programme). In addition, a conservation breeding initiative of Dutch, German, Swiss, Hungarian and Austrian turtle breeders specialised in Chinese turtle species (Erhaltungszuchtinitiative Chinesische Schildkröten), has already bred all extant *Cuora* species (Artner *in litt.* 1999).

Within the European Studbook Foundation *C. galbinifrons* is captive bred but in very limited numbers (less than 10 specimens) (H. Zwartepoorte, European Studbook Foundation, *in litt*. to TRAFFIC Europe, November 2001 cited in TRAFFIC Europe *in litt*. to TRAFFIC International, 5 November, 2001.

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Lissemys punctata Bonnaterre, 1789

Indian Flapshell Turtle
Totue de l'Inde
Tortuga plana indiana

Order: TESTUDINES **Family: TRIONYCHIDAE**

SUMMARY

The Indian flapshell turtle, *Lissemy punctata* is generally recognised to include two subspecies, *L. p. andersoni* and *L. p. punctata*, with some uncertainty over whether a third subspecies, *L. p. scutata,* could actually be a separate species - *L. scutata.* The species is widely distributed within the southern Asian region from Pakistan eastwards to Myanmar and from Nepal south to Sri Lanka and possibly Thailand, although again, there is some uncertainty over the distribution of the species, partially allied to the taxonomic difficulties.

L. punctata inhabits the quiet water of rivers, streams, marshes, ponds, lakes, irrigation canals and tanks, with a preference for muddy-bottomed habitats, and can burrow into the soil to avoid water loss. The species feeds on aquatic vegetation, small fish, insects, tadpoles earthworms, carrion etc. Males mature at less than 15 cm and females at 27.5 cm in length; adults normally reach a weight of 1-2 kg. The clutch size varies between 2-8 eggs and the spherical eggs are laid from August to December. There are indications that more than one clutch may be laid each year.

L. p. punctata was included in CITES Appendix I in 1975, but in 1995, this subspecies was removed from Appendix I when the species was included in Appendix II. CITES reported data shows that from 1995-2000, all reported international trade has been in live specimens (apart from one seizure of two *L. p. punctata* specimens). Bangladesh has been the only reported country of origin for specimens in trade for 1995-2000; with total reported imports totalling 352 live specimens for this period. Three hundred of these were imported by Japan, with the remainder being imported by the USA. Israel and Norway have been the only other reported destinations of *L. punctata*, each for one live specimen in 1995.

The main threats to the species on a global scale are habitat degradation and collection for both local consumption and for export. Various parts of the species are considered to possess medicinal properties. In 1994, reviewers of the CITES amendment proposal for *L. punctata* noted that international trade did not appear to threaten the survival of *Lissemys*, but cautioned that there was a need to monitor this trade, particularly in light of the high-level trade in softshell turtles to East Asia. It appears that in several range States today, there are indications of illegal international trade, which in conjunction with strong domestic use in many range States, could pose a threat to the survival of *L. punctata* in the wild. However, China, which has been a major importer of many species of Chelonia in recent years has now instituted import restrictions.

Although considered relatively easy to rear in captivity, commercial captive breeding on a small scale only appears to occur in China.

The species is recommended under Decision 11.106 for inclusion in category 2.

TAXONOMY

There remains dispute as to the existence of a third *Lissemys* taxon. Some authors (e.g. Iverson, 1992 [the standard CITES reference for the distribution of CITES-listed turtle species] cited in Anon., 1994b) recognise a second species, *L. scutata*, but others consider this to be a third subspecies, *L. p. scutata* (e.g. Wermuth and Mertens, 1961 [reprinted in 1996, this is the standard reference for the names of CITES-listed turtle species]. Although not specifically mentioned by name, the supporting statement of the proposal to amend the CITES Appendices to include *L. punctata* in Appendix II in 1994 incorporated the unique distribution of *L. p. scutata* (see **Distribution and Population**) in the distribution of *L. punctata* (Anon., 1994a). S.M.A. Rashid (Centre for Advanced Research in Natural Resources & Management *in litt*. to IUCN/SSC Wildlife Trade Programme, 7 September 2001) notes that differentiating between the subspecies of *L. punctata* is problematic. He recommends that additional research be undertaken to clarify the taxonomic identification of the two subspecies

L. p. andersoni and *L. p. punctata*, and *L. (p.) scutata*. Since the standard CITES reference for the taxonomy of this genus does not recognise *L. scutata*, available information for *L. (p). scutata* has been included here.

DISTRIBUTION AND POPULATION

Also known as the spotted turtle or the Indo-Gangetic flap-shell, accounts of the distribution of *Lissemys punctata* differ considerably. The CITES species database lists the distribution of *L. punctata* as: Bangladesh; India; Myanmar; Nepal; Pakistan; and Sri Lanka (Anon., 2001a). The Appendix II-listing proposal for *L. punctata* states that the species also occurs in Thailand (Anon., 1994a). However, according to Anon. (2000a), the species only occurs in Bangladesh, India and Pakistan, whilst Rashid (*in litt.* to IUCN/SSC Wildlife Trade Programme, 7 September 2001) gives the species' distribution as Bangladesh, India and Myanmar.

The different opinions regarding the taxonomy of *Lissemys* (re *L. (p.) scutata*) do not explain the different accounts of the species' distribution. There is no doubt, historical or present, that the subspecies *L. p. punctata*, inhabits Sri Lanka and that *L. p. andersoni* inhabits Pakistan; omissions of these countries as range States are errors. Occurrence of the species in Thailand is doubtful, and if confirmed, it is extremely marginal. The taxon relating to Thailand is *L. (p.) scutata*, and therefore the inclusion of Thailand as a range State will differ according to one's view of the taxonomy of *L. punctata* (TRAFFIC Southeast Asia *in litt.* to TRAFFIC International, 29 November 2001).

L. punctata is not considered globally threatened according to the 2000 IUCN Red List (Hilton-Taylor, 2000).

The generally accepted distributions for the different subspecies of *Lissemys punctata* are as follows:

L. p. andersoni: the Indo-Gangetic plain; Pakistan, North India, Nepal, Bangladesh to extreme Western Myanmar (Das, 1985)

L. p. punctata: South India and Sri Lanka (Das, 1985; 1991), although it has more recently been found in Bangladesh (Rashid and Munjural Hannan Khan, 2000)

L. (p.) scutata: Myanmar and extreme Western Thailand (TRAFFIC Southeast Asia *in litt.* to TRAFFIC International, 29 November 2001).

Bangladesh

The species is listed as Vulnerable in the Red Book of Threatened Amphibians and Reptiles of Bangladesh (Anon., 2000a).

Although the species is more abundant in the southern districts, it is found throughout the country. It is relatively scarce in northern districts and its presence in the hill districts of the Chittagong Hill Tracts requires confirmation, however, it has been recorded from the Teknaf Peninsula in the southeast bordering Myanmar (Rashid *in litt.* to IUCN/SSC Wildlife Trade Programme, 7 September 2001). Two subspecies are reportedly found in Bangladesh; *L. p. andersoni* is the more abundant subspecies being found throughout the country including southeastern and northeastern areas adjoining hilly forests. It is considered very common. The second subspecies, *L. p. punctata*, is considered uncommon and is mostly restricted to the south, particularly Noakhali and Barisal (Rashid and Munjural Hannan Khan, 2000). Data on population abundance or density estimates are not available. However, based on field observations over a number of years, Rashid (*in litt.* to IUCN/SSC Wildlife Trade Programme, 7 September 2001) believes that the population appears to have declined drastically.

India

The species is reported to be distributed almost throughout the Indian Peninsula, and occurs in the Brahmaputra and Ganga basin, but not in the primary Western Ghat habitats, and in the hills of northeastern India. It is believed to have been introduced in the desert regions (Choudhury *et al.*, 2000). Shrestha (1997) and Das (1991) also note that it is present in the Andaman Islands. The species is present in almost all protected areas with freshwater wetlands, and it is reported to be common and the population stable (Bhupathy *et al.*, 2000; Choudhury *et al.*, 2000). However, a 1996 Conservation Assessment and Management Plan (CAMP) / Biodiversity Conservation Prioritisation Project considered *L. punctata* as Least Concern: Near Threatened in

India (Hanfee 1999, cited in Anon. and Anon., 2000b). This means that the species does not qualify for Conservation Dependant, but is close to qualifying for Vulnerable. Ghosh (*in litt*. to the CITES Management Authority of India, 1993 cited in Anon., 1994a) noted that the population of *L. punctata* was showing a general decline due to reclamation of wetlands and pollution of water bodies. At this time (1993), this decline was not considered "alarming" enough to warrant listing the species in Schedule 1 of the Indian Wildlife (Protection) Act. The species was subsequently listed in Schedule 1.

Myanmar

The species is found in western Myanmar in the Arakan (*L. p. andersoni*), Irrawaddy and Salween river systems as well as some smaller rivers in Tenasserinm (*L. (p.) scutata*) (Ernst and Barbour, 1989; Iverson, 1992 cited in Anon., 1994a; P.P. van Dijk *in litt.* to Species Survival Commission, Cambridge, 1994). As for virtually all turtle species native to Myanmar, few data are available to assess the status or trends of the population, with old and fragmented observations still being the main source of information on occurrence and distribution of turtles in Myanmar. However, according to Platt *et al*. (2000) and van Dijk (1997), available evidence suggests that substantial declines of many turtle species have occurred as a result of over-harvesting. In 1994, *L. (p.) scutata* was the most, or second-most frequently encountered turtle species (van Dijk *in litt.* to Species Survival Commission, Cambridge, 1994), however, local populations of *L. (p.) scutata* were thought to be possibly decreasing due to intensive local hunting.

Nepal

The species is reported to be found in the Terai region (southern Nepal) (Anon., 1994a) and *L. p. andersoni* has been recorded in Belbari (Das, 1991). Although Anon. (2000c) and Shrestha (1997) report that the species is considered common in Nepal, the CITES Management Authority of Nepal (*in litt.* to IUCN/SSC Wildlife Trade Programme, 7 November 2001) states that the species is considered threatened and has experienced population declines. The range of the species is limited.

Pakistan

L. p. andersoni is found in the Indus and Ganges drainage areas, from the Northeast border to the sea (Anon., 1994a; Das, 1991).

Sri Lanka

The subspecies *L. p. punctata* is widely distributed throughout the country including the North-Central, Northern, North-Western, Western and Southern provinces (Anon., 1994a; Das, 1991). A 1998 CAMP workshop report noted that *L. p. punctata* inhabits the low country and mid-elevations from the coast up to 1 200 m, with an extent of occurrence of over 20 000 km^2 and an area of occupancy over 2 000 km^2. Many, fragmented populations are known. A decrease of available habitat of at least 20% over the past 20 years was noted, as was a predicted further 20% loss over the next 20 years. Habitat loss has been caused by deforestation and a loss and decrease in quality of remaining habitat (de Silva *et al*., 2000 cited in TRAFFIC Southeast Asia *in litt.* to TRAFFIC International, 29 November 2001).

In 1994, the subspecies was reported to be threatened due to intensive local use (I. Das *in litt.* to Species Survival Commission, Cambridge, 1994). The species is considered Threatened in Sri Lanka according to the 1999 list of threatened fauna of Sri Lanka (Anon., 2000d).

Thailand

A small population of *L. (p.) scutata* (approximately 25 individuals in 1994) was discovered just prior to 1994, and is thought to occur in the upper Ataran River in Western Thailand (van Dijk *in litt*. to Species Survival Commission, Cambridge, 1994). Occurrence of the species in Thailand is doubtful, and if confirmed, it is extremely marginal (TRAFFIC Southeast Asia *in litt.* to TRAFFIC International, 29 November 2001).

HABITAT AND ECOLOGY

The habitat and ecology of *L. punctata* at the country level is poorly known except for in one or two range States. *L. punctata* inhabits a variety of freshwater habitats. This small species has an omnivorous diet, with a highly variable clutch size of between 2 and 15 eggs.

Bangladesh

L. punctata inhabits the quiet water of rivers, streams, marshes, ponds, lakes, irrigation canals and tanks, with a preference for muddy-bottomed habitats. When rivers and ponds dry up in summer, it burrows 3-6 cm into the soil to avoid predation and reduce moisture loss (Anon., 2000a). The species feeds on aquatic vegetation, small fish, insects, tadpoles, earthworms, carrion etc. It is the smallest soft-shell species within Bangladesh, with males maturing at less than 15 cm and females at 27.5 cm in length. The largest female recorded was approximately 37 cm long and weighed 7 kg (Anon., 2000a; Das, 1991); adults normally reach a weight of 1-2 kg (Rashid *in litt.* to IUCN/SSC Wildlife Trade Programme, 7 September 2001). Females lay spherical eggs from September to December, with the clutch size varying between 2-8 eggs (Anon., 2000a).

India

The species inhabits practically all freshwater bodies (Choudhury *et al*., 2000). *L. punctata* takes plant and animal material fairly impartially but exhibits a preference for animal matter (Varghese and Tonapi, 1986).

Cannibalism in the species has also been documented.

In northern India, the species is reported to hibernate between November and February, males becoming inactive before females and emerging later than females. When waters dry up at the onset of summer, the species burrows into the soil and aestivates for several months (Das, 1991). Feeding habits were found to change with the seasons in northern India, the species was herbivorous after emergence from hibernation in February, then became carnivorous before reverting back to herbivory in November, at the onset of hibernation (Yadava and Prasad, 1979 cited in Das, 1991).

Mating was observed in April in the wild, and from May to July in captivity (Duda and Gupta 1981 cited in Das, 1991). In the Madras area of south India, the subspecies *L. p. punctata* nests between September and November, producing a clutch of between 3-8 almost spherical eggs measuring 25.0-33.0 mm. At a temperature of 32.6ºC, the incubation period is around nine months, and mean hatchling carapace length is 42 mm with a weight of 8.2g (Vijaya, 1982 cited in Das, 1991). Hatchlings do not emerge before the next rains; but emergence does coincide with the period of high water levels and availability of food.

Nepal

L. punctata prefers weedy, shallow rivers and reservoirs with muddy bottoms (Shrestha, 1997).

Pakistan

In the Jammu area, the species lays eggs between August and October, laying 5-13 eggs (Duda and Gupta, 1982 cited in Das, 1991). Observations also indicate possible retention of eggs during unfavourable nesting seasons (Duda and Sahi, 1978 cited in Das, 1991).

Sri Lanka

Deraniyagala (1939, cited in Das, 1991) reported finding a female with 11 developed eggs and 18 “immature eggs” in early June, suggesting more than one clutch may be laid per season. Deraniyagala (1953, cited in Das, 1991) thought that the species laid 2-6 eggs, within a few weeks of each other.

THREATS TO SURVIVAL AND DOMESTIC USE

The main threats to the species on a global scale are habitat degradation and collection for both local consumption and for export (TRAFFIC Southeast Asia *in litt.* to TRAFFIC International, 29 November 2001). The species is also utilised in several countries for its medicinal properties.

Bangladesh

The threats to the species include habitat loss and over-collection of both adults and eggs (Anon., 2000a). Rashid (*in litt*. to IUCN/SSC Wildlife Trade Programme, 7 September 2001) also notes that habitat loss is a threat to the species and believes that even though additional potential habitat exists, the combination of habitat loss and the significant increase in the volume of harvest will make it extremely difficult for the population to recover. As such, the present volume of trade apparently surpasses the threshold level that could be supported by the population of *L. punctata*. The volume of harvest, and hence trade, in turtles is very high during the winter and early summer months (October-April) when water levels are lower and harvesting is easier. Most adult females are gravid during this time and hence their removal reduces recruitment to the population (Rashid and Munjural Hannan Khan, 2000).

Prior to the recent international commercial trade, the major local uses of turtles and their products were for consumption for food, eggs as delicacies, and for use in traditional medicines. Local trade and consumption of *L. punctata is* reported to have been carried out on a relatively sustainable basis until the country's independence in 1971, after which time the commercial exploitation of natural resources gained momentum and all freshwater turtles became extensively involved in local trade (Rashid and Munjural Hannan Khan, 2000). *L. punctata* has several local trade names: Sundhi Kasim; Futi Kasim; Tila Kasim; and Dhur Kasim. Local trade usually involves live animals, which after being bought from the markets are slaughtered for meat. The shells are in many cases dried and used in traditional medicine to heal burns and treat cattle wounds (Rashid *in litt*. to IUCN/SSC Wildlife Trade Programme, 7 September 2001). *L. punctata* is currently one of the six most important turtle species in terms of numbers involved in the local trade within Bangladesh, primarily for consumption as food (Rashid and Munjural Hannan Khan, 2000).

All specimens in trade are from wild sources. Quantification of the volume of domestic trade is impossible since there is no government agency with responsibility for this task, nor any recording system in place to quantify the trade volumes. However, to give a very general picture of the trade volume of turtles, there are approximately 64,000 villages in Bangladesh, with each having an average of two markets per week, with turtles sold in the vast majority of these markets in differing volumes (Rashid *in litt*. to IUCN/SSC Wildlife Trade Programme, 7 September 2001).

India

According to Choudhury and Bhupathy (1993), habitat loss is not considered a major threat to the species' survival. However, Ghosh (*in litt*. to the CITES Management Authority of India, 1993 cited in Anon., 1994a) reported that the population of *L. punctata* was generally declining due to reclamation of wetlands, pollution of water bodies etc. *L. punctata* is exploited throughout the country to varying degrees (Choudhury and Bhupathy, 1993). In 1994, Hanfee considered the trade in India to be "moderately large" (TRAFFIC India *in litt.* to IUCN Species Survival Commission, Cambridge, 1994). The species is the most common softshell turtle in trade and is available in markets nine months of the year. Most are consumed locally for the meat trade (Bhupathy *et al*., 2000). The species is also used in traditional medicine; the flesh is used to treat tuberculosis (Das, 1991), burnt shell is used to treat skin diseases, and both blood and ground shell mixed with oil are used to treat stomach ailments. Religious use of turtles was recorded in coastal Andhra Pradesh, Orissa, Gujarat and the temple towns of Tamil Nadu and Uttar Pradesh (along the Ganges River). In most cases turtles were kept in sacred ponds and devotees were allowed to feed them; *L. punctata* was one of the preferred species (Choudhury and Bhupathy, 1993). Vijaya (1982, cited in Das, 1991) found that these turtles are considered sacred in certain areas of West Bengal, in eastern India, where they are kept tied to stakes near village ponds to guard the household against evil spirits. Villagers have also reported that in many parts of India, *L. punctata* are placed in wells to clear them of insects (Das, 1991).

The consumption of freshwater turtle meat in India is particularly popular among the people of West Bengal. All major towns and cities along the Ganges River in Uttar Pradesh were reported to be collection centres for turtles

sent to markets in Calcutta. The banks of the river are heavily populated by a number of tribes and castes, all of whom are known to harvest turtles for their meat and carapaces. *L. punctata* is the most widespread turtle species in the region of Uttar Pradesh and it is also the most heavily exploited. Turtleshells, irrespective of the species, were being sold in 1993-1994 for approximately Rs 5 (USD 0.15 at 1995 exchange rates) direct to manufacturers for processing into combs and brush handles. Ground turtle shell (preferably softshells) were being used by villagers in the treatment of eye allergies and the meat was considered beneficial in the treatment of tuberculosis. Juveniles were kept as pets by village children. In 1995 the level of turtle trade in this region appeared low although it was noted that there were indications that the trade was going 'underground' and that new trade routes were opening up (Hanfee, 1995). The current level of exploitation of the species is unknown.

According to Choudhury and Bhupathy (1993) 50-60% of turtles confiscated in Caluctta markets comprised *L. punctata*. Bhupathy *et al*. (2000) note that although most trade is for local consumption, a 'limited' number are smuggled out to Bangladesh.

Myanmar

No information is available on the specific exploitation of *L. punctata* in Myanmar (TRAFFIC Southeast Asia *in litt*. to TRAFFIC International, 29 November 2001). According to Platt *et al*., (2000) all chelonian species (except *L. scutata*) in Myanmar should be regarded as threatened by levels of harvest that are almost certainly unsustainable. Many turtles are collected for local consumption, but among some ethnic groups eating turtle flesh is discouraged by the belief that this practice is responsible for skin disorders, particularly among women. The majority of turtles collected are for the export market (primarily to China) which involves both live specimens and carapaces. In more remote areas, the meat is consumed locally and only the plastrons are sold to traders due to poor transport infrastructure.

A limited number of turtles are reportedly smuggled into Bangladesh (S.M.A. Rashid *pers. comm.*, cited in Platt *et al*., 2000).

Nepal

The species is threatened by extensive collection of sand and gravel from riverbanks, and the development of irrigation systems and power dams. Trade in turtles involves a relatively small percentage of the human population, primarily the Tharu, Darahi, Raji and Majhis, who sell both the meat and the eggs. However, there is considerable trade in turtles in several regions, including the Terai where *L. punctata* is found (Shrestha, 1997). The CITES Management Authority of Nepal (*in litt.* to IUCN/SSC Wildlife Trade Programme, 7 November 2001) reports that *L. punctata* provides a source of food for local communities, but the volume of this illegal harvest is unknown. There are very few reported incidents of poaching and illegal trade of the species in the southern part of Nepal.

Sri Lanka

In 1994, *L. p. punctata* was reported to be threatened by intensive use at the local level (I. Das *in litt.* to Species Survival Commission, Cambridge, 1994). A 1998 CAMP workshop identified hunting for food, habitat fragmentation and habitat loss as effective threats to the Sri Lankan population. It was also noted that the species' flesh is used for preparation of indigenous medicines (de Silva *et al*., 2000 cited in TRAFFIC Southeast Asia *in litt.* to TRAFFIC International, 29 November 2001).

INTERNATIONAL TRADE

L. p. punctata was listed on CITES Appendix I with effect from 1 July 1975. It is presumed that this listing had the intention of listing the yellow-spotted subspecies form which was later renamed to *L. p. andersoni* (Anon., 1994a). The United Kingdom entered a reservation on the listing on behalf of Hong Kong on 31 October 1976, which was withdrawn on 7 March 1978. The COP 9 amendment proposal, submitted by the Swiss Confederation on behalf of the Animals Committee, to list *L. punctata* in CITES Appendix II included the deletion of *L. p. punctata* from Appendix I. The listing came into effect on 16 February 1995.

A comparative tabulation of trade in *L. punctata* from 1995-2000 is given in the Appendix. Apart from one record of an export from Bangladesh of two *L. p. punctata* specimens seized upon import into the US, all reported

international trade has been in live specimens. Bangladesh has been the only reported country of origin for specimens in trade for 1995-2000 with total reported imports directly from Bangladesh totalling 352 live specimens for this period. Three hundred of these were imported by Japan, with the remainder being imported by the USA. Israel and Norway have been the only other reported destinations of *L. punctata*, each for one live specimen in 1995. Neither Bangladesh nor any of the other range States have established national voluntary export quotas for *L. punctata*.

In 1994, reviewers of the CITES amendment proposal for *L. punctata* noted that international trade did not appear to threaten the survival of *Lissemys*, but cautioned that there was a need to monitor this trade, particularly in light of the high-level trade in softshell turtles to East Asia (Anon., 1994b). As detailed below, it appears that in several range States today, indications of substantial illegal international trade, which in conjunction with strong domestic use in many range States, could pose a threat to the survival of *L. punctata* in the wild.

Several indications of illegal trade are given in the country sections below, however, there are also confirmed reports of illegal trade by way of seizure reports for the period 1995-present. Although not reported in their CITES Annual reports, the Japanese authorities seized the import of 198 live *L. punctata* specimens in 1995. Thirty of these were seized at Kansai International Airport upon import from Thailand. A further 13 live specimens were seized in 1998 (Ministry of Economics, Trade and Industry *in litt.* to TRAFFIC East Asia Japan, May 1999). The country of origin was unknown.

On 9 February 2001 at Chek Lap Kok Airport in Hong Kong, Customs officers seized a shipment from Bangladesh declared to contain crabs and eels. Upon inspection, the containers were found to contain approximately 800 live turtles including CITES Appendix I species and 556 live specimens of *L. punctata* (Agriculture, Fisheries and Conservation Department *in litt.* to TRAFFIC East Asia, 14 November 2001).

Bangladesh

All chelonian species found in Bangladesh are exploited for international trade with freshwater turtles becoming a major commodity for export as of the mid-1970s. However, the 1980s and early 1990s were the peak periods for commercial exploitation and export of turtles, and species such as *L. punctata* were exported 'unabated' during these periods, with exports destined primarily for the Far East, with some to the United Kingdom and the USA. Exports formerly involved only live specimens, however, there are now unconfirmed reports that the trade strategy has recently shifted to the export of frozen turtle meat under the label of other seafood products. The magnitude and volume of turtle exports increased significantly from 1995-1998 based on annual earnings (Anon., 1998a cited in Rashid and Munjural Hannan Khan, 2000). Rashid (*in litt*. to IUCN/SSC Wildlife Trade Programme, 7 September 2001) estimates that government reported trade figures for turtles are generally 60-70% lower than their true level since they rely solely on information provided by traders who under-report their export volumes.

Being of a small size, the species was previously an affordable source of meat for those on low incomes. Due to increased demand, prices have recently increased by 30-40% to 57-71 TK/kg (USD 1–1.25/kg) which has made the species unaffordable for many who used to buy it on a weekly basis (Rashid *in litt*. to IUCN/SSC Wildlife Trade Programme, 7 September 2001).

The capital city, Dhaka, is the major centre for the export of live turtles, but the port cities of Chittagong and Khulna also have turtle holding centres for export. As of 1998, there were 20 registered agencies spread across the country that were involved in the export of turtles (Anon., 1998b cited in Rashid and Munjural Hannan Khan, 2000). According to Bhupathy *et al*. (2000), few *L. punctata* are apparently exported. However, Rashid (*in litt.* to IUCN/SSC Wildlife Trade Programme, 7 September 2001) notes that although *L. punctata* is one of the most common species in local trade, trade in this species is no longer predominantly local. Rashid estimates that 60% of the current levels of *L. punctata* collection is intended for export. Turtle trading houses exist in the majority of cities and townships; these operate 24hrs/day and receive turtle consignments that are then supplied to exporters. When exporters have depleted stocks of another species intended for export, *L. punctata* is one of several species commonly substituted for the depleted species. Rashid estimates that virtually none of the *L. punctata* exported from Bangladesh is recorded because it is commonly being exported as substitute species and goes under the name of a different species.

Bangladesh is also reported to act as a trans-shipment port for turtles which are smuggled in from neighbouring India and Myanmar. Reportedly, the illegal trade goes in both ways, with large numbers of *L. punctata* reportedly being smuggled into neighbouring India (mainly Calcutta) for consumption (Rashid and Munjural Hannan Khan, 2000). According to CITES annual report data, two specimens of *L. p. punctata* exported from Bangladesh were seized upon import into the USA in 1998.

China

Documentation exists of trade in *L. punctata* in Chinese food markets: Meier (2000) reports that approximately 50 specimens of *L .p. andersoni* were offered at Qing Ping market, Guangzhou, on a single day in August 1995, and Salzberg (1998) noted that *L. p. andersoni* had been observed for sale in Guangzhou and/or Shenzhen markets in July 1997. The species was not recorded by Artner and Hofer (2001) in Chinese markets in 1999 or 2000, although *L. (p.) scutata* was encountered (cited in TRAFFIC Southeast Asia *in litt.* to TRAFFIC International, 29 November 2001).

On 20 April 2001, during a visit by TRAFFIC East Asia to Ruili on the China-Myanmar border, a trader was seen packing illegally imported *Lissemys (p.) scutata* into a crate measuring 1 x 1 x 1 m. The live specimens were individually wrapped in cloth and the box would have been full upon completion of packing. Depending on the packing method and material used, a crate this size could have contained between 300-700 turtles each of 1-2 kg in weight. The specimens were reported to have originated from Myanmar and were destined for Shanghai via Kunming for consumption as food (TRAFFIC East Asia and TRAFFIC Southeast Asia *in litt*. to TRAFFIC International, 9 November 2001).

India

Bupathy *et al.* (2000) note that although *L. punctata* is not being exported to China at this time, the species may be expected to enter the export trade as stocks of other Asian species decline and become unavailable. Illegal exports of *L. punctata* to unknown destinations have been observed (Hanfee, pers. obs. cited in Choudhury *et al.*, 2000).

Myanmar

The export of turtles from Myanmar is illegal (see Conservation Measures), however, the existence of large-scale illegal trade in turtles from Myanmar to China has long been suspected (Jenkins, 1995) and the presence of many species endemic to Myanmar in Chinese markets suggests extensive trade (Kuchling, 1995).

Japan

Live specimens of *L. punctata* are sold at pet shops within Japan. A brief web-based review of the availability of *L. punctata* in Japanese pet shops was conducted in October 2001. Both *L. p. punctata* and *L. p. andersoni* were advertised for sale at a cost per individual of JPY 58 000 (USD 486) and JPY 42 000 - 80 000 (USD 352-671) respectively. The most expensive individual was 23 cm in length and originated from Myanmar. Unpriced juveniles from reportedly captive bred sources were also advertised for sale (Anon., 2001b).

Thailand

Occasionally, animals have been observed for sale as pets in Chatuchak Market, Bangkok over the course of incidental market surveys during 1997-1999 (van Dijk, 1999).

The species has not been recorded in CITES reported international trade in other Southeast Asian countries (TRAFFIC Southeast Asia *in litt.* to TRAFFIC International, 29 November 2001)

CONSERVATION MEASURES

Import of *Lissemys* into the USA is affected by the four-inch (ten cm)-rule, which came into effect in the USA in 1975. This rule was imposed by the USA Food and Drug Administration to prevent transmission of turtle-associated *Salmonella* to children.

Bangladesh

The species is included in Schedule I of the Bangladesh Wildlife Preservation (Amendment) Act (BWPA) of 1974. This does not protect the species, instead such listed species can be hunted, captured and traded once a permit has been obtained from the relevant government office. Schedule III comprises a list of animals that are protected and can not be hunted, captured, traded; this includes all reptiles when immature or not fully-grown and therefore automatically includes juvenile *L. punctata*. Under the Act, the Forest Department (under the Ministry of Environment and Forest) is responsible for the deployment and enforcement of the Act. Other offices such as the Customs, Police, Bangladesh Rifles, and other authorities will render all assistance to the Forest Department for enforcement (Rashid and Munjural Hannan Khan, 2000). However, according to Rashid (*in litt*. to IUCN/SSC Wildlife Trade Programme, 7 September 2001), there is very little evidence of the enforcement of punitive measures as prescribed in the BWPA for collectors and traders involved in illegal collection or trade.

Specimens less than one kilogram in weight are not allowed to be exported, however, it has been known for under-weight specimens to have been exported (Rashid and Munjural Hannan Khan, 2000). Rashid (*in litt*. to IUCN/SSC Wildlife Trade Programme, 7 September 2001) believes it would be extremely difficult for the government to impose restrictions such as harvest or export quotas on this species since so little is known of its population size and actual levels of export. The Forest Department reportedly issues permits for 'limited quantities' of Schedule I species for export (Das, 2001). The CITES Scientific Authority has yet to be designated according to Rashid and Munjural Hannan Khan (2000), however, the CITES website states that the Bangladesh Wildlife Advisory Board serves as the Scientific Authority.

China

A new regulation has recently been imposed in China controlling the import of turtles into the country. Notification No. [2000]51, concerning the Strengthening the Live Reptile Import and Export Management issued by the China CITES Management Authority in June 2000, stipulates that:

6. Import of specimens listed in Appendix II of CITES are not allowed from those countries which have not established an annual export quota;

7. Commercial imports of all species from Indonesia, Cambodia and Thailand are suspended;

8. Imports into Guangdong and Hainan Provinces must arrive only in Guangzhou Baiyun Airport, Shenzhen Huangtian Airport and Haikou Meilan Airport. Imports into other provinces and municipalities are to be determined by the local administration. The import port should be indicated in the certificate of export/import.

India

The Indian Wildlife (Protection) Act of 1972 includes most native turtle species in its Schedules. *L. punctata* is included in Schedule I, which includes endangered species that may only be hunted under exceptional circumstances; trade is prohibited (TRAFFIC Southeast Asia *in litt*. to TRAFFIC International, 29 November 2001). Violations involving Schedule I species carry penalties of between two and six years imprisonment and fines. The judiciary has reportedly been lenient in imposing penalties for cases involving violations of wildlife laws (Bhupathy *et al*., 2000).

According to Bhupathy and Webb (cited in Anon., 1994a), eggs of *Lissemys* (species unstated, but probably *L. p. andersoni* based on distribution) are maintained and hatched in artificial hatcheries in Karnal and Lucknow and released in to the wild as part of the Turtle Rehabilitation programme. The current status of this initiative is unknown.

Myanmar

Blanket protection is extended to all wildlife species, but it is unclear whether this is provided all or in part by the Burma Wildlife Protection Act of 1936 (TRAFFIC Southeast Asia *in litt*. to TRAFFIC International, 29 November 2001). Protective legislation is enforced by the Wildlife Division of the Forest Department and the Department of Fisheries. The Department of Fisheries does not issue permits for the harvest of turtles and Law 34 provides stiff penalties for those engaged in turtle trading. Violators face a fine of USD 1500 and up to two years in jail; twenty

three people were sentenced to jail for turtle trading in 1998. However, the trade in turtles is so extensive that enforcement measures reportedly appear largely ineffectual. Turtles are protected in wildlife sanctuaries and national parks, but anti-poaching enforcement is reported to be minimal (Bhupathy *et al*., 2000; Platt *et al*., 2000). TRAFFIC Southeast Asia (*in litt*. to TRAFFIC International, 29 November 2001) believes that although Myanmar's current legislation prohibits the commercial exploitation of natural resources including tortoises and freshwater turtles, it allows collection for subsistence use.

Nepal

The species is protected and it is therefore illegal to harvest the species (CITES Management Authority of Nepal *in litt.* to IUCN/SSC Wildlife Trade Programme, 7 November 2001).

Pakistan

L. punctata was not included in any species protection legislation as of 1991. A federal ban was imposed in August 1981 on the export of all wild mammals, reptiles and certain birds including their parts, products and derivatives; the current state of this ban is unknown (Gaski and Hemley, 1991 cited in TRAFFIC Southeast Asia *in litt*. to TRAFFIC International, 29 November 2001).

Sri Lanka

The Fauna and Flora Protection Ordinance of 1938 provides for the establishment and regulation of national reserves and sanctuaries, governs the hunting, collecting and trade of wild fauna and flora, and establishes licensing and permitting requirements. The ordinance generally prohibits the commercial export of indigenous live wild birds, mammals and reptiles, their eggs, skins or other parts unless licensed. Das (2001) noted that *Melanochelys trijuga* and *L. punctata* are protected under the 1972 Amendment to the Ordinance, though the species are not listed by Gaski and Hemley (1991 cited in TRAFFIC Southeast Asia *in litt*. to TRAFFIC International, 29 November 2001).

CAPTIVE BREEDING

There is no known captive breeding of this species in Southeast Asia, outside China, and very limited information available on captive breeding of this species in South Asia (TRAFFIC Southeast Asia *in litt*. to TRAFFIC International 29 November 2001). However, the species appears relatively easy to raise in captivity.

According to the International Species Information System (Anon., 2001c) 4 males, 5 females and 15 specimens of unknown sex of *Lissemys punctata* are kept in zoos, no hatchlings have been reported within the last six months. At the subspecies level, a single female of *L. p. punctata* is kept in a zoo and for *L. p. andersoni,* 3 males, 2 females and 16 specimens of unknown sex are kept in zoos, no hatchlings have been reported in the last six months.

China

A visit was made to an indoor captive breeding farm in Nan Hai, Guangzhou, in October 2001, where a few *L. punctata* were observed. The facility claimed to breed approximately 200-300 specimens of *L. punctata*/year and that the species had been successfully bred in captivity for the past 10 years. The price (probably wholesale) was reported as RMB 40/kg (approx. USD 5/kg) (TRAFFIC East Asia and TRAFFIC Southeast Asia *in litt*. to TRAFFIC International, 9 November 2001).

India

The species thrives well in captivity (Anon., 1994a;b). Whitaker and Andrews (1998, cited in TRAFFIC Southeast Asia *in litt*. to TRAFFIC International, 29 November 2001) noted that 65 clutches had been laid and incubated at the Centre for Herpetology / Madras Crocodile Bank during 1988-1995. Whitaker (1998 cited in TRAFFIC Southeast Asia *in litt.* to TRAFFIC International, 29 November 2001) proposed that the species could easily be reared in village ponds for human consumption. Whitaker (pers comm. to TRAFFIC Southeast Asia, 8 December 2001) noted that no organised efforts were implemented to encourage village-level raising and management of the species, as this was already an established practice in various villages.

Bangladesh

There are no commercial turtle farms in operation in Bangladesh (Rashid *in litt.* to IUCN/SSC Wildlife Trade Programme, 7 September 2001).

Nepal

There are no captive breeding operations or restocking efforts for this species in Nepal (CITES Management Authority of Nepal *in litt.* to IUCN/SSC Wildlife Trade Programme, 7 November 2001).

Sri Lanka

There are apparently no organised attempts to breed *L. punctata* in captivity for either commercial or conservation purposes (de Silva *et al.*, 2000 cited in TRAFFIC Southeast Asia *in litt.* to TRAFFIC International, 29 November 2001).

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Annex

Comparative tabulation of all trade in *Lisemys punctata* 1995-2000

					Imports reported					Exports reported				
Year	**Taxon**	**Imp.**	**Exp.**	**Origin**	**Quantity**	**Units**	**Term**	**Purpose**	**Source**	**Quantity**	**Units**	**Term**	**Purpose**	**Source**
1995	Lissemys punctata	IL	NL	XX						1		Live	T	O
1995	*Lissemys punctata*	NO	DK	XX						1		Live	Z	U
1996	*Lissemys punctata*	JP	BD		200		Live	T						
1996	*Lissemys punctata*	JP	US	BD	20		Live	T	W	20		Live	T	W
1996	*Lissemys p. punctata*	US	BD		50		Live	T	W					
1997	*Lissemys punctata*	JP	BD		100		Live	T	W					
1998	*Lissemys p. punctata*	US	BD		2		Specimens		I					

Source: CITES annual report data compiled by UNEP-WCMC.

Pyxis planicauda Grandidier, 1867

Flat-tailed Spider tortoise
Pyxide à queue platte
Tortue de colna plana

Order: TESTUDINES

Family: TESTUDINIDAE

SUMMARY

The flat-tailed spider tortoise *Pyxis planicauda* is endemic to the Menabe region on the central west coast of Madagascar. Even within this small area, its distribution is fragmented and thought to be limited to a maximum of four dry deciduous forests. The maximum area of distribution is estimated to be 2 000-5 000 km^2, with its actual area of occupancy within that area thought to be between 11-500 km^2. The species is thought to have been extirpated from some forest fragments due to over-harvest and other disjunct populations may now be functionally extinct. Although the total population size is unknown, it is believed to be less than 10 000 individuals and declining although evidence in the form of formal population surveys is scant. The species is currently considered Endangered by IUCN and a workshop in 2001 proposed that the species be included in the IUCN category of Critically Endangered.

P. planicauda is a small tortoise, with a maximum carapace length of approximately 13.4 cm. The species matures at 12-14 years old and produces an estimated 1-3 eggs each year thereafter. The main threats to the species include habitat degradation and reduction, and the harvest of live animals as parental stock for commercial breeding facilities in Madagascar and for the international pet trade. The species' habitat was estimated to have decreased by 32% from 1960-1993, and it is estimated that it will be further reduced by 51-80% in total by 2006.

There is virtually no domestic trade in the species other than the harvest for commercial breeding purposes. All current trade is thought to consist of wild adult specimens. During 1990-2000, CITES reported data indicate that Madagascar exported approximately 100 live specimens, with the majority of these being exported in 1998 to Japan. Madagascar established export quotas for 2000 and 2001: the quota for 2000 was for 25 live specimens, which was later revised to 800 live specimens, and a zero quota was instituted for 2001. The export quota for 2000 is reported to have been exceeded by 324 animals, and the quota of 2001 by 40 animals. Anecdotal evidence suggests that illegal harvest and trade of *P. planicauda* occurs, potentially in very significant numbers. There is concern that the harvest of adults is not sustainable.

This species is considered difficult to breed in captivity, with poor success even in specialised breeding centres. In addition, the low rate of reproduction calls into question the feasibility of establishing effective and sustainable commercial captive breeding operations. However, since 1999, the species has been harvested to establish brood stock for commercial captive breeding operations in Madagascar. Seven establishments were reportedly licensed in 1999/2000 to take 200 individuals each from the wild, half for export and half to be retained for breeding purposes.

The species is recommended under Decision 11.106 for inclusion in category 1.

DISTRIBUTION AND POPULATION

Also known as the Madagascar flat-shelled tortoise, the flat-shelled spider tortoise and the flat-backed spider tortoise, the CITES species database notes that the distribution of *Pyxis planicauda* is limited to Madagascar (Anon., 2001a).

P. planicauda is classified as Endangered according the 2000 IUCN Red List (EN A1cd, B1+2bcd) Madagascar. This classification is based on a population reduction of at least 50% over the last three generations as indicated by a decline in area of occupancy, extent of occurrence and/or quality of habitat, and actual or potential levels of exploitation. The species has an extent of occurrence estimated to be less than 5 000 km^2 or area of occupancy estimated to be less than 5 000 km^2, with an inferred, observed or projected continuing decline in the: area of occupancy; area, extent and/or quality of habitat; and the number of locations or subpopulations (Hilton-Taylor, 2000)

The species was recently proposed for listing as Critically Endangered (CR A3acd) in the IUCN Red List by the participants of a CAMP workshop organised in Madagascar by the IUCN Conservation Breeding Specialist Group. This was based on an estimated, inferred or suspected population reduction of at least 80% over the next three generations, due to potential levels of exploitation, and a decline in the area of occupancy, extent of occurrence and/or quality of habitat) (Anon., 2001b). However, this proposed listing has yet to be formally reviewed by the Red List Authority.

The species is only found in dry deciduous lowland forest on the central west coast of Madagascar in the Menabe region of Toliara province. The Menabe region is delimited to the south by the Mangoky River, to the north by the Manambolo River, to the east by the Bemaraha massif, and to the west by the Mozambique channel (Rakotombololona, 1998). The distribution of *P. planicauda* within this area is fragmented through forest clearance. The species occurs from the River Morondava in the south to the Tsiribihina in the north; and one small population is known north of the Tsiribihina (Dr G. Kuchling, University of Western Australia, *in litt*. to IUCN/SSC Wildlife Trade Programme, 11 September 2001). *P. planicauda* is limited to pockets of lowland dry deciduous forest in the forests of Andranomena and Amborompotsy (north of the town of Morondava); the Kirindy Forest (which adjoins that of Amborompotsy) and the Shafotsy Forest (Bloxam *et al*., 1996; Rakotombololona, 1998; Tidd, *et al*., 2001). The species is thought to have been extirpated from some forest fragments due to over-harvest (R. Gibson, Durrell Wildlife Conservation Trust [DWCT], *in litt.* to IUCN/SSC Wildlife Trade Programme, 20 August 2001), and other disjunct populations may now be functionally extinct (Anon., 2001b).

The CITES Management Authority of Madagascar (*in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001) reports that the species' area of distribution is 190 000 ha (1 900 km^2), whilst Tidd *et al.* (2001) report a maximum of approximately 200 000 ha (2 000 km^2). At a recent CAMP workshop, the area of distribution was estimated to be between 101-5 000 km^2 and the actual area of occupancy of the species was estimated as just 11-500 km^2 (Anon., 2001b).

The habitat is estimated to have been reduced by 32% between 1960 and 1993 according to Tidd *et al*. (2001), and it is predicted that suitable habitat will be further reduced by 51-80% by 2006 (Anon., 2001b).

Although the total population size for *P. planicauda* is unknown, the species is believed to number fewer than 10 000 individuals in the wild, based on a combination of limited density estimates, reduction of habitat and recent levels of trade (Anon., 2001b). Tentative estimates of the numbers and density of the species have been made in small forest plots, but the estimates are subject to extreme error and great variation (Gibson, *in litt*. to IUCN/SSC Wildlife Trade Programme, 20 August 2001). In 1991, timed searches in 8 km^2 of the Kirindy Forest over several weeks identified 54 specimens, with ages ranging from less than one year to more than 22 years (Quentin and Hayes, 1991). A subsequent survey in 1996 to determine the density and abundance of *P. planicauda* was carried out in 20 000 m^2 (0.2 km^2) of the Kirindy Forest. During the course of the 11 day study, a total of 12 tortoises were encountered, and 83% of these were recaptured during the study. The small number of tortoises encountered and high recapture rate suggested that *P. planicauda* occurs in low densities in the Kirindy Forest, and therefore that numbers are correspondingly low (Bloxam *et al*., 1996). Density within the main forest block of the region has been estimated at 0.5 tortoises/ha (50 individuals/km^2). Higher densities of 2-6 tortoises/ha (200-600/km^2) have been recorded for fragmented, degraded areas (Durbin and Randriamanampisoa, 2000 cited in W.F. Rakotombololona and J. Durbin, DWCT, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001). The density at the site of greatest harvest was 1 tortoise/ha (100/ km^2) in February 2001 after two seasons of intense collection, but local people reported much higher densities before collection started (Rakotombololona, 2001 cited in Rakotombololona and Durbin, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001).

Summary of various *P. planicauda* studies

Date	Location	Area surveyed	No. of tortoises	Calculated density	Reference
1991	Kirindy	8 km^2	Tortoises encountered on 54 occasions?	?6.75/km^2 but no record of recapture rate	Quentin & Hayes, 1991
1996	Kirindy	20 000 ha (20km^2)	12 in 11 days 83% recapture	0.6/km^2	Bloxam *et al*., 1996

	"Main forest block"			0.5/ha (50/km^2)	Durbin & Randriamanampisoa, 2000
				2-6/ha (20-60/km^2) 1/ha (100/km$^{2)}$	Durbin and Randriamanampisoa, 2000 cited in W.F. Rakotombololona and J. Durbin, DWCT, *in litt.* to IUCN/SSC Wildlife Trade Programme, 23 November 2001 Kuchling; *in litt*. 2001; Rakotombololona, 2001 cited in Rakotombololona and Durbin, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001

There are some indications that population density is higher in some slightly degraded (but not cleared) forest areas than in natural, undisturbed forests. However, it is unclear if this observation is due to the fact that tortoises have concentrated in these degraded patches by moving there from surrounding areas which became unsuitable, or if slight degradation *per se* favours the species and results in higher densities. Due to the slow intrinsic population growth rate of the species and the rapid shrinking and deterioration of the forest habitats, the first scenario is thought more likely by Kuchling (*in litt.* to IUCN/SSC Wildlife Trade Programme, 11 September 2001). Conversely, the CITES Management Authority of Madagascar believes that the species prefers degraded habitat (*in litt.* to CITES Secretariat, November 2001). Kuchling notes that a density of one tortoise/ha (100/ km^2) may be a reasonable estimate for most habitats, however, he cautions that although population surveys continue to be undertaken by the DWCT, data are still insufficient to enable population modelling and the current research intensity may not be sufficient to provide adequate data. This may be particularly true since much of the current work on distribution and population of *P. planicauda* is often secondary work added to field surveys undertaken on the Endangered Malagasy Giant Rat *Hypogeomys antimena* (Gibson, *in litt*. to IUCN/SSC Wildlife Trade Programme, 20 August 2001).

HABITAT AND ECOLOGY

The species is known locally as Kapidolo (pronounced Kapidool) and has a dorso-ventrally flattened tail giving rise to its common name (Gibson, *in litt*. to IUCN/SSC Wildlife Trade Programme, 20 August 2001). Identification of the species is manageable for a competent herpetologist but is considered difficult for anyone else because it resembles *P. arachnoides* (TRAFFIC Southeast Asia, *in litt*. to TRAFFIC International, 29 November 2001; Rakotombololona and Durbin, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001).

P. planicauda is a small tortoise, with a maximum carapace length of approximately 13.4 cm (Kuchling and Bloxam 1998). Males weigh approximately 300-400 g and females 475-670 g (Bloxam and Hayes, 1991; Rakotombololona, unpub, cited in Razandrimamilafiniarivo *et al*., 2000). The species enters torpor throughout the dry season from April/May to November/December (Gibson, *in litt.* to IUCN/SSC Wildlife Trade Programme, 20 August 2001). After the rains, *P. planicauda* individuals become most active and are relatively easy to find, particularly in January and February. At this time, it is thought to be relatively easy to find all the individuals in a single area (Rakotombololona and Durbin, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001).

It takes at least 10 years for secondary sex characteristics to become visible in *P. planicauda* (Durbin and Randriamanampisoa, 2000 cited in Rakotombololona and Durbin, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001). Sexual maturation is estimated to occur at 12-14 years of age and females also have a very limited reproductive output; only 1-3 eggs are laid per breeding season (i.e. per year) (Anon., 2001b). The incubation period is 911months with eggs hatching en masse in early November. Data on the species' reproductive biology, activity, and behaviour continues to be collected in captive colonies at Jersey Zoo and DWCT in Madagascar, as well as elsewhere outside Madagascar (Gibson, *in litt*. to IUCN/SSC Wildlife Trade Programme, 20 August 2001). Health problems including intestinal and blood parasites have been observed in both captive and wild individuals, and these have caused numerous mortalities in captivity (Lopéz, 2001 cited in Rakotombololona and Durbin, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001).

THREATS TO SURVIVAL AND DOMESTIC USE

The habitat of *P. planicauda* is fragmented and disappearing rapidly (Anon., 2001b; Tidd, *et al*., 2001). Based on analyses of satellite images, the species' habitat of primary, dense dry forests was estimated to have been reduced by 32% between 1963 and 1993 Between 1963 and 1993 the area of primary dense forest declined from 162 000 to 133 000 ha in the Tsiribihina to Tomitsy area, from 54 000 to 36 000 ha in the Tomitsy to Morondava area, and from 93 000 to 41 000 ha in the Morondava to Maharivo area. The total loss of primary dense forest was 99,000 ha, or 32 % of the 1963 forest. Deforestation rates are reported to be increasing, and as much as 50% of the 76 000 ha remaining in the southern portion of the species' range may be destroyed before 2010. A 50% reduction in the remaining 73 000 ha of habitat in the northern portion of its known range may occur by 2040 (Tidd *et al*., 2001). At a recent CAMP workshop, it was suggested that 51-80% of the species' habitat may be lost in the next 5 years (Anon., 2001b), however, the basis for this estimate is not clear. This high rate of habitat destruction is aggravating the impacts of trade (Kuchling, *in litt*. to IUCN/SSC Wildlife Trade Programme, 11 September 2001). This habitat disturbance and the associated decrease in habitat quality may render the species increasingly unlikely to survive their periods of torpor and/or reduce their ability to obtain sufficient nutrition for egg production (Gibson, *in litt*. to IUCN/SSC Wildlife Trade Programme, 20 August 2001). The size of the population is not stable and is decreasing due to collection for commercial trade, fires and the clearing of forests (CITES Management Authority of Madagascar, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001). According to (Anon., 2001b), the population is predicted to reduce by 80% during the next three generations.

Natural predators are not generally thought to threaten the survival of the species. However, increased numbers of introduced predators (e.g. cats, dogs, mongoose, pigs) will increase both egg and neonate, and possibly adult mortality. The species is especially susceptible in the dry season as they are unable to take any preventative measures whilst they are in a state of torpor. The occurrence of domestic/semi-feral dogs increased dramatically with forest fragmentation and opening up of the forest for logging and oil exploration (Gibson, *in litt*. to IUCN/SSC Wildlife Trade Programme, 20 August 2001; Kuchling, *in litt*. to IUCN/SSC Wildlife Trade Programme, 11 September 2001). Predation by dogs and the Bushpig *Potamochoerus larvatus*, as well as flooding caused by cyclones, are listed as threats to the species by the CITES Management Authority of Madagascar (*in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001).

The species is thought to have been extirpated from some forest fragments due to over-collection for commercial trade. Such recent collection (1998-2001) has imperilled many of the disjunct elements of the population, and some of these may now be functionally extinct. If reproductive females in particular are collected, the capacity of the population to recover is thought to be severely compromised due to its low reproductive rate (Anon., 2001b; Gibson, *in litt*. to IUCN/SSC Wildlife Trade Programme, 20 August 2001; Rakotombololona and Durbin, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001). Participants of a recent CAMP workshop considered that the species is highly unlikely to be able to sustain adult harvest, at even modest levels (Anon., 2001b).

The species is not apparently consumed for food within Madagascar and there is no local use of any of their parts (CITES Management Authority of Madagascar, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001; Rakotombololona and Durbin, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001). Although at a local level the species may be offered as pets to tourists, trade at the national level is thought to be only for international export for the pet trade (Gibson, *in litt*. to IUCN/SSC Wildlife Trade Programme, 20 August 2001). Collection from the wild has only commenced in significant numbers since late 1999 according to Rahagalala and Randrianasolo (2001 cited in Rakotombololona and Durbin, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001). All current trade is thought to be comprised of wild adult specimens (age 10 years plus), since captive breeding operations within Madagascar have been in operation only since late 1999 (Durbin and Randriamanampisoa, 2000 cited in Rakotombololona and Durbin, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001). However, "captive bred" specimens have been advertised for sale in Japan.

Live adult *P. planicauda* are bought by intermediaries from villagers within the tortoise's range. These individuals are either sold on to traders for export or for commercial captive-breeding. Permits were issued by the Malagasy Eaux et Forêts authorities to at least seven operations in 1999 and 2000 allowing each to collect 200 *P. planicauda*, of which 100 would be kept for captive breeding purposes and 100 would be exported (Direction Général des Eaux et Forêts, pers. comm., cited in Rakotombololona and Durbin, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001).

The CITES Management Authority has confirmed that illegal harvest and trade of *P. planicauda* possibly takes place and they are investigating such activities (CITES Management Authority of Madagascar, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001). Anecdotal information also suggests that illegal collection and trade occurs, but the majority of tortoises collected are reported to appear to be sold on to established trading operations. An example quoted by reviewers involves traders asking villagers to collect tortoises, with the local people being paid FMG 3 000-5 000 (approximately USD 0.5-0.85) per animal (Rakotombololona, 2000 cited in Rakotombololona and Durbin, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001). This collection has been reported to have effectively extirpated the tortoise population in the south-western part of its range (Toto Volahy and Rakotombololona, 2001 cited in Rakotombololona and Durbin, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001). Very recent information suggests that harvest has spread to Masoarivo in the northern part of the range in late 2001 (Rakotombololona and Durbin, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001).

INTERNATIONAL TRADE

The listing of *P. planicauda* in CITES Appendix II entered into effect in 1 July 1975. The United Kingdom (hereafter referred to as the UK) entered a reservation on the *Pyxis* spp. listing on behalf of Hong Kong on 31 October 1976, which was withdrawn on 3 July 1978 (Anon., 2001a).

A comparative tabulation and gross and net trade data for all trade in *P. planicauda* for 1990-2000 are given in the Annex. According to the comparative tabulation data, a total of 106 specimens have been reported as being exported or re-exported during this period. Madagascar has reported exporting a total of 80 live specimens (60 of these for trade and 20 for breeding / scientific purposes) and two bodies of *P. planicauda* (for scientific purposes) for 1990-1998. The USA has also reported importing 20 live specimens from Madagascar in 1999, thus, according to available data, the total exports from Madagascar are a minimum of 100 specimens for 1990-1999. The majority of these exports occurred in 1998. The main importer of *P. planicauda* was Japan. Other destinations for *P. planicauda* included Germany, Indonesia, the Russian Federation, the UK and the USA. Since the species is endemic to Madagascar, the export records from Indonesia, Nigeria and Thailand that do not mention Madagascar as the country of origin are likely to be incomplete.

Madagascar has established voluntary export quotas for *P. planicauda* for 2000 and 2001:

> 2000: 25 live specimens (CITES Notification No. 2000/035), later revised to 800 live specimens (CITES Notification No. 2000/053.)
>
> 2001: 0 live specimens (CITES Notification No. 2001/041).

The basis for setting these quota levels is not known. According to the CITES Management Authority of Madagascar (*in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001), a cautious export quota was established for the total period 2000-2001 of 1 200 individuals which was said to have been completely used in 2000. Therefore the quota for 2001 was revised to zero. This information indicates that the quota established for 2000 was not respected.

Data for trade occurring in 2000 and 2001 is scarce since the annual report for 2001 is not yet due, Madagascar has not submitted an annual report for 2000 (nor for 1999), and the vast majority of data from countries of import for 2000 are not yet available for review. It is therefore not possible to compare the export quota against levels of specimens reported in CITES trade data.

However, some import data is available from a small number of Parties. A total of 911 individuals were reported to have been imported into the USA in 2000 (Balcet, *in litt*. July 2001 cited in Rakotombololona and Durbin, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001). Switzerland directly imported from Madagascar 63 live *P. planicauda* specimens in 2000, and 90 live specimens in 2001. Whilst the export permit for 50 of the 90 animals imported in 2001 was issued in December 2000, the export permit for the remaining 40 animals was issued in January 2001. After this time Switzerland prohibited the import of *P. planicauda* (CITES Management Authority of Switzerland, *in litt.* to TRAFFIC Europe, November 2001 cited in TRAFFIC Europe, *in litt.* to TRAFFIC International, 8 November 2001). In February 2001, 100 live specimens of *P. planicauda* were imported into the Czech Republic from Madagascar; whilst the export permit was issued in December 2000 (CITES Management Authority of the Czech Republic, *in litt*. to TRAFFIC Europe, October 2001 cited in

TRAFFIC Europe, *in litt.* to TRAFFIC International, 8 November 2001). The total number of specimens reported here to have been imported from Madagascar during 2001 apparently exceeded the 2001 quota by 324 specimens, although details of the dates of when the export permits were issued would be required before this figure could be confirmed.

Both Swiss and Czech traders have offered *P. planicauda* for sale to hobbyist circles in EU Member States for between EUR 760-820 (approximately USD 685-740) per specimen (DGHT Chelonian Working Group, *in litt*. to TRAFFIC Europe, October 2001). Live specimens of *P. planicauda* were also offered for sale by a trader in Austria (TRAFFIC Europe-Germany, pers. obs., September 2000, cited in TRAFFIC Europe, *in litt.* to TRAFFIC International, 8 November 2001).

A brief internet review of Japanese pet shops during October 2001 revealed that six shops were advertising the sale of species with the common name as "Madagascar flat shell tortoise". Both juvenile and adults have been offered for sale. Some individuals, of an unspecified age, were stated to derive from captive breeding operations even though other sources report that all trade involves wild specimens only. Prices ranged from JPY 45 000-210 000 (USD 377-1 760) per specimen (TRAFFIC East Asia Japan *in litt.* to TRAFFIC International 5 November 2001). Eight adult specimens of *P. planicauda* were observed in a single pet shop in Hong Kong in October 2001, but no prices were advertised (TRAFFIC East Asia and TRAFFIC South East Asia, *in litt*. to TRAFFIC International, 9 November 2001). There are unconfirmed records of the species being offered for sale as pets in Bangkok, Thailand (TRAFFIC South East Asia, *in litt*. to TRAFFIC International, 29 November 2001).

Due to the species very low fecundity, there is no possibility that animals in international commercial trade are captive bred in the strict CITES sense at this time (Gibson, *in litt*. to IUCN/SSC Wildlife Trade Programme, 20 August 2001). Since captive breeding operations for commercial purposes have only been established since late 1999 and the species takes at least 10 years to reach sexual maturity, this statement will presumably apply till approximately 2010. In the meantime, juveniles could be obtained from gravid females if Madagascar continues to allow harvest from the wild.

The volume of CITES reported trade is believed to underestimate the total export volume, with the number of specimens being offered by traders thought to be higher than the official export quotas (Kuchling, *in litt*. to IUCN/SSC Wildlife Trade Programme, 11 September 2001). Although there are no supporting data, trade in recent years is reported to have greatly exceeded the export quota. There have been anecdotal reports of several thousands of *P. planicauda* specimens reaching the USA over the past 2-3 years, and many hundreds reaching Europe, especially the Czech Republic (Gibson, *in litt*. to IUCN/SSC Wildlife Trade Programme, 20 August 2001).

CONSERVATION MEASURES

Import of *P. planicauda* into the USA is affected by the four-inch (10 cm)-rule, which came into effect in the USA in 1975. This rule was imposed by the USA Food and Drug Administration to prevent transmission of turtle-associated *Salmonella* to children.

Although several reviewers were not aware of any national protection measures for the species, the CITES Management Authority of Madagascar (*in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001) states that the species is protected at the national level by Ordinance No. 60-126 of 3 October 1960 which regulates hunting and fishing and provides for the protection of nature. However, it is not stated what level of protection this legislation affords to *P. planicauda,* or how this is enforced. According to Kuchling (*in litt*. to IUCN/SSC Wildlife Trade Programme, 11 September 2001), the species is fully protected under Malagasy law.

The CITES Management Authority of Madagascar (*in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001) notes that wild harvest is controlled through a permit system. It also reports that the species and / or its habitat is also protected by traditional taboos, as well as the presence of national parks and private nature reserves. However, according to Kuchling (*in litt*. to IUCN/SSC Wildlife Trade Programme, 11 September 2001), no habitat is effectively protected, particularly the most suitable habitats.

The Durrell Wildlife Conservation Trust (DWCT) has signed a protocol with the government of Madagascar for the conservation of endangered species (Anon., 1994). Within the framework of the protocol, numerous permits have been issued so that DWCT have been able to undertake research into the distribution and status studies of

P. planicauda. However, no advice has been sought from DWCT by the Malagasy CITES Authorities regarding the impact of collection activities or appropriate harvest and trade levels (Rakotombololona and Durbin, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001).

CAPTIVE BREEDING

This species has proved difficult to rear and breed in captivity with poor success even in specialised breeding centres (Anon., 2001c cited in Rakotombololona and Durbin, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001; Razandrimamilafiniarivo *et al.*, 2000. The low rate of reproduction calls into question the feasibility of establishing effective and sustainable commercial captive breeding operations. However, the Ministry of Water and Forests has tried to promote the captive breeding of *P. planicauda* (CITES Management Authority of Madagascar, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001). Since late 1999, at least seven breeding operations intending to breed the species in captivity for commercial purposes have been established in Madagascar (Rakotombololona and Durbin, *in litt*. to IUCN/SSC Wildlife Trade Programme, 23 November 2001).

DWCT initiated captive breeding of the species in Madagascar for conservation purposes in the late 1980s. From 1995-1999, the project had produced 19 *P. planicauda* hatchlings; by the end of 2000, only 7 of these (37%) had survived (Razandrimamilafiniarivo *et al*., 2000). Only two *P. planicauda* individuals are known to have been bred outside Madagascar, both at the Jersey Zoo in the UK, the first in August 1995 and the second in June 2001 (Buley and Gibson, in press, cited in TRAFFIC Europe, *in litt.* to TRAFFIC International, 8 November 2001; Gibson, *in litt*. to IUCN/SSC Wildlife Trade Programme, 20 August 2001).

The species is more widespread in zoos as a result of recent legal and illegal trade [the latter presumably referring to seized specimens] according to Gibson (*in litt*. to IUCN/SSC Wildlife Trade Programme, 20 August 2001). According to the International Species Information System, 30 males, 37 females and 1 specimen of unknown sex of *P. planicauda* are kept in zoos, 1 hatchling has been reported within the last six months (Anon., 2001d).

The species is only rarely kept among hobbyists in Europe and there are no known successful captive breeding activities in Europe. The lack of breeding success in Europe may not necessarily be due to the species being difficult to breed in captivity, but rather that the species has not been kept extensively in captivity according to V. Loehr (Chelonian Society of the Netherlands and Chair of the European Studbook for *Pyxis*, pers. comm. to TRAFFIC Europe, October 2001 cited in TRAFFIC Europe, *in litt.* to TRAFFIC International, 8 November 2001).

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Annex

Comparative tabulation of all trade in *P. planicauda*, 1990-2000

				Imports reported					**Exports reported**			
Year	Imp.	Exp.	Origin	Quantity	Units	Term	Purpose	Source	Quantity Units	Term	Purpose	Source
1990	GB	MG							6	Live	S	
1993	GB	MG		8		Live						
1993	US	GB	MG	8		Live	T	W	8	Live		
1995	GB	MG							4	Bodies	S	W
1995	RU	NG							2	Live	Z	W
1995	US	MG		5		Live		W	5	Live	S	W
1996	US	MG							2	Live	S	W
1996	US	MG		2		Specimens		O				
1997	GB	MG							3	Live	S	W
1998	GB	GB	MG	2		Bodies	S	F				
1998	GB	GB	MG	2		Bodies	S	W				
1998	GB	MG							2	Bodies	S	W
1998	ID	MG		4		Live	T	W	4	Live	B	W
1998	JP	MG							60	Live	T	W
1998	US	JP	MG	5		Live	T	W				
1999	HK	ID	MG	2		Live	T	W				
1999	US	ID							4	Live	T	W
1999	US	ID	MG						6	Live	T	W
1999	US	MG		20		Live	T	W				
1999	US	TH		1		Live	T	W				
2000	DE	HK	MG	2		Live	B	W				
2000	DE	US	MG	3		Live	B	W				

Source: CITES annual report data compiled by UNEP-WCMC.

Gross and net trade in *P. planicauda*, 1990-2000

Year	Term	Unit	Exp./Imp.	Origin	Gross exports	Gross imports	Net exports	Net imports
1990	Live		GB		0	6	0	6
1990	Live		MG		6	0	6	0
1993	Live		GB		0	8	0	8
1993	Live		MG		8	0	8	0
1993	Live		GB	MG	8	0	8	0
1993	Live		US	MG	0	8	0	8
1995	Bodies		GB		0	4	0	4
1995	Bodies		MG		4	0	4	0
1995	Live		MG		5	0	5	0
1995	Live		NG		2	0	2	0
1995	Live		RU		0	2	0	2
1995	Live		US		0	5	0	5
1996	Live		MG		2	0	2	0
1996	Live		US		0	2	0	2
1996	Specimens		MG		2	0	2	0
1996	Specimens		US		0	2	0	2
1997	Live		GB		0	3	0	3
1997	Live		MG		3	0	3	0
1998	Bodies		GB		0	2	0	2
1998	Bodies		MG		2	0	2	0
1998	Bodies		GB	MG	4	4	0	0
1998	Live		ID		0	4	0	4
1998	Live		JP		0	60	0	60
1998	Live		MG		64	0	64	0
1998	Live		JP	MG	5	0	5	0
1998	Live		US	MG	0	5	0	5
1999	Live		ID		4	0	4	0
1999	Live		MG		20	0	20	0
1999	Live		TH		1	0	1	0
1999	Live		US		0	25	0	25
1999	Live		HK	MG	0	2	0	2
1999	Live		ID	MG	8	0	8	0
1999	Live		US	MG	0	6	0	6
2000	Live		DE	MG	0	5	0	5
2000	Live		HK	MG	2	0	2	0
2000	Live		US	MG	3	0	3	0

Source: CITES annual report data compiled by UNEP-WCMC.