AMENDMENTS TO APPENDICES I AND II OF THE CONVENTION

Proposals submitted pursuant to Resolution on Ranching

A. PROPOSAL

Transfer of the Ecuador population of *Melanosuchus niger* from Appendix I to Appendix II.

B. PROPONENT

Ecuador.

C. SUPPORTING STATEMENT

1. Taxonomy

11. Class: Reptilia

12. Order: Crocodylia

13. Family: Crocodylidae

14. Species: *Melanosuchus niger*

15. Common Names: English: Black Caiman
French: Caïman noir
Spanish: Cocodrilo negro, Lagarto

16. Code Numbers:

2. Biological Data

21. Distribution: The black caiman is widely distributed throughout the Amazon River basin, but populations are known from peripheral areas outside the Amazon as well. Range countries include Bolivia, Brazil, Colombia, French Guiana, Guyana, and Peru (Thorbjarnarson, 1992).

In Ecuador, Asanza (1992) outlines the current distribution as follows: "Significant populations can still be found in the Aguarico River system (Cuyabeno Lakes and River), Guepi, (Lagartococha Lake/River system), Imuya, Pacuya, and Zancudococha Lakes, Cocaya River); The Napo River system (Jivino and Indillana Rivers, Taracoa, Limoncocha, Anango, Challuacocha and Panacocha Lakes, Tiputini and Yasuni Rivers, Garzacocha and Jatuncocha Lakes; lower Nashino and Cononaco Rivers; The middle and lower Curaray River; lower Pindoyacu River; the Pastaza River system (Bufeo, Capahuara and lower Ishpingo Rivers); lower Yaupi and upper Norona Rivers (Fig. 2 in attached report). Hines and Rice (1994) found black caiman throughout the Napo river system,in the region of the Lagartococha and the Yasuni. They also report on one survey along the Bobonaza to the lower Pastaza, then up to the mouth of the Ishpingo. They found no black caiman, and local Indians indicated that none occurred there. Additional surveys should be conducted in the Pastaza River system to clarify black caiman distribution in this portion of Ecuador.

22. Population: Populations of black caiman are considered to be severely depleted in four of the seven nations in which the species occurs, and are depleted in the remainder (Thorbjarnarson, 1992). However, in areas where surveys have been conducted, it appears

that viable populations are present. In Bolivia (Pacheco, 1993) found densities of *M. niger* that appear to be comparable to other recovered crocodilian populations. Even though Paycheck felt that black caimans were still recovering from past over-harvest, he reported densities among the most abundant of those studied thus far in South America (Table 1). In Guyana, *M. niger* is also reported to be relatively abundant (Gorzula and Woolford, 1990 in Thorbjarnarson, 1992). Thorbjarnarson (1992) also cites relatively good populations remaining scattered in isolated areas of Guyana, Peru, Ecuador, and Brazil.

In an area so vast as that encompassed by the range of the black caiman, much effort and money would be necessary to determine status range wide. However, it is noteworthy that during the period (1950s to 1970s) when black caiman populations were thought to be depleted by commercial hunting throughout much of its range (Groombridge, 1987) (King and Videz Roco, 1989), the American alligator (*Alligator mississippiensis*) was also classified as endangered. After extensive status research, biologists found that even though populations had been reduced, it was largely the visible portion that was depleted and a viable population of wary animals still existed (Hines, 1979). The same scenario has been observed in other crocodilians (Hollands, 1987). Because of these observations, it is unwise to reject the possibility of healthy black caiman populations in appropriate habitat anywhere in the species range.

In Ecuador (Asanza, 1992) reported mean densities on the Cuyabeno Lakes and Cuyabeno Lake and River systems as 5.68 animals/km and 3.15 respectively at a ratio of one *M. niger* to five *Caiman crocodilus*. He also reported densities of 23.53 and 23.59 animals/km on Zancudococha and Imuya with a ratio of 3 *M. niger* to one *C.crocodilus*.

Asanza reported one area as declining (Limoncocha); total counts have dropped from 400+ to 100+ animals. However, he provides no data on size structure of the population nor does he report any effort to account for the effect of very intensive tourist use of the area which may be introducing a serious wariness bias into nightlight surveys.Other biologist have noted that harassment resulting from repeated surveys, or night hunting may affect observability (Woodward pers. comm.) (Delaney *et al.*, 1986).

Surveys conducted in 1992 and 1993 along 18 permanently established routes revealed densities ranging from 0 to 13.25 black caimans/km. On two of the 18, no black caiman were observed. But on one of those, (Yuturi), one 2m+ animal was observed during the daylight (Hines and Rice, 1994) (Table 1). The Ecuador populations appear healthy when compared with other crocodilian populations (Woodward and Moore, 1990, Pacheco, 1993). Data presented in Table 3 provides insight into the similarities in nightlight survey data from other crocodilian populations in other parts of the world.

A viable population will have all size (age) classes represented in it with the smaller animals making up the largest proportion of the total. Size class distribution data observed on the surveys reported on by Hines and Rice (1994) appears to have a size/age distribution typical of a healthy population with 34% <0.6m and 29%>1.8m (sexually mature) (Fig. 1).

23. Habitat: The black caiman occupies a variety of habitats including larger rivers, streams, oxbow lakes and in some cases, seasonally flooded savannahs (Thorbjarnarson, 1992). Observations made during the 1992-93 surveys in Ecuador suggest that lagoons and oxbows are preferred habitat (Hines and Rice, 1994).

Habitat partitioning between *C. crocodilus* and *M. niger* may occur as suggested by Magnusson (1982). In Ecuador it appears that *M. niger* prefers lagoons and slower moving waters, while *C. crocodilus* will occupy streams or lagoons (Hines and Rice, 1994). However, some areas that appear to be good black caiman habitat are dominated by

common caiman suggesting that the later were more effective competitors after past populations were reduced (Asanza, 1992) and (Hines and Rice, 1994).Hines and Rice report that 71% of the animals observed on their surveys were black caimans (Table 2). However, they also emphasize that they were seeking black caiman habitat to survey.

There are few published data describing black caiman habitat in detail. In Bolivia (Pacheco, 1993) found that larger individuals tend to be found more often in open water and less often in both water and vegetation than the smaller ones. Observations made during population surveys in Ecuador indicate similar habitat use. In fact, young were always found in close proximity to vegetative cover and the necessary components of good black caiman production appear similar to alligator production habitat (Hines and Rice, 1994). Continued investigation into what constitutes the important components of habitat is important in regard to the future management and conservation of black caiman.

3. Trade Data

31. National Utilization: There are no large tanneries in Ecuador capable of producing leather of the quality of those in Japan, Europe, and other parts of South America. However, there are manufacturers capable of producing quality goods from tanned leather. The market for such goods within the country is probably limited to a few hundred skins per year. The possibility of in-country tanneries and manufacturers expanding always exists.

The market for meat is unknown. Caiman meat is widely eaten in the Amazon region but that may or may not translate to market demand throughout the country. Also, export market prices may be high enough to make it unattractive in local markets.

32. Potential Legal Trade: The major market for raw black caiman skins is export to Europe and the Pacific rim with some skins going to South American tanneries. It has been about 20 years since the black caiman was a significant item in the skin trade. According to interviews with tanners and manufacturers, the black caiman skin appears to rank in the low end of the classic designation (Ashley pers. comm.). The fact that past trade throughout the range may have numbered five million skins during the 1960s (Fitthau, 1973) would appear to substantiate a reasonably high demand. Asanza (1992) reports that in Ecuadorian Amazonia during a period of 40 years (1930-1970) 500,000 skins were taken.

A rapidly grown ranch caiman harvested at 1.2 to 1.7 meters may, in fact, produce a belly skin that is less bony, easier to work and more nearly a classic skin than skins from those animals harvested from the wild.

Black caiman skins will have to compete with the 300,000 legal classic skins already in the market (Ashley pers. comm.). In the beginning, because these skins have slightly different characteristics than other crocodilians there may be a market niche for black caiman skins.

The total number of skins the market will absorb at profitable prices is unknown. However, the numbers proposed to be produced for the next 3-5 years can undoubtedly be absorbed at current world prices.

33. Illegal Trade: There are few, if any, black caiman skins moving in the international market now (Ashly pers. comm.). There are rumours of small numbers of skins being tanned in some areas of South America. But, for the most part, it appears that there is very little commercial utilization.

There are reports of hatchlings being taken in Ecuador (Asanza in Thorbjarnarson, 1992) but it is highly probable that if it is occurring it is having little impact.

34. Potential Trade Threats

A ranching programme with a tagging system in place does not threaten wild populations. Furthermore, an enforced size limit on skins exported further reduces the prospects of trade adversely affecting wild caiman stocks.

The possibility of skins being taken illegally from another country or within Ecuador and exported through legal channels exists. However, a well developed legal industry within Ecuador, plus a government commitment to enforce tagging of exported animals, will counter the majority of such illegal efforts.

4. Protection Status

41. National: Ecuador became a signatory of CITES in 1975 and the controls afforded by this treaty provides regulation regarding exports.

Ecuadorian law regulates the protection and management of all wildlife within its borders. The following is the translation of the "Ley Forestal y de Conservación de Areas Naturales y Vida Silvestre y su Reglamento General de Aplicación" which is the law regarding wildlife.

FOREST LAW.

Title II, Chapter III

Art. 76.- All wildlife is under government jurisdiction and it corresponds to the Agriculture and Cattle Ministry (MAG) to protect, manage and conserve it, for which is shall exercise the following functions.

a) The MAG shall control the hunting, collecting, apprehension, transport and trade of animals and other elements of wildlife;*
b) It shall prevent and control soil and water contamination, as well as the degradation of the environment.
c) Protect and prevent the loss of threatened or endangered species.*
d) Establish animal ranches, nurseries, botanic gardens, and research stations to investigate the reproduction, and promote wildlife.*
e) Develop activities that demonstrate the use and domestic exploitation of wildlife, using methods that maintain its integrity;*
f) Comply and insure the compliance of national and international conventions on environmental and wildlife conservation;* and
g) Any other that the law and regulation assign.

Art. 77.- The utilization of wildlife not encompassed within the natural areas managed by the State, will be regulated by the MAG, which shall determine which species may not be captured, utilized, collected and/or exploited.

FOREST LAW, RULES FOR APPLICATION

Chapter VII

On the control and movement of forestry products and wildlife.

Art. 146.- The MAG shall authorize through the national forestry programme, the export of specimens, wildlife products and byproducts for scientific and educational purposes, or exchange between scientific institutions. The MAG shall also authorize the export when said species reach a reproductive level that alters the natural balance, or when said specimens have been obtained through adequate management procedures in captive or semi-captive programmes.

Title II

Of the natural areas and wildlife.

*Reform

Art 2.- Art. 199 shall read:
" Art. 199.- The activities permitted within the natural areas System of the State, are as follows: preservation, protection, investigation, recovery and restoration, education and culture, recreation and controlled tourism, controlled sports hunting and fishing, reasonable exploitation of wildlife.
These activities shall be authorized by the National Forestry Directory, on the bases of the category of management of natural areas."

LAW No.08, LAW TO ESTABLISH THE "INSTITUTO ECUATORIANO FORESTAL Y DE AREAS NATURALES Y DE VIDA SILVESTRE (INEFAN)

ART.2.- The INEFAN is the executive organism that the Agriculture and Cattle Ministry has given the authority on the Forestry Law, Conservation of Natural Areas and wildlife. Its general application rules and other general dispositions and regulations applied to Forest resources, Natural Areas and Wildlife.

There is presently an ongoing effort to rewrite much of Ecuadorian wildlife law. Section 7 of this document proposes a three year experimental approach to caiman ranching with specific commitments in regard to tagging, farm registrations and quotas.

During the three year experimental period, the regulatory process will continue to be adjusted so that ranching can continue to operate within the constraints of established optimum sustained yield principles.

In addition to international and national laws which are designed to protect black caiman within Ecuador, large land areas are set aside as reserves and national parks which offer some additional protection. A summary of these areas is provide in (Fig. 2).

Illegal commercial hunting does not appear to be widespread even though there are occasional rumors that it is occurring. Also, there may be some random killing where large animals come into contact with regular human activity. In many cases, the value placed upon the opportunity to collect eggs or hatchlings will provide a strong incentive for local people to protect their caiman from these activities.

Caiman are widely eaten by people in the Amazon region. However, *C. crocodilus* and *Paleosuchus* sp. are preferred over *M. niger*. There are reports of large black caimans being taken for medicinal purposes (Hines and Rice, 1994). None of these appear to pose a serious threat to the status of black caiman.

4.2 Neighbouring Countries: Black caiman range in Colombia included the region from the southern city of Leticia to the Rio Atacuari along the border with Peru, and in the Putumayo, Caqueta and lower Apaporis rivers (Poltkin *et al.*, 1983). Surveys by Poltkin in the 1970s found very few individuals.

There have been no reported surveys since those in the 1970s but we would speculate that some recovery has occurred there as it apparently has in other parts of its range. Black caiman have been protected in Colombia since 1969 with a total ban on hunting and egg collection (Resolution, 411) (INDERENA Resolution, 573 of 1969 (Poltkin *et al.*, 1983).

Plotkin *et al.* (1983) considered the black caiman to be on the verge of extinction in Peru in the 1970s.

However, data from Cocha Cashu in Manu National Park since the 1970s suggest that populations have recovered in this small area with counts of 24.74-27.75/km of shoreline (4/km) Herron (1985) in Thorbjarnarson (1992). Other counts ranged from 28/km in the Samiria River to 3.11/km in the swamp areas of the Jenaro Herrera region (Verdi *et al.*, 1980, Vasquez, 1982-1983) in Thorbjarnarson (1992).

Hunting of black caiman is prohibited in all cases except for subsistence purposes. (Poltkin *et al.*, 1983).

43. Additional Protection Needs: Following is a summary of the actions that are necessary for a successful caiman ranching programme.

Those that have been implemented to any degree are identified by an asterisk, those that have been committed to in this document by a double asterisk.

(1) Establish a permitting and licensing structure to permit the establishment and operation of a caiman ranch as prescribed by the Management Authority.**
(2) Require that any black caiman skin that is harvested from a ranch be tagged with a serially numbered self-locking tag.**
(3) Require that all products other than skins are marked to identify their origin.**
(4) Establish the right of the Management Authority to inventory stocks on ranches.**
(5) Develop a infrastructure with the charge of monitoring country-wide populations of black caimans.*
(6) Develop a Management Plan that will insure maintenance of the population on Appendix II.*
(7) Complete the formulation of regulations during the 3 year experimental period necessary to assure that the ranching programme is successful from both a economic and conservation perspective.
(8) During the 3 year experimental period prospective caiman ranchers, landstewards and conservationists should form an organization whose primary objective is the proper management and conservation of crocodilians.

5. Information on Similar Species

There are 4 species of crocodilians in addition to *M. niger* which occur in Ecuador. On the Amazon side of the Andes the common caiman is common throughout the region (Asanza in Thorbjarnarson, 1992).

It is widely hunted for food but still appears abundant and was found on every survey route inventoried by Hines and Rice (1994).

Asanza also reports that *Paleosuchus trigonatus* is commonly found in black water rivers and clear creeks up to 800m elevation throughout the Amazon region of Ecuador. He likewise reports *P. palpebrosus* in the Cuyabeno region and in Yasuni National Park.

Ken Rice observed dead *Paleosuchus* sp. in the possession of indigenous people while surveying for black caimans in the region of the lower Pastaza.

Both species are commonly eaten by indigenous people but their skins have no commercial value.

On the Pacific side, *C. c. chiapasius* was considered by Medem, (in Thorbjarnarson, 1992) to be on the verge of extinction in the 1970s. Asanza (in Thorbjarnarson, 1992) reported them to be found throughout the region in low numbers.

The American crocodile (*Crocodylus acutus*) was at one time very abundant along the coast of Ecuador (King *et al.*, 1982). Thorbjarnarson (1992) citing other observers indicates there are scattered populations remaining. Asanza, in Thorbjarnarson found small numbers in rivers and channels near San Lorenzo and in the Miguel-Cayapas River. In the Esmeraldas and Aguas Verdes he reported seeing 40 individuals; in the Manglares-Churute Reserve and Estero Peñafiel 60 well dispersed individuals and another 30 at Taura on land owned by the Ecuadorian Air Force.

CITES classification of crocodilians in Ecuador are as follows:

(1) *C. c. crocodilus* - Appendix II
(2) *C. c. chiapasius* - Appendix II
(3) *Crocodylus acutus* - Appendix I
(4) *Paleosuchus palpebrous* - Appendix II
(5) *Paleosuchus trigonatus* - Appendix II
(6) *Melanosuchus niger* - Appendix I

6. Comments from Countries of Origin

7. Ranching Proposal

71. Background: In 1991 Mr Pablo Evans contracted with a wildlife consultant, Mr. Tommy Hines of Rt. 3 Box 509, Newberry, Florida, to advise him in regard to the possibilities of ranching black caiman *Melanosuchus niger* in Ecuador.

A proposal to survey the Amazon region of Ecuador to determine the status of black caiman was presented to Mr Evans and the Ecuadorian Management Authority by Mr Hines. The IUCN Crocodile Specialist Group endorsed the survey. Mr. Evans financed it and the Management Authority issued permits allowing the survey to proceed.

The data presented in these reports indicate that a viable population of black caiman exist in the Amazon region of Ecuador. There has been one interim report submitted by Mr Hines, and one seminar sponsored by Mr Evans, and there is a more complete report attached.

Ranching of crocodilians which involves the sustained removal of eggs or young from the wild is considered the safest harvest strategy by most crocodilian biologists (Craig, 1992; Joanen, pers. comm.). For the following reasons, it is our position that a ranching programme would provide the most long term benefits to the conservation of the black caiman.

With the discovery of oil in the Amazon region and the opening of the Trans-Andean pipeline, many people from diverse cultural backgrounds emigrated to the region. The fact that many settlers are unfamiliar with their new environment, coupled with relatively low *per capita* income and the vulnerability of the rainforest ecosystem, a situation is created that could lead to over-exploitation of the resources in this region. However, a commitment to sustainable utilization and the opportunity for stewardship of a resource to bring economic benefit to both indigenous peoples and immigrants provides a powerful conservation tool (Hines and Rice, 1994).

72. Establishment of Experimental Egg and Hatchling Quotas: An adequate assessment of the total amount of production habitat prevents the establishment of a country wide egg quota. Therefore, we propose a quota of 1,500 eggs and/or hatchlings to be removed from the wild. During the three year experimental period there will be only one permittee. The permittee (Mr Evans) will finance an additional assessment of the extent and quality of production habitat. These data will be made available to the Management Authority to provide a basis for establishing additional quotas.

73. Additional Data Collection and Population Monitoring: In addition to the data collection in regard to production habitat, annual population monitoring will continue utilizing standard nightlight survey techniques to determine population densities and size structure (Hines and Rice, 1994). All of the sites where hatchlings or eggs are removed will be surveyed, as well as additional control areas.Surveys will also be replicated throughout the year in an effort to quantify the effects of environmental variables upon caiman visibility.

Annual surveys will be performed by a joint effort between Mr Evans and the Management Authority. Mr Evans will assist by financing a training course with the assistance of an outside crocodilian biologist, and will also provide necessary fuel and equipment. The Management Authority will provide personnel.

74. Expanded Egg and Hatchling Collection: At the conclusion of the three year period an estimate of the total number of eggs possible to safely take will be generated. This estimate will be based on expanded population surveys and assessments of the quantity of production habitat.The quota and the methodology used to establish it will be reviewed by an independent crocodilian biologist and the Crocodile Specialist Group. Additional ranching permits will be considered at that time.

75. Return of Animals to the Wild: Until there are data which demonstrate that a return of animals to the wild is unnecessary, we will require that a minimum of 5% of the eggs or hatchlings collected be returned to the wild at 1.2 meters in length. The rate of return is based upon a model developed for the Nile crocodile (*Crocodylus niloticus*) (Craig, 1992) which indicates that if 5% of the number of collected eggs are returned as crocodiles at 1.2 m in length sustainability is achieved even when all eggs are collected. Because of the difficulty of access in the Amazon region there is little possibility of collecting all of the available eggs even if that were the objective. In view of such natural constraints, the proposed return rate provides a most conservative approach. Priority release sites will be those areas from which eggs or hatchlings were collected or those areas that appear to be good black caiman habitat, but which have densities that fall below 4.5 animals/km.

The Management Authority will reserve the right to adjust return rates if population data that have been collected by standardized techniques demonstrate that it is necessary to maintain the population.

76. Housing Requirements: Any caiman ranching operation in Ecuador will meet the following requirements:

(1) Animals must be kept in a secure and humane manner;
(2) Pens must be constructed in a manner that will permit them to be washed and maintained in a sanitary condition;
(3) Housing must be constructed in a manner that will permit inventory of the caiman stock on the premises.

77. Harvest and Tagging: Before animals can be harvested from a permitted ranching operation, a CITES tag for each individual taken must be issued by the Management Authority. These tags will be self-locking, can only be used in the year they are issued, and will be stamped with the words "Black Caiman, Ecuador" and the tag number.

The number of animals taken will be based solely on the number that was legally taken from the wild, adjusted to account for mortality reported by ranchers and or Management Authority inventories. Each tag number, the belly width of the animal in centimetres, and the ranch from which the animal is harvested will be recorded. One copy of these records remains with the Management Authority, one copy with the ranch, and one copy will accompany the lot of skins being exported.

No animal larger than 2.2 meters will be legal to harvest from ranches or exported from Ecuador.

78. Products: The major products to be derived from caiman are skins and meat. Minor products may include other external body parts, fat, and internal body parts. Whenever these are sold they will be accompanied by documentation of the producing ranch and the CITES tag number of the animal from which they were derived.

79. Monitoring and Reporting Procedures: The permitted ranches will be required to submit an annual report to the Ecuador Management Authority listing the number of hatchlings and eggs removed from the wild, the mortality rates of hatchlings and eggs, and the number of animals harvested. Any other products sold must be listed and the tag numbers of the animals from which they were derived identified. In addition, this report must list the number of animals returned to the wild, their size, and the location where they were released.

To meet the criteria established in Resolutions Conf. 3.15 and 5.16, an annual report will be submitted by the Management Authority to the CITES Secretariat and will include any new information on:

1. the status of the wild population;
2. the number of eggs or young taken from the wild;
3. an estimate of the percentage of total population taken;
4. The number of animals released and their survival rates estimated on the basis of surveys and tagging programmes,if any;
5. The mortality rate in captivity and the causes of mortality;
6. production, sales and export of products; and conservation programmes and scientific experiments carried out in relation to the ranching operation or the wild population concerned.

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E9-EC01.PRO

A Report on a Survey to Assess the Status of Black Caiman (*Melanosuchus niger*) in The Amazon Region of Ecuador

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BLACK CAIMAN in ECUADOR
AN ASSESSMENT of STATUS and RECOMMENDATIONS
for SUSTAINED YIELD MANAGEMENT

Background

The black caiman (*Melanosuchus niger*) is the largest member of the Alligatoridae, with adult males surpassing 4m in length (Thorbjarnarson, 1992). They occur throughout the Amazon basin of South America from the Amazon River in the east to Ecuador in the west (Groombridge, 1987). Thorbjarnarson list the range countries as Bolivia, Brazil, Colombia, Ecuador, Peru and Guyana and French Guyana which are peripheral areas outside the Amazon region.

Populations were thought to be seriously depleted by commercial hunting in the 1950's and 1960's throughout much of its range (Groombridge, 1987, King and Videz Roca, 1989). Notably, the American alligator (*Alligator mississippiensis*) in Florida was also classified as endangered during this period. However, after extensive research, biologists found evidence that only the visible portion of the population had been depleted and a viable population of wary animals still existed (Hines, 1979).

This same scenario has been observed in other crocodilian species (Hollands, 1987). Therefore, when we were asked by Mr Pablo Evans, an Ecuadorian business man, to assess the status of the black caiman in Ecuador in regard to caiman ranching we did not instantly reject the possibility of healthy black caiman populations occurring there.

By the 1970's it appears that most commercial hunting of black caiman ceased due to the depletion of assessable populations and new international regulations (e.g.,CITES).

Distribution in Ecuador: Isolated populations were known to exist in the Amazon region of Ecuador in the 1980's (Plotkin *et al.*, 1983). Black caimans were reported "common" in the lower Rio Aguarico, Rio Yasuni, and Rio Lagartococha system near the Peruvian border (Groombridge, 1982).

Asanza reported that populations also occurred in the Cuyabeno region, Limoncocha, and Zancudococha (see Thorbjarnarson, 1992). Asanza (1992) outlines the current distribution of black caimans in Ecuador as follows; "Significant populations can still be found in the Aguirco River system (Cuyabeno Lakes and River), Guepi, (Lagartococha Lake system and River), Imuya, Pacuya, and Zancudococha Lakes, (Cocaya River); the Napo River system (Jivino and Indillana Challuacocha and Panacocha Lakes, Tiputini and Yasuni Rivers, Garzacocha and Jatuncocha Lakes); lower Nashino and Cononaco Rivers; the middle and lower Curaray River; lower Pindoyacu River; the Pastaza River system (Buefo, Capahuara and lower Ishpingo Rivers); lower Yaupi and upper Narona Rivers" (Fig. 2).

Population status: There are no published country wide assessments of population status nor any infrastructure in place to monitor trends country wide.

Asanza (1992) reports that populations of black caimans continue to decline through out much of its range in Ecuador but presents no data to support such a conclusion except a reported 8 year decline on Limoncocha. No attempt to correct for wariness was reported even though Limoncocha has been intensively used by tourists during this period to observe caimans. Asanza further reports stable populations in the Cuyabeno Lakes and River system with mean densities of 5.68 animals/km and 3.15/km respectively at a ratio of 1 black caiman (*M. niger*) to 5 common caimans (*Caiman crocodilus*). His surveys produce densities of 23.53/km and 23.59/km on Zancudococha and Imuya respectively at a ratio of 3 black caimans to 1 common caiman.

Objectives

Based upon Mr Evans request we provided a proposal that included the following objectives:

1) To determine the population status and distribution of black caimans in the Amazon region of Ecuador;

2) To generate information and recommendations concerning the management and conservation of black caimans in Ecuador;

3) To provide Mr Pablo Evans with recommendations regarding the feasibility of a caiman ranching programme in Ecuador.

Methods

The study area for the surveys included lagoons, backwaters and disjunct oxbows associated with the Rio Napo (from Coco to Rocafuerte), and similar habitats associated with the Rio Lagartococha and the Rio Yasuni. Surveys were also conducted along the Rio Pastaza in the southern portion of the Amazon region of Ecuador (Fig. 2).

Based on interviews with locals and examination of the literature (Plokin *et al.*, 1983; Asanza, 1985) candidate survey sites were selected. Permanent survey routes were established during daylight hours and general habitat features were recorded. Beginning and ending points of the routes were documented with a Global Positioning System (GPS) and GPS points were recorded along the entire survey route. Other parameters measured at the beginning of the survey, included water and air temperatures as well as general observations concerning water levels and recent rainfall. Selected routes were replicated from 2 two 5 times throughout the year to quantify annual variation in numbers of caimans observed.

Survey lengths were calculated by satellite photo interpretation (LANDSAT) and time/length estimates during surveys. Survey routes were located on computer enhanced photographs using the recorded GPS co-ordinates. When possible the size of the areas inventoried were also determined.

Surveys were initiated approximately one hour after sunset utilizing either a motorized five m. aluminum boat or three to five m. dugout canoes. Animals were spotted with a 200,000 candlepower light and recorded by .3m size classes. When species could not be determined, animals were placed into an unknown category by size class. These animals were added to known species counts in the same proportion that the known animals were observed. Broader size classes were established for those animals that could not be sized accurately and in some cases when no estimate of size was possible the animal was simply recorded as unknown. In order to verify our size classification five immature and one mature female black caimans, were captured, measured, and released. We also measured two black caimans killed by local fishermen, who took the animals in order to extract the abdominal fat for medicinal purposes.

Results and Discussion

Population surveys: During the course of two major survey efforts in the spring of 1992 and 1993, we established 18 permanent survey routes and conducted 28 separate nightlight counts. Replicate surveys were conducted on 5 routes (Table 1). However, there were still an insufficient number of replications to establish an adequate measure of variability.

A total of 131.2km was inventoried on 28 separate surveys. Densities ranged from 0 to 13.25 black caimans/km with a mean density of 4.65/km. On 2 of the 18 transects there were no black caiman observed during the survey; on one of these 1 animal was sighted during daylight hours (Table 1). We have been unable at this point to measure, with any degree of confidence the effects of environmental variables upon our ability to observe black caimans. However, based upon other studies, we felt certain

that water levels, among other things affected observability (Woodward and Marion, 1978). Some evidence of this is apparent when counts on 2 transects where water level fluctuations were as great as 3 meters were compared during times of low water (dry season) and times of high water (rainy season).

Lagartococha River South, generated a count of 6.61 animals/km; during the dry season (3/8/92); during the wet season (10/21/92), and a time of much higher water 5.22 animals/km were sighted. A smaller decline was noted under similar circumstances on Jatuncocha (Table 1). Taracoa and Anango which are not subject to as much change in water levels did not register declines in observability over the same period. The significance of fluctuations in regard to any of these counts is mostly speculation. However, it is apparent that cover adjacent to lagoons and water level fluctuation affects the observability of caimans in Amazon region habitats.

When all counts are combined 71% of the crocodilians on our transects were *M. niger*, the remainder were *C. crocodilus* (Table 2). Because we surveyed those areas that appeared to be good black caiman habitat that ratio almost certainly does not represent the ratio for the whole region. However, in the lagoons and other areas that appear to be good habitat these data may correctly depict the situation.

Observed size distribution on all surveys is presented in Fig. 1. As you would expect in a healthy population the younger size classes (.3m-.6m) animals make up the largest segment (34%).

The 1.8-2.7+ size classes appeared to be over represented in our sample. This may be due to our inability to access the shallow water areas which is probably better small caiman habitat.

Habitat: One objective from the onset was to quantify habitat during this phase of the study utilizing satellite imagery. One set of LANSAT photos was secured but because of logistical and technical difficulties, a widespread analysis of available habitat has not been possible. Until that is accomplished, a comparison of the area we surveyed with what is available will provide some insight into the quantity of habitat. Lagoons and oxbows appear to be preferred habitat and these are associated with the rivers in the Amazon region. Also, in some cases the slower moving sections of rivers are satisfactory habitat. The Napo is the major river and appears to have some of the better lagoons associated with it. However, there are as many as 9 other rivers in the region that are significant streams and collectively amount to approximately 1500 to 1800 kms. We surveyed only major lagoons and oxbows along approximately 200-250 kms of river.

Distribution: Black caimans occur throughout the region of the Rio Napo, from Coco to the Peruvian border, in the region of Lagartococha, Zancudococha, up the Rio Yasuni as documented by the surveys reported on here. Asanza (1992) also reports their occurrence in the Aguarico River system north of the area where our efforts were concentrated. In addition, Asanza lists the Pastaza River system as being within the present range of the species. We did not conduct extensive surveys in the entire region but one survey along the lower Pastaza did not reveal the occurrence of black caiman and local Indians indicated none occurred there.

Summary: Data generated by this study reveals the occurrence of a widespread population of black caimans in the region of the Rio Napo, Lagartococha and Rio Yasuni. The densities observed throughout the area (4.65/km) are comparable with similarly collected data from other recovered crocodilian populations; it is also noteworthy that densities are comparable to those reported by Pacheco (1993) (Table 3). Data presented by Asanza (1992) (18+/km) in Imuya and Zancudacocha are comparable with some of what are considered dense populations of other crocodilians and are slightly higher than our counts for the same areas (Table 1).

Observed size structure data were characteristic of a productive population. Yet, it is probable that the younger age classes were not represented in our survey data as they occur in the population, due to our inability to observe large areas of heavily vegetated wetlands. The percentage of large animals present may also indicate a population that is not subject to undue hunting pressure.

Additional data needs

The distribution of black caimans within Ecuador needs some further clarification. Asanza (1992) includes the lower Pastaza as an area that is occupied by black caimans. We surveyed along the middle and lower Bobonaza to the lower Pastaza, then up to the mouth of the Isphingo and found no black caiman and local Indians indicated that none occurred there. Additional surveys should be conducted in the Pastaza River system to clarify distribution in that area. Also, surveys need to be performed in the region of the Cononaco, the Curaray and lower Pindoyacu Rivers. This area is the most remote section of Ecuador and because of its occupation by the Guarani Indians it is almost certain that no commercial hunting took place there. Populations in this region should be more representative of a pristine situation.

Data in regard to the quantity and quality of habitat needs further refinement. Satellite imagery was obtained for the region of the Rio Napo but similar data for the remainder of the Amazon region should be procured and a more detailed analysis of habitat carried out.

Observations made during this study indicate that natal habitat is that which contains more vegetation and shallow water and that large males occupy the deeper open water. Pacheco (1993) found a similar partitioning of habitat by size class. However, further investigation is needed into habitat use, particularly the role that the very extensive wet forested areas play in regard to reproduction.

In some cases, we observed what appeared to be good black caiman habitat dominated by the common caiman and hypothesized that the latter were more competitive, and perhaps hindering the recovery of black caimans. Other biologists have noted this (Asanza, 1992; Magnusson, 1982). The extent and effects of the interaction between these two species should be examined further, especially the extent to which this is a legacy of the over-exploitation of black caiman populations. This situation might present a management option to manipulate populations to favour increases in black caiman population levels.

Natural history parameters such as clutch size, incubation, period, nest success, hatchling mortality and growth rates all are important areas of investigation in regard to the management of both the wild populations and management in a ranching situation.

A caiman ranching industry is obligated to assist in funding such studies because of their own self interest as well as the long term conservation benefits.

There is a large body of data in regard to captive rearing other crocodilians. However, trial and error testing and systematic research is needed to perfect incubation techniques, nutrition and other husbandry requirements.

Management recommendations

Wild population management: The most important aspect of management of black caimans in the wild is to systematically monitor populations. Permanent transects set up during this study should be run annually utilizing standard nightlight survey techniques for the next 5 years. After the 5 years only those areas where egg and hatchling collection is occurring need to be monitored annually with other areas surveyed every two to three years. In order to improve the population estimating value of night light counts, a significant number of survey routes should be replicated at least 4 times during a given year to access variability due to water level fluctuations and other environmental parameters.

The only wild harvest recommended is the removal of hatchlings or eggs on a sustained yield basis to provide animals to be reared in captivity to produce skins, meat and other byproducts. The younger age classes are the most expendable portion of a crocodilian population and a significant portion of these age classes can be removed without impacting populations (Jennings *et al.*, 1988; Hines *et al.*, 1987; Craig, 1992) (Fig. 3 and Fig. 4).

Based upon data contained in this report and that presented by Asanza (1992) there are obviously healthy populations of black caimans in Ecuador that can provide significant numbers of hatchlings or eggs without risk to the population. However, there are not enough data to provide a basis for establishing a maximum number of eggs or hatchlings to be taken. Consequently, we propose that the ranching programme be considered as experimental for three years and that one permit be granted to Mr Evans for 1500 to 1800 eggs and/or hatchlings per year. A quota at that level would represent the egg production of 50 or less adult females which could be found at any number of survey sites we visited. During the 3 year period Mr Evans would help finance additional survey work which will provide a basis for an estimate of population.

In order to simplify the regulation of hatchling or egg removal we recommend that at this point rather than attempt to establish local quotas that a return of animals to the wild be required. This management technique is used in other similar programmes, or at least the option to require it is retained by the Management Authority. In Louisiana *A. mississippiensis* eggs are harvested at a rate of 100% of the observed nest and 17% are returned at 1.2m (Joanen, pers. comm.). Most of the collections in Louisiana are occurring in coastal marsh where visibility is good and a high proportion of the nest are being collected: in addition many of these populations are subject to a wild harvest (Joanen, pers. comm.). According to a model developed by Craig (1992), if 5% of *Crocodylus niloticus* eggs collected are returned to the wild at 1.2m, the population will achieve sustainability, even if all eggs are collected. Craig's model assumes no other harvest is occurring. In view of the fact that production habitat in the Amazon region is very difficult to access, and that no other legal adult harvest is occurring, the Craig model appears to be suitable for the Amazon region. At the onset we recommend an annual return of 5% of the previous years collection rate. These animals should be returned to the wild at 1.2m in length and released in areas of habitat that provide some protection from large male caimans. Priority release sites should be the same locality from which eggs or hatchlings were collected. After 2-3 years, if size structure in these areas appears normal some animals can be returned to other areas of good habitat where densities are below 4.5/km. We further recommend that the return programme remain in effect until there are data which demonstrate it is unnecessary. The Management Authority should retain the right to adjust the rate of return if there are valid data which demonstrate it is necessary to maintain the population.

Eggs are more expendable to the population than hatchlings and if collected correctly, are more desirable to the rancher (Fig. 3 and Fig. 4). The logistics of egg collection and the fact that nesting may occur over a long period of time may make egg collection impractical. However, we recommend that both the collection of eggs and hatchlings be attempted and have submitted a proposal outlining how to systematically evaluate both approaches.

Management of skins and other products: In order to control illegal taking and movement of skins ranches must first be licensed, and a tagging system and size limit on skins exported implemented. All skins exported must have a self-locking tag attached which has been issued by the Ecuador Management Authority. It must be serially numbered, have the year, Ecuador and black caiman stamped on it. In addition to being tagged, any skin or product that is exported or otherwise in commerce must be accompanied by documentation of the ranch from which it was derived. Furthermore, the size of the animal and the date it was skinned should be included in the documents.

The number of tags issued must be based upon the number of eggs and hatchlings collected and the reported mortality. To further insure that no breeding size animals are taken from the wild, no skin larger than 2.2 m should be allowed to be exported.

Ranchers must be required to keep records and submit periodic reports on their operations. These records should include the numbers of eggs or hatchlings collected, hatchability, and mortality rates. The Management Authority should maintain the right to inventory stocks in captivity and to observe releases of animals back to the wild.

Philosophical basis of management

Ecuador is diverse in culture and the variety of wildlife habitats within its borders. With the discovery of oil in the Amazon region and the opening of the Trans-Andean pipeline in 1972 (Price-Waterhouse, 1981), many people with diverse backgrounds emigrated to the Amazon region and together with indigenous people became stewards of this vast and heretofore untapped resource (Organization of American States, 1975). Roads that have opened the rainforest to oil exploration have also led to settlement by Sierran groups that were unfamiliar with their new environment (Organization of American States, 1975). Coupled with an annual per capita income of US$ 1,043 (U.S. Dept. of State, 1991) this provides a situation favourable to over-exploitation of resources available in the region including the recovering black caiman. But a commitment to sustainable utilization and the encouragement of both indigenous and immigrants to take responsibility for stewardship, can provide a powerful conservation tool. However, a commitment to conservation by landstewards without economic incentives is weak and almost surely destined to failure.

Consequently, for the black caiman management programme, as proposed here, to provide the powerful conservation benefits that are possible, the landstewards must participate in the exploitation and receive significant economic benefits. They then have a vested interest in the conservation of the resource.

Finally, the black caiman, one of the important wild species in the region, falls into a group of species that have been successfully managed throughout the world in a manner similar to what we propose here. Given the pressure on natural resources that will inevitably result from the changes taking place in the Amazon region, there is little doubt that a sustained yield approach to resource management is vital to an effective wildlife conservation programme. Hopefully, this project can provide guidance in that direction.

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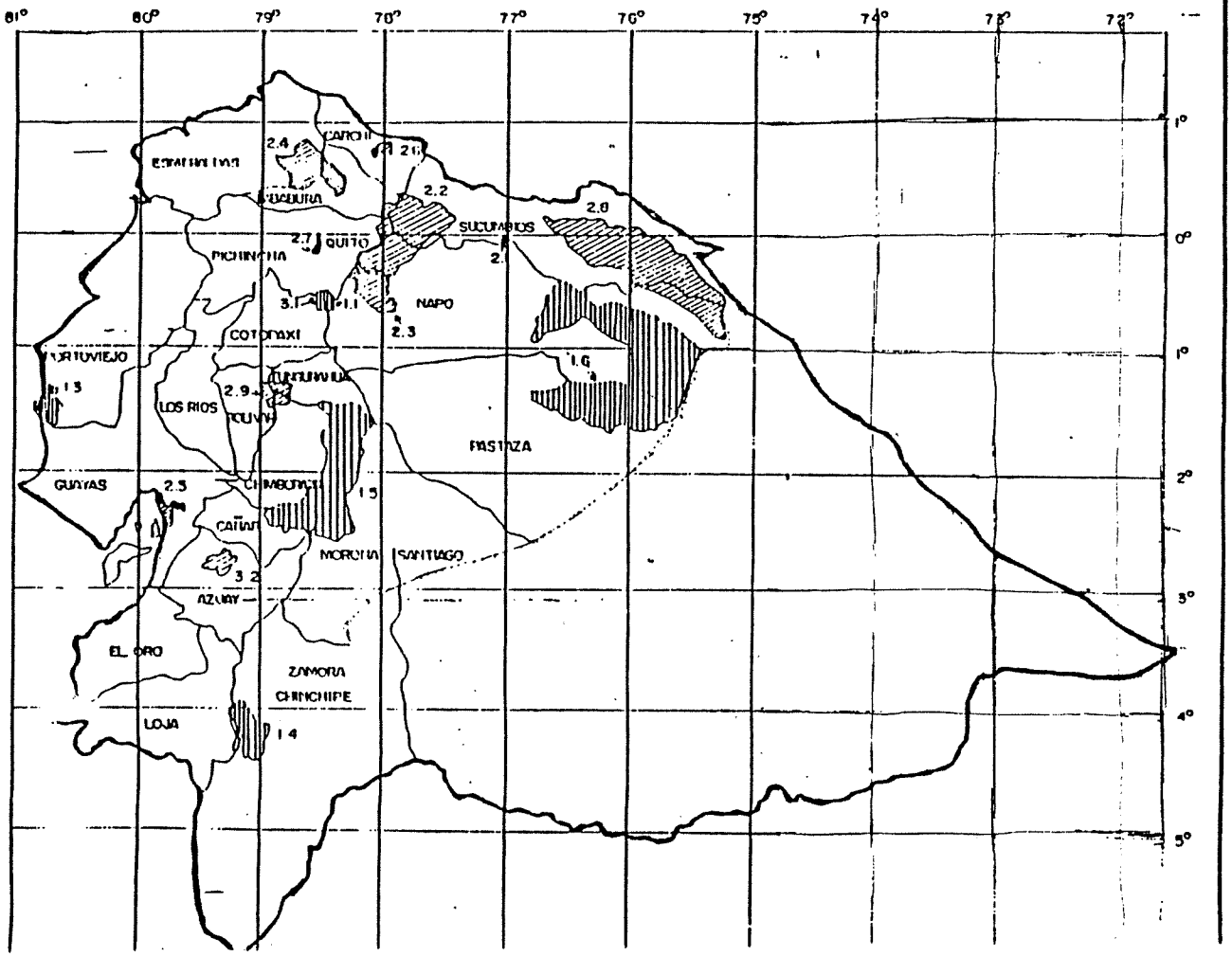
I N E F A N

INSTITUTO ECUATORIANO FORESTAL Y DE AREAS NATURALES Y VIDA SILVESTRE

SISTEMA NACIONAL DE AREAS PROTEGIDAS DEL ECUADOR



Parques Nacionales

1.6 Yasuni	982,000 ha
Total	982,000 ha

Reservas

Biologica

2.1 Limoncocha	4,613 ha

Producción de Fauna

2.8 Cuyabeno	655,781 ha
Total	660,394 ha

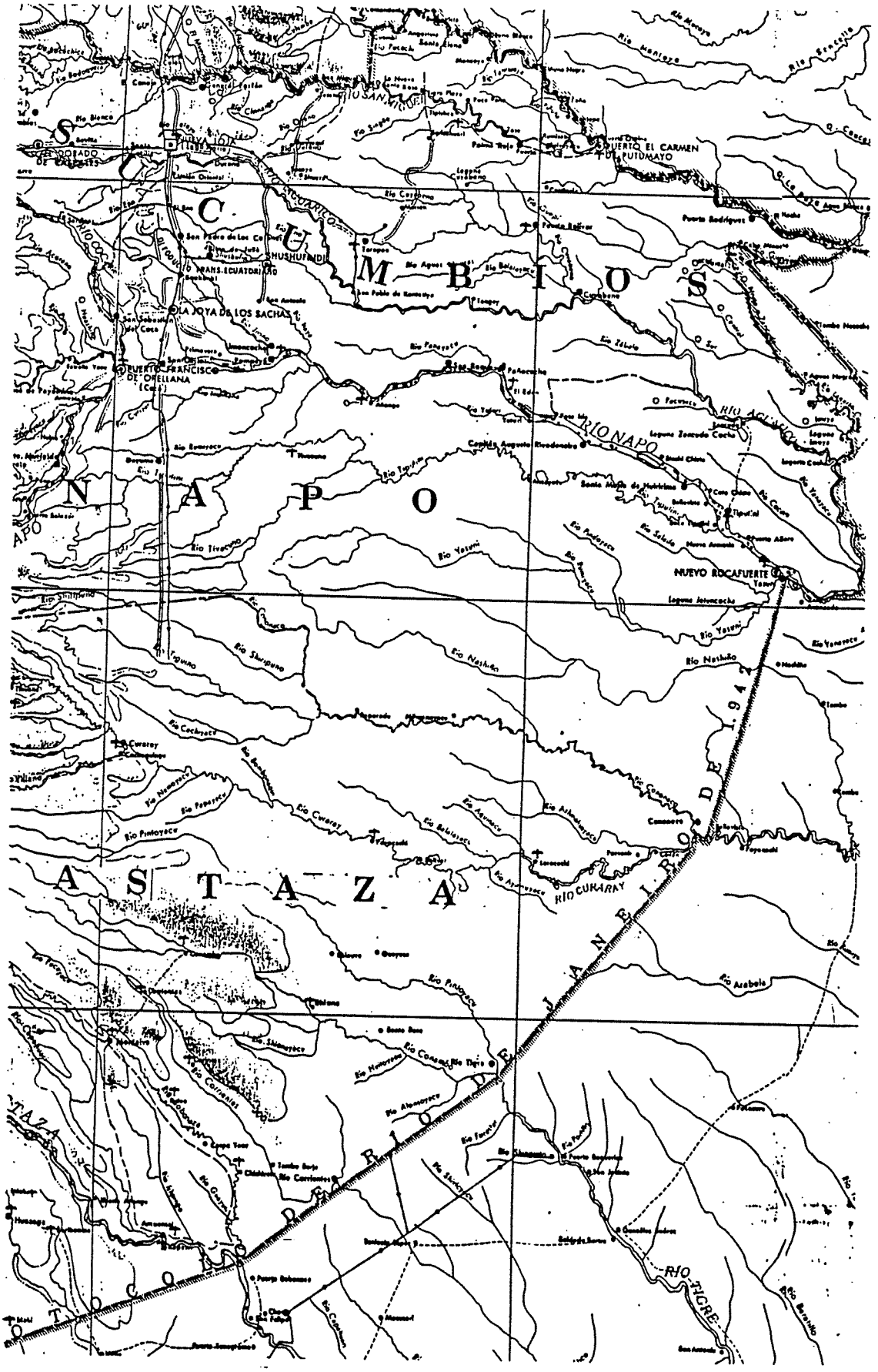


Fig. 2 Amazon Region of Ecuador

Tabla 1. Resultados del Censo de Melanosuchus niger en el Ecuador

FECHA	AREA CENSADA	DISTANCIA (KM)*	AJUST. MELAN**	MELAN POR KM
29-Feb-92	ANANGO	2	15	7.5
27-Apr-92	ANANGO	2	10	5
09-Jun-92	ANANGO	2	12	6
04-Oct-92	ANANGO	2	9	4.5
02-Mar-92	CHALLUA COCHA	1.9	22	11.9
29-Apr-93	CHALLUA COCHA	1.9	21	11.35
07-Jun-92	CHALLUA COCHA	1.9	24	12.97
24-Apr-92	CHICHA COCHA	1.8	1	1.88
09-Mar-92	DRAGA COCHA	2	1	0.5
27-Apr-93	GARZA COCHA	0	11	1.77
04-Mar-92	JATUN COCHA	10	17	1.7
28-Apr-93	JATUN COCHA	10	13	1.3
10-Mar-92	HAURMI (YUTURI)	3	11	3.67
06-Mar-92	IMUYA (FLOTEL RANCHO)	4	53	13.25
07-Mar-92	LAGARTO COCHA NORTE	8.1	3	0.37
08-Mar-92	LAGARTO COCHA SUR	7.4	49	6.61
21-Oct-92	LAGARTO COCHA SUR	7.4	39	5.26
03-May-93	LAGO SAN PEDRO	3	0	0
13-Mar-92	LIMONCOCHA	8	82	10.25
01-Mar-92	MANDURI COCHA	3	2	0.67
26-Apr-93	RIO YASUNI	7	1	0.14
29-Apr-93	TAMBO COCHA	3	19	6.33
12-Mar-92	TARACOA	6	17	2.83
05-May-92	TARACOA	6	19	3.17
04-Jun-92	TARACOA	6	12	2
01-May-93	TARACOA	6	15	2.5
03-Mar-92	RIO YUTURI	6.7	0	0
20-Oct-92	ZANCUDO COCHA	7	40	5.71
TOTAL	28 CENSOS	131.2	518	4.65

* Distancias en los censo son calculadas por interpretacion de fotos de satelite y estimaciones tiempo/distancia.

** Ajust. = Melan. contados + proporcion de desconocidos.

Tabla 2. Resultados del Censo de Melanosuchus niger y Caiman crocodilus en el Ecuador.

FECHA	AREA CENSADA	TOTAL MELAN	TOTAL CAIMAN	PROP MELAN
29-Feb-92	ANANGO	7	1	0.88
27-Apr-92	ANANGO	5	0	1.00
09-Jun-92	ANANGO	7	0	1.00
04-Oct-92	ANANGO	3	0	1.00
02-Mar-92	CHALLUA COCHA	19	0	1.00
29-Apr-93	CHALLUA COCHA	12	0	1.00
07-Jun-92	CHALLUA COCHA	19	1	0.95
24-Apr-92	CHICHA COCHA	1	1	0.50
09-Mar-92	DRAGA COCHA	1	0	1.00
27-Apr-93	GARZA COCHA	9	6	0.60
04-Mar-92	JATUN COCHA	7	28	0.20
28-Apr-93	JATUN COCHA	9	5	0.64
10-Mar-92	HAURMI (YUTURI)	8	0	1.00
06-Mar-92	IMUYA (FLOTEL RANCHO)	23	21	0.52
07-Mar-92	LAGARTO COCHA NORTE	2	51	0.04
08-Mar-92	LAGARTO COCHA SUR	35	20	0.64
21-Oct-92	LAGARTO COCHA SUR	14	6	0.70
03-May-93	LAGO SAN PEDRO	0	35	0.00
13-Mar-92	LIMONCOCHA	49	1	0.98
01-Mar-92	MANDURI COCHA	1	5	0.17
26-Apr-93	RIO YASUNI	1	3	0.25
29-Apr-93	TAMBO COCHA	18	0	1.00
12-Mar-92	TARACOA	10	0	1.00
05-May-92	TARACOA	13	1	0.93
04-Jun-92	TARACOA	10	1	0.91
01-May-93	TARACOA	14	0	1.00
03-Mar-92	RIO YUTURI	0	1	0.00
20-Oct-92	ZANCUDO COCHA	11	1	0.92
TOTAL	28 CENSOS	309	188	0.62

POBLACION ACTUAL M. niger EN ECUADOR.

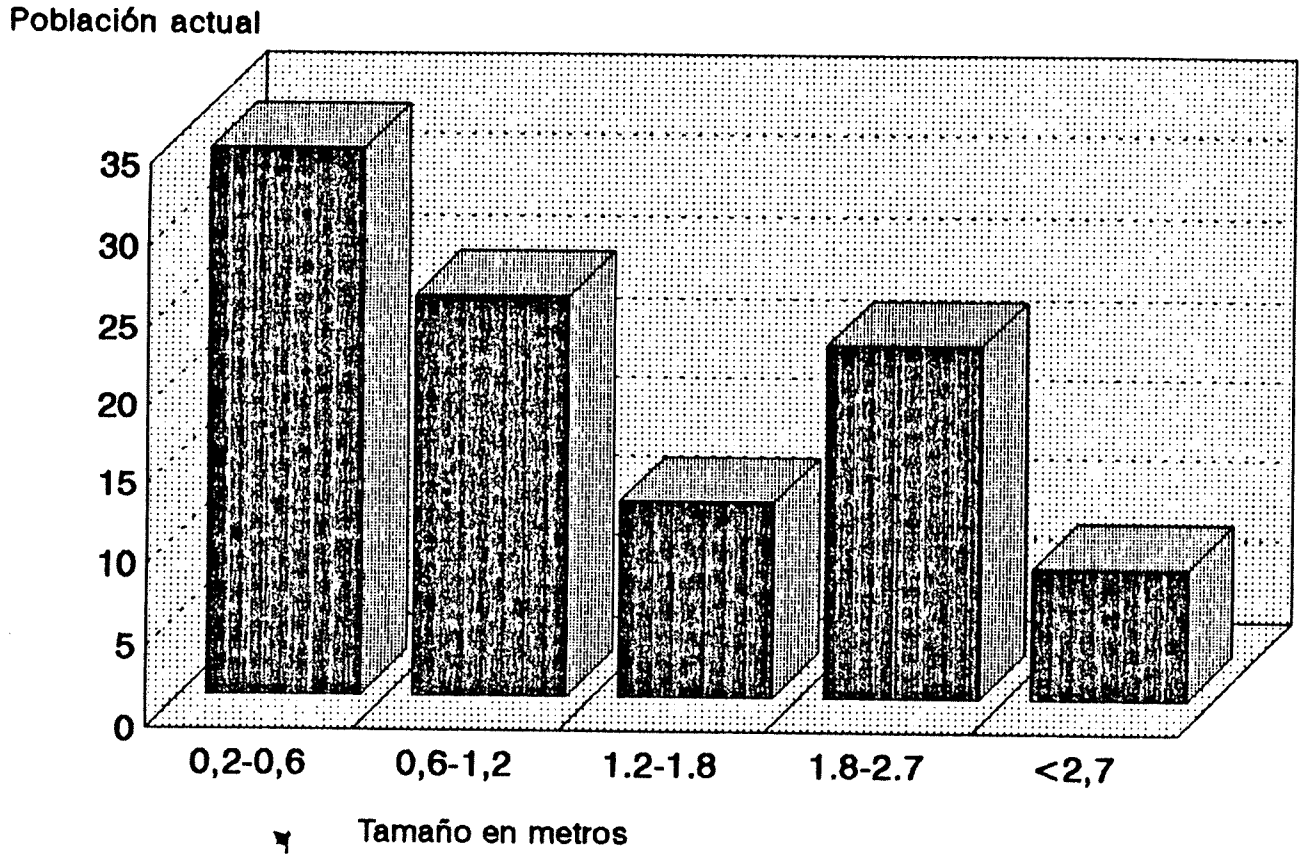


Fig. 1 Distribución por tamaño de M. niger en Ecuador durante censos de 1992-1993.

Tabla 3. Comparacion de densidades de cocodrilianos en varias regiones del mundo

Especie	Abundancia * Cant/km	Localidad	Referencia
Alligator mississippiensis	5.1–77.1	Fl.	Woodward y Moore (1990)
A. mississippiensis	7.8	Fl.	Wood y Humphrey (1983)
Caiman crocodilus	.17–17.1	Brazil	Brazaitis et. al. (1990)
C. crocodilus	6.6–9.0	Peru	Gorzula y Sejnas (1990)
C. crocodilus	1.6–155.7	Venezuela	Gorzula y Woolford (1990)
C. yacare	3.0	Bolivia	Ergucta y Pacheco (1990)
C. yacare	.2–70	Bolivia	King y Videz Roco (1989)
C. acutus	6.3	Haiti	Thorbjarnarson (1988)
Melanosuchus niger	.3–15.8	Bolivia	Pacheco (1993)
M. niger	0.0–2.0	Brazil	Brazaitis et. al. (1990)
M. niger	7.4	Guyana	Gorzula y Woolford (1990)
M. niger	.53–17.7	Ecuador	Asanza (1992)
M. niger	0.0–13.25	Ecuador	Hines y Rice (1994) **

* Expresado como animales por km.
** Datos reportados en esta publicacion.

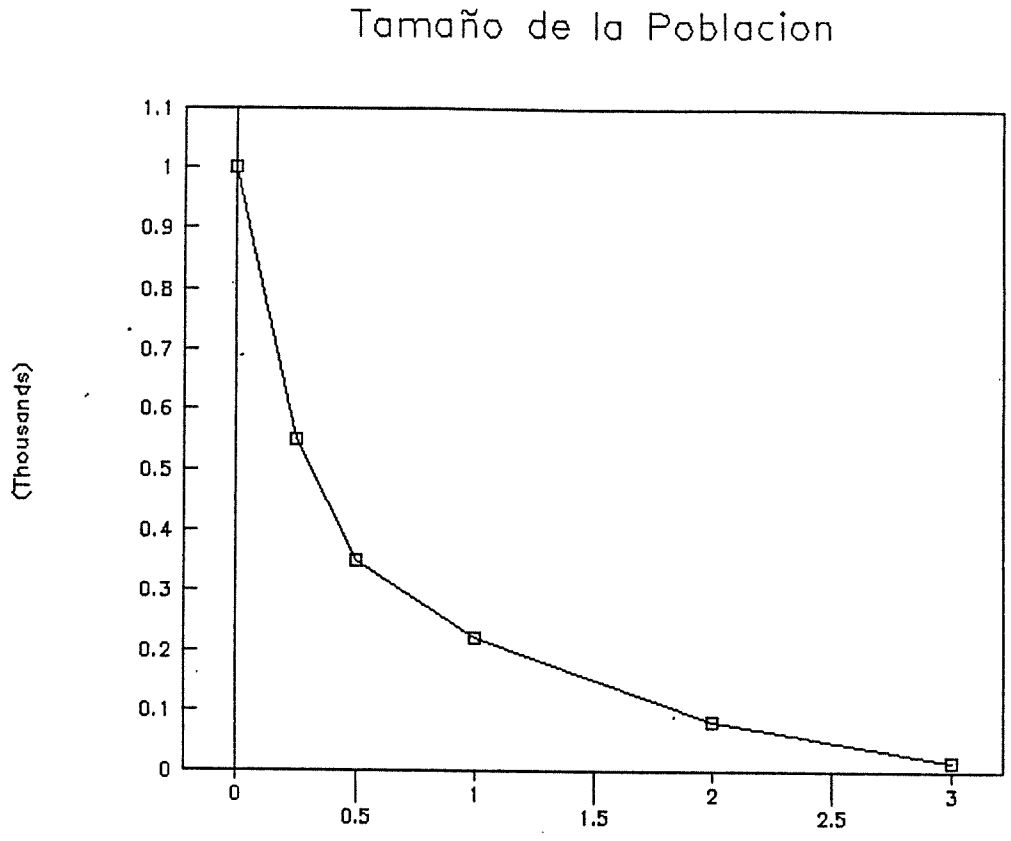


Fig.3 Relativa abundancia de las diferentes clases de tamaño en una población.

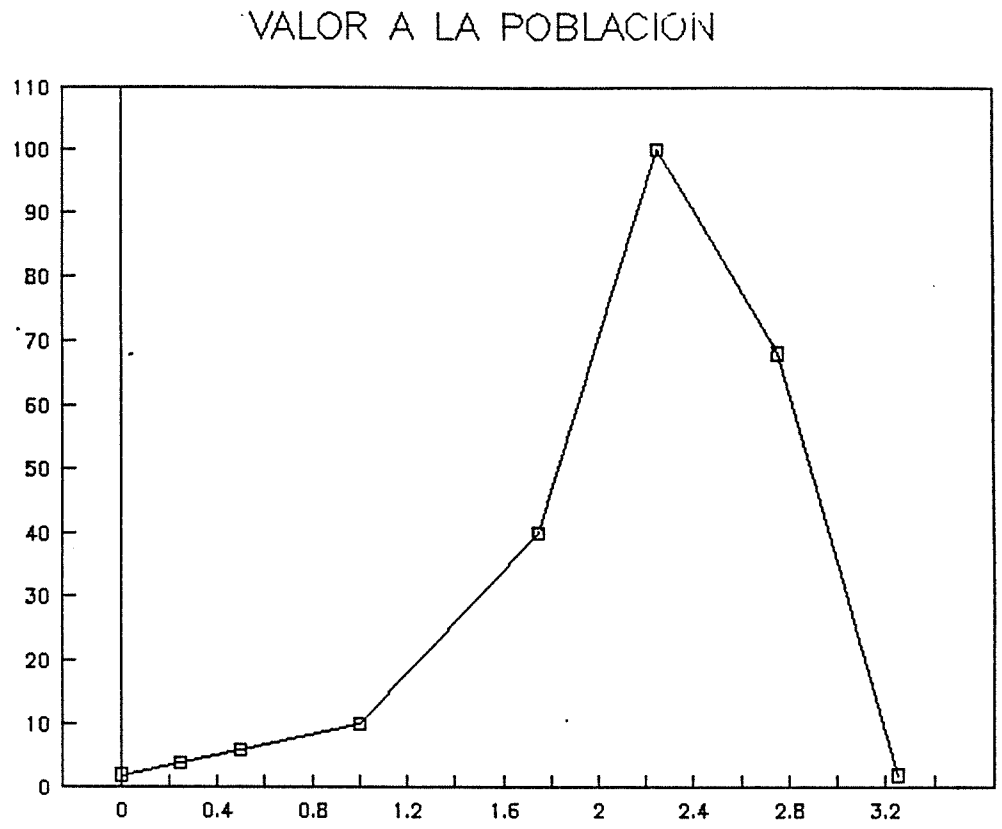


Fig.4 El valor reproductivo esperado de cocodrilianos basado en su tamaño. (en una escala de 100).