A Review of the Distribution and Conservation Status of the Giant Otter (*Pteronura brasiliensis*), with Special Emphasis on the Guayana Shield Region

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By Jessica Groenendijk
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A Review of the Distribution and Conservation Status of the Giant Otter (*Pteronura brasiliensis*), with Special Emphasis on the Guayana Shield Region

1.0 Summary

The Giant Otter (*Pteronura brasiliensis*, Zimmerman, 1780) is the largest of the world's 13 otter species and is endemic to the rainforests and wetlands of South America. In the 1940s, '50s and '60s, it became a valuable target of the pelt trade and it was the high demand for *Pteronura* skins during this period which is the main factor responsible for the Giant Otter's decline and current 'vulnerable' status (IUCN, 1996). Although trade bans came into effect in the mid-1970s and the species has since enjoyed both national protection as well as that afforded by the CITES Convention, the Giant Otter may only just be recovering from the brink of extinction. However, more recently it confronts a far greater threat in comparison to current levels of poaching, that of habitat degradation and destruction resulting from the exploitation of hydrocarbon and mineral resources, industrial pollution, improved infrastructure, colonisation, overfishing, deforestation, and poorly managed tourism.

The Giant Otter is a top predator, and may be regarded as a bio-indicator as well as an ambassador of healthy aquatic habitats within its rainforest environment. It is therefore of paramount importance that a comprehensive, integrated conservation strategy is established and implemented towards the protection of the species in the wild. Key factors include new surveys of its current distribution and status, the promotion of education programmes and publicity campaigns in order to gain local, national and international support, a strong commitment to habitat preservation, research into the respective impacts of the afore-mentioned threats, and finally, possible upgrading of *Pteronura*'s 'vulnerable' listing to the more critical 'endangered' status.

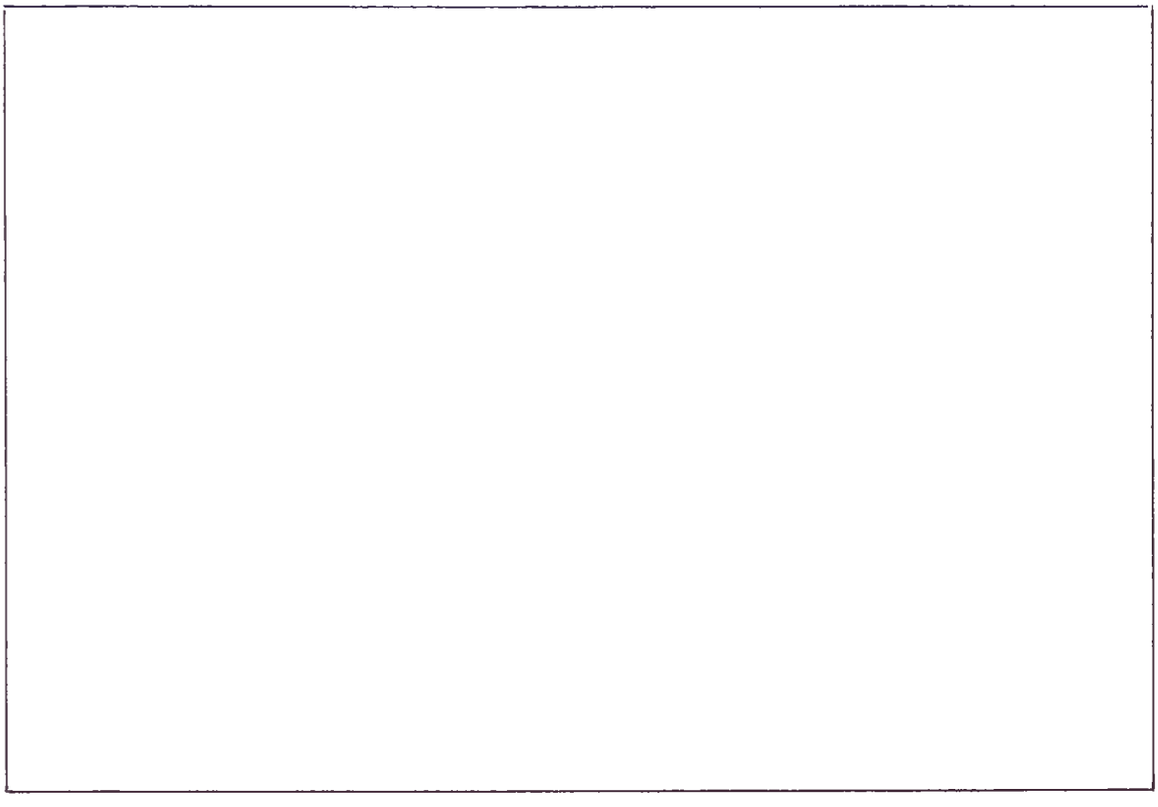
Rather than give a detailed account of the ecology and behaviour of the Giant Otter, this paper seeks to summarise data on its distribution and conservation status, including threats both current as well as historical, based on available reports and unpublished documents, as well as personal communications with *Pteronura* authorities (individuals who have conducted field research or worked with captive specimens in the past or are doing so presently). Elements of Giant Otter ecology are only referred to if deemed significant within the context of its conservation. Special emphasis is placed on the Guayana Shield region, as requested by the International Fund for Animal Welfare. In conclusion, measures and recommendations towards the future protection of this species have been compiled from all available literature, including initiatives which are currently underway.

3.0 Biology, Ecology and Behaviour

In order to better comprehend *Pteronura* conservation, the ecological and behavioural attributes of the species have been summarised below (but is by no means complete), relying on the review by Carter & Rosas as a principle source of information. There is a general consensus amongst authors that relatively little is yet known of Giant Otter biology and ecology, whether in captivity or in the wild. There are also important, fundamental differences between the study sites selected for research by, for instance, Duplaix (in forests which are permanently flooded during the rainy season), Laidler (in a semi-natural environment including irrigation canals) and Schenck & Staib (in oxbow lakes which are only occasionally flooded).

3.1 Morphology

In terms of body length, *Pteronura brasiliensis* is the largest of the world's 13 otter species, (the sea otter, with its considerably more compact body, may weigh considerably more; as much as 45 kg). Giant Otter males attain an overall length of 1.5 to 1.8 m and a weight of between 26 and 32 kg; females generally measure 1.5 to 1.7 m in length and may weigh between 22 and 26 kg (Duplaix, 1980). These are tentative figures; Cabrera and Yepes (1940; in Duplaix, 1980) and Mondolfi (1970; in Duplaix, 1980) recorded individuals totalling a length of 2.2 m while Santos (1945; in Duplaix, 1980) noted a specimen measuring 2.4 m (Duplaix, 1980).



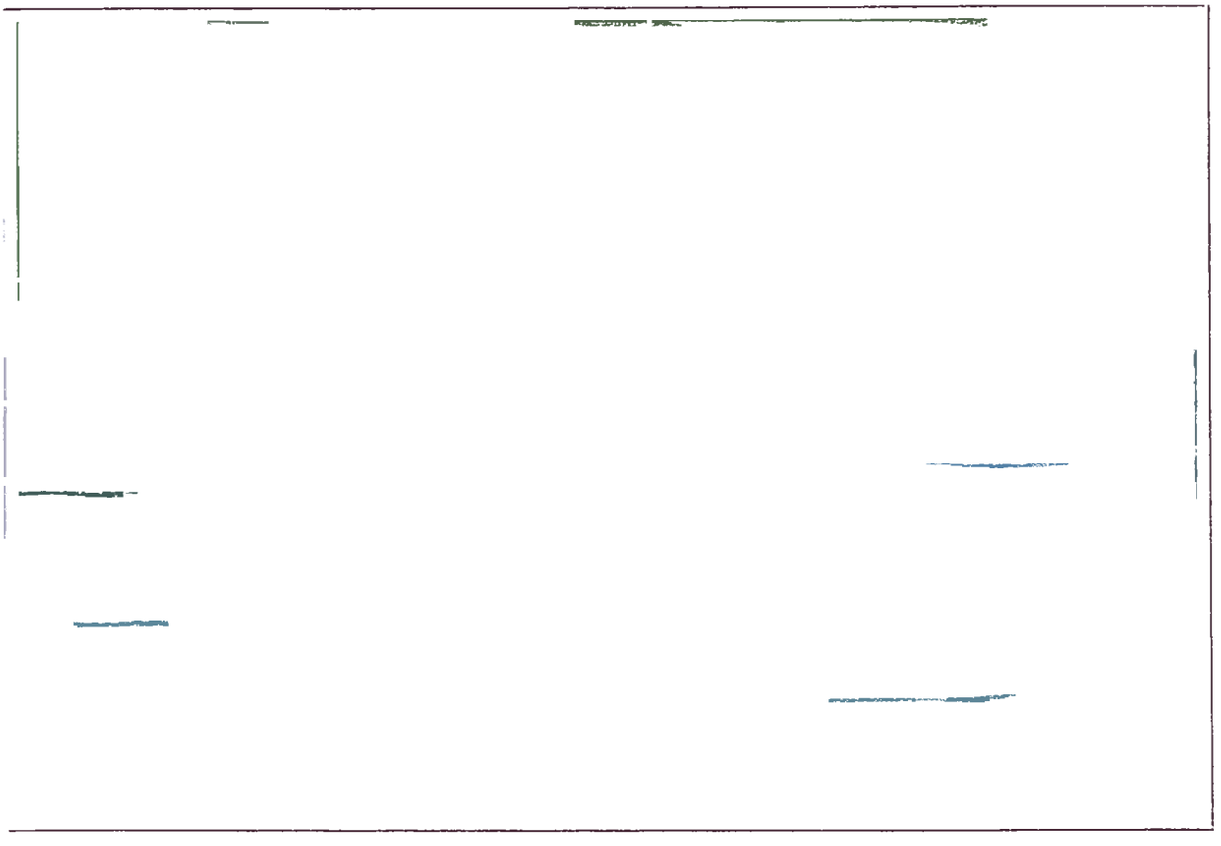
A close-up of two Giant Otters; note the cream throat markings which facilitate identification of individuals during field research.

Coat colour ranges from fawn to reddish-brown to very dark burnt umber, the dense, velvet-like fur being composed mainly of short, waterproof guard hairs with very little under-fur. The throat and chest are usually marked with irregular cream-coloured patches or spots (which may be virtually absent or form a large white area); the muzzle, lips and chin are often spotted white (Duplaix, 1980).

These markings enable straightforward identification of individual animals as they are highly specific. The short, squat limbs end in large, fleshy feet with very well developed webbing, extending to the tips of the clawed digits. The tail is dorso-ventrally flattened like that of a beaver, and thickly muscular at the base. Two sub-caudal anal scent glands are used in territorial marking.

The head is broad and bullet-shaped, with a blunt, sloping muzzle, and is supported by a long, muscular neck (Duplaix, 1980). Long and numerous facial whiskers protrude from the muzzle, forehead and temples and are believed to be highly sensitive in order to facilitate prey location in turbid waters, when vision is impaired (Duplaix, 1980). The otter's nostrils (placed forward on top of the head), and its small, round ear pinnae (set high and well back), may both be closed to prevent entry of water while diving. Hearing is acute, and well-developed scroll bones in the nasal chambers suggest a keen sense of smell (Duplaix, 1980) over distances greater than 100 m (Schenck, 1998; pers. comm.). Giant Otters are exclusively diurnal (although a group of 5 was observed traversing Colombian savannah by night; Valbuena, 1998; pers. comm.) and hunt primarily by sight; they are capable of recognising observers at distances of 50 m (Duplaix, 1980).

It is difficult to distinguish between the male and female Giant Otter as there is no fundamental difference in head or body size. The gender is only recognisable outside the water, when it is possible to observe the genitals or teats. The scrotum is not visible until the males are at least one year old (Staib, 1993).



A periscoping Giant Otter investigates an intruder.

The Giant Otter is primarily terrestrial but has become exceptionally well adapted to the pursuit of its prey in aquatic environments. When on land, it appears somewhat hunched and clumsy but in fact may travel a considerable distance between water bodies, tending to use well-worn paths. When

investigating the approach of a boat or when trying to locate a member of the family unit, the Giant Otter will periscope, that is, crane its neck and head straight out of the water while remaining stationary by paddling all four feet. At high speed it is the undulating tail which propels the body and the feet which steer. Particularly large lungs compared to other mammals, in combination with a greater tidal volume (an ability to absorb more oxygen from each breath), assist when swimming underwater. Although further research should be carried out (Schenck, 1998; pers. comm.), there are preliminary indications that Giant Otters communicate underwater much as whales, dolphins and porpoises do.

Giant Otters feed largely on a variety of fish both in deep as well as shallow water, possibly with increased success when hunting as a coordinated group. In Peru, it was found that two species in particular are preferred - the boca chico (*Prochilodus caudi fasciatus*) and the bujurki (*Satanoperca jurupari*) - although the precise reason for this preference over other species such as the abundant piranha is not yet clear (Schenck, 1998; pers. comm.). Duplaix (1980) found that Characoids formed the bulk of *Pteronura*'s diet. Giant Otters have also been known to feed very occasionally on frogs, water birds (Brecht-Munn & Munn, 1988), freshwater crabs (Duplaix, 1980), small mammals and snakes (Laidler, 1984). Giant Otters may consume around 4 kg of fish each per day (Staib & Schenck, 1994). The latter illustrates the great significance of fish to *Pteronura*'s ecology.

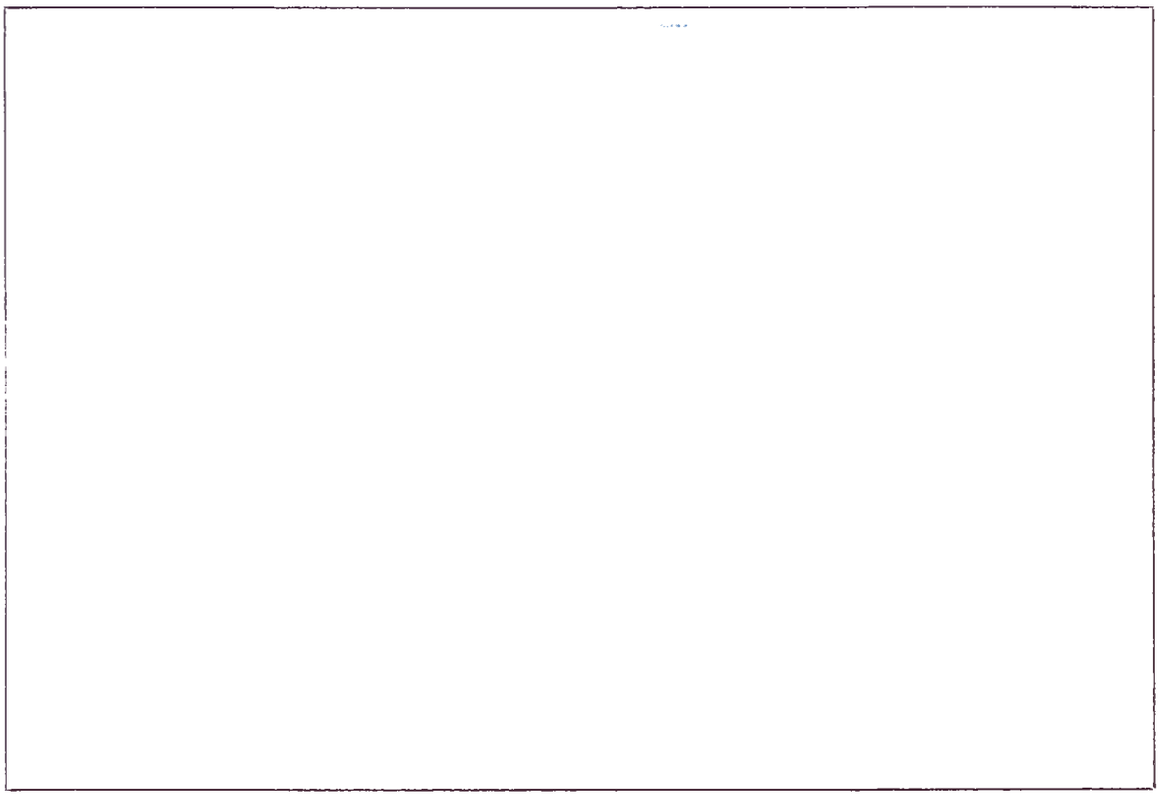
3.2 Habitat

The Giant Otter may be found in a wide variety of habitats, but most importantly in slow-moving rivers and creeks as well as oxbow lakes, swamps and marshes. Duplaix found that, in her study area, *Pteronura brasiliensis* particularly favoured black-water creeks, so-called because the water is stained dark brown with humic materials derived from decomposing vegetation (Duplaix, 1980). Blackwater is more transparent than white-water bodies, where visibility is but a few centimetres due to a heavy silt load. Duplaix (1980) suggests that the key factors influencing Giant Otter habitat preference are low, sloping banks with adequate vegetation cover and easy access to forest creeks or swampy areas, as well as an abundance of vulnerable prey in relatively shallow waters. However, Duplaix (1980) points out that seasonality factors affect the distribution and biomass of fish populations; henee, *Pteronura* habitat choice must revolve largely around accessibility to suitable fishing sites all year round.

In south-eastern Peru within the Manu Biosphere Reserve, white-water bodies dominate, so-called due to the sediments which tend to remain in constant suspension. Staib & Schenck (1994) found that, rather than the associated rivers, otters preferred the white-water oxbow lakes or 'cochas' which characteristically have no current, water depth is less variable, and fish are plentiful due to a high primary production (compared to black-water bodies) and henee a greater concentration of nutrients. Moreover, the sediments eventually settle to the bottom of the oxbow lakes so that the water is clearer than that of the parent river. Nonetheless, Schenck and Staib also concluded that habitat parameters, such as lake vegetation cover, are generally not statistically related to Giant Otter density. There is one exception, however, and that is lake size (Schenck, 1998; pers. comm.). A single, large cocha is more easily defended by a group of Giant Otters than several smaller cochas which are usually spaced some distance apart (Frank, 1998; pers. comm.).

Rivers are often used solely as a means to travel from one cocha to another. However, in isolated regions where there is little human disturbance, the rivers themselves may be inhabited on a more permanent basis by this species (Staib & Schenck, 1994). In fact, it is possible that the Madre de Dios River itself (of which the Manu River is a tributary), and the huge oxbow lakes which are

associated with it, historically sheltered the highest density of Giant Otters in the region. Presently, however, the Madre de Dios is a major transport route and colonisation by man has resulted in clear-cutting for timber and agriculture, as well as gold mining. Such high levels of disturbance increase the risk of group extinction while decreasing opportunities for oxbow lake re-colonisation, thereby forcing the Giant Otters into the smaller Manu River. The latter may therefore not be the ideal habitat - the paradise for Giant Otters - as was first believed, but may in fact be the last resort, a final area of retreat. Isolated habitats, in combination with a lack of mates and a high transient mortality, inhibit population recovery as well as re-colonisation of new areas (Schenck, 1998; pers. comm.).



Typical Giant Otter habitat in the tropical rain forest of south-eastern Peru.

3.3 Group structure

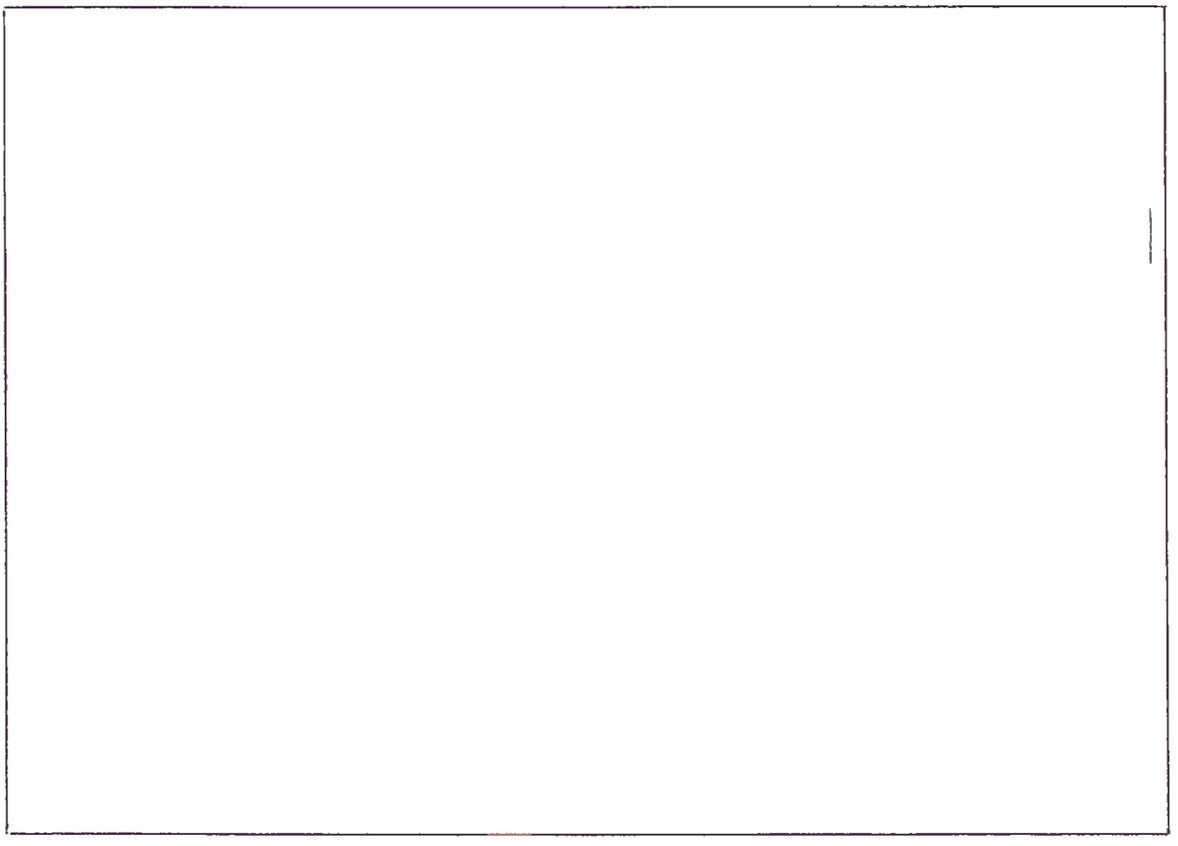
A Giant Otter population includes both resident groups as well as solitary transients. Authors agree that a resident *Pteronura brasiliensis* family unit usually represents one reproductive pair which remains in its home range for several years, plus their offspring (1 or more subadults and 1 or more cubs) born during the previous two years. Giant Otters have occasionally been observed in groups of up to 20 individuals although such reports tend to be tentative and historical rather than recent. It is interesting, however, that people living in the Peruvian rainforest claim to have frequently seen large groups of 30 or so Giant Otters travelling overland from cocha to cocha (various, 1996; pers. comm.). In fact, Duplaix mentions having recorded a group totalling 16 animals (1980), possibly composed of two family units travelling together. Periodically therefore, it seems that Giant Otter groups may temporarily coalesce around particularly abundant food sources, when seeking out suitable habitats, or (Schenck, 1998; pers. comm.) if one group, fleeing from the approach of a threat such as a noisy boat, is forced into the neighbouring territory of a second group. Group sizes which are more usually observed number between 3 and 9 individuals (Mondolfi & Trebbau, 1978; Duplaix, 1980; Staib, 1993).

A transient or floater is normally either a sub-adult which has abandoned its family unit as it approaches sexual maturity (at two years of age) or an adult which has lost its mate; in both cases, there is no longer a link to an established resident group and the transient has adopted a nomadic way of life, migrating over large distances in order to seek a mate and establish its own home range. There is no obvious hierarchy within a Giant Otter group and aggression is rare.

3.4 Group home ranges

In Suriname and Guyana, Giant Otters appeared to have large home ranges (12 to 32 km of creek including its tributaries, or 20 square km of lake) which may overlap and which encompass smaller territories (2 to 9.6 km of creek or 5 square km of lake) centred around attractive feeding locations (Duplaix, 1980; Laidler, 1984). In seasonally flooded areas, only the latter are defended by each family group throughout the dry season, whereas they are apparently abandoned during the rainy season when Giant Otters follow the fish into the flooded forests (Duplaix, 1980). Population densities are typically low.

In south-eastern Peru, Staib & Schenck (1994) describe how Giant Otter home ranges usually encompass at least one oxbow lake, almost always several streams or swamp areas, and a stretch of river. However, it is possible for one *Pteronura brasiliensis* group to permanently inhabit a lake provided it is no less than 6 km in length and 200 m in width. A group lives in one stable home range for both the rainy season (October-April) as well as the dry season (May-September). Two different groups were never observed in the same home range nor was any interaction between two different family units ever noted. Only transient Giant Otters may visit different home ranges, but without joining the resident, reproductive groups (Staib, 1993).



A Giant Otter marking area, also known as a campsite, advertises territory boundaries as well as the characteristics of the resident group.

fish are particularly abundant (Carter & Rosas, 1997). An average of 2 to 4 cubs (litter sizes ranging from 1 to 6) are born following a gestation period of 64 to 71 days (Wunnemann, 1993). Cubs are cared for by both parents as well as their more mature siblings (which may act as babysitters; Schenck, 1998; pers. comm.) and stay within the family den for 2 to 3 (or 3 to 4; Wunnemann, 1993) weeks before being introduced to the water. Their eyes open and they are able to swim after 1 month; by 6 weeks cubs may regularly be observed playing near the den entrance. In the wild, Staib (1993) found that, after two months, the cubs begin to beg noisily for fish. They do not hunt and travel with the family unit until they are 3 to 4 months old. Cubs are weaned by 9 months and after 10 months they can no longer be distinguished from adults in the wild. Juveniles begin marking on the family group's campsite at about 1 year of age and remain with the family unit until they reach sexual maturity (Carter & Rosas, 1997).

The facts that Giant Otters attain sexual maturity only after 2 years, that only the adult female within a family group gives birth to cubs, that juveniles remain with the unit for a relatively long period of time, and that mortality among cubs and solitary individuals is high (Staib, 1993), should be kept in mind when considering appropriate conservation measures. Rates of reproduction, colonisation and hence population recovery are slow.

Very recently, Mondolfi & Trebbau produced a second report which provides an update on the distribution and status of the Giant Otter in Venezuela (1997). Their new data illustrates the presence of *Pteronura* in the State of Apure; on the Cinaruco River, where groups of 5 individuals each were sighted in 1993 and 1994, on the Capanaparo River and in the Cinaruco-Capanaparo National Park which encompasses tributaries of both rivers, and finally, on tributaries of the Apure and Arauca Rivers as well as the Cano Guaritico. In the State of Portuguesa, it is the Cano Iguez, tributary of the Guanarito and eventually the Portuguesa Rivers, which still shelters Giant Otters.

A large group of between 20 and 25 individuals was filmed in the Aguaro-Guariquito National Park, within the State of Guarico. This species is also present on the Middle Orinoco, in the localities of Cabruta and Parmana. In the State of Anzoategui, it is only the Caris River, tributary of the Orinoco, where *Pteronura* may be encountered. Its distribution in the State of Bolivar, however, is more widespread; on the Grande, Maniapure, Las Nieves, and La Plata Rivers all of which eventually flow into the Orinoco and its delta; on the Caura River and its tributaries, the Mocho, Nichare and Tabaro Rivers; and in La Urbana on the Orinoco.

Giant Otters have also been encountered on the Morichal Largo and Guarapiche Rivers in the State of Monagas. In the State of Sucre, *Pteronura* may be found on the Cano Ajies and the Cano Guariquen (together forming the Turuepano National Park) as well as the Cano La Brea, all of which flow into the Gulf of Paria. Canos Guapoa, Mano and Guiniquina, in the middle, south-eastern and north-eastern areas of the Orinoco Delta respectively, within the State of Delta Amacuro, have also been reported as being inhabited by this species. Finally, in the State of Amazonas, Giant Otters have been recorded in the Maniapiare, Upper Ventuari, Yutaje, Sipapo, Casiquiare (as well as its tributaries), Mavaca, and Baria Rivers. One group of 7 Giant Otters and two groups of two individuals each were recently observed within one day on the Ventauri River (Hajek, 1998; pers. comm.). Terborgh (1995) also reported a Giant Otter sighting on Guri Lake, a gold mining area (Schenck, 1997; pers. comm.).

4.2 Suriname

From mid-July 1976 to end-March 1978, Duplaix encountered a total of 252 Giant Otters, verifying their presence (in terms of evidence and/or direct sightings) on the following rivers and their respective major tributaries (the latter are in parentheses) - the Corantijn River; the Wayombo River; the Nickerie River (Maratakka); the Coppename River (Coesewijne, Tibiti and Tangnimama); and the Commewijne River (Cassewenica, Cottica and Perica). She received reports (unconfirmed by sightings or evidence) suggesting that *Pteronura* also inhabited the Kabelebo and Lucie tributaries of the Corantijn; the Mapana and Coermotibo tributaries of the Commewijne; and the Saramacca, Suriname (Para) and Marowijne Rivers.

Sightings, evidence and/or reports of Giant Otters were recorded by Duplaix on several creeks, too numerous to mention here but associated with the majority of the afore-mentioned rivers. Of these, Kaboeri Creek, a small tributary of the Corantijn River, is the most well known since much of the pioneering fieldwork was carried out here. In fact, a viable population of Giant Otters still inhabits Kaboeri Creek and is protected by the local Amerindian population; motorised transport is not permitted to enter the creek (Reichart, 1997; pers. comm.). A Dutch team of biologists visited the area recently (August 1997) and reported having seen 3 groups in one single day, each comprising an estimated 5 individuals (Schouten, 1997; pers. comm.).

4.3 Guyana

Melquist (1984; in Carter & Rosas, 1997) reported the presence of Giant Otters near the city of Morawhanna, and on the Mahaica, Abrary, Mashivean and Morewan Rivers (the latter two are tributaries of the upper Esequibo in southern Guyana). Laidler (1984) carried out her fieldwork in the Demerara District which encompasses the Russell Lake (actually a swamp), as well as the Mahaica River and a number of its tributaries, including Lama Creek and Maduni Creek. Healthy populations were encountered on the upper Mazaruni Basin as well as the upper Potaro River, and unconfirmed reports suggested their presence in Spectacle Lake and on the northern Rupununi River (Laidler & Laidler, 1983; in Carter & Rosas, 1997). There have also been recent sightings in the Karanambu area on the edge of the Rupununi Savannah (central Guyana), where up to 20 individuals may be found during the dry season in groups of 3 to 10 (Shackley, 1996).

4.4 French Guiana

Very little data is available on the Giant Otter population of French Guiana; Melquist (1984; in Carter & Rosas, 1997) assumes that it is widely distributed within the as yet relatively pristine rainforest interior. In 1994 and 1995, Wood reports having seen the species on the Tapanahoni upstream of Apetima near Tepou Top, on the Litani near Saut Lavaud, and on the Approuage at Saut Mapau (1998, pers. comm.). Vie (1998) believes that, although not abundant, there is a viable population and widespread distribution of Giant Otters throughout the country, with probable local extinctions. He reports having seen the species or of having heard accounts of their presence on the Approuage de Kaw, Comte, Sinnamary, Maroni and Montsinery River basins (pers. comm.).

4.5 Colombia

Donadio (1978) quotes Roger Foote who surveyed the Colombian Amazon in 1975 as having received two reports on the Putumayo River of recently killed Giant Otters, as well as of a skin brought to Leticia from a nearby stream, an individual observed on a tributary of the Javari River in 1973 and a report of two Giant Otters killed in the same region the previous year. Grimwood noted between 1967 and 1968 that *Pteronura* was entirely absent from the Guejar, Ariari and Guayabero Rivers but that 2 specimens had been seen on the Cabra River, while 2 others were heard in lagoons of the Arirai and Guayabero Rivers (Donadio, 1978). In 1967, 3 Giant Otters were sighted on the upper Bita River.

Defler (1986) carried out a census during 1981, 1982 and 1983 on the Tomo, Tuparrito, Tuparro Rivers as well as Quinvaza Creek of El Tuparro National Park in north-eastern Colombia, and observed an estimated 30 different groups of Giant Otters, varying from solitary individuals to a family of 7 Defler considered it likely that healthy populations inhabited the Bita River, just north but outside the Park Melquist reported Giant Otters in the Sierra de la Macarena National Park and the Arauca Sanctuary; a total of 24 otters were counted on the Miritiparena River in 1976 (Melquist, 1984; in Carter and Rosas, 1997)

There are unconfirmed reports that the Giant Otter is returning to the Caqueta River and its tributaries (Andrade, 1997; pers comm) However, Andrade is of the opinion that the status of *Pteronura* in Colombia must be urgently established with new field data Priority areas are the entire Orinoco basin (the Arauca, Casanare, and Meta Rivers including tributaries) and in the most populated Amazon areas, such as the Guaviare, Vichada and Inirida Rivers as well as the western reaches of the Putumayo and Caqueta Rivers (1997, pers comm)

4.6 Brazil

Very little further data has apparently come to light since Carter & Rosas (1997) reviewed the Giant Otter situation in Brazil, much of which was derived from personal communications during 1995. A summary of *Pteronura* sightings follows: on the Unini River and possibly the upper Jau and Pauini Rivers within Jau National Park (in the Negro River basin); on the Itapara and Itaparazinho Creeks (near Boiacu; 1991), and on the Catrimani (1994) and Uraricoera Rivers (tributaries of the Branco River; 1988); on the lower Parima; on the Xixuau, Xiparana and Mucucuau Creeks of the lower Jauaperi River; on the upper Javari (1981) and the Japura Rivers (1984) both of which are in the Solimoes River basin; on the Rio Acre Ecological Station in the Purus basin; on the Canuma, the Aripuana and its Branco tributary in the Madeira River basin; on the Roosevelt River (1992); sizeable Giant Otter populations on the upper Jamari and the upper Jatapu River; on Paraiso Creek (1987); in the area of the Balbina hydroelectric dam and on the Pitinga River (1994) in the Uatuma River basin; in Tapajos National Park and Ique Ecological Station and probably on remote tributaries of the Tapajos River; in the Trombetas Federal Biological Reserve; on a tributary of the upper Trombetas (1985) and on the Curua-Una River (1982); on the mid Xingu (1993); in the Lago Piratuba Federal Biological Reserve and Araguaia National Park; on the Paraim River of the upper Tocantins basin; in the State of Maranhao (no specific details provided); on almost all rivers in the upper Paraguai River basin or Pantanal due to a decrease in hunting pressure, including the Paraguai River itself, the Sao Lourenco, Itiquira and Piquiri tributaries in the northern Pantanal, and the Negro and Aquidauana Rivers in the southern region; in the northern Pantanal between the cities of Pocone and Porto Jofre and on the Ivenheima River; possibly on the Paranapanema River within the Morro do Diabo Forest Reserve and the Rio Doce State Park; in the Corrego do Veado and Sooretama Federal Biological Reserves and the Campos do Jordao State Park; and finally, on both the Branco and das Minas Rivers in the Atlantic Forest. The Giant Otter is virtually extinct in the entire eastern region of Brazil, with only very rare sightings on tributaries of the Parana (in Carter & Rosas, 1997).

Roosmalen reports having seen a healthy population on the Rio Xixau, a tributary of the Jauaperi which eventually flows into the Rio Negro, and on the Uracoeria River (tributary of the Rio Branco), 20 minutes by boat from an IBAMA (Brazilian Institute for the Environment) field station. Furthermore, he knows of undisturbed populations in the Madeira-Tapajos interfluvium, on the Aripuana, Manicore, Acari, Sucunduri, Abacaxis, Andira and Gurapa/Mamuru Rivers, and on the Upper Purus River (1998, pers. comm.).

4.7 Peru

In the Department of Madre de Dios in south-eastern Peru, Schenck & Staib (1992) counted 45 Giant Otters on at least 24 lakes within the Manu Biosphere Reserve (250 km of the Manu River were censused upstream of its confluence with the Madre de Dios). Brecht-Munn & Munn (1988) suggested that the total number of animals on the Manu River and its associated oxbow lakes was approximately 100. This was later reduced to about 65 individuals (Staib & Schenck, 1994) in an area encompassing 18,000 square kilometres. In the Tambopata-Candamo Reserved Zone, 20 animals were sighted on 7 lakes during 2 surveys; the total in this region is estimated to be around 25 Giant Otters (Staib & Schenck, 1994). *Pteronura* was also observed on the Los Amigos, Blanco, Madre de Dios, Heath (Staib & Schenck, 1994) and Pinquen Rivers (1994, pers. observ.). Finally, a total of 11 Giant Otters were sighted on the Las Piedras River during an expedition in September / October 1996 (pers. observ.). In 1994, 18 individuals were encountered on this same river (Wust, 1996; pers. comm.).

Brack-Egg (1978) reports that, in the past, Giant Otters frequented the Pacaya-Samiria National Reserve located within the northern Department of Loreto. However, a survey carried out in 1995 by Schenck and Estremadoyro failed to locate evidence of the presence of Giant Otters within this same reserve. On the other hand, the fact that 3 Giant Otters currently form part of the Iquitos zoo collection and that 2 cubs were found in the harbour of Iquitos, reportedly purchased from locals near the border of the Pacaya-Samiria National Reserve, suggest that there are still remnant populations of *Pteronura* in this region (Schenck & Staib, 1995). In fact, very recently, this theory was confirmed when two Giant Otter families were observed in the Pacaya-Samiria Reserve (Schenck, 1998; pers. comm.).

4.8 Bolivia

A survey carried out in 1987 of the principal rivers of the Amboro National Park failed to provide evidence of *Pteronura*, although it was believed to be a possible visitor (Dunstone & Strachan, 1987). However, according to the Bolivian Red Data Book for vertebrates (1996), there have been relatively recent reports of Giant Otters in the Amboro National Park (Anderson et al., 1993), as well as the Beni Biological Station Biosphere Reserve (Cabot et al., 1989), the Rivers Blanco and Negro Wildlife Reserve (Rumiz, 1993; Tapia, 1994), the Mamore River, and the Noel Kempff National Park (Anon., 1994). In fact, 65 Giant Otters were counted in the latter (McFarren, 1994; in Carter & Rosas, 1997) and up to 300 individuals are said to inhabit the park and surrounding area (Quinn, pers. comm.; in Carter & Rosas, 1997). Isolated populations are also considered to be present in and around the Manuripi Heath National Wildlife Reserve in the Pando province (Dunstone & Strachan, 1987).

4.9 Ecuador

Melendres (1978) and Melquist (1984; in Carter & Rosas, 1997) report sightings on the Aguarico, Pucuno, Indillama, Pana Yacu, Cuyabeno and Tarapoa tributaries of the Napo River (including the Garza, Lagarto and Anango Cochas); the Gueppi tributary on the Putumayo River, the Oso Yacu, Ishpingo and Bobonaza tributaries of the Pastaza River (Giant Otter presence on the latter two tributaries was confirmed recently by Araya, 1997; pers. comm.); and the Shiona tributary of the Conambo River. There are occasional records of solitary animals or small groups in the Yasuni National Park (Yacu Pacha, 1997). Araya also recently observed *Pteronura* on the Capahuari and Kusutkau Rivers, within the south-eastern lowlands of Ecuador. Group sizes ranged from 4 to 8 individuals. According to preliminary observations and interviews with the local Achuar indigenous people, Giant otters are relatively abundant and not threatened in this region (Araya, 1997; pers. comm.).

4.10 Paraguay

Limited information suggests that *Pteronura* inhabits the Parana River and the Verde and Ypane tributaries of the Paraguay River. Remnant populations may be present in the marshes adjacent to the Pilcomaya and Paraguai Rivers in the south (Melquist, 1984; in Carter & Rosas, 1997). Villalba (1997; pers. comm.) reports that strong evidence has been found indicating the presence of this species in four areas of Paraguay: a canine tooth in the Ka-I rague Private Reserve, sightings in the Paraguay River, sightings and footprints in the Mbaracayu, and footprints in Marquetti Cue (or Ko-e pyahu), a lagoon 15 kilometres North-West of the Mbaracayu. A subspecies, *Pteronura brasiliensis paranensis*, was described by Rengger in 1830 (Duplaix, 1980; Dignum & Diaz, 1997) as inhabiting the Parana and Paraguay Rivers, but is not widely recognised since no recent taxonomic studies have supported its subspecific status (Carter & Rosas, 1997).

pressure which was exerted on the Giant Otter in the Caura and Nichare Rivers in order to obtain skins for the export market has since ceased.

In Colombia, intense hunting nearly exterminated Giant Otter populations in vast areas of the Orinoco and Amazon basins (Mondolfi, 1970; in Carter & Rosas, 1997). Chehebar (1990) suggests that many other Giant Otter populations exist in Colombia, but this is undocumented (in Foster-Turley *et al.*, 1990). Andrade (1997, pers. comm.) believes that the species is stable, if not recovering, in areas far from human reach. This, however, does not imply that the species is not endangered in the remainder of the country. The status of the species is critical within the Orinoco basin (llanos orientales). Individuals have been sighted in areas close to oil wells in Arauca (Oxy oil fields) which are protected from hunters and settlers.

In Brazil, Giant Otters frequent the Amazon and upper Paraguai River basins as well as restricted areas of the Atlantic Forest. The Brazilian Amazon probably still supports significant populations of Giant Otters in isolated pockets, although this is unconfirmed due to the logistical problems of surveying such a vast area. Giant Otters also inhabit the south-eastern and central western regions of Brazil, but are believed to be extinct in southern Brazil (Rosas *et al.*, 1991; in Carter & Rosas, 1997). In the Pantanal, the species appears to be recovering although tourism and fishing activities pose potential problems (Schweizer, 1998; pers. comm.). Roosmalen concludes that *Pteronura* populations are currently not faring too badly, particularly in Roraima and neighbouring Guyana and Suriname (1998, pers. comm.).

Giant Otters are found only in isolated locations in Ecuador while in Bolivia, although it has been recorded in the Departments of Pando, Beni and Santa Cruz, the only significant population may be that inhabiting the Noel Kempff National Park. In Peru, Giant Otters are absent from much of their former range and remnant populations are confined only to undisturbed secluded tributaries of the Amazon (Chehebar, 1990; in Foster-Turley *et al.*, 1990). The population of Manu Biosphere Reserve has been relatively stable since 1990 and it seems reasonable to assume that surrounding, uninhabited rivers such as the Chandles, Purus and Tahuamanu, may still harbour remnant populations. In Paraguay, Giant Otter groups are few and far between whereas in Uruguay and Argentina, the species seems to be virtually extinct. However, it is perhaps premature to assume that the latter is indeed the case (Soutullo, 1998; pers. comm.).

4.14 Giant Otters in captivity

Giant Otters are noisy, charismatic and very active during the day; they would therefore appear to be an ideal, popular species to include in a zoological exhibition. However, apart from the fact that, in Europe, the expense of providing a suitable environment during the winter is very great (Cowan, 1997; pers. comm.), breeding this animal or, more specifically, the rearing of Giant Otter pups has proved to be a complex procedure.

Sheila Sykes of the Zoological Society of Philadelphia is currently conducting a worldwide survey of institutions holding Giant Otters in their collections. She compiled much of the data mentioned below (see Table 1), for the purpose of publication in a forthcoming expanded edition of the North American River Otter Husbandry Notebook (originally produced by Jan Reed-Smith).

In 1997, the total number of *Pteronura* specimens held in captivity within South America is believed to be at least 14 males and 18 females; the total known number of Giant Otters in Europe and North America combined is 7 males and 2 females. According to the International Zoo

Yearbook, there were 11 males and 6 females in 6 collections in 1992, and 10 males and 3 females in 6 collections in 1994 (Cowan, 1997; pers. comm.). However, IZY only records the existence of specimens which are reported to them. This suggests that there may be many more individuals currently being held in captivity (particularly in South America), which are not represented in the above figures.

The Carl Hagenbeck Tierpark in Germany first incorporated the species in its collection in 1961. It was only in 1990, however, that a breeding pair produced 2 successful litters. Within the next 3 years, 3 additional litters were reared successfully. However, in 1993, the breeding female died and any efforts at propagation have failed since then. Currently, all Giant Otters known to be housed in Europe and North America (with the exception of the founding father) are offspring from Hagenbeck's only successful breeding pair (Sykes, 1997). Inbreeding and hence genetic impoverishment is potentially a problem unless unrelated females are introduced into the breeding stock, perhaps imported from South American zoos.

Several other zoological parks in Europe and North America have attempted to breed Giant Otters, without success thus far. Although adults tend to be quite robust, pups frequently die shortly after birth or are killed by their mothers. Handrearing has proved to be extremely problematic and other complications may arise including abortion, infections and gastroenteritis; the latter has resulted in the deaths of at least one litter in Venezuela (Trebbau, 1972). In cases of stress, the female may stop lactating and the cubs die of hunger within a few days (Wunnemann, 1992; in Schenck, 1993). Between 1970 and 1997, 69 litters were born in 6 zoos. Of the 145-147 pups born alive, only 20 survived to one year of age (Sykes, 1998).

In South America, detailed information relating to breeding success has been somewhat vague. Wunneman (1993) reports that breeding first occurred in the Caracas and Sao Paulo zoos and later in the zoo of Brasilia. However, the majority of these breedings did not last for more than one generation.

Karl Kranz of the Philadelphia Zoological Society has suggested design criteria for Giant Otter enclosures (1996). *Pteronura brasiliensis* requires a very complex, stimulating and spacious environment, up to 75% of which should be dry land (although Schenck mentions that, in the wild, a large expanse of water is more important; 1998, pers. comm.). Moreover, Kranz concluded that the male needs to be separated from the female for successful rearing of the pups. It may also be necessary to separate any juveniles as their vigorous play with pups tends to injure the latter. Carl Hagenbeck's Tierpark considers the complete isolation of mother and young in the first few weeks after parturition vital for successful breeding.

Wunneman (1993) argues that there are several good reasons for promoting the propagation of a captive population of *Pteronura* : (I) the species is an excellent ambassador of its vanishing habitat and could therefore be involved in a public education programme to gain the support of individuals who would otherwise never see Giant Otters; (ii) much may be learnt of *Pteronura* biology from specimens kept in zoological collections; (iii) and finally, there may be a demand in the future for a self-sustaining, captive genetic reserve for possible (and highly controversial) reintroductions of viable populations into the wild. All these factors could contribute towards a committed conservation effort by zoological collections. However, the latter must not detract from the urgent and foremost necessity to restore and/or preserve the natural habitats of Giant Otters in the wild.

At present, there is no cooperative breeding programme or studbook for the Giant Otter despite the evident need for such an approach. Wunnemann suggests a memorandum of agreement with the relevant Brazilian or other South American authorities as well as a programme which not only maintains and breeds the species but also generates income towards their conservation and research (1998, pers. comm.). However, a key problem is the current lack of communication and cooperation between South American and European institutions; improved links between the two continents should therefore be actively encouraged (Winkler, 1998; pers. comm.).

Table 1. Locations where Giant Otters are currently held in captivity (only data obtained and confirmed during 1997 is included).

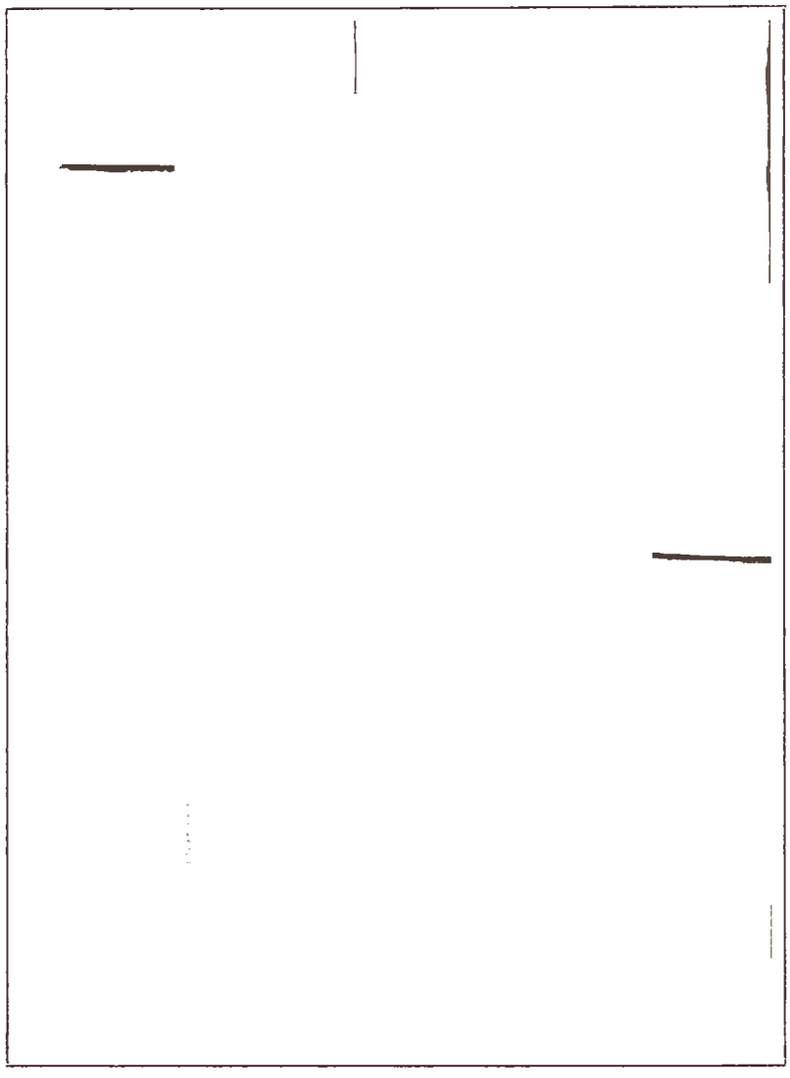
Location	M	F	Source
Buenos Aires ARGENTINA	2	1	Gatz, 1997
Parque Ecologico Americana, SP	0	1	Gatz, 1997
Emilio Goeldi Museum, Belem	1	1	Gatz, 1997
Jardim Zoologico de Brasilia, DF	3	2	Gatz, 1997
Carajas	1	1	Gatz, 1997
Cuiaba, MT	0	3	Gatz, 1997
Curitiba	1	1	Gatz, 1997
Parque Zoologico de Goiania, GO	1	1	Gatz, 1997
Manaus, AM	0	1	Gatz, 1997
Sorocaba, SP BRAZIL	1	2	Gatz, 1997
Fundacion Zoologico de Cali COLOMBIA	1	1	Sykes, 1997
Chestnut Centre Conservation Park ENGLAND	1	1	Heap, pers. comm.
Montsinery Zoological Park FRENCH GUIANA	0	1	Wood, pers. comm.
Carl Hagenbeck Tierpark, Hamburg	1	0	Sykes, pers. comm.
Tierpark Dortmund	1	1	Schappert, pers. comm.
Zoo Duisburg GERMANY	2	0	Sykes, 1997
Guyana Zoological Park GUYANA	0	1	Sykes, 1997
Quistococha Zoo, Iquitos PERU	1	2	Estremadoyro, pers. comm.
Emperor Valley Zoo TRINIDAD	1	0	Sykes, 1997
Zool. Soc. of Philadelphia UNITED STATES	2	0	Kranz, pers. comm.
Zool. Leslie Pantin, Turmero	1	0	Gatz, 1997
Parque del Este, Caracas VENEZUELA	1	1	Trebbau, pers. comm.

5.0 Past and Present Threats

In the past, pelt hunters posed the greatest threat to Giant Otter populations and drove the species to the brink of extinction. However, the current, overall impact of the killing of, or trade in, *Pteronura* specimens is likely to be minor compared to the severe pressures exerted by widespread and increasing colonisation as well as intensive exploitation of natural resources by man, leading to the contamination and destruction of formerly pristine tropical rainforests and water systems.

5.1 Hunting

Giant Otter fur is amongst the finest in the world and the species itself is a simple and valuable target being large, diurnal, highly social and vocal, as well as regrettably curious; entire groups readily approach canoes to investigate. During the 1940s, '50s, '60s and '70s, the high demand for *Pteronura* skins led to relentless, uncontrolled hunting. Before the implementation of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), the USA and Europe (West Germany and the UK in particular) were the main importers of Giant Otter pelts (Doughty & Myers, 1971; in Carter & Rosas, 1997). Trade bans did not generally come into effect until the mid-1970s.



A Giant Otter pelt, clearly indicating the species' considerable size.

Between 1960 and 1969, 19,925 Giant Otter skins were legally exported from Brazil; a pelt was worth the equivalent of 50 US$, so the incentive to hunt was great (Smith, 1981; in Mason & Macdonald, 1986). Another source states that between 1960 and 1967, over 40,663 pelts were exported from Brazil (Best, 1984; in Carter & Rosas, 1997). In the early 1980s, a skin could be sold in European markets for 250 US$ (Nowak, year unknown). In 1946, 2,017 pelts were exported from the Peruvian Amazon whereas during the 1950s and 1960s the annual figure was consistently less than 1000 with only 210 exported during 1966 when an amount of 1,700 soles or 23 English pounds was paid by local dealers; over the period 1946 to 1973, 23,980 pelts were officially exported from Peru (Brack-Egg, 1978), not including those skins which were exported via Leticia, Colombia. The export of Giant Otter pelts from Peru was eventually banned in 1970. In 1965 and according to official statistics, 1,032 skins were exported from Colombia, compared to only 311 in 1970 and 85 in 1971 (Donadio, 1978). These figures reflect the dwindling numbers occurring in the wild during the hunting decades. *Pteronura brasiliensis* finally received legal protection in most South American countries by the mid-1970s.

Mondolfi & Trebbau (1978) described how clandestine commercial hunting was sponsored by Colombian and Brazilian traders who purchased Giant Otter skins from Venezuelan native hunters, or who went poaching themselves. Each *Pteronura* pelt fetched 500 bolivars or about 2,000 Colombian pesos and was smuggled from the Venezuelan Orinoco region to Colombia, via Puerto Carreno, a Colombian port directly opposite Puerto Paez in Venezuela. Skins obtained in Amazonas, Venezuela, were usually smuggled to Colombia by means of the Vichada, Inirida or Guaviare Rivers. Brazilian traders travelling in and out of Venezuela via the Negro River sold their Brazilian manufactured products, including shotguns and ammunition, and bought *Pteronura* skins, amongst others. The port of destination in Brazil was Manaus.

The number of pelts illegally collected in Venezuela is unknown as it was impossible to keep statistics of undercover exports from the country to Colombia and Brazil. Venezuela was one of the last countries to ban the hunting of Giant Otters in 1979. Since the cessation of the skin trade, the current status of the Giant Otter in Venezuela appears to have improved slightly (Mondolfi & Trebbau, 1997). Nonetheless, during the beginning of 1996 and in the words of Mondolfi & Trebbau, "armed visitors killed 10 Giant Otters as well as 2 river dolphins (*Inia geoffrensis*)", an action which was denounced by the Venezuelan press (1997). Tentative verbal reports suggest that, in Guyana and French Guiana, uncontrolled hunting currently poses a serious threat to Giant Otters (Singh, Veening, 1998; pers. comm.).

All the afore-mentioned statistics probably represent only a fraction of the actual numbers of Giant Otters killed and exported. The sale of many skins is not officially recorded due to smuggling or under-invoicing by exporters (Donadio, 1978), dependent cubs are killed with the death of a parent (Carter & Rosas, 1997), and 60% of specimens sink and are lost before they can be recovered by hunters (Coimbra-Filho, 1972; in Carter & Rosas, 1997).

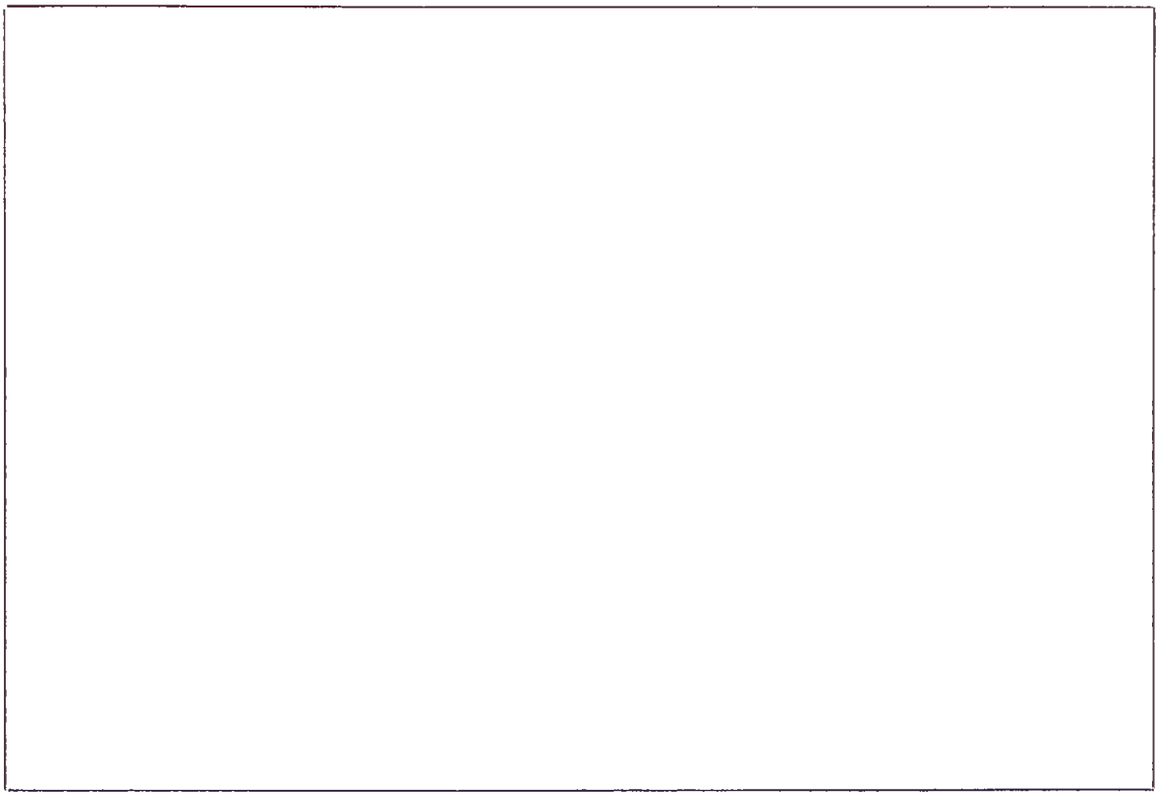
In Ecuador, there have been recent reports of two *Pteronura* pelts being offered for sale in the market for approximately 40,000 to 50,000 sucres or 9 to 10 US$ each. A bargain price of 6 US$ would apparently have been accepted. However, there appears to be little local demand for Giant Otter skins as they had yet to be sold. It would also seem that Giant Otter furs are no longer being exported (Araya, 1997; pers. comm.) and that hunting pressure has been greatly reduced in consequence. In Madre de Dios, Peru, illegal hunting continues but on a low scale. Schenck (1993) reports 6 Giant Otters killed within a 20 month study period. A pelt market barely exists, however,

since the hunters again found it difficult to sell their trophies (Schenck, 1993). In general, it can be said that the current extent of poaching and illegal trade is unknown but is probably still taking a comparatively limited though significant toll.

It is perhaps interesting to note that, in the early 1970s, a keeper in the zoo of Brasilia was killed by a family of Giant Otters during an attempt to rescue a child who had fallen into the enclosure. According to Roosmalen (1998, pers. comm.), this event prompted a widespread native belief in Brazil that Giant Otters will attack, capsize your canoe and tear you to pieces, and therefore provided an ideal excuse to hunt these competitors for fish almost into oblivion.

5.2 Mining

Gold mining in the Amazon basin - on the Orinoco, upper Paraguai, Saramacca, Marowijne, Madre de Dios, Madeira, Negro, Branco and Tapajos Rivers - is a widely recognised and severe problem, involving 1.2 million people over an area of approximately 170,000 square kilometres with a total gold production of roughly 200 tons (in Gutleb *et al.*, 1997).



Gold mining, and the associated use of mercury, poses a serious and potentially long-term threat to the Giant Otter.

Mercury (Hg) is used to separate gold particles from river sediments by means of a process known as amalgamation. The compound is then heated in order to evaporate the mercury; gold eventually remains. Up to 20% of the mercury used is discharged directly into the river while an additional 20% is lost to the atmosphere. The total annual amount of Hg lost within the Amazon gold mining regions is estimated to be up to 128,000 kg per year, of which 55% enters the atmosphere in the form of elemental Hg and 45% enters the rivers as metallic Hg (Lacerda *et al.*,1990; in Gutleb *et al.*, 1997). The production of 1 gm of gold requires 1 to 4 gm of mercury (Pfeiffer, 1988; in Gutleb *et al.*, 1997). The discharge of mercury into rivers leads to an 11.8 fold increase of this heavy metal in

the afore-mentioned project, some field testing of commercially available retorts indicated that there was strong resistance among garimpeiros (informal gold miners) to their use as the latter results in a fused, discoloured lump which fetches a lower price in gold trading posts and which is difficult to separate into the weight percentages with which workers are paid (Cleary, 1996).

Dredging for gold also results in large amounts of suspended particulate matter in water courses, which reduces light penetration, buries bottom-dwelling algae species, and affects the respiratory systems of fish. These factors, in turn, will influence *Pteronura* habitat suitability. However, it is the development which normally accompanies large-scale mining of bauxite, iron ore and coal, which results in the disturbance, destruction and settlement of extensive areas of previously forested land. The forest east of the Tocantins River in Brazil, for example, is expected to be almost entirely destroyed by the turn of the century due to iron ore mining and development in the Serra dos Carajas region (Johns, 1988; in Carter & Rosas, 1997).

The use of cyanide in mining activities and the associated water pollution affects not only water quality but also the availability of fish stocks on which Giant Otters depend. Recent mining disasters such as the 1995 cyanide spill at the Omai gold mine in Guyana, when 4 billion litres of effluent were released into the Omai River, have endangered the Guyanese *Pteronura* population (Shackley, 1996). Mine water is frequently acidic and is often contaminated by heavy metals which are toxic to fish (Macdonald & Mason, 1990).

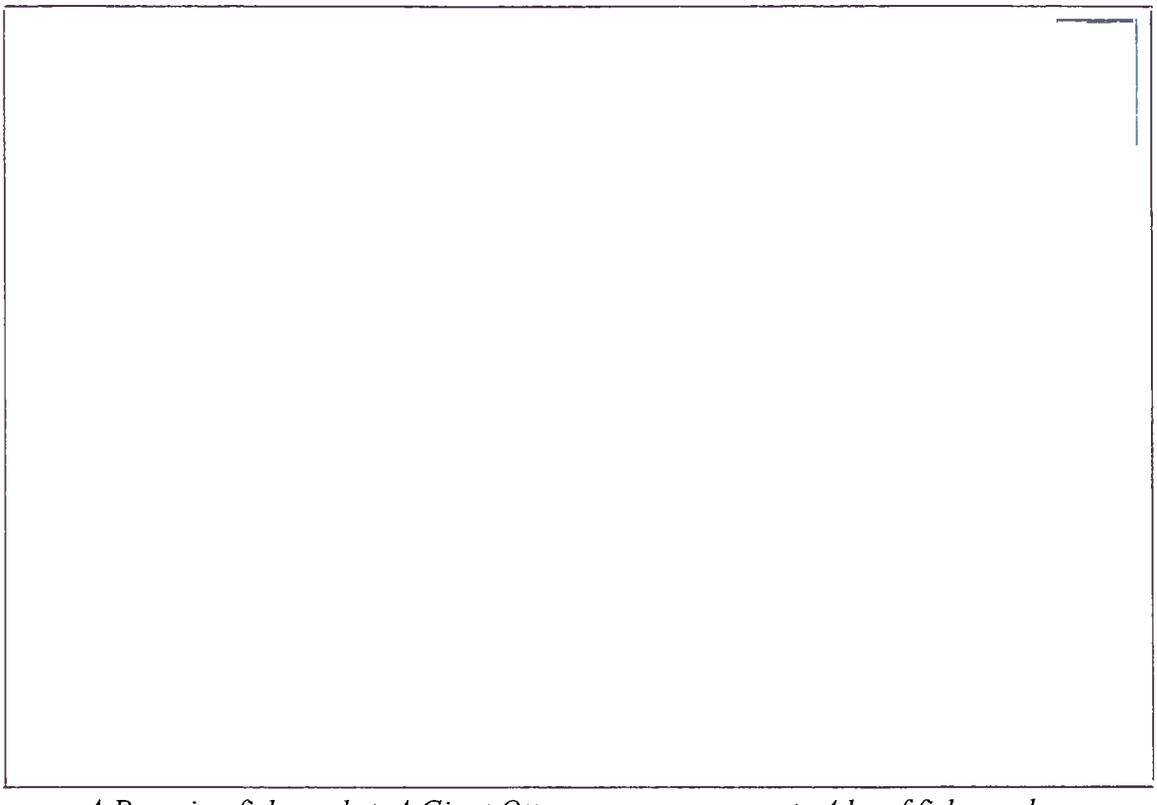
5.3 Conflicts with indigenous peoples and fishermen (overfishing)

Duplaix (1980) received reports of otters drowning in nets which had been placed across the entrances of small forest creeks or being captured in spring traps used to catch *Hoplias*, a species of fish. She also noticed that the presence of a commercial fisherman who had purchased a licence to exploit fish on the Coesewijne River led to increased shyness amongst the Giant Otters. Indigenous peoples may poison small streams and ponds using plant toxins (known as 'barbasco' in Peru) which paralyse the respiratory systems of fish (Shackley, 1996). Colonists have adopted this age-old method on a grander scale and may strip a water body almost completely of its fish stock, as has been reported in Peru (various, pers. comm.). It is reasonable to assume that this practice, combined with the intensive use of seine and gill nets which sometimes entirely span wide rivers or oxbow lakes and which are used particularly effectively when many fish species are migrating, pose a severe threat to the *Pteronura* population.

Gerrits & Baas (1997) report deterioration of fish stocks, in the Middle Amazon of Brazil, through intensified fishing practices, mercury pollution, and habitat destruction. The causes include demographic explosion, gold mining, hydroelectric dams, improved infrastructure and cattle ranching (deforestation). As a result, indigenous peoples and settlers are forced to intensify fishing efforts, despite which catches are lower. There is also a shift towards the capture of other fish species. This phenomenon of increased pressure on fish populations may be extrapolated to many other South American countries and therefore represents a serious threat to Giant Otters.

In Ecuador, the Giant Otter is perceived to be the bearer of magic spells and as such assists the shamans of the Achuar indigenous people (Araya, 1997; pers. comm.). The latter therefore do not hunt this species, thereby contributing towards its survival within their lands. In south-eastern Peru, however, *Pteronura* is not a significant mystical animal within the Machiguenga culture, unlike the jaguar (Schenck, 1997; pers. comm.). Instead, Giant Otters are increasingly being regarded as competitors for fish and there have been reports of at least one individual being killed for fun in the

community of Diamante (Schenck, 1997; pers. comm.). The extreme shyness of the Giant Otters in Cocha Maisal, Manu National Park, suggests that this group is being disturbed and perhaps persecuted by the local Machiguenga settlers (Schenck, Staib & Storch, 1997). In sharp contrast, however, there have been recent reports of how the local Amerindian people in Suriname refuse access of motorised transport on Kaboeri Creek in an effort to avoid disturbance of the resident Giant Otters (Reichart, 1997; pers. comm.; Schouten, 1997; pers. comm.).



A Peruvian fish market. A Giant Otter may consume up to 4 kg of fish per day; declining fish populations therefore represent a serious threat.

In Guyana, the Macuxi Indians very much regard *Pteronura* as competitors for fish. Nets have increased fishing efficiency and have gradually resulted in reduced fish stocks. However, it is the Giant Otters who are frequently blamed for this phenomenon as they are seen to eat up to 4 kg of fish each per day. In fact, the 20 or so otters near Karanambu consume nearly 30,000 kg of fish each year so perhaps it is not surprising that the Macuxi bear a resentment towards the Giant Otters, particularly so during the rainy season when fish stocks are at their lowest (Shackley, 1996). The element of competition between man and otter has also been reported in Venezuela.

Small numbers of Giant Otters are hunted for meat by indigenous peoples in Colombia and Guyana (Defler, 1986; Laidler & Laidler, 1983; in Carter & Rosas, 1997), captured for the zoo trade (Schweizer, 1992; in Carter & Rosas, 1997) or taken from dens as cubs to be sold or kept as pets (Duplaix, 1980; Carter & Rosas, 1997). Possible cases of deliberate injury have been reported in Guyana (Duplaix, 1980; Shackley, 1996).

5.4 Fossil fuels

Mobil has carried out seismic exploration for hydrocarbons in the Las Piedras and Tambopata watersheds, in south-eastern Peru, and the oil company is currently drilling a well in the latter of the two locations, both of which are inhabited by Giant Otters. Such activities may have both a direct

impact on resident Giant Otter populations (although this has been undocumented thus far), as well as indirect negative influences. Bahuaja-Sonene National Park was established very recently in the Tambopata region but does not include, as was originally planned, an uninhabited primary rainforest roughly 6,000 square kilometres in area, because it is located within the boundaries of Mobil's Block 78. Instead, it will retain its lesser Zona Reservada status although a proviso is included that this area could be added to the National Park, in due course (TReeS, 1996). Las Piedras Block 77 is believed to be the home of several uncontacted indigenous peoples, and, in the event that Mobil returns to the region to carry out further hydrocarbon activities, it is possible that the latter will catalyse the migration of indigenous groups into Manu National Park thereby potentially exerting greater pressure on the resident fauna, including Giant Otters. The migration of colonists and loggers into the Las Piedras area itself is also of considerable concern (Groenendijk & Hajek, 1997). A decision is yet to be made as to whether the oil company will return to the Las Piedras region.

In eastern Venezuela, a recent and potentially damaging development is oil exploration within the Orinoco Delta, on the Cano La Brea in the State of Sucre, and on the Guarapiche River in the State of Monagas. Oil concessions (Occidental, Maxus, PetroEcuador and possibly Shell in the future) currently overlap the boundaries of Yasuni National Park and the Cuyabeno Wildlife Reserve in Ecuador, both of which are home to the Giant Otter. Within the last 20 years, Texaco has severely and extensively contaminated pristine Ecuadorian rainforests, releasing over 16 million gallons of oil into aquatic systems from ruptures in one of its main pipelines. Further damage has been caused by more than 4.3 million gallons of untreated waste which was discharged into the watershed daily (Kane, 1994; in Carter & Rosas, 1997).

Accidental and/or deliberate spills of oil, effluents and drilling muds have a particularly harmful environmental impact on water bodies. Noise pollution caused by seismic exploration, heavy boat traffic and helicopter overflights frightens away wildlife. Environmental Impact Assessments and Management Plans are often illprepared and inadequate. The road building that is frequently associated with hydrocarbon exploitation results in an influx of colonists, hoping to benefit from the oil company's presence.

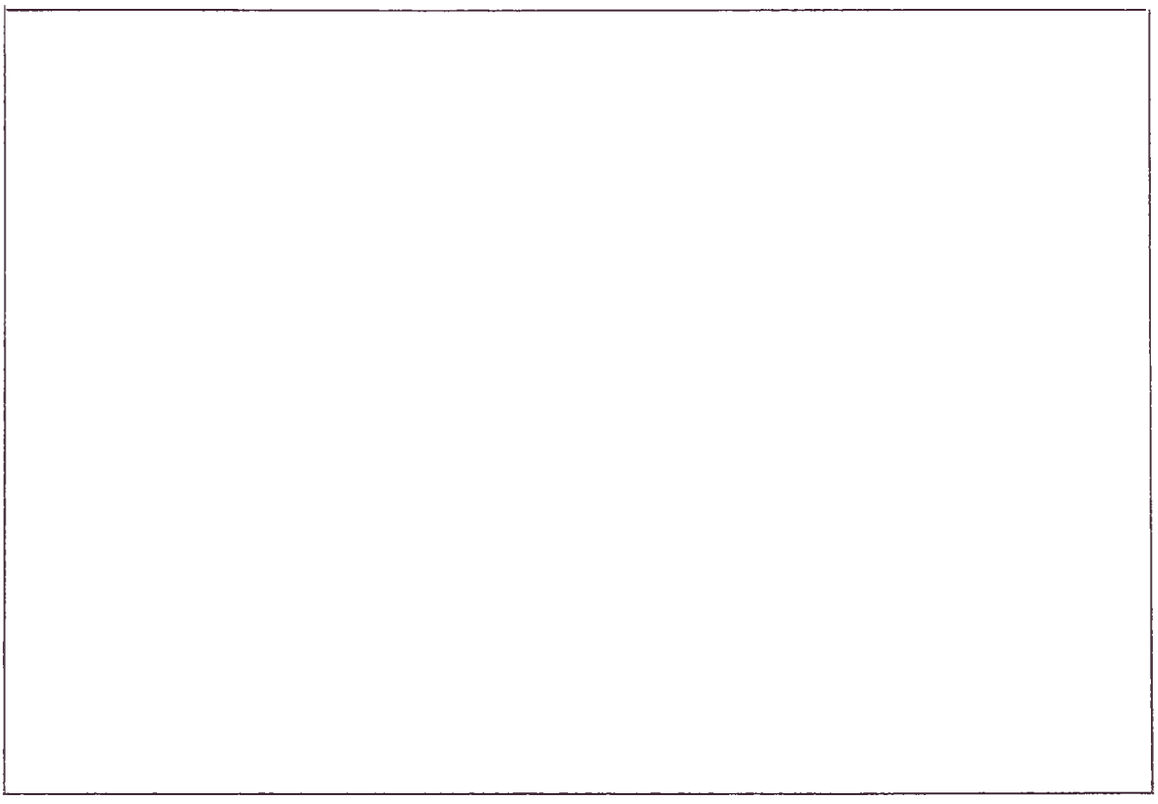
5.5 Industrial pollution

Wood pulp processing plants, crude oil refineries, alcohol distilleries and the intensive use of agricultural pesticides and other toxic substances have also affected aquatic fauna, particularly in the more developed Paraguai, Orinoco and La Plata River basins. Impacts include eutrophication, deoxygenation, alterations in temperature and pH, fish mortality, and changes in the species composition of fish stocks (Carter & Rosas, 1997). Oil, organochlorines (pesticides) and heavy metals have direct impacts on otters and are the compounds which generate most concern. Polychlorinated biphenyls (PCBs) have a wide variety of industrial uses and it has been suggested that their accumulation in otters is largely responsible for the decline, or even extinction, of otter populations in many parts of the world (Leonards, 1997). However, Schenck believes that PCBs are unlikely to have a significant impact on *Pteronura* as the latter normally inhabit areas which are far removed from industry (1998, pers. comm.). On the other hand, PCBs do have a tendency to disperse over great distances, not unlike mercury (Bergmans, 1998; pers. comm.).

5.6 Tourism - the Peruvian experience

In Manu National Park, Peru, canoe trips on oxbow lakes have been, and still are, a major tourist attraction, in order to observe Giant Otters as well as other fauna. Three lakes in particular were visited by tourists in the past, Cochas Otorongo, Juarez and Salvador, representing nearly half of the

resident *Pteronura brasiliensis* population. Excursions became so frequent, however, and were so poorly managed that, in 1991, 2 different otter groups lost their litters, probably due to stress. Giant Otters are very sensitive to disturbance and have also been known to spontaneously abandon their home ranges. In response to this negative development, boat trips on Otorongo were prohibited in 1992. Fortunately, Giant Otters at Juarez also have access to several undisturbed water bodies in the vicinity. By 1996, *Pteronura* groups on Cochas Otorongo and Juarez had once again successfully reared young. However, the situation was believed to be critical at Cocha Salvador, the third and most heavily frequented lake, as the resident otter group failed to reproduce for three consecutive years. This was most likely due to intrusion by tourist boats. Attempts have been made to restrict such excursions to selected parts of the lake, leaving the remaining area comparatively undisturbed, but this may prove to be inadequate. Park authorities and tour operators have therefore been recommended to ban boats from the lake and to use observation platforms instead (Schenck, Staib & Storch, 1997).



Observation platforms are thought to be a low-impact means of observing Giant Otters in their natural environment

Two important simulation models - for local group dynamics and for oxbow lake re-colonisation - have been developed recently, the results of which may be used as a basis for recommendations towards Giant Otter conservation management in the Manu Biosphere Reserve, Peru (Frank, Schenck & Staib, 1998). Although these models were designed around empirical findings specific to habitat conditions in southeastern Peru, lessons may be learnt which are relevant to the Guiana Shield countries, amongst others. One conclusion is that long-term regional otter persistence may only be attained given a minimum number of oxbow lakes with a low basic mortality and a low degree of stress. This implies that large oxbow lakes, located far from domestic animals, gold mining and human disturbances (such as tourism), are indispensable for the survival of the Giant Otter in Peru.

affect fish populations and species composition by interrupting migratory routes, and profoundly alter hydrological and water quality conditions in the long-term (Carter & Rosas, 1997).

The Hidrovia Paraguay-Parana Waterway Project aims to ensure year-round navigability for large barges (of about 2,000 tons) on roughly 3,400 kilometres of the Paraguay-Parana River system, transgressing 5 countries: Brazil (through the Pantanal), Bolivia, Paraguay, Argentina and Uruguay. Amongst other impacts, river beds will be deepened by means of extensive dredging while banks will have to be strengthened and channels straightened. Critical areas of the watershed will be transformed into agricultural land, thereby considerably increasing erosion and hence siltation. Heavy barge traffic will cause severe disturbance while markedly reducing fish stocks (Lovera, 1997). The implications for the remnant Giant Otter populations which inhabit this region are extremely serious.

- Ana Maria Martinez-Sanchez began an investigation in September 1996 on the middle reaches of the Caqueta River, focussing in particular on Giant Otter behaviour. She collected data during different hydrological phases (high, low and transition waters) and completed the field research in May 1997. She is now preparing the project report (Martinez-Sanchez, 1997; pers. comm.).

- Hans Dignum and Jaime Alberto Diaz Sarmiento have developed a proposal which will investigate the status (distribution and abundance) and autoecology (reproduction, diet, and habitat use) of the Giant Otter on the lower Yari / Mesay River basins in the Middle Caqueta Region (Colombian Amazon). The organising institute is the Fundacion Universidad de Bogota, Jorge Tadeo Lozano, and the duration of the project is expected to be 18 months, between 1998 and 1999, involving one complete hydrological cycle (Diaz, 1997; pers. comm.). The university also has a programme (BOA-96/99) for the ecological evaluation of aquatic ecosystems in the pristine waters of the Caqueta River basin; it includes the study of aquatic mammals such as the Giant Otter (Diaz, 1997; pers. comm.).

- Andrade reports that a Giant Otter project was due to start in Amacayacu National Park (an Amazon river close to Leticia), Colombia, by Sandra Beltran of the Centro de Investigaciones Cientificas, Universidad Jorge Tadeo Lozano. This study also has the support of the Whale and Dolphin Conservation Society (1997, pers. comm.)

Guyana

- Diane McTurk, owner of the Karanambu cattle ranch in the Rupununi region of central Guyana, runs a giant otter rehabilitation programme. Her work has resulted in the reintroduction of 27 cubs to the wild over a period of 10 years. Mortality rates are high; at least 50% of repatriated cubs are lost after their release, most killed by wild otters or falling victim to predation by people or black caiman (Shackley, 1996). One specimen was shot at point-blank range by an Amerindian hunter as it approached the canoe (Laidler & Laidler, 1995). According to Shackley (1996), "the seasonal presence of a population of perhaps 20 Giant Otters on Karanambu territory is related to Diane McTurk's activities and would probably not be maintained in her absence". In fact, the Giant Otter is not native to Karanambu but is found in the Simoni area to the east. No form of monitoring has taken place, at least until 1995, and further investigation is required to determine the success of the programme and whether, or to what extent, rehabilitation affects local otter ecology (Shackley, 1996).

- Karanambu, located at a junction of four major ecological zones, is one of Guyana's leading ecotourism destinations. A new research station is planned, one of a series monitoring a biological corridor running through Guyana from the Iwokrama Rainforest Project in the north to the Kanaku mountains of the south. The station will act as Giant Otter research headquarters and as a focus for a project designed to integrate ecological research with the provision of development opportunities for local communities. It will also provide accommodation for visiting scientists while investigating local threats to otter communities (Shackley, 1996).

- The Philadelphia Zoo is hoping to develop a research programme that will lead to a countrywide survey of Giant Otter distribution and abundance in Guyana as well as educational and training opportunities for University of Guyana graduates and students as well as Amerindians in the interior. In addition, there is some interest in using Giant Otter hair samples for examining genetic diversity in isolated populations and the effects of mercury contamination on the otters. The zoo is currently in the process of seeking funds for these programmes which will be carried

out in cooperation with the University of Guyana and the Iwokrama International Centre for Rain Forest Conservation and Development. Iwokrama will also be working on estimating abundance of Giant Otters and other large mammals in the Iwokrama Forest over the next year (Watkins, 1998; pers. comm.).

Ecuador

- Yacu Pacha is also involved with two additional projects in Ecuador: (i) a study into the population, home range, ecological and ethological aspects of a group of Giant Otters on the Tiputini River in Yasuni National Park. The latter has two research stations run by private universities from Quito. This research was initiated in April 1997 and is being carried out by Miguel Rodriguez, supervised by Victor Utreras (coordinator of Yacu Pacha). The conclusions (preliminary results have already been established) will be published in April 1998 in the form of a graduate thesis (Araya, 1997; pers. comm.); (ii) a distributional map of the Giant Otter in Ecuador. Started in June 1997 and carried out by Ignacio Araya and Victor Utreras, this project compiles all sightings records throughout Ecuadorian Amazonia, including 3 Yacu Pacha field trips (two of which have been realised thus far) to specific regions where *Pteronura* is suspected to be relatively abundant. The study is expected to be completed by the end of 1997 (Araya, 1997; pers. comm.).

Peru

- The Giant Otter Project in Peru has produced a drawing book as part of the environmental education programme, in which *Pteronura* is used as a flagship species by means of a central character, a young otter named Pepe. The booklet is designed to deepen rural and urban children's appreciation and understanding of their natural surroundings and is currently being distributed together with colour pencils. This initiative is financially supported by a grant from the German Federal Ministry of the Environment via the German Technical aid agency, GTZ (Schenck, Staib & Storch, 1997).

- In September 1998, a new computer model on Giant Otter population dynamics and conservation will be presented to the Peruvian authorities (Schenck, 1997; pers. comm.) at the first Peruvian Giant Otter Symposium. This two-day event will be funded by the Frankfurt Zoological Society and organised by Christof Schenck. A key objective is the establishment of guidelines for the IUCN Otter Action Plan which is to be revised by the year 2000.

- In 1999, a Peruvian scientist will be looking at the status and distribution of the Giant Otter in the Pacaya-Samiria Reserve, northern Peru, in view of the recent sighting of two Giant Otter groups where previously they had not been recorded (Schenck, 1998; pers. comm.).

- At least two independent film companies (BBC and Partridge) are planning to film Giant Otters in south-eastern Peru in the near future (Schenck, 1998; pers. comm.).

General

- Robert Dulfer organised the VII th International Otter Colloquium which took place in March 14-19, 1998, in Trebon, Czech Republic. The Giant Otter was one of the key species discussed.

- Gonzalo Medina (Coordinator of the IUCN / SSC Otter Specialist Group) distributed a survey to otter experts in order to establish the conservation status of all otter species inhabiting Latin America. The results were presented in the afore-mentioned Otter Colloquium.

- The South American Network for Giant Otters (SANGO) is a cooperative idea of Christof Schenck / Elke Staib and Yacu Pachu (Quito, Ecuador). It is a proposal to establish a network between organisations and scientists for the conservation and protection of Giant Otters in the whole of South America (Wiessmeyer, 1997; pers. comm.). Very much in the preliminary stages, it will depend on contacts throughout the Giant Otter's range (Schenck, 1997; pers. comm.).

- Sheila Sykes of the Philadelphia Zoological Society is currently assimilating data on the husbandry and management of captive Giant Otters in zoological exhibitions all over the world, the results of which will be compiled and published in the forthcoming edition of the North American River Otter Husbandry Notebook (1997, pers. comm.).

7.2 Legislation

- In order to contribute towards the protection of wetlands and wildlife, all governments which have not already done so (that is, Colombia and Guyana) should sign the Ramsar Convention on Wetlands of International Importance, as well as other international conservation agreements (Foster-Turley, 1990).

7.3 Species protection

- Ranch owners who are willing to afford protection to Giant Otters inhabiting their lands should be encouraged and assisted (Mondolfi & Trebbau, 1997).

- Zoological collections in South America should be supported in their efforts to breed Giant Otters and a cooperative breeding programme, including a studbook, must be established so that a self-sustaining captive stock may eventually provide animals for the reintroduction of viable populations into the wild. Enhanced communication between European and South American zoos is necessary to facilitate the loan or purchase of genetically suitable individuals. The feasibility of reintroducing Giant Otters in appropriate habitats, in combination with a monitoring programme in order to supervise the released animals while preventing their illegal capture, should be evaluated. However, translocation (of a group from one region to another) and reintroduction (of a captive population into its natural habitat) should only ever be considered as a last resort.

- The control and vaccination of domestic animals (cats and dogs) should be considered where the latter are in close proximity to resident Giant Otter groups. The potential impacts of diseases such as parvovirus, rabies and distemper should be researched more extensively.

- Carter and Rosas have proposed that the status of the Giant Otter should be altered from 'vulnerable' to 'endangered' according to the A1 criterion of endangered species of IUCN (1996). The species has experienced a severe decline over the last five generations in terms of total numbers, distribution and quality of habitat (particularly in the southern range of its original distribution), while the remaining scattered populations in South America face immediate and increasing threats to their habitats (Carter & Rosas, 1997).

7.4 Habitat preservation

- A strong commitment to habitat preservation is mandatory and must include the upgrading and creation of protected areas to include Giant Otter populations. Game wardens must be trained with respect to *Pteronura* morphology, ecology and behaviour. National and international protection and trade legislation must be adequately enforced and game wardens must be sufficiently well equipped (with canoes, engines, gasoline, and medicine) to be able to effectively patrol protected areas against poachers. Management plans for protected areas should take the particular needs of this species into account. Fragmentation of Giant Otter populations must be halted by means of the creation of natural corridors which will permit migration of individuals between sub-populations, as well as recolonisation of habitats which remain intact. This entails the management of forest and wetland ecosystems on a long-term sustainable use basis.

7.5 Education

- An education programme must be developed and implemented in communities which are located within or near areas where there are Giant Otter populations. Posters, leaflets, videos,

radio interviews, and lectures in schools (teachers are a key target group; children may then convey the message to their parents) and community centres are appropriate for this purpose and should refer to its protected status. A publicity campaign involving television programmes, magazine and newspaper articles, and illustrated books will gain international interest and support (Mondolfi & Trebbau, 1997). Education could also include capacity building of NGOs and universities to improve proposal and budget formulation. Indigenous peoples and their needs should also be integrated into the conservation and sustainable management of this species.

- Tourism may pose a significant threat to Giant Otters unless the following measures are implemented: education of tourist guides; prohibition of tourist groups accompanied by unlicensed guides; coordination among tourist agencies to stagger visits; adequate provision of information to tourists with respect to conduct in the area and their likely impact on the environment; provision of alternative attractions to relieve pressure on *Pteronura* habitats; restriction of the number of sites that may be visited by tourists while leaving the remainder undisturbed; and improved administration and regulation (Staib & Schenck, 1994). The feasibility of using the Giant Otter as a key species within a well structured and sensitively managed ecotourism programme should be investigated further.

7.6 Monitoring

- Hydroelectric projects, agricultural schemes, infrastructural developments and the activities of oil, mining and logging companies must take into account the habitat requirements of Giant Otters (as well as river dolphins and particular fish species etc.). Detailed environmental impact assessments and management plans should be submitted without exception. Independent monitoring is essential as are long-term studies into the ecological impacts of dams, mining and oil exploration.

- Remote sensing technologies must be used to assess trends in habitat quantity and quality on a large scale; rates of deforestation and wetland drainage should be monitored regularly. Efforts should be made to restore riparian habitats.

In conclusion, further research must be complemented by concrete action, including improved legislation, species protection, habitat preservation, educational measures and enhanced monitoring. Long-term, international cooperation, support and environmental funds (the first phase of one of the studies currently underway was financed by an oil company) will be required as soon as possible if the afore-mentioned proposed activities and programmes are to be carried out effectively. The latter must subsequently be followed up to determine whether their primary objectives are being achieved. Only a comprehensive, committed conservation strategy will ensure a brighter future for the Giant Otter in South America.

Table 2. Giant Otter contacts and geographic areas of specialisation

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