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The Amazonian Manatee

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Among the sirenians, the Amazonian manatee (*Trichechus inunguis*) is the only endemic species in the Amazon Basin and the only sirenian restricted to freshwater systems. Indigenous groups living in areas where the Amazonian manatee occurs have their own names for the species (*yacu-huagra* in Kichwa, *entsania-yawa* in Shuar, *siáya-wêkî* in Siona, *airuwe* in Ticuna, and *yuwara* in Cocama and Yagua). Non-Indigenous terms liken the manatee to land cattle (*vaca de água*, *vaca del Amazonas*, *manatí*, or *vaca marina* in Spanish, and *peixe-boi* in Portuguese), names that reflect the large, round nostrils both animals have in common, in addition to their shared herbivorous diet.

The Amazonian manatee is probably a branch of the trichechids that invaded the Caribbean region in the early Miocene epoch and then became isolated in the Amazon Basin after the origin of the Andes in the early Pliocene, some 5 million years ago[1]. The species inhabits lakes, rivers and channels of white, black, and clear water in the Amazon region[2] (map 5.1). However, highly productive white water is the preferred habitat of the species. Manatees have played a significant role in Amazon basin culture, having been hunted for subsistence by Indigenous people for hundreds of years[3].

Exploitation by non-Indigenous peoples apparently started in 1542 when Francisco de Orellana and crew went down the Amazon and were offered manatee meat by the Indians. Despite protective legislation currently in place, manatees are hunted to this day throughout the Amazon. While fishers with harpoons are currently the main threat, other more efficient techniques have reached the backwaters of the Amazon and may be on the increase. In particular, the use of nets is on the rise everywhere and presents a threat of both accidental and deliberate capture.

The huge dimensions and complexity of the Amazon region make estimating the size of the population a real challenge. The manatee has been under pressure from human activities for centuries (including hunting, pollution, and habitat destruction), and there is good rea-

Map 5.1. Amazonian manatee distribution. (Map by Ellen McElhinny.)

son to believe the population level is below the carrying capacity of its environment[4]. In this chapter we present the general biology, habitat use, current status, and main threats and include recommendations for the manatee's conservation.

Distribution and Habitat Needs

Amazonian manatees have a wide distribution, ranging from the headwaters in Ecuador, Peru, and Colombia to the estuary in Brazil. They are typically found throughout lowland forested areas at altitudes below 300 m. Manatees are rare in some areas and have been extirpated in others[5]. The largest populations probably occur in the Brazilian Amazon, most notably in the Solimões, Negro, Japurá, Juruá, Tocantins, and Tapajós river systems. Most records in Ecuador are from the extreme northeast[6]. In Peru, Amazonian manatees occur in the Samiria, Pacaya, and Yanayacu-Pucate rivers[7] and in the Javari and Amazonas rivers near the Colombian border. In Colombia they also occur in the Amazon, Putumayo, and lower Caquetá rivers. All through their range manatees occupy a great range of black and mixed-water lakes, including large expanses of *várzea* (floodplains and seasonally flooded forest) and *igapó* (permanently waterlogged swamp forest)[8].

Amazonian manatees prefer shallow, 1–4 m deep, calm waters away from human activities with easy access to patches of aquatic vegetation. Annual variation in river levels through the Amazon Basin may reach 10–15 m. The seasonal variation of water levels profoundly influences manatee life in terms of both feeding and protection from human predation. Amazonian manatees undertake long seasonal movements, using lakes and *várzea* areas during high waters when the production of aquatic plants increases. As observed in the mid-Solimões area in Brazil and in the Colombian Amazon, when the river level drops, manatees move to deeper water bodies where they spend the dry season.

Population Dynamics

While there are no accurate population estimates available for the Amazon, there is no doubt that numbers are lower than in the past due to long-term hunting; in fact, manatee habitat is believed to be below carrying capacity[9]. Although subsistence hunting seems to be the present primary cause of decline in population, it is not the only one. From 1935 to 1954 commercial hunting was responsible for the deaths of several thousand manatees[10]. One of the most problematic and pressing questions is the lack of population estimates. The only basin-wide minimum estimate of 10,000 animals[11] must be viewed with caution. Interviews with local inhabitants suggest increased sightings in some areas and fewer sightings in others. Conditions in the region conspire against an easy answer: most waters inhabited by Amazonian manatees are very murky, and Amazonian manatees are extremely secretive, perhaps an adaptation to hunting.

The annual reproductive rate of sirenian populations is approximately 5%[12], an obstacle to recovery for an exploited population[13]. Slow reproduction rates, combined with continued subsistence hunting, suggest that the population is likely to continue to decrease. Nevertheless, genetic diversity of *T. inunguis* was found to be high[14]. Recent analyses from the mitochondrial DNA control region[15] suggest that Amazonian manatees are undergoing a population expansion, although estimates vary as to when this began. Although the Amazonian manatee is not found outside the Amazon Basin, hybridization has recently been confirmed between the *T. manatus* and *T. inunguis* species at the mouth of the Amazon River in Brazil[16].

Legal Status

In Brazil the Amazonian manatee is classified as a "vulnerable species"[17] and has been protected by law since 1967 under the Wildlife Protection Law (No. 5197 of 3 January 1967) and Edicts No. 3481 of 31 May 1973 and N-11 of 21 February 1986. In Ecuador, where it is classified as "critically endangered," the manatee is considered the most threatened Amazonian mammal and is protected by Resolución No. 105 of the Ministry of Environment (Registro Oficial No. 5 of 28 January 2000) [18]. In Colombia (*Libro Rojo de Mamíferos Amenazados de Colombia)* manatees are considered endangered (see http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria#categories, criteria EN A.2c, d, and A.3c, d), mainly due to loss of habitat and hunting, and are protected by Resolución 574 of 1969. In Peru Amazonian manatees are protected under the *Reglamento de Ordenamiento Pesquero de la Amazonía Peruana* (R.M. No. 147–2001-PE) of 30 April 2001.

Threats

Subsistence and Commercial Hunting

Historically, Amazonian manatees have been caught by Indigenous peoples for local consumption and trade. From precolonial times manatees were the focus of in-

ternational trade, which peaked during the Industrial Revolution, when their skin was valued for building machinery parts[19]. And *mixira* (manatee meat preserved in its own fat) was commercially available and widely distributed throughout the nineteenth century.

Subsistence hunting and the illegal sale of meat still exist throughout the species' range, despite widespread awareness of the animal's protected status. Hunting and trading in manatee products are practiced by Indigenous peoples[20], colonists, and the military[21] and are the primary threat to manatees. Hunting is usually carried out by men, and the capture of a manatee may be considered an act of machismo, since it is so difficult. In the past there were specialized manatee hunters and, while a few hunters are still left, manatee hunting is now usually secondary to the capture of *paiche* (*Arapaima gigas,* a large freshwater fish) [22]. Traditional hand-held harpoon hunts account for from 55% to over 90% of hunting events. Hunting strategies include looking for manatees in feeding sites and mating areas and using captured calves as bait to attract and harpoon the mothers. Most hunters (over 75%) are between 30 and 59 years of age. Manatee products are mostly used for subsistence; the value of meat varies from US$0.40 to US$3.00/kg (for comparison, beef sells for approximately US$3.00/kg). The average annual family income is US$500.00 in the Brazilian Amazon.

It is difficult to quantify the number of manatees killed. Even expert manatee hunters may pretend not to know what a manatee is, and locals are wary of talking to outsiders, especially if it is a one-time event. Some hunters justify their acts by saying that hunting for food is allowed. Although current Brazilian legislation (Law No. 6905/98) does allow subsistence hunting, it is only for those who can prove dire need[23]. In the Colombian Amazon the Ticuna and other Indigenous communities have been granted some level of autonomy or may be so remote as to make enforcement impossible[24]. During May and June 2004 seven manatees were killed in two villages in the Samiria River Basin in Peru, suggesting high hunting pressure[25]. In Peru's Pacaya Samiria Reserve, manatees are caught by specialized fishers, usually *ribereños* (people who live near the rivers) descended from the Cocama-Cocamilla Indigenous group. In Peru and in the Colombia-Peru border area, hunters set traps remarkably similar to those used for West African manatees; traps that might be responsible for an increase in hunting.

Hunting is easier during normal low water periods and extreme droughts. During the 1995 drought records for ten towns in the Brazilian state of Amazonas showed 443 manatees killed; in 1997 a record 648 manatees were killed[26]; and in 1998 475 cases were recorded[27].

As early as the nineteenth century, the practice of setting strong nets across narrow entrances to lakes or streams to catch manatees began[28]. Nets may allow non-traditional peoples to move into areas and set specially made gillnets. A freezer boat working with a large trawl net on the Purus River in 1999 caused the death of 14 animals[29].

Fishing traps are illegal in both Colombia and Peru, but traps (*pari* or fence, with an entrance above which hangs a harpoon) are being used in Peru[30] and the Atacuari area on the Colombia-Peru border, where a dozen manatees perished between 1998 and 2002.

The use of nets and traps represents a cultural change[31]. Both allow a number of animals to be caught for sale with minimal effort, skill, or knowledge of manatees and their habits. Young people are not interested in harpoon hunting. They go to school in urban areas and spend less time in their villages, so they tend to fish with nets, which demands less time and effort; their participation in manatee hunting is usually opportunistic.

Accidental Captures in Gillnets

The second most important threat to Amazonian manatees is the accidental catch of young animals in fishing nets, which has been documented in Peru[32], Colombia, and Brazil. Young animals are particularly vulnerable to fishing nets; if the manatee survives, hunters may raise it, sell it, or give it away for consumption or as a pet. Over half of the 44 calves that have arrived at Centro de Pesquisa e Preservação de Mamíferos Aquáticos (CPPMA) in Brazil since 1992 were caught in gillnets[33]. The number of calves rescued from gillnets every year in Brazil has been increasing, but this number is certainly a small reflection of what is happening in the Amazon as a whole[34].

Habitat Alteration and Disturbance

The third most significant threat to the survival of these manatees is human activity that causes loss, alteration, and fragmentation of habitats[35], notably in Colombia[36].

Very few cases of Amazonian manatees being hit by boats have been recorded in Brazil[37]; this may be due to a tendency for the species to avoid busy, noisy places. Manatee absence from areas where they were recorded previously in Peru and Colombia may be partially attributed to increasing boat traffic[38] and temporary beach settlement during the dry season[39]. On the Tapajós River, proposed government projects to transport soybeans will greatly increase barge traffic[40]. Other

activities thought to displace manatees from typical use areas include large nets set in *remansos* (calm backwaters) and channels of the Colombian Amazon, the cutting of grasses, and fishing with trot lines in floating meadows[41].

The construction of hydroelectric dams and oil exploration and production may be particularly damaging to manatee habitat. The current relatively high level of genetic diversity observed in the Amazonian manatee might change if all 80 hydroelectric power plants planned for Amazonia[42] are built. These dams will act as barriers isolating manatee populations[43]. Petrobras (the Brazilian multinational oil company) was granted permission to explore for oil in Yasuni National Park, a development that will involve considerable traffic, with the potential for oil spills and soil contamination. Another problem is fishing by Indigenous people who use dynamite and by outsiders who employ toxic substances to poison fish.

Local, National and International Uses

An adult manatee may produce more than 80 kg of meat, which is greatly appreciated in the Amazon region and is consumed for subsistence and offered for sale. The skin is also cooked and eaten with sauce[44] or added to black bean stew. The meat is usually salted and sun-dried, but it is the preparation of *mixira* that leads to greater pressure on the species, since it is highly valued and may be conserved for six months to a year. The fat is used in cooking, to fry fish and to make local dishes such as *beiju* and *tapioca*[45]. The meat is compared to bush meat, and local people claim they can distinguish seven different flavors.

Hunters are afraid of the environmental police in Brazil and, therefore, only sell manatee products to neighbors or nearby communities, although when possible they also take manatee products to town markets and sometimes even to the state capitals. An entire manatee may be ordered in the Belém (Para state) market. In Colombia people used to give away parts of the animal to other members of the community; now, due to cash needs, they sell at least part of the meat to restaurants, institutions (military, boarding schools), and others at approximately US$1.50/kg. A large manatee can provide the equivalent of a monthly urban minimum salary, "a real bonanza"[46]. Before 1998 Puerto Nariño police were among the greatest buyers. In Atacuari, on the Colombia-Peru border, manatee meat is sold to military posts or traded for favors or compensation for some tasks; in the Lagartococha river system, one of the most remote areas in Ecuador, demand for animal protein arises largely from the military posts[47].

Household and Medicinal Uses

The scapula is used to stir *farinha* (manioc flour). From the ribs, locals make *gaponga* (small pieces of rib that are thrown into the water to simulate the sound of fruit falling and thereby attract *tambaqui* fish). The skin is currently used to enclose and carry heavy materials, make braided cables or whips[48], drums[49], *rilhos* (a wooden handle with leather ring on the end, to get cocoa), and as bait to attract carnivorous fish like *tucunaré*[50]. The fat has long been used for lubricating tools[51]. Locals may use pieces of manatee bone as charms—often called *puçanga*—to give them luck when searching for a manatee to kill.

Besides food, manatee products are also used as medicine. The fat (pureed or mixed with *andiroba* oil) is used for respiratory diseases, swellings, muscle pain, bone diseases (including rheumatism), and hernias[52]. In fairs, commercial businesses, and drugstores in the state of São Paulo (Brazil) and even in Porto Alegre (southernmost capital in Brazil), creams are made of fake manatee fat[53] because of its alleged healing properties. Skin, toasted and ground, is made into a tea used to treat hernias, respiratory diseases, and impotency[54]. Tea made from the powder of the ear bone is offered as a cure for deafness; similarly, the stapes (or small middle ear bone) may be hung around the neck as treatment[55].

Captivity Issues

Calves are sold as pets or sold or given to politicians, authorities, and wealthy influential people in other Amazonian countries. Trafficking in calves in Colombia has been common for several years, and there are recent cases in the Leticia-Tabatinga-Benjamin Constant area. In the Brazil-Colombia border area, calves cost about R$300,00 (~US$143.00)[56]. There were at least three cases of calves captured in Peru and offered for sale in Colombia between 2003 and 2005[57]. Evidence for similar activities in Manaus comes from complaints about hotels using them for exhibits. When kept as pets, manatees are generally maintained in inadequate private enclosures, such as pools or small lakes. Siona and Quechua Indians keep them as pets but raise them for food[58].

Most illegal captivity sites are in the interior of the Brazilian Amazon, where animals are ordered and maintained in ponds, tanks, and small lakes by local landowners, hotels, and hunter-fishers. Animals in private captivity are a problem. IBAMA (Brazil's envi-

ronmental law enforcement agency), does not have a clear policy and does not have adequate resources to move the animals to institutions—CPPMA; the National Institute for Amazonian Research (INPA, Instituto Nacional de Pesquisas da Amazônia); or the National Rubbertapper Council (CNS, Conselho Nacional de Seringueiros)—much less to incur the high costs associated with raising manatees in captivity. The release of captive-reared animals is further complicated because it is not generally known where the manatees in captivity originated and because hunting continues in all areas. A few years ago a community-based rehabilitation program involving short-term captivity followed by release in the original place of capture started in the Amanã region of Brazil[59]. The actual number of illegally kept manatees is unknown, but it is thought to be a significant problem.

Presently there are more than 100 manatees legally held in five Brazilian Amazonian institutions. Most arrived as orphans after their mothers ended up in meat markets; a few had lost their mothers and were found swimming alone, following boats, or trapped after a severe drought[60]. The Letícia Zoo held captives from approximately 1990; the last one died in 2005. Three Brazilian research centers are reviewing proposals to reintroduce captive-raised manatees back into the wild.

Cultural Beliefs

Live manatees have no central position in Ticuna mythology, but the meat is used in one of the most important rites, the *pelazón* or female puberty ceremony[61]. Ticuna stories describe how grubs transform into manatees in the giant *Ceiba* tree. The grubs grow fat on the leaves and build cocoons, which, after a heavy thunderstorm, fall into a river and float down; by the time they reach a lake they have turned into manatees[62].

Another relevant Ticuna strategy is the concept of *lagos bravos* or wild lakes: these are dangerous places protected by mythical guardians such as enormous anacondas or aquatic jaguars. People are afraid to fish there, creating unofficial aquatic reserves.

There are taboos associated with manatee meat eating. Meat is said to be noxious and cause skin diseases, diarrhea, and occasionally death[63]. This type of belief or restriction, plus low commercial value (in Peru), might provide opportunities for manatee conservation[64]. Usually the skull and bones are tossed in the river; this is done out of fear of someone using the bones to perform some kind of black magic that would cause the hunter not to catch a manatee again; that is, fear of *panema* (bad luck).

Research

At present there are relatively few manatee field projects in place, and research is being carried out in only a small portion of the species' range. Since the mid-1970s, the National Institute for Amazonian Research (INPA, Instituto Nacional de Pesquisas da Amazônia) in Manaus, Brazil, has conducted most of its work on captive manatees, addressing rescue and rehabilitation activities, health, and morphological, anatomical, reproductive, and physiological studies. In 1993 Brazil's Mamirauá Institute for Sustainable Development (IDSM, Instituto de Desenvolvimento Sustentável Mamirauá) located in Tefé, Amazonas state, started the first long-term research program on free-ranging manatees in the Amazon's two large, sustainable development reserves, Mamirauá and Amanã (over 3,500,000 ha). So far it has successfully monitored five animals for medium- to long-term periods, which helped to define migratory routes. IDSM also works very closely with the local inhabitants of the reserves, monitoring hunting levels, documenting traditional knowledge, and implementing educational programs.

The Centro de Pesquisa e Preservação de Mamíferos Aquáticos (CPPMA), established in 1992, is involved in the rehabilitation of orphaned manatees and in environmental education activities, with a view toward making locals co-responsible for the conservation and appropriate use of natural resources[65]. The Institute for Ecological Research (IPE, Instituto de Pesquisas Ecológicas) focuses on research and conservation involving wild populations in the lower Negro River region, Amazonas[66]. The Centro de Mamíferos Aquáticos (CMA, Center for Aquatic Mammals) started a project in 2001 in Pará state, that includes the rescue and rehabilitation of animals in illegal captivity and surveys on the conservation and status of Amazonian manatees in the main rivers of the Brazilian Amazon. In 1998 the Omacha Foundation started working in Colombia's Puerto Narinõ area, carrying out studies on hunting, feeding ecology, distribution, and use of habitat; more recently, under the Natütama Foundation, this research has extended into abundance studies and direct observations of manatees through a co-investigation program based on local knowledge, and it includes education and awareness building as priorities. In Ecuador, studies have been occasional, as there is no institution with a project specifically dedicated to

manatees. In Peru the Durrell Institute at the University of Kent maintains a long-term monitoring program in the Samiria River[67].

Conservation and Management

In 1997 Brazil's IBAMA started a campaign to protect the manatee by enforcing regulations in critical hunting areas and has covered five main rivers (middle Solimões, lower Amazonas, middle Purus, upper Juruá, and lower Uatumã). Owing to the permanent work and protection activities by the environmental program of Amazonas Energia (a private power company that manages the Balbina Hydroelectric Dam), hunting is believed to be decreasing in the lower Uatumã River (from a high of 73 in 1995 to zero in 2003 and 2004 and one in 2005)[68]. In Colombia's Puerto Nariño area the hunting trend has also been decreasing for the past five years. Between 1998 and 2003, 47 hunted manatees were recorded in the area of Puerto Nariño (Zaragoza to Atacuari)[69]. With the campaign in key communities to reduce hunting, the number of hunted animals decreased from ten in 1998–99 to four in 2003. In 2004 two animals were hunted, and in 2005 none were hunted[70]. Although legislation is important, it is not sufficient: due to educational programs about the low reproductive rate of manatees and reduced numbers in the area, most fishers agreed to stop hunting, and those who continue to do so now tend to be isolated by the community.

In Ecuador the Siona Indians are said to practice a self-imposed ban on manatee hunting because of low manatee populations[71]. However, some of the Siona do not know of this ban, and hunting probably continues[72]. There is no cultural check on manatee exploitation in Peru, where they are hunted and trapped everywhere, and it is particularly discouraging that reserve guards are avidly hunting manatees as well. Although aware of the illegality, hunters think that manatees may be taken if they have a special permit or if the take is for the purpose of a communal celebration. There is no fear of law enforcement, since detection levels, enforcement, and punishment are so weak. Protein source alternatives may reduce hunting pressures, but further research is needed to evaluate the status and sustainability of white-lipped peccary, small fish species, and agriculture for these riverine people. Educational campaigns should also be directed at hunters, focusing on pertinent biological information and the effects of hunting pressure on manatee populations[73]. Hunters have been actively involved in data collection in other regions of the Peruvian Amazon[74]. Community-based conservation might increase awareness and, therefore, increase the opportunities for changing attitudes about manatees[75].

The Mamirauá Sustainable Development Reserve, established in Brazil in 1992, had a management plan approved in 1996 that includes guidelines to reduce the number of manatees taken. Colombia has the only management plan specifically designed for manatees.

Conservation strategies in the Colombian Amazon and the Mamirauá Reserve include involving fishers and hunters in manatee research activities and conducting workshops, thus incorporating hunters into an information/conservation network with the added advantage that they also become ambassadors. Locals have additionally been incorporated as co-researchers, trained in telemetry, global positioning systems (GPS), radio communications, the use of hydrophones, photography, data analyses, etc.[76]

This approach has produced a generalized acceptance of the fact that hunting may not be sustainable and manatees need to be protected[77]. From a conservation standpoint, two important information gaps remain: locals typically do not regard manatees as a functioning part of aquatic ecosystems (e.g., their role in returning large quantities of feces and nutrients to the water) and are unfamiliar with the manatee life cycle (including information about their long gestation period, lengthy calf dependency, and extended birthing intervals)[78].

Hunters in the Puerto Nariño area have decided that it is important to exercise "self-control" and have recommended no hunting for at least ten years. In addition, calves found alive in nets should be released, and females with calves should never be hunted. While not everyone agreed, the majority thought that those who did not exercise self-control should be sanctioned (e.g., community work assigned by the local authority) but not sent to jail (except in the case of continuing offenders)[79]. The fishers/hunters also called for alternatives to compensate them for not hunting manatees, given overall economic and social pressures on their community, including increasing human populations, more boats, widespread use of fishing nets, and lack of employment of young people.[80] Although hunting has decreased and the few hunters who persist have been identified and censured, there also needs to be strong legislation upon which to base enforcement, or the commitment may weaken[81]. Captive manatees may be used to stimulate conservation, and every effort should be made to link locals to the rehabilitation and reintroduction of manatees. There is a far greater appeal in seeing a manatee taking milk from a bottle or playing than in a chunk of meat[82].

Given that manatees are distributed in such remote areas and that enforcement is so weak, educational and participative strategies are fundamental to achieving manatee conservation. In the past decade or so, working with communities has become a more widespread conservation tool throughout the Amazon countries; in Colombia's case, this includes disseminating the importance and status of the manatee, socializing information about legal protection, and creating a sense of ownership by local inhabitants[83].

Research and Conservation Needs

There is clearly a need for further research, especially in countries where few studies have been carried out, such as Peru and Ecuador. It is also important that alternative techniques, both direct and indirect, be explored to try to estimate manatee numbers accurately. The use of sonar equipment (on the high tech end) or surveys by canoe with the help of locals (on the low tech end) should be attempted. These methods have already been used in Colombia and Brazil. The collaboration of local hunters is fundamental to the success of all research projects, not only because of their traditional knowledge but also as a way to increase their awareness in favor of manatee conservation. The generalized lack of biological knowledge among local people about reproductive parameters, especially slow reproductive rates, as identified in Brazil, Colombia and Peru, makes educational campaigns vital. The effect of manatee feces fertilization on phytoplankton production could be quite important, particularly in lake systems[84], and should be investigated. The ecological impact of extirpating manatees in a given area is probably not measurable, but their serious depletion or removal undoubtedly brings costs to the environment as a whole[85].

Despite all the laws, conservation and enforcement are difficult as there are few control mechanisms, and the regions in question are very remote. Recommended conservation measures include:

- additional preserves (including areas where no adverse human activities will take place);
- evaluation of whether present protected areas contribute to manatee conservation, and appropriate adjustments, if necessary;
- research on manatee vulnerability to oil spills and human presence, and better population estimates;
- implementation of national environmental education plans, especially with people in and near areas inhabited by manatees, including discouragement of captive trade;
- full implementation of hunting and trade prohibitions (including all consumers);
- implementation of binational and regional plans, with the agreement and support of governments, and educating border garrisons to ensure that military personnel become manatee guardians;
- evaluation of the potential for the return of captive manatees to areas that could maintain healthy populations[86]; and
- future conservation strategies should take into account the likelihood of interspecific hybridization, especially when considering reintroduction of animals[87].

Outlook for the Future

Although traditional hunting still occurs throughout the area, it may be naturally slowing down with the aging of the professional hunters. However, new threats lurk on the horizon, such as the use of nets and traps. Should those practices become widespread, manatees would be facing very harsh times. Data on captivity methods should be carefully monitored and educational campaigns should be developed to address this concern.

Enforcement should be enhanced, especially in town markets and produce fairs, to reduce the illegal trade in manatees and their products. Enforcement in reserves may be conducted by trained volunteers or paid wardens, who can be on site at the time of any capture. Workshops and/or electronic meetings should be held among authorities and researchers, possibly in multinational meetings, to deal with the growing problem of illegal captivity. Community-based rehabilitation centers may help to solve the captive manatee problem and increase awareness about manatee conservation. Existing reserves that contain manatee populations must be enforced and need management/action plans to be developed and implemented in collaboration with the local inhabitants. Critical areas used by manatees, especially during dry periods, must be identified and included in such plans.