



## Protected Area Profile – Perú Manglares de Tumbes National Sanctuary

**Date of most recent on-site evaluation:** October 2003

**Date of publication:** November 2003

**Location:** Zarumilla province, Tumbes department

**Year of creation:** 1988

**Area:** 2,972 hectares

**Ecoregion:** Tumbes/Piura dry forests – Perú, Ecuador

**Habitats:** Pacific tropical sea, equatorial dry forests



### Summary

#### *Description*

Manglares de Tumbes National Sanctuary encompasses mangrove forests and xeric vegetation, with salty grasslands and sand dunes. The sanctuary protects a great diversity of flora and fauna, terrestrial and aquatic, migratory and local. The mangroves inhabit the brackish area where the saltwater of the ocean and the freshwater of the river mix. This area experiences significant tidal action and receives substantial sediments from the river. Equatorial dry forest is found on islands and areas adjacent to mangrove stands throughout the park. On dry land, the flora is typically scrub vegetation with some arboreal species.

#### *Biodiversity*

The mangrove stands are home to an abundant number of common and endemic species. Besides the famous mollusks and crustaceans (black conchs and shrimp), the sanctuary protects a large variety of commercially important fish, more than 200 species of birds (including many rare or endangered species), and rare and threatened mammals, including the Crab-eating raccoon (*Procyon cancrivorus*) and the neotropical otter (*Lutra longicaudis*). Mangrove forests composed of over 40 varieties of plants, among them the distinguished Red mangrove (*Rhizophora mangle*).

#### *Threats*

The principal threats to Manglares de Tumbes National Sanctuary are the presence of shrimp farmers who deforest and pollute the area, the excessive extraction of natural resources (particularly conchs and crabs), and pollution from surrounding villages. Other threats include: contamination from domestic effluents and agricultural runoff; forest and scrubland destruction to create fish farms; increasing unregulated tourism; and the negative influence of the El Niño phenomenon, which alters ecosystem patterns affecting mangroves.



## Description

Mangroves, according to the RAMSAR<sup>1</sup> convention, are tropical wetlands found in saltwater, estuaries, or intertidal lagoons.<sup>2</sup> The mangroves of Tumbes are located in a geodynamically active area – the mangroves are literally trapping sediment runoff from the Andes and expanding the territory of the South American continent.<sup>3</sup>

The sanctuary is situated on the coastal plain in a slightly undulating landscape paralleling the coast.<sup>4</sup> The currents, sediments, and tides of Ecuador's Jubones River and Peru's Zarumilla River strongly influence the geomorphology of the area.<sup>5</sup> The geological stratification includes rocks formed between the Paleozoic and Quaternary eras, with recent sedimentary rock from the Mesozoic. The oldest rocks in the area are quartzite and shale.<sup>6</sup> Geomorphically, the area presents four well-defined units that are directly related to the geology and climate: hills and plains from the Miocene basin, the marine-alluvial interface, the coastal plain, and the delta sediment area.<sup>7</sup>

Soils in the areas are morphologically deep, of medium texture and of imperfect to poor drainage, with some areas having groundwater 50 to 60 cm below the surface. The soil's coloration varies from dark grey to nearly black at the surface and varies in pH from moderately acidic to moderately basic. In some cases, it is extremely acidic in the lower horizons. The soil is moderately to lightly salty, with increasing salinity with increasing soil depth. There is little mineral or organic content in the soil.<sup>8</sup>

The principal river passing through the sanctuary is the Zarumilla River, which experiences highly variable flow, depending on precipitation in the watershed. The primary tributaries are the Piedritas, Tronco Seco, and El Padre, which only flow during the rainy season. From Ecuador flow the Jubones, Arenillas, Santa Rosa, and El Guayas rivers.<sup>9</sup>

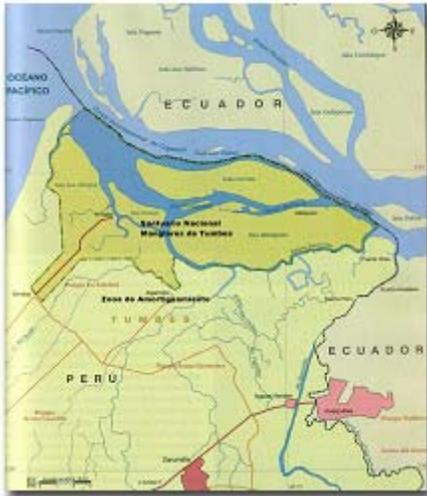
The weather in Manglares de Tumbes National Sanctuary is semi-arid, with mean annual temperatures between 22 and 27 degrees Celsius and average annual relative humidity of between 72 and 86%.<sup>10</sup> Under normal conditions, rains are sparse and only occur during the rainy season between January and March. The rest of the year is considered dry, except during El Niño years, which are wetter than normal.<sup>11</sup>

### Access



The city of Tumbes is the closest major town. Access is available off the Pan American Highway. In the direction of Zarumilla, the El Bendito exit provides access to the dirt road leading to the sanctuary. The area is also accessible by boat via Punta Capones (the limit of mangroves), the international canal (the Ecuador/Peru border), or any of the many canals in the estuary.

*Access road to the National Sanctuary.*



## Biodiversity

Stands of mangrove are the appropriate and, sometimes, only habitat for a range of resident and migratory birds, fish, reptiles, mammals, mollusks, and crustaceans.<sup>12</sup> Besides the famous mollusks and crustaceans (black conchs and shrimp), the sanctuary protects a great variety of commercially important fish, more than 200 species of birds (including many rare or endangered species), and rare and threatened mammals, including the Crab-eating raccoon (*Procyon cancrivorus*) and the neotropical otter (*Lutra longicaudis*).<sup>13</sup>

The mangroves in the sanctuary are the southernmost occurrence of the mangroves in the Pacific coast of South America. The semi-arid climate and the dynamic and fragile character of the ecosystem make the area a high conservation priority.<sup>14</sup>



*The twisted roots of the mangrove. Photo: MM.*

## Flora

Mangroves fall into one of three evergreen tree families: Rhizophoraceae, Verbenaceae and Combretaceae. There are five species of mangrove: two species known as red mangrove (*Rhizophora mangle* and *Rhizophora harrisonii*), black mangrove (*Avicennia germinans*), white mangrove (*Laguncularia racemosa*), and the button mangrove (*Conocarpus erectus*). Each is adapted to thrive in a highly saline and flood-prone environment that is equally terrestrial and marine.<sup>15</sup>

Mangrove thickets in Tumbes are formed by a collection of over 40 species of plants, most notably the Red mangrove (*Rhizophora mangle*). Mangroves prosper in warm, equatorial waters between the Tropics of Cancer and Capricorn and mangroves inhabit the brackish area where the saltwater of the ocean and the freshwater of the river mix. This area experiences significant tidal

action and receives substantial sediment from the river. Mangroves reproduce from seeds – single pods that break open when they fall from the tree or as floating pods that drift until they land on dry land – or through vegetative means – through stringy branches that take root when they touch sediment. This adaptation makes distinguishing roots from trunks nearly impossible. A vast network of canals and estuaries connects the complex systems of mangrove thickets. This network serves to transport the flow of saltwater from the ocean during high tide and the flow of freshwater during low tide.<sup>16</sup>

Vegetation at the margins of the estuaries is characterized by tidal flux and the morphology of the Tumbes and Zarumilla Rivers. Mangroves at the extreme margins are sparse and stunted, subject to more extreme tides and salinity. Equatorial dry forest dominates the central, dry portion of islands and the uplands surrounding the mangrove stands. On dry land, the vegetation is scrubland, typical of the vetch and grassy biotypes.<sup>17</sup>



Mangrove vegetation, subject to the tides. Photo: DS

The scrublands surrounding the mangrove thickets include shrub species like *Phitecellobium excelsum*, *Cordia lutea*, *Mimosa acantholoba*, and Palo brea (*Cercidium praecox*). Tree species include *Chorisia sp.*, Hualtaco (*Loxopterigium huasango*), Incense tree (*Bursera graveolens*), *Cochlospermum sp.*, Kiawe (*Prosopis pallida*), *Caesalpinia corymbosa*, and Sapote (*Capparis angulata*). Seasonal herbaceous vegetation is represented by grassy species such as *Antephora sp.*, *Aristida adscencionis*, *Bouteloua aristoides*, Stinkgrass (*Eragrostis cilianensis*), legumes such as *Stylosanthes sp.*, *Crotalaria sp.*, *Tephrosia purpurea*, and *Tephrosia cinerea*, and the genera *Cyperus* and *Scirpus*. Other species in the scrubland include Saltgrass (*Distichlis spicata*), *Brachiaria mutica*, *Antephora hermaphrodita*, Crowfoot grass (*Dactyloctenium aegyptium*), Crowngrass (*Paspalum racemosum*), *Ipomoea crassifolia*, *Cocobus prostratus*, and *Bidens pilosa*.<sup>18</sup>

### Fauna



Seven species of mammals inhabit the Manglares de Tumbes National Sanctuary. Important species for conservation include the rare Crab-eating raccoon (*Procyon cancrivorus*) and the Neotropical otter (*Lutra langicaudis*). There are eight species of reptiles, including the endangered Tumbes Crocodile (*Crocodylus acutus*) and sea turtles like the Green Turtle (*Chelonia mydas*) and the Olive Ridley Turtle (*Lepidochelys olivacea*). 120 species of birds are present in

the coastal area, 57 of which require mature mangrove stands ten years or older. Eight species are found only in mangroves: Clipper rail (*Rallus longirostris*), Rufous-necked wood rail (*Aramides axillaries*), Mangrove Blackhawk (*Buteogallus subtilis*), Yellow-crowned night heron (*Nyctanassa violaceus*), Bare-throated night heron (*Tigrisoma mexicanum*), White ibis (*Eudocimus albus*), Yellow warbler (*Dendroica petechia*), and the Great-tailed grackle (*Quiscalus mexicanus*). More than thirty species of birds inhabit the scrublands surrounding the mangroves. The sanctuary is home to 93 species of fish, 33 species of gastropods, 34 species of crustaceans, and 24 species of bivalves.

This rich ecosystem possesses species with immense economic value, particularly the Black conch (*Anadara tuberculosa*), *Anadara similis*, *Anadara grandis*, *Chione subrugosa*, Penshell (*Atrina maura*), and *Mytella guyanensis*. Among the crustaceans, *Ucides occidentalis* is the most important. Also important are four species from the genus *Penaeus*, the White shrimp (*P. vannamei*), *P. stylirostris*, *P. occidentalis*, and Yellow-legged shrimp (*P. californiensis*), as well as the lobster *Panulirus gracilis*.<sup>19</sup>

The Tumbes crocodile was highly persecuted for its skins, bringing it to the brink of extinction. One of only four neotropical crocodile species in existence, it is only occasionally found in the wild in remote portions of the Tumbes River.<sup>20</sup> Equally rare is the Crab-eating raccoon. Conversations with a former park guard suggest that conch harvesters killed raccoons by destroying their habitat because they eat the conchs.<sup>21</sup>

## Management

The principal objective for creating Manglares de Tumbes National Sanctuary was to protect the only mangrove ecosystem in Peru. The area is home to a great diversity of residential and migratory wildlife, is a highly productive aquatic ecosystem, and is essential for controlling erosion in the delta region.<sup>22</sup>

In 1982, the mangrove forests of Peru occupied 5,964 hectares. Over the past ten years, the forest shrank to 4,540 hectares as various economic activities have been pursued in the ecosystem, particularly shrimp farming. To address this habitat destruction and other problems, the Center for Conservation Data (CDC) of the National Agrarian University in Molina and the National Forest and Fauna Institute (INFOR) of the Ministry of Agriculture (with the support of the World Wildlife Fund (WWF)) organized to protect the ecosystem. To this end, the organizations published “Strategies for Conserving the Mangroves of Northwest Peru,” which served as the base for the government’s establishment on March 2, 1988 of Manglares de Tumbes National Sanctuary (DS No 018-88-AG). Management Resolution No. 327-2001-INRENA established the buffer zone surrounding the sanctuary on December 12, 2001.

Under the auspices of WWF, the NGOs Pro Naturaleza and the Agrarian Union of Tumbes initiated the “Support for Manglares de Tumbes National Sanctuary” project soon after the creation of the sanctuary. The project has been working in the ecosystem ever since. In 1992, the group initiated studies to provide the foundation for territorial planning and development. In 1995, the group started the “Management and Use Project for Mangrove Forests in Northwest Peru” (the Mangrove Project) with the support of the government of the Netherlands. The project sought to strengthen the area’s administration, consolidate user organizations for

sustainable and community development, assess the natural resources of the area, and strengthen public participation in the planning process.

To date, the main achievements of project include: basic infrastructure for the area, recognition of the authority of the area, enactment of the Master Plan, the organization of a management committee, interinstitutional and intercommunal cooperation, a plan for tourism and public use, and a strategy for conserving the ecosystem.<sup>23</sup>

Because Los Manglares de Tumbes National Sanctuary is not included in the region's Noroeste Biosphere Reserve (which includes the Tumbes Reserve Zone, Cerros de Amotape National Park, and El Angolo Hunting Reserve) its inclusion is in the works. In practice, the sanctuary is considered part of the biosphere reserve and all planning and management activities are undertaken with this perspective. Following the guidelines of the Worldwide Network of Biosphere Reserves proposed under the Seville Strategy of 1995, ecosystem management is integrated with regional planning. The reserves contain both core zones and conservation areas. The strategy for protecting biodiversity and promoting sustainable development in the reserves utilizes a series of programs in education, research, public participation, monitoring and evaluation, and international cooperation.



### Administration

INRENA, the National Institute of Natural Resources and Protected Areas Management, under the Ministry of Agriculture, oversees Peru's natural areas. The actual administration of the area follows Law Number 26834, the Law of Protected Natural Areas from June of 1997, and Supreme Decree Number 038-2001-AG.



*Control Station in El Algarrobo. Photo: DS.*

The administration of the Noroeste Biosphere Reserve, under INRENA, oversees the management of Tumbes Reserve Zone, Cerros del Amotape National Park, the El Angolo Hunting Reserve, and Los Manglares de Tumbes National Sanctuary. The INRENA administration in charge of the four areas includes twenty-one park rangers, three professionals, an administrator, and a director of the protected area. Los Manglares de Tumbes has one control station located with a National Police station in El Algarrobo, next to the Paracas canal. The outpost houses three park rangers, lacks radio

communications, and has basic facilities, including a small interpretive center. The park rangers rotate throughout the preserves of the Biosphere Reserve every three months.

A system of volunteer park rangers also exists to participate in patrol and maintenance operations on a part-time basis. At any one time, between one and two volunteers man each control station. Nonetheless, patrols in the protected area are limited due to the limited number of personnel, particularly in isolated portions of the reserve and the Ecuadorian border.

(During our visit, the control station was abandoned. According to personnel, all staff members were attending a conference in Tumbes. Interviewed park rangers assured us that the control station was never left unattended. While on patrol or in rotation, volunteers man the station.)

### *Budget*

The budget for the National Sanctuary falls under the general budget for the Biosphere Reserve. The total budget for the administration of the entire region is \$200,000 US each year, which includes salaries, uniforms, fuel, patrol and security costs, and administrative costs.

### **Human Influence**

The organized social groups in the mangrove ecosystem are the traditional resource users, non-traditional users, itinerant users from local villages, itinerant users from the margins of urban areas, immigrant users, and users from far away places.

Economically, the Manglares de Tumbes ecosystem is one of the most productive extractive areas in the Tumbes department. During the harvest season for prawns, shellfish, crustaceans, and estuarine fish, the area generates a raw revenue of approximately 25 million US dollars. Socially, the ecosystem accounts for roughly 10% of the economic activity of the entire department.<sup>24</sup>

Zarumilla, the capital of Zarumilla province, lies 15 kilometers from the sanctuary and has a population of 35,000. The town is home to many of the people who use the resources of the sanctuary and the surrounding areas and many of the farmers who occupy the buffer zone surrounding the preserve.

Other population centers nearby include Aguas Verdes in Peru and Huaquillas and Puerto Hualtaco in Ecuador. Huaquillas, a frontier town in Ecuador's El Oro province, borders Aguas Verdes and similarly influences the sanctuary from the other side of the International Canal.<sup>25</sup> Motorboats from Puerto Hualtaco access many of the shrimp farms.

The small town of El Bendito (pop. 500) in the province and district of Zarumilla borders the sanctuary and is surrounded by mangroves and shrimp farms. Controversy surrounds this small town; many people, including local authorities, government institutions, non-governmental organizations, and shrimp farmers, believe that town should abandon the area on the pretext that its presence has a detrimental effect on the mangroves. The



*El Bendito Photo: DS.*

town residents accuse these critics of wanting to appropriate their land for tourism and shrimp farming.

The controversy over El Bendito grows greater with any reference towards their origin. The town affirms its identity as a traditional community of “Los Walingos.” The term “Walingo” refers to native people in the area who have always used the natural resources of the mangroves. On these grounds, the town is seeking official recognition as a native community, the only one only on the entire Peruvian coast. The National Commission of Indigenous, Amazonian, and Afroperuvian People (CONAPA) and the Commission of Peruvian Indigenous People (COPIP) support this action. If designated a native or traditional artesian community, the residents are granted special consideration under the law, including recognition of their territory and protection as an indigenous people.

Residents in the region refer to town as El Bendito because it is rumored that the inhabitants are able to grow everything that they plant, thus the name El Bendito, or “The Blessed.” As the shrimp industry came to dominate the local economy, the town captured and sold shrimp larva to supply the industry. Since there was money to be had, these activities attracted outsiders into the area and, before long, El Bendito was a commercial center. The influx of immigrants created some tensions for the town. Today, however, the shrimp industry is in decline and the price of larva has dropped, and the area is severely depressed.

In an interview, the president of El Bendito community group affirmed that, beyond the interests of the shrimp industry, there are parties in the regional government with sights on changing the character of the town. “These areas have a tremendous potential for tourism. We have not confirmed this, but the regional governor has made initial inquiries in Lima with the Ministry of Tourism about the possibility of relocating our town. There are interests who want governmental support to construct tourist facilities on the island in anticipation of the completed complex at Playa Hermosa. Now we are an obstacle for these developers. There will be a cemetery here because we are not going to move... we will not be taken away.”<sup>26</sup>



*Members of the El Bendito Directive. Photo: DS.*

The population of El Bendito has a quarrel with many of the neighboring shrimp facilities, particularly Latin Mar and Fragata. These production facilities, because of their intensity and methods, produce effluents that flow directly into mangroves in the buffer zone, affecting the vegetation and wildlife and destroying the ecosystem. Local resource users agree that the contamination has been detrimental to the population of black conchs and crabs, decreasing the harvest levels and affected the local economy. The president of El Bendito referred the matter to INRENA in

Tumbes. Magali Acuy, a biological specialist, visited the site, denounced the practices of the shrimp farmers, and nearly lost his job as a result.

The president of El Bendito understands that there exist fierce resistance to the town of El Bendito, the shrimp farmers, INRENA, and other natural resource users. One source of resistance is an official with the regional governor and former director of the NGO ProNaturaleza in 1993 when the Manglares Project secured funding. As the president says, “We saw the deceitful way he ran the project...and now he attacks us like he is the Director of Natural Resources for the regional governor.”

The president continued, "His role is to be low profile. He is a very capable man, utilizing the organized power of The San Pedro Association of Hydrobiological Product Extractors (ASEPROHI) against El Bendito. This organization represents extractive workers in the estuary from Zarumilla and Tumbes dedicated to crab and black conch harvest. They attack our community, saying that we aren't a community, that El Bendito doesn't exist, that it is a refuge for delinquents and prostitutes. This organization submitted a document to the Ministry of Fisheries declaring that our accusations of pollution from the shrimp industry were false because they, as workers in the estuary, had never seen any evidence of pollution. This is but one of the many differences we have with ASEPROHI. They are our companions, but their actions betray the interests of all workers. You could easily conclude that my village is in this alone - the support I receive is primarily moral, and while COPIP finances a few trips for me, this is not enough. This village has been around for more than 100 years. Unfortunately, there was never any organization. Moreover, the richness of the land that was once our blessing became our damnation in the 80s and 90s as people from Lima, Trujillo, Piura, and Chiclayo came for the shrimp larvae."<sup>27</sup>

The Director of Natural Resources for the Regional Governor of Tumbes suggested in an interview that there is no threat of disappearance for the community of El Bendito or the mangrove ecosystem it depends upon. "They possess the site of El Bendito, on the margins of the sanctuary. Generally, they don't enter the sanctuary to extract resources, rather they use the beach areas adjacent to it since they raise larvae. It was the consequence of the rise in the shrimp industry that the town developed. Nevertheless, I find their claims of native rights unfounded. They are pretending to be a native community. Before they were the Association for the Development of El Bendito, they had a committee of conchers, a committee of larvae harvesters, but only in the past two years have they developed this idea of wanting to be a native community. Furthermore, they have established an enclosed territory that overlaps the interests of private property, and they disregard agricultural and aquacultural property, including that of Puerto Pizarro. This is a bit contradictory and has created some conflict within the entire community of the Tumbes province."<sup>28</sup>

### *Tourism*

Both national and international tourists visit the sanctuary. Facilities at this point are very precarious. There is a newly constructed pier (built in coordination of ProNaturaleza) near INRENA's El Algarrobo control post. The pier counts a little luxury in the area, with air conditioning, benches, and a view of the mangroves. It also has a tiny pier on the "Paracas" canal for boats to visit the mangroves. In the interior of the sanctuary, they have constructed a small observation platform with a small dock.

There are tour agencies and guides that take tourists into the area. Regional high schools also organize study visits. There is a movement to involve local residents in the tourist activities. Both INRENA and ProNaturaleza have agreed with ASEPROHI to move tourists through the travel agencies. This recent agreement includes training and capacity building. The residents of El Bendito also want to involve themselves in ecotourism. According to the coordinator of ProNaturaleza, the organization is looking for support from the local communities, but it is first important to organize and build infrastructure before promoting tourism. They work more easily and with more success with ASEPROHI in Zarumilla.

A local tourism promoter shared his impressions after his last visit to the sanctuary. “We presented ourselves on October 3, 2003 at the Manglares de Tumbes National Sanctuary. Upon arrival, we were saddened to discover that the 3.5 kilometers of road between the entrance to the sanctuary and the El Algarrobo control post were covered in cows and goats. They say this is the buffer area, but I consider this a dangerous area for cattle. It’s a shame the way the cows defecate everywhere and destroy the area. Once, when we entered the transitional forest, we saw a lot of cut trees and some burned trees where plums were being planted. With the burning, the ceibo trees appear to be damaged. The tourists, who come to see the mangroves, were shocked by the sight in the transitional forest. The tourists were frightened and turned to me asking, “Is this the Mangrove Sanctuary you were pretending to show me?” These people have traveled immense distances to get to this point and to hire a specialist to lead the tour. They are understandably disappointed.

In the interview, the tourism operator also complained about the inefficient and slow process to obtain entrance permits to the area. He confirmed that one must submit for the permits 48 hours before hand. “This is inherently problematic, as tourists arrive spontaneously with a desire to see the mangroves and there is no time to make the formal permit application. These tourists typically come to visit the sanctuary for only a day, not to camp or stay in the facilities. It used to be that we handled these tourists ourselves and found a way to work them into our schedule, but now we have to apply earlier for the permits. Most tourists just aren’t going to wait around for two days to gain entrance. And another matter, sometimes INRENA has problems with the guides we bring even though they are the employees of my company and I have to work with an ecological specialist because there are zones as delicate as the zones that no one can enter.”<sup>29</sup>

### *Conservation and Research*

Since the creation of the protected area, a series of research and conservation projects have been carried out, including:

The project “Apoyo al Santuario Nacional los Manglares de Tumbes” undertaken by ProNaturaleza in cooperation with Tumbes Agrarian Union under the auspices of the WWF.

The Management and Integral Use Project for the Mangroves of the Northwest coast of Peru – “Proyecto Manglares” 1995 - 99 by ProNaturaleza from funding from the Netherlands.

In 1997- 1998, public participation processes by INRENA, Pro Naturaleza, and CTAR Tumbes (with the support of the German Technical Co-op and the Government of the Netherlands)

elaborated the strategies for conservation and sustainable development in the Noroeste Biosphere Reserve and the master plan of the Manglares de Tumbes National Sanctuary.

Additionally, it is worth noting the following studies and related publications:

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## **Threats**

The threats to the Manglares de Tumbes National Sanctuary include:

- The presence of shrimpers
- Resource extraction
- Trash and contamination
- Aquaculture activities
- The El Niño phenomenon

The mangrove forest was so dense and impenetrable that it seemed to be protected from everything. Among the roots, twisted and intricate, thrived a group of strange and fascinating creatures: crimson colored crabs, snails with thick carapaces, oysters, clams, and a myriad of tiny fish. All of these organisms thrived where the forest met the sea.

Humans discovered they could use the resources the place offered. They fished in the canals and estuaries, collected conchs and clams in the mud, and captured shrimp among the mangrove roots. They learned how to recognize the fluctuations of the tides in order to enter the forest and find food for their families.

Quickly, humans thought they could get even more benefits from the place. Their population was growing and they had to compete with others in working in the ecosystem. It soon became necessary to go deeper and deeper into the mangroves to find the same resources. They began taking conchs in excessive quantities and of smaller sizes, not only for themselves, but as commerce, too. The demands on the system grew. People appeared who had discovered that you could capture shrimp larvae and grow them to adulthood in the security of a cage. And so began the movement to subjugate the old forests and destroy them to create single purpose, man-made shrimp lagoons.<sup>30</sup>

### *Presence of Shrimpers*

Thirty years have passed since shrimp was first raised in the region. In that time, there has been a boom in activity and the area has filled with lagoons for farming shrimp. Each lagoon, or pool, requires anywhere from one to three hectares and each shrimp facility, constructed one after another, has between ten and twenty pools. This takes up an immense amount of land. To construct these pools, the forest was cut, soil mechanically removed, a hollow dug and then filled with water. The water comes from the surrounding mangroves. Bigger pools have canals leading to them to supply water. For example, the Paracas canal that passes by the El Algarrobo control post paralleling the entrance road is supplemented from water from the mangrove area. This canal directly connects the shrimp facilities with the protected area.



*Intensive shrimping operations.*



*Artesian shrimp production. Photos: DS.*

This all has translated into a tremendous change for the countryside and the wooded terrain. Thirty years ago, there was a ceibo forest and all sorts of wildlife, including iguanas and lizards, along the road to El Salto through El Bendito. None of this exists today. Now you can only observe shrimping operations and some small trees sprouting up in abandoned ponds.

When the mangroves are cut, the suite of species that live among their roots are also impacted, particularly oysters, crustaceans, sea urchins, and snails. Spawning sites are disappearing for many marine and mangrove species, as are nesting and roosting sites for birds. In addition to destroying primary habitat for diverse species, another negative impact is the decline in potential tourism and interest in the ecosystem as a natural wonder.<sup>31</sup>

In an interview, a former park guard estimated that surrounding the mangroves lie roughly 40 shrimping operations, each taking up between 60 and 70 acres each. One of the largest is the Paracas facility, with two camps, one in El Bendito adjacent to the natural area called “El Árabe,” and one 41-hectare facility inside the park boundaries. The Jahuaytanara shrimp facility existed prior to the park’s creation. In 1988, the new protected area managed to take a part of the 21-hectare Lanzarumilla shrimping facility. The agricultural and fisheries ministry in Zarumilla had already received all the documents for the operation. The only entity that did not approve the facility was the sanctuary. With the assistance of the NGO the Peruvian Society for Environmental Rights, the conflict was resolved in twenty-four hours. It was a great defense and today INRENA is in place to stop the advance of the shrimping operations into the sanctuary.<sup>32</sup>

Though the adults live and reproduce at sea, shrimp larvae use the safety of the mangroves during their development. The tiniest larvae arrive like plankton in the tidal flow and grow large in the richness of the estuary. The shrimping industry has always relied on collecting these larval shrimp and raising them to adulthood in the confines of the ponds. Larvae are typically caught with fine nets. These nets are not species selective and eels and other juvenile fish are trapped along with the shrimp. This by-catch is thrown away, adding to the degradation of the ecosystem.



Collecting wild larvae adds diversity to the cultivated shrimps. The species raised most frequently are the white shrimp (*Litopennaeus vannamei*) and the blue shrimp (*Litopennaeus stylirostris*). Raising the shrimp in a laboratory setting allows for greater control over which species reproduce. The tendency among shrimp farmers is to purchase the larvae from the labs, choosing the best species and minimizing the risk of white spot disease.

White spot disease (known as “mancha blanca” in Spanish) has negatively impacted the shrimp industry. It is a virus that affects the immune system of shrimp, making them susceptible to fungus, bacteria, protozoan, and massive die-offs. The disease has caused losses for investors who must abandon, sell, or restart their farming operations. The private industry, in collaboration with the Ministry of Fisheries and the Peruvian Sea Institute (IMARPE), has begun to learn to live with the virus. New control methods have been implemented, such as biosecurity protocols.<sup>33</sup>

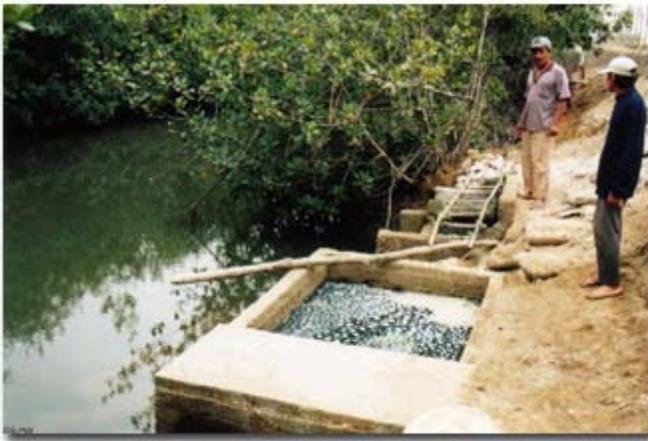
Lately, the shrimp farmers have noticed that the lands surrounding the mangroves have a high iron concentration that is negatively impacting yields. Similarly, the abundance of organic material around the ponds increases their acidity and iron and aluminum concentrations can reach toxic levels.<sup>34</sup> This has apparently caused some recovery from the shrimp farms, though not in the mangroves but on the surrounding uplands. Along the Panamerican Highway, however, new shrimp farms are being built.

In the interior of the protected area, there are three shrimp farms, only one of which still operates on a small scale. These farms were present before the creation of the park. Around eight farms are in operation in the buffer zone. Some of these farms raise shrimp in a more traditional manner, in pools with circulating water flows, while others use intensive aquaculture techniques, with chemicals, closed pools, and effluent discharges. While both methods impact the environment, the consequences of the intensive aquaculture are much more apparent.

In an interview, the caretaker of one of the shrimp farms asserted that the shrimp companies had been established in the area of the national sanctuary for more than 20 years, but without a doubt, he said that there are no new farms being creating inside the park. Most of the new industry is being located south of the sanctuary in Tumbes. The caretaker vouched for the economic

productivity of the shrimp farms in comparison to collecting conchs and crabs. He said that a traditional shrimp farm with a few ponds generates at least 8 tons of shrimp every four months. At 18 soles a kilogram (without setbacks or disease), this generates between 90,000 and 100,000 soles.<sup>35</sup>

The residents of El Bendito are in opposition to two shrimp farms, Fragata and Latin Mar, in the area south of the sanctuary. The town believes that these operations pollute the mangrove areas the town uses for subsistence. The two firms use plastic-covered ponds to maintain a constant temperature and pumps to circulate the water. These operations collect their effluents in small concrete settling ponds. The effluent tends to be saturated with organic material, sediments, and residual chemicals and disinfectants. The ponds are in constant danger of overflowing. Local residents confirm that the effluents back up sometimes before they can be transferred.



*Effluent collection – these discharge straight into the water*

The effluents are directed by a system of pipes and discharged into the mangroves. The impacts of the effluents are readily apparent: dead conchs, crustaceans, and crabs, dried out mangroves, and a burnt landscape. The residents of El Bendito have a strong reaction to these sights. Though they are not against shrimp farming, the town does want the farms to stop this destruction and follow RAMSAR measures and national laws. El Bendito claims to have been warned by the two companies to stop their denouncements. The legal means El Bendito has pursued have stagnated, most likely due to the undue influence of the shrimp farmers.

Local residents also report that the shrimp farms use chloro-phosphates to clean the ponds before and between harvest cycles. The farms discharge the chemicals straight into the waters surrounding the mangroves. In the water, these chemicals form a milky liquid that the ecosystem is unable to assimilate. The chemicals accumulate in the same sediments that the conchs burrow into. Similarly, the process of raising shrimp in close-quartered, confined ponds requires immense quantities of antibiotics that are eventually discharged into the estuary. In the close confines of the ponds, the shrimp are fed a mix of fishmeal and corn. Their excrement accumulates in the ponds and must be frequently



*The contaminants are finally discharged into the mangroves*

drawn off by massive suction apparatuses and discharged into the mangroves. The estuaries most affected are the venado, the tortuga, the culebra, the tapa, the lagarto, and the envidia.

There are other farms, like Virazón or Mifar, that produce shrimp in a more traditional manner that elicit no major complaints from local residents. The effluents from these farms do not tend to be contaminated and the locals get along with the employees and management. In contrast with the intensive cultivation farms, these farms employ local residents. Without a doubt, the traditional farms, with their constant input of freshwater, use more water. But unlike the intensive operations, these farms have a minimal constant discharge, rather than irregular massive events. Their impacts tend to be diffused over the entire mangrove system. The smaller, traditional farms also tend to use fewer chemicals.

The residents of El Bendito referred the situation to the Peruvian Sea Institute (IMARPE). As the state organization that monitors the coastline, IMARPE has never shared its data with the local residents. According to the president of El Bendito, “the problem comes from Lima and the head of the head of the Protected Areas Bureau, who had to find an equilibrium with the shrimp farmers. This came at the expense of the communities. INRENA Tumbes will admit that they are limited by Lima’s actions.” He believes that the Minister of Production and IMARPE will always defend the shrimp farming industry.

The interviewee maintains that if the resources of the mangroves disappear, so too will the community. “Either they go or my town goes. Either two people get rich or 100 of us go poor.” The mayor believes that the shrimp farms pay the Municipality of Zarumilla 40 soles per month in taxes and he believes this money should go to El Bendito. “They are using our resources and benefiting from the destruction of our resources.” The lands occupied by the shrimp farms were originally sold as arid lands. “We defended this land against their mafia. We are the only point of resistance against their interests – without us, they would have it all. Soon there won’t be any mangroves left and judgment will be rendered down upon all of us.”<sup>36</sup>



*Effluents discharging directly into the environment. Photo: DS.*



*Mangrove killed by the effluents. Photo: MM*

### *Resource Extraction*

The main resource harvesting activity in the mangroves is the extraction of crabs and black conchs. Many extractors depend on these resources for their subsistence and many are traditional, older villagers dedicated to the activity. Today, also, there are outsiders arriving to enter the mangroves and extract resources. These people tend to lack experience and do not use traditional extraction techniques. The majority of users abuse the natural resources and the resources suffer— large crabs and black conchs are becoming increasingly harder to find.

Fishing occurs alongside crabbing and conching, mainly with hook and line, but also with more effective, less discriminating nets. Additionally, some of the mangrove vegetation is cut, though sporadically and on a small scale. Locals and, primarily, Ecuadorians use the straight mangrove trunks in their home construction or they sell them to others.

In addition to the people of El Bendito, 350 traditional extractors and sanctuary users (divided by specialty) are registered through The San Pedro Association of Hydrobiological Product Extractors (ASEPROHI). The group is organized into committees comprised of approximately 50 conchers, 130 crabbers, and almost 45 artisan fishermen, all grouped as traditional extractors. The town of El Bendito is concerned for the fate of the resources in the area, particularly black conchs and unchecked extraction from members of ASEPROHI and users from Zarumilla. This has generated tensions and social conflicts.

During conversations with the executive committee of ASEPROHI, they declared that compared to the shrimping industry, which altered the natural dynamics of the ecosystem of the mangroves, they only impacted areas that traditionally have been banks of conchs and crabs. They suggest that any problem that exists can be attributed to incursions from Ecuadorian users, despite their best efforts to address the issue. Approximately 30 to 40 individuals enter the sanctuary via the international canal and catch conchs and crabs and use explosives for fishing. These people tend

to be unemployed and their illegal activities allow them to have a meager subsistence existence at the expense of the mangroves. The impacts of their non-traditional techniques are marked.

In response to the critical state of aquatic resources, particularly conchs and crabs, ASEPROHI proposed a ban on harvesting during September and October of 2003. ASEPROHI channeled their proposal through the Office of Natural Resource Management and Environment of the Regional Government, who gathered interinstitutional support from IMARPE, the Regional Office of the Ministry of Production, local towns, and key players for a regional ordinance. On August 15, 2003, Regional Ordinance 007 decreed the first regional ban on crab harvest. The ordinance prohibited crab harvesting in the mangrove ecosystem for 45 days. The objective of ordinance was to revitalize the degraded ecosystem and generate consciousness about the economic value of the mangrove ecosystem.

The 45-day closed season passed, despite tremendous objections and promises. The Region and Ministry of Fisheries did assume their responsibilities, though problems developed regarding the needs of subsistence crabbers. Ultimately, the participation of users led to a successful closed season, from which the users have acquired greater conscience on the sustainable management of the mangrove resources.

In view of the success achieved through the crabbing season, a regional ordinance has been proposed to establish a season for black conch harvest. The majority of conch production comes from Ecuadorian mangroves since Ecuador's territory contains more mangrove forests. These forests tend to be in a more degraded state than Peru's. Tumbes contributes approximately between 10% and 15% of the total volume of black conchs that are extracted.



*A traditional extractor from El Bendito. Photo: MM.*

These production proportions do not correspond to the actual territorial distribution – Peru only possesses between 2 and 5 % of the total mangrove forest (Ecuador has destroyed a third of its original 280,000 hectares of mangroves. Peru has less than 5,000 hectares of mangrove remaining). Set against this disparity is the challenge of coordinating closed harvest seasons with Ecuadorian authorities. Ecuador has been regulating the seasons for crab and conch harvest in its mangrove forests for more than a decade. A closed season for black conch is in the works for 2004 in Peru and, ideally, this ban will correspond to limits in the Ecuadorian mangroves.

The immense pressure exists from unemployed and unaffiliated people entering into the mangroves and altering the production areas. Generally, most of the poachers are Ecuadorian. An interviewee described members of the Crabbers Committee struggling to put food on the

table during the closed season, while Ecuadorians enter the Peruvian forest from the other side and continue the harvest. He accuses the police, Navy, and INRENA of being tourists, hardly vigilant against the incursions.

According to members of the ASEPROHI executive committee, the cost of the closed season on the users has been greater than 145,000 soles. Considering that the 130 members of the guild typically remove 45 crabs a day each, for the 45-day closed season there are in excess of 260,000 crabs not harvested. At one sole per crab, this figure is significantly higher than the committee estimates (and even higher if, by some estimates, crabbers harvest 80-100 crabs each per day).

In the end, the closed season serves as a good lesson for the users and residents of the area, reminding them that they determine the stability of the ecosystem. Even though this notion was presented to INRENA headquarters and to those in charge of the protected area, neither showed any action in enforcing or participating in the closed season.<sup>37</sup>



In interview with regional director of the Office of Natural Resource Management and Environment of the Regional Government, he stressed that the mangrove ecosystem is home to more than 3,000 people with a variety of backgrounds and ideas about the best way to manage the natural resources of the forest. The majority of them are Tumbesinos and traditional resource users who belong to different groups than the residents of El Bendito. Nonetheless, all are conscious of the importance of the ecosystem – the closed

season is a response to and product of this mindset, as facilitated by the Office.

Arguably, the centralized nature of the decision and implementation process has limited previous efforts at regulating the aquatic resources by ProNaturaleza, among others. But the regional government has received the crabbers' request, discussed the details of the closures with the local INRENA office, and carried through with the action. The director believes that the issues surrounding the crab season have been resolved and stands prepared to address the management of the black conch and other aquatic resources.<sup>38</sup>

### *Litter and Contamination*

The Peruvian mangrove ecosystem in general and, particularly, the national sanctuary suffer from the negative impacts of contamination. The two main sources of pollution include the shrimp farms and solids and domestic effluents from human settlements. Aquas Verdes in Peru, Huaquillas in Ecuador, and all of the smaller settlements along the Zarumilla River in Peru and the Gran Estero in Ecuador contribute contaminants to the ecosystem.

Pollution also comes in the form of insecticides and fungicides used in agriculture upstream. These chemicals flow into tributaries and accumulate in the mangroves. Heavy metals and other by-products of the mining industry in Ecuador also enter the ecosystem. Very little is known about the extent or affects of these contaminants.

In an interview, a tour operator confirmed that trash abounds all along the entrance road to the sanctuary. This path through the transitional forest would be excellent habitat for observing cactus, birds and trees were it not for the extent of trash and litter.<sup>39</sup> Unfortunately, the police and INRENA headquarters reveal that the proper authorities offer no guidance or relief - the headquarter's grounds are littered with trash and empty motor oil containers. It should be no surprise that the same occurs in the surrounding areas, where plastic, cans, bottles, and miscellaneous trash is widespread and abundant.



*Plastic trash along the entrance road. Photos: DS.*

Increased deforestation along the Zarumilla River causes erosion and deposits unnaturally large sediment loads in the mangroves. The largest consequence of the altered sedimentation regime is a disturbance of the tidal dynamics. Increased sedimentation causes an increase in the size of the swells, which in turn erodes the shoreline and the footing of the mangroves.

### *Agriculture*

The formal buffer zone and the areas immediately adjacent to the sanctuary are severely threatened by agriculture. Agriculture is popular now to the extent that it competes with ranches for land. The buffer zone is being systematic destroyed as farmers organize, move in, cut the trees, and burn the land. The La Soledad Committee of Prairie Farmers has established itself adjacent to the sanctuary and is systematically removing native trees, cactus, and shrubs, replacing them with plum trees. The farmers claim that they had been allotted these lands. A similar organization, the Committee of Turumillas, operates in a similar fashion, only to the south of El Bendito. Other farmers are moving into abandoned shrimp farms and converting the young forests that had recovered on the sites.



*Deforestation of the transition forest that surrounds the mangroves to open up land for agriculture, photos Diego Shoobridge*

An interview with a farmer at one of these plots confirms that all the plots belong to the Committee, whose 55 members have registered the parcels each year. The Department of Agriculture gave the Committee certificate of possession before the National Sanctuary was created and did not stop after its formal declaration. The first plums were planted six years ago, and cultivation depends on rainfall. To ensure that the fruit trees receive the most water, all of the native vegetation is cut and removed. Lacking fences, cows are this farmer's greatest threat (at least they fertilize the fields). The interviewee confirms that many ranchers exist in the buffer zones, most possessing around one hundred cattle. The interviewee also commented that most of the firewood removed from the agricultural lands goes to the Vaso de Leche program for food preparation.<sup>40</sup>

### *The El Niño Phenomenon*

The El Niño Phenomenon is a warm ocean current originating off the coast of northern Peru that periodically surfaces and alters climatic patterns. Its main local consequence is extreme, severe flooding that tends to restore forest ecosystems while destroying infrastructure and cultivated fields.

El Niño affects the mangroves when long periods of flooding (months) inundate the forest. The abundant fresh water causes osmotic shock that can kill the trees. Shellfish, including *Anadara grandis*, *Chione subrugosa*, *Atrina maura*, *Ostrea columbiensis*, *Ostrea coreziensis* and *Cuides* sp. are also affected. The shrimp farming industry is affected as well, as flooding threatens the integrity of the ponds, inundates the equipment, flushes larvae out into the estuary, and increases contamination.<sup>41</sup>

Any natural disturbance, including El Niño, can potentially produce significant changes to the riverbed, water levels, chemical composition, and temperature, impacting sensitive species.<sup>42</sup>

## **Future Threats**

### *Increases in the Current Threats*

If the present threats continue to deteriorate the mangrove ecosystem at the current pace, the natural resources of the sanctuary will be severely affected. Unfortunately, most everything indicates that the threats will only increase, particularly from aquatic resource extraction and shrimp farming. The increasing settlement and conversion of the buffer zone and the affluence of opportunistic extractors both threaten the system. Trash and contamination originate both within and outside of the protected area, creating a management challenge. If the shrimp farming industry revives, the reactivation of old ponds and the creation of new ones will undoubtedly affect the protected area and the surround forests and uplands. Unless all these activities are stopped and properly managed, they run the risk of diminishing the richness and integrity of the sanctuary.

### *An Increase in Unregulated Tourism*

Because mangrove ecosystems are very fragile, the constant human presence and increase in visitors threatens the system. Following recent years of increased tourism and the anticipated influx of tourists to the Playa Hermosa project in Tumbes, the influence of tourism to the area will increase significantly. Unless measures are taken to organize and regulate tourism in the sanctuary area, the increased tourism will disturb the system. Increased river traffic, human congestion, disturbed fauna, waste generation, and soil compaction all negatively affect the protected area and diminish the quality of the tourist experience.

## **Recommended Solutions**

### *Aquaculture*

All the appropriate agencies, including the Ministry of Fisheries, IMARPE, the Ministry of Production, INRENA, Municipalities and the Regional Government, should be in direct coordination for the authorization, permitting, and placement of new shrimp farms. New and reactivated shrimp farms should not be allowed in the areas around the sanctuary. Farms in operation should be required to present their Environmental Compliance Plans (PAMAs), and all new or reactivated farms should conduct environmental impact studies and environmental management plans.

The effluents, particularly those from the concentrated breeding facilities, should be treated and not directly discharged into the mangrove forests. Oxidation ponds, filters, and other mitigation processes should be implemented to minimize contamination. INRENA should lead a coordinated effort to monitor the effluents and general activity of the shrimp farms.



*Accumulation of the effluents creates a crust over the soil, photo Diego Shoobridge*

The General Law of Fishing, Decree Law Number 25977 of December 1992 establishes norms for aquaculture through Title V. Title XI establishes prohibitions, infractions and sanctions. Article 76

Clause 6 of the title prohibits the abandonment or discharge of any materials, waste water, toxic materials, contaminants, or other elements that constitute a danger for navigation, life, or the environment. Clause 7 explicitly prohibits the destruction of mangroves and estuaries. Supreme Decree Number 008-2002-PE of March 2002 provides the legal sanction to prosecute infractions and violations of the law.

The Regional Government and local municipalities should be committed to overseeing the shrimp farming industry. If necessary, they should suspend permits of non-compliant businesses and cancel the permits of chronic polluters.<sup>43</sup>

Similarly, standards should be established and enforced concerning the use and capture of wild shrimp larvae. The illegal export of wild larvae to Ecuador should be stopped through the coordinated efforts of INRENA and the National Police. Ultimately, wild larvae harvesting should be stopped and supply shifted to laboratory-raised larvae.

Laboratory-raised larvae (mostly originating from Ecuador), however, should be strictly controlled by the Animal and Agrarian Health Service (SENASA) Tumbes to avoid propagating and spreading any illnesses or unwanted species that could affect the mangrove ecosystem. Control measures, including sanitary guidelines and inspections, should be established and overseen by SENASA, INRENA, and local and regional governments.

Attention should be given to the situation of El Bendito and its inhabitants. Given their proximity and dependence upon the sanctuary, they should be given a greater say in its management. Efforts should be made to involve and consult the local population on matters that will affect them. Hopefully, this will encourage participation and reduce conflicts.

The shrimp farming businesses will continue to drive Tumbes' economy, but they should be held to certain standards, including: compliance with local and national environmental legislation; established contamination prevention standards; constant improvement of aspects of their operation that are non-sustainable; involvement with local communities; and general environmental stewardship.<sup>44</sup>

### *Resource Extraction*

Access to the interior of the sanctuary should be reduced. Clear management plans with monitoring programs and sanctions for non-compliance should be established. For resource extraction, these plans should include harvest limits, harvest seasons, guidelines for harvest technology and techniques, and registration requirements. INRENA should coordinate directly with the Ministry of Production – Fisheries for these plans. This plan should be applied not just to the sanctuary area, but to the surrounding area as well. Priority should be given for controlling opportunistic extraction.

Given the positive results from the first closed season for crabs, defined seasons for other resources should be promoted and normalized. INRENA should take the lead on coordinating these seasons in Peru and between Peru and Ecuador for crabs and black conch.

The National Police and the Navy should have a greater presence in the mangrove estuary and enforce illegal extraction laws, particularly by Ecuadorian poachers. Fishermen who use explosives or poison should be punished to the full extent of the law to ensure that these methods do not continue or expand. Finally, INRENA should promote advancements in legislation and provide training for protected area and natural resource management.

### *Litter and Contamination*

Studies should be carried out to determine the impact of water pollution on the mangroves and the sanctuary. Both contamination and litter have their origins outside of the sanctuary and therefore should be addressed outside of the sanctuary. Local municipalities, which discharge both liquid and solid waste into upstream waterways, should be accountable for the pollution they create.

The trash and litter along the entrance road to the sanctuary should be addressed. Ideally, INRENA, the National Police, and the municipality of Zarumilla should take responsibility for the 7 kilometers of road between the entrance and El Algarrobo. Local residents and adjacent shrimp farms should be involved. Hopefully, future problems could be avoided if all relevant parties participate in the clean up. Awareness campaigns and appropriate training for local residents and resource users may also help. Additionally, the trash collection systems for El Bendito and the El Salto Navy base should be examined and addressed – these two locations are major sources of trash in the vicinity of the sanctuary.

During the evaluation visit to gather data and information for this report, the area immediately surrounding the National Police control post was deplorably littered. The staff should be reprimanded and forced to maintain the post in clean, exemplary conditions. Similarly, the port is littered with oil containers that will ultimately pollute the mangroves – this garbage should be removed. Farmers in the region should be encouraged to stop or limit their use of herbicides, pesticides, and fertilizer. If necessary, taxes or other price adjustments should be applied to limit their use.



To control erosion and sedimentation, reforestation and soil management programs should be implemented for the main stem and tributaries of the Zarumilla River. The management of the mangrove ecosystem is dependent upon management of the larger watershed. Given that much of the contamination originates from Ecuador, its ultimate solution will require international coordination. INRENA should make contact with Ecuadorian authorities to establish strategies and joint management plans for litter and contamination.

### *Agriculture*

INRENA's multiple interests in the buffer zone should be defined. Gaps in INRENA's legal mandate and other organizations linger, leaving the buffer zone somewhat unregulated. Often, when infractions occur, multiple agencies will shift the responsibility to one another. In these instances, INRENA should step in and coordinate enforcement activities. Because interventions should be carried out as joint actions between the district attorney's office and the National Police, interinstitutional cooperation is essential.<sup>45</sup>



Though no cattle were observed in the interior of the sanctuary, grazing in the buffer zone should be restricted, especially adjacent areas between Algarrobo and El Bendito, around Pampas de Soledad, toward the beach and the El Salto Navy base, towards the Zarumilla estuary, and along the international canal. Removing cattle from these areas will allow the transitional forest to recover.

Agricultural activities should also be restricted. Because some farmers were present in the buffer zones before the creation of the park (like the farmers in Pampas de Soledad), immediate withdrawal is untenable. However, new agricultural activities should not be allowed. The current dimensions of plots in the buffer zone should be monitored and assistance on planting and tending to those plots should be offered. This will help limit chemical inputs into the mangroves. Large trees, especially ceibos (*Ceiba trichistandra*), should be legally protected. INRENA should coordinate with the Department of Agriculture to ensure that no further agricultural settlements are established and to ensure harmonious land use.

Deforested areas should be reforested to improve ecosystem function and connectivity. Because the Peruvian mangroves are loosely connected to mangroves in the Gulf of Guayaquil, conservation actions, reforestation plans, and sustainable management should be coordinated between Peru and Ecuador.<sup>46</sup>

### *Increases in Unorganized Tourism*

To minimize the negative impacts associated with increased tourism, the master plans for tourism, public use, and the sanctuary should be applied. Tourist congestion should be avoided and restricted areas should be established. Guides should be instructed on the proper management of tourists and park resources. Finally, the pollutants and trash associated with tourists and their vehicles should be attended to and minimized.

## **Conclusions**

The main objective of Manglares de Tumbes National Sanctuary is to protect and conserve the only mangrove ecosystem in Peru and its great number of flora and migratory and resident fauna. For such a limited distribution, the forest is being lost at a considerable rate. Urgent measures are needed to prevent the complete deterioration of the ecosystem.

The mangrove ecosystem has become one of the most productive extractive areas in the entire Tumbes province. Traditional, non-traditional, rural, urban, transient, and immigrant extractors all utilize the system. Thanks to international support, the protected area has basic infrastructure, a physical presence, delineated boundaries, and a management plan and committee.

Shrimp farms have changed the landscape and the nature of the forested lands surrounding the sanctuary through deforestation and contaminated effluents. Resource harvesters enter the mangroves to collect increasingly scarce crabs and black conchs. Neighboring settlements litter and pollute the ecosystem. Deforestation in the watershed increases erosion and sedimentation in the sanctuary. Settlers move into the buffer zone, remove or graze the forest, and start agricultural settlements. Between these groups and uses, the natural resources and function of the ecosystem are strained.

Solutions abound: new and reactivated shrimp farms should not be permitted adjacent to the sanctuary without environmental impact statements and environmental management plans; farms currently in operation should implement Environmental Compliance Plans; effluents should be treated and not directly discharged into the mangroves; interior access should be limited in the sanctuary and violations enforced; harvest seasons should be created for aquatic resources and

coordinated between Peru and Ecuador; municipalities should treat their waste and create organized litter collection; international interinstitutional cooperation should address trans-boundary waste issues; in the buffer zone, grazing and agriculture should be restricted and forests should be protected; and tourist activities should be appropriately planned and managed. Finally, efforts should continue to incorporate the Manglares de Tumbes National Sanctuary into the Noroeste Biosphere Reserve.



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\* Field support to gather information and take photos for this report comes from Miguel Morán and Norma Alzamora Remicio helped systematize the bibliographic information.

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## Notes

<sup>1</sup> RAMSAR Convention, the section on Internationally Important Wetlands emphasizes their importance as habitat for aquatic and migratory birds.

<sup>2</sup> Aportes para un manejo sostenible de los Manglares de Tumbes. Informes y productos finales del proyecto manejo y uso integral de los manglares de la costa norte del Perú. Pro Naturaleza. Abril 2000. Pág. 13.

<sup>3</sup> Monitoreo de los Cambios en la Cobertura y Uso de la Tierra en el Ecosistema Manglar de Tumbes (1982-1992). Informe Vol. I. Oficina Nacional de Evaluación de Recursos Naturales ONERN. Fundación Peruana para la Conservación de la Naturaleza. Lima, Setiembre 1992. Pág. 20.

<sup>4</sup> Plan Maestro del Santuario Nacional Los Manglares de Tumbes. INRENA/Pro Naturaleza. Junio 2001. Pág. 7.

<sup>5</sup> Plan Maestro del Santuario Nacional Los Manglares de Tumbes. INRENA/Pro Naturaleza. Junio 2001. Pág. 7.

<sup>6</sup> Monitoreo de los Cambios en la Cobertura y Uso de la Tierra en el Ecosistema Manglar de Tumbes (1982-1992). Informe Vol. I. Oficina Nacional de Evaluación de Recursos Naturales ONERN. Fundación Peruana para la Conservación de la Naturaleza. Lima, Setiembre 1992. Pág. 20.

<sup>7</sup> Monitoreo de los Cambios en la Cobertura y Uso de la Tierra en el Ecosistema Manglar de Tumbes (1982-1992). Informe Vol. I. Oficina Nacional de Evaluación de Recursos Naturales ONERN. Fundación Peruana para la Conservación de la Naturaleza. Lima, Setiembre 1992. Págs. 21 – 25.

<sup>8</sup> Monitoreo de los Cambios en la Cobertura y Uso de la Tierra en el Ecosistema Manglar de Tumbes (1982-1992). Informe Vol. I. Oficina Nacional de Evaluación de Recursos Naturales ONERN. Fundación Peruana para la Conservación de la Naturaleza. Lima, Setiembre 1992. Pág. 26.

<sup>9</sup> Plan Maestro del Santuario Nacional Los Manglares de Tumbes. INRENA/Pro Naturaleza. Junio 2001. Pág. 8.

<sup>10</sup> Monitoreo de los Cambios en la Cobertura y Uso de la Tierra en el Ecosistema Manglar de Tumbes (1982-1992). Informe Vol. I. Oficina Nacional de Evaluación de Recursos Naturales ONERN. Fundación Peruana para la Conservación de la Naturaleza. Lima, Setiembre 1992. Pág.18.

<sup>11</sup> Monitoreo de los Cambios en la Cobertura y Uso de la Tierra en el Ecosistema Manglar de Tumbes (1982-1992). Informe Vol. I. Oficina Nacional de Evaluación de Recursos Naturales ONERN. Fundación Peruana para la Conservación de la Naturaleza. Lima, Setiembre 1992. Pág. 19.

<sup>12</sup> Estrategia de Conservación del Ecosistema de los Manglares de Tumbes. INRENA Tumbes, Junio 2001. Pág. 4.

<sup>13</sup> Walter Wust. Santuarios Naturales del Perú. Paracas y las áreas protegidas de la costa. La República, Ediciones Peisa. Lima 2003. Pág. 76.

<sup>14</sup> Estrategia de Conservación del Ecosistema de los Manglares de Tumbes. INRENA Tumbes, Junio 2001. Pág. 5.

<sup>15</sup> Estrategia de Conservación del Ecosistema de los Manglares de Tumbes. INRENA Tumbes, Junio 2001. Pág. 4.

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- <sup>16</sup> Walter Wust. Santuarios Naturales del Perú. Paracas y las áreas protegidas de la costa. La República, Ediciones Peisa. Lima 2003. Pág. 80-81.
- <sup>17</sup> Estrategia de Conservación del Ecosistema de los Manglares de Tumbes. INRENA Tumbes, Junio 2001. Pág. 4.
- <sup>18</sup> Monitoreo de los Cambios en la Cobertura y Uso de la Tierra en el Ecosistema Manglar de Tumbes (1982-1992). Informe Vol. I. Oficina Nacional de Evaluación de Recursos Naturales ONERN. Fundación Peruana para la Conservación de la Naturaleza. Lima, Setiembre 1992. Págs. 29 – 31.
- <sup>19</sup> Estrategia de Conservación del Ecosistema de los Manglares de Tumbes. INRENA Tumbes, Junio 2001. Pág. 4-5.
- <sup>20</sup> Monitoreo de los Cambios en la Cobertura y Uso de la Tierra en el Ecosistema Manglar de Tumbes (1982-1992). Informe Vol. I. Oficina Nacional de Evaluación de Recursos Naturales ONERN. Fundación Peruana para la Conservación de la Naturaleza. Lima, Setiembre 1992. Págs. 33 – 34.
- <sup>21</sup> Interview with former park guard Santos Peña, 06/10/03.
- <sup>22</sup> Walter Wust. Santuarios Naturales del Perú. Paracas y las áreas protegidas de la costa. La República, Ediciones Peisa. Lima 2003. Pág. 76.
- <sup>23</sup> Estrategia de Conservación del Ecosistema de los Manglares de Tumbes. INRENA Tumbes, Junio 2001. Pág. i-iii.
- <sup>24</sup> Estrategia de Conservación del Ecosistema de los Manglares de Tumbes. INRENA Tumbes, Junio 2001. Pág. 6.
- <sup>25</sup> INRENA. Plan Maestro Santuario Nacional Manglares de Tumbes. Junio 2001. Pág. 15.
- <sup>26</sup> Interview with Julio Rubén Bustamante Soto, President of the Comunidad de El Bendito, Provincia de Zarumilla, 02/10/03.
- <sup>27</sup> Interview with Julio Rubén Bustamante Soto, President of the Comunidad de El Bendito, Provincia de Zarumilla, 02/10/03.
- <sup>28</sup> Interview with Manuel Leiva Castillo, Gerente Regional de Recursos Naturales y Gestión del Medio Ambiente del Gobierno Regional de Tumbes, 06/10/03.
- <sup>29</sup> Interview with Leonor Hevia, director of the travel agency Preference Tours de Tumbes, 06/10/03.
- <sup>30</sup> Walter Wust. Santuarios Naturales del Perú. Paracas y las áreas protegidas de la costa. La República, Ediciones Peisa. Lima 2003. Págs. 78-79.
- <sup>31</sup> Monitoreo de los Cambios en la Cobertura y Uso de la Tierra en el Ecosistema Manglar de Tumbes (1982-1992). Informe Vol. I. Oficina Nacional de Evaluación de Recursos Naturales ONERN. Fundación Peruana para la Conservación de la Naturaleza. Lima, Setiembre 1992. Pág. 39.
- <sup>32</sup> Interview with former park guard Santos Peña, 06/10/03.
- <sup>33</sup> Walter Wust. Santuarios Naturales del Perú. Paracas y las áreas protegidas de la costa. La República, Ediciones Peisa. Lima 2003. Pág. 84.
- <sup>34</sup> Monitoreo de los Cambios en la Cobertura y Uso de la Tierra en el Ecosistema Manglar de Tumbes (1982-1992). Informe Vol. I. Oficina Nacional de Evaluación de Recursos Naturales ONERN. Fundación Peruana para la Conservación de la Naturaleza. Lima, Setiembre 1992. Pág. 81.
- <sup>35</sup> Interview with guard Esteban Inoquio Cruz of the Chimú shrimp farm, 30/09/03.
- <sup>36</sup> Interview with Julio Rubén Bustamante Soto, President of the Comunidad de El Bendito, Provincia de Zarumilla, 02/10/03.
- <sup>37</sup> Interview with the Asociación de Extractores de Productos Hidrobiológicos San Pedro ASEPROHI, 06/10/03. Se contó con la presencia del Sr. José Peña, Asesor Técnico del Comité de Concheros y Cangrejeros del Departamento de Tumbes, del Sr. Lenor Alani Romero, Presidente del Comité de Concheros del Departamento de Tumbes y del Sr. Santiago Roberto Aguay Urbina, Presidente del Comité de Cangrejeros del Departamento de Tumbes.
- <sup>38</sup> Interview with Manuel Leiva Castillo, Gerente Regional de Recursos Naturales y Gestión del Medio Ambiente del Gobierno Regional de Tumbes, 06/10/03.
- <sup>39</sup> Interview with Leonor Hevia, director of the travel agency Preference Tours de Tumbes, 06/10/03.
- <sup>40</sup> Interview with Julio Infante, farmer and member of the Comité de Agricultores Pampas de la Soledad, 01/10/03.
- <sup>41</sup> Monitoreo de los Cambios en la Cobertura y Uso de la Tierra en el Ecosistema Manglar de Tumbes (1982-1992). Informe Vol. I. Oficina Nacional de Evaluación de Recursos Naturales ONERN. Fundación Peruana para la Conservación de la Naturaleza. Lima, Setiembre 1992. Pág. 38.
- <sup>42</sup> Manglares del Perú. Revisión Histórica 1942-2002. Estudio realizado por AB SUSTENTA SAC, Josefina Takahashi, Ph.D. para el Proyecto Fortalecimiento del Sistema Nacional de Áreas Naturales Protegidas- FANPE: INRENA-GTZ. Junio 2002. Pág. 27.
- <sup>43</sup> Decreto Supremo N° 008-2002-PE Reglamento de inspecciones y del procedimiento sancionador de las infracciones en las actividades pesqueras y acuícolas (03/07/2002).

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<sup>44</sup> Walter Wust. Santuarios Naturales del Perú. Paracas y las áreas protegidas de la costa. La República, Ediciones Peisa. Lima 2003. Pág. 85.

<sup>45</sup> Artículo No. 25 de la Ley No. 26834 Ley de Áreas Naturales Protegidas del 17/06/97 establece que las zonas de amortiguamiento son aquellas zonas adyacentes a las áreas naturales protegidas del sistema, que por su naturaleza y ubicación requieren un tratamiento especial para garantizar la conservación del área protegida. El plan maestro de cada área definirá la extensión que corresponda a su zona de amortiguamiento. Las actividades que se realicen en las zonas de amortiguamiento no deben poner en riesgo el cumplimiento de los fines del área natural protegida. Así mismo, los artículos del No. 61 al No. 64 del Reglamento de la Ley de Áreas Naturales Protegidas Decreto Supremo No. 038-2001-AG del 22/06/01 se refieren a las zonas de amortiguamiento.

<sup>46</sup> Manglares del Perú. Revisión Histórica 1942-2002. Estudio realizado por AB SUSTENTA SAC, Josefina Takahashi, Ph.D. para el Proyecto Fortalecimiento del Sistema Nacional de Áreas Naturales Protegidas- FANPE: INRENA-GTZ. Junio 2002. Pág. 27-28.