

Information Sheet on Ramsar Wetlands

1. **Date this sheet was completed/updated:** May 2000

2. **Country:** Ecuador

3. **Name of wetland:** La Segua (La Sabana or Pampas)

4. **Geographical coordinates:**

0 41' - 0 44' South latitude
80 9' - 80 14' West longitude

5. **Altitude:** 9 metres above sea level

6. **Area:** 1,836 hectares

7. **Overview:**

The La Segua marsh is a freshwater wetland located at the junction of the Carrizal and Chone rivers. It comprises a central marsh, which is almost always flooded, and a broad floodplain, which is covered with water during the rainy season. Its soils are sand, clay or heavy clay, with fluvial deposits of recent fine sediments. The water is of average quality, however, with the presence of faecal coliformes, high level of suspended solids and a low percentage of dissolved oxygen. The wetland does not have a wide diversity of living organisms, but there is a high density of each species. The fauna living in or using the marsh includes 12 species of fish, 2 species of crayfish (*Macrobrachyum americanus* and *M. tenellum*), turtles of the genus *Chelydra* and 164 species of birds (22 migratory and 63 aquatic species). The flora is represented by 39 species in 27 families of wild vegetation. During the rainy season, aquatic plants predominate, especially *lechuguin* (*Eichhornia crassipes*). In this season, the marsh can reach an average depth of 1.27 metres. During the dry season, the floodplain fills with Gramineae and Cyperaceae, and the body of water decreases to about 525 hectares with an average depth of 67 centimetres.

There are four towns (Larrea, La Sabana, La Segua and San Antonio) around the marsh with a total population of approximately 1700 persons. The majority of the local inhabitants are involved in fishing, ranching and agriculture within the wetland.

8. **Wetland type:**

Continental O, P, Ts, W

9. **Ramsar criteria:**

1a, 1c, 2c, 3a, 4a, 4b

10. **Map of site included?** Please tick yes -or- no

11. Name and address of the compiler of this form:

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12. Justification of the criteria selected under point 9, on previous page:

1a - The La Segua marsh sustains a diversity of fish (tilapia, chame and crayfish) important in fisheries. These resources in turn provide a livelihood for the inhabitants of the four communities surrounding the wetland. In summer, land in the marsh is used for growing short-cycle crops such as maize, rice, watermelons, melons, beans and broad beans that represent income for local inhabitants. In addition to the resources mentioned, the marsh provides the communities with a series of services and benefits that are almost never recognised and much less valued economically. These include a) reduction in the impact of flooding, b) maintenance of the fish fauna that is the basis of the fisheries in the marsh, c) fertilization and provision of water to the land used for agriculture, d) refuge for wildlife (mammals, birds, reptiles and fish) and e) recreation.

1c - The La Segua wetland is part of the lower basin of the Chone River and has always served as a natural stabilizer of flooding caused by the overflowing of the rivers. In addition, traps are constructed that retain sediments from the Chone and Carrizal rivers reducing the sediment load toward the Chone River estuary. Because of changes (landfill, draining and dikes) produced in the wetland in recent years, its role as a regulator has decreased, but the marsh does play an important role in the surrounding area.

2c - There are large populations of aquatic birds that take refuge in this wetland, both resident species that use it as a refuge in the summer and migratory species that use the wetland as a resting site.

4b - The La Segua wetland forms an area for migration of the chame (*Dormitator latrifrons*) during its life cycle. The chame, which spends part of its life in an estuarine environment and another part in a freshwater lentic environment, migrates from estuarine areas as a juvenile to marsh areas where it grows and feeds until reaching the adult stage. It then returns to the lower parts (estuaries) to mate and lay eggs.

13. General location:

The La Segua wetland is within the jurisdiction of the parish of San Antonio, in Chone canton in Manabí province in continental Ecuador. The nearest important city is Chone, approximately 20 kilometres away. There are four towns around the wetland: San Antonio with 908 inhabitants in 1991; La Segua with a population in 1997 of 280 persons; La Sabana with 313 inhabitants in 1997; and Larrea which is basically a village where 61 persons lived in 1997.

14. Physical features:

Geology and geomorphology: The marsh's landscape is old sedimentary relief with river valleys, basins, decantation ponds and a constantly flooded low-altitude floodplain. It is poorly drained low ground with the water table at the surface and with the presence of aquatic vegetation.

Origin: Natural

Hydrology: The La Segua marsh is formed by a permanently flooded central marsh and a broad floodplain that is covered with water only during the rainy season (December-April). At its extreme northern edge, the marsh joins the Carrizal River, which constantly carries water from the wetland to the estuary of the Chone River.

Soil type and chemical composition: The soils are sand, clay or heavy clay with recent fine sediment deposits.

Water quality: A WQI of 0.56 indicates that the water is of average quality. The presence of faecal coliformes and the high quantity of suspended solids are the main limitations preventing direct human consumption of water. Water with high levels of suspended solids causes serious problems for the life of aquatic organisms. For example, water transparency is reduced, contributing to a decrease in primary productivity through joining with heavy metals and this can increase water temperature through absorption of sun rays by particles. Also, a low percentage of saturated oxygen limits water quality, because the majority of aquatic organisms need oxygen for their metabolism. Some animals, those that adapt to low levels of oxygenation, can, on the other hand, reach levels of overpopulation. Because this area is exploited for agriculture, there are organic wastes that are degraded by anaerobic bacteria, which consume a large quantity of oxygen. This might be the reason for the low concentrations of this important element.

Depth, fluctuations in level and permanence of the water: Water level varies from one season to the next. In summer, the flooded area decreases to approximately 525 hectares. The average depth in winter is 1.27 metres, while in summer it is 67 centimetres.

Watershed basin: The marsh is fed by water from the flooding of the Carrizal and Chone rivers.

Runoff basin: In the summer (the dry season), water from the wetland runs off to the lower parts of the estuary of the Chone River, carrying with it a large quantity of biomass (*lechuguines*).

Climate: According to Koeppen's climatic classification, the area of the marsh is tropical monsoon (Amw) with a single predominant winter. Total annual rainfall is 1000 to 2000 mm concentrated mainly in the months of January to May. Average annual temperature is 25 C (IGM 1995).

15. Hydrological values:

The marsh is a natural sump for rainwater producing a shallow but large area of wetland. It is a natural barrier against exceptionally high tides and plays an important role in maintaining water quality. This wetland, created primarily by flooding of the Carrizal and Chone rivers and surface runoff from the surrounding hills, functions as a regulator of the hydrologic cycle farther down stream. Thanks to its outlet canals, it functions as a sediment sump, maintaining water quality and decreasing flooding down river.

16. Ecological features:

1) Zones:

Permanently flooded - This zone is formed mainly a marsh with a water level that partially decreases in the dry season. In the rainy season (especially December), it forms shallow lakes (approximately 6 metres in depth), which cover almost all of La Segua. Many of these areas are drained for growing short-cycle crops (primarily maize).

Subject to flooding - This zone is surrounded by wetland, formed basically by Gramineae and Cyperaceae, with a light density of trees and shrubs.

2) Plant structure and representative species:

Permanently flooded zone - The herbaceous stratum is predominant. There is, nonetheless, a high density of representatives of the most common aquatic species such as *Eichhornia crassipes* and *E. luzula*. Shrub stratum is very poor, dominated by legumes such as *Senna alata* and *Aeschynomene* spp. The arboreal stratum has a very low population level, and in some cases it does not exist.

Area subject to flooding - The arboreal stratum is formed by sporadic groups of trees: *algarrobo* (*Prosopis inermis*), a large number of *guabas* (*Inga* spp.) and *Acacia aroma*. The density of the shrub stratum is low and not very diverse. *Senna alata* and *S. bicapsularis* dominate.

3) Farming:

Most of the wetland is used for ranching and farming, especially for growing short-cycle maize, harvested three

months before the wetland is completely flooded. In addition, citrus fruit such as orange (*Citrus* spp.), limes and lemons as well as rice are planted. Aquatic plants such as *Eichhornia crassipes* are almost completely harvested in order to sow pasture for grazing.

17. Noteworthy flora:

Floating plants:

Araceae: *Lechuga* (*Pistia stratioides*) is a rare species in the dry season. In the rainy season, it is found mainly in the southwest.

Convolvulaceae: *Ipomea acuatica* is a plant relatively abundant in both seasons and adapts well to the environment.

Lemnaceae: *Lenteja* (*Lemna minor* and *Lemna* spp.) is relatively abundant.

Mimosaceae: *Mondonguillo* (*Neptunia oleraceae*) is not very abundant and is found primarily in the northern part of the lake.

Pontederiaceae: *Eichhornia* spp., *Eichhornia azurea*, and *Eichhornia crassipes*, commonly called *lechuguín*, water hyacinth or *acuática*, are common plants in the rainy season, although their population decreases in summer. They quickly reproduce in the flooded area, but are often eliminated through burning because they are considered to be weeds.

Typhaceae: *Totora* (*Typha* spp.) grows along the edge of the lake.

Plants permanently rooted in the lake:

Asteraceae: Although the species has not been identified, it is known that a plant was recently introduced, probably dispersed by migratory birds.

Juncaceae: *Junco* (*Juncus* spp.) is native to La Sabana on the edge of the wetland.

Mimosaceae: *Pie de sabana* (*Mimosa leicorp*) grows on the edge of the lagoon and is very abundant both in La Segua and La Sabana.

Nymphaeaceae: *Platillo*, *maravilla* or *lirio de agua* (*Nymphaea ampla*) is not very abundant. It is found in the flooded area during the rainy season and at the edge of the lagoon in the dry season. In some cases, invertebrates live among its roots.

Plants on the floodplain:

Alismataceae: *Echinodorus bracteata*

Amarantaceae: *Alternanthera* spp.

Asteraceae: *Pectis arenaria* is a terrestrial species found only on the flood plain.

Borraginaceae: *Heliotropium* spp.

Caesalpinaceae: *Senna occidentalis* is an indicator species for areas that have been highly altered.

Capparidaceae: *Capparis* spp. and *Asclepia curassavica* are terrestrial and are found only on the floodplain.

Convolvulaceae: *Matacabra* (*Ipomea carnea*) grows on the shores of the wetland over a large area and remains during the rainy season.

Cyperaceae: *Cyperus* spp., *Cyperus diffusus*, *Cyperus ferrugineus* and *Eleocharis elegans* are very abundant species in the dry season. They are usually found on the shores of the lagoon.

Mimosaceae: *Pie de sabana* (*Mimosa acantholoba*) lives on the shores of the lagoon and is very abundant both in La Segua and La Sabana.

Onagraceae: *Lugwigia octovalis* is an aggressive invading plant, especially in drained areas and is a clear indicator of the areas that have been modified.

Poaceae: *Cenchrus brownei*, *Cenchrus ciliaris*, *Digitaria* spp., crudge (*Hymenachne amplexicanlis*), *Leptochloa* spp. and *Macrantha* spp. are found in pastures and along the edges of the lagoon. They are often abundant.

Polygonaceae: No species has been recorded.

Rubiaceae: *Randia amata*

Sapindaceae: *Cardiospermum halicabum*

Solanaceae: *Solanum* spp.

Vervenaceae: *Phyla strigulosa*

Trees in the marsh:

Anacardiaceae: Mango (*Mangifera indica*)

Bignoniaceae: *Mate* (*Crescentia cujete*)

Caesalpinaceae: *Caraca* or *abejón* (*Cassia* spp.)

Fabaceae: *Palo prieto* (*Erythrina glauca*)

Mimosaceae: *Guaba* (*Inga* spp.), *guachapelí* (*Albizia guachapele*), *algarrobo* (*Prosopis* spp.), tamarind (*Tamarindus indica*)

Myrtaceae: *Guayaba* (*Psidium guajava*)

Rutaceae: Orange (*Citrus sinensis*) and lemon (*Citrus limon*)

Salicaceae: willow (*Salix* spp.) is an introduced species and is found in La Sabana.

Among the shrubs, *Scabiosa atropurpurea* is not native to the wetland but is invading the area. Its presence was first recorded in 1996. It is a shrub in the Dipsacaceae family, normally growing in cold forests. In this quality, it is found in collections in herbaria with recorded sightings only in Azuay province (2350 metres above sea level) and Imbabura province (2800 metres above sea level). Obviously, this indicates that it is found at the site as a result of farming practices and is, therefore, considered an introduced weed, which is growing aggressively in the flooded areas of the wetland.

18. Noteworthy fauna:

Mammals - Eight species of mammals have been recorded of which two are native to the wetland: the South American river otter (*Lontra longicaudis*) and the *murciélago pescador* (*Noctilio leporinus*). Among the endangered species are the white-tailed deer (*Odocoileus virginianus*), hunted for its meat, and the South American river otter (*Lontra longicaudis*). According to CITES, these species are in danger of local extinction in several countries, although no information exists on the area studied. A fox (*Caluromys derbianus*), *Didelphis marsupialis* and *Philander opossum* are common. Among the species not related with the wetland are *Odocoileus virginianus* and the tayra (*Eira barbara*). Although *Lontra longicaudis*, *Odocoileus virginianus* and *Eira barbara* have been reported in the Wetlands Inventory for Ecuador (Briones et al. 1997), the PMRC, which has been working since 1993 in the wetland, feels that there is reason to doubt the presence of these species in the wetland, because no observations have occurred since 1993.

Birds - La Segua marsh is visited annually by migratory birds; which arrive from August to January. They use the favourable conditions of this ecosystem as a place for resting, feeding, mating or nesting. A total of 44 families and 164 species of birds have been reported both in the dry and wet seasons. Out of the total number of species identified, 22 are migratory and arrive from the northern hemisphere, 2 travel from the southern hemisphere, 63 are aquatic and the rest (77) are species from terrestrial environments.

Among the most important are the following species. The red-marked parakeet (*Aratinga erythrogenys*), which sleeps in the wetland and passes through the marsh in search of wooded areas for feeding. It usually lives in the arid regions of western Ecuador. This species is on the list of endangered birds because of commercial hunting. The *pato andino* (*Netta erythrophthalma*) is found in areas of rice fields near the *lechuguines* and in areas of abundant emerged vegetation. It lives primarily in the interAndean regions between 2000 and

3200 metres in altitude. This species is very rare and is endangered. The peregrine falcon (*Falco peregrinus*) is a migratory species, which lives in North America. It has been observed in all parts of the wetland, but is found primarily in the coastal area of mangroves, coastal deserts and marshes. The pigeon hawk (*Falco columbarius*) has been observed very little in the area. It migrates from North America and has been reported in all parts of the marsh. It rests on dead tree trunks to hunt smaller birds for feeding. This species is found mostly at the mouth of the Chone River in mangroves, coastal deserts and marshes. *Ixobrychus exilis* lives in marshes where there is heavy emerged vegetation and is a timid bird that hides in the *lechuguines*. This species is seldom reported in the area. *Plegadis facinellus* is very rarely observed. It flies in small flocks and has been seen feeding in the wetland. It lives in freshwater and saltwater marshes. It was observed for the first time in the marsh in December 1996, the second sighting reported in Ecuador. It is now in danger of extinction. *Carduelis semirrostris* lives on the floodplain but there are few reported observations. This species is in danger of extinction because of its limited distribution in Ecuador. All of these species are very important for the wetland because some of them are disappearing and there are few reported sightings in this ecosystem and the rest of Ecuador.

Species that visit the wetland during the two seasons of the year to reproduce or mate have also been recorded, for example, the species *Bulbucus ibis*, typical of the wetlands, lives near where there are cattle and horses and was observed in nesting colonies, sharing the area with other species of birds. *Egretta thula* is a cosmopolitan species, living in pastures, along rivers, among crops and in marshes. It is adapted to all environments of the wetland. It has been observed in nesting colonies sharing its area with other species of birds. *Casmerodius albus* is a robust species, living on flood plains and along the edges of the lagoon, feeding on fish, amphibians and insects. During the mating period, it forms couples and lives in nesting colonies. *Butorides striatus* is a species frequently observed in the wetland, living in the marsh among abundant aquatic and shrub vegetation. It does not nest with the herons, preferring to nest in shrubs near the flooded area. *Phalacrocorax olivaceus* lives in estuaries and freshwater wetlands. It feeds on fish and crustaceans, preferring to nest among the heron colonies. *Dendrocigna autumnalis* and *D. bicolor* live in marsh areas with abundant aquatic vegetation (*lechuguines*), usually in all areas of the wetland. They form couples and are endangered, mainly during the dry season when they are hunted. *Porphyrola martinica* and *Gallinula chloropus* feed on small invertebrates. They live in all parts of the wetland, preferably in areas of freshwater marshes, shrubs, rice fields and sectors of abundant aquatic vegetation, preferring to nest during the rainy season. *Jacana jacana* forms flocks of five specimens, living in marsh areas with abundant aquatic and floating vegetation. It builds nests in *lechuguines* and protects them in couples. *Fluvicola nengeta* lies along the edges of the lakes and in trees where it feeds on insects and lives alone

or as a couple. *Furnarius leucopus* is an often-noticed species because of its call on the floodplain. It usually lives alone or as a couple, building nests in tree branches that look like small mud ovens.

Reptiles - Four species of reptiles have been identified: common caiman (*Caiman crocodylus*), *tortuga mordedora* (*Chelydra serpentina*), an abundant turtle in the marsh and in the rivers, green iguana (*Iguana iguana*) and the boa constrictor (*Boa constrictor*).

Amphibians - One species, *Leptodactylus* spp., has been recorded as directly related to this ecosystem and living on the shore of the wetland on floating vegetation.

Fish - Twelve species have been identified: ten native species and two introduced species. The first, chame (*Dormitator latifrons*), is the most abundant native species and the most profitable species in the marsh. It lives in both estuarine and river environments. *Vieja* (*Aequidens rivulatus*) is abundant and is specific to the river environment. There is a large demand for it. *Huayja* (*Lebiasina bimaculatus*) and *guabina* (*Eliotris picta*) are river species, not abundant in the wetland and not sold commercially. *Guanchiche* (*Haplias microlepis*), *sardinita* (*Astianax* spp.) and *babudo* (*Rhamdia wagneri*) are river species in trade, but not very abundant. *Lisa* (*Mugil* spp.) is a marketable species but is scarce, living in estuarine environments. Two species of fish have not been identified. Locally, they are called *odola* and *bongo*. Two exotic species of tilapia (*Sarotherodon niloticus* and *S. mossambicus*) are abundant and economically profitable. They live in the estuarine and river ecosystems.

Crustaceans - Three species of crustaceans have been recorded: *jaiba* (*Callinectes* spp.) occasionally captured in its juvenile phase and usually very scarce; and two species of crayfish locally called *mestiza* (*Machrobrachyum tenellum*) and *cacaño* (*Machrobrachyum americanus*). They are abundant in the rainy season in the rivers, and there is a demand for them.

19. Social and cultural values:

A large part of the resources created by the marsh have several forms of use and each of them has several users.

Fishing - This is the traditional activity in the wetland, because of the abundant production of fish, especially *chame* (*Dormitator latifrons*). According to fishermen in the marsh, during earlier periods of flooding the inhabitants of La Sabana caught chames when the marsh overflowed onto the road. Every year in the month of September, the town of La Segua holds a chame festival. This celebration is held because of the dietary and economic importance represented by this resource represents.

In studies carried out on the chame by PHIMA-CRM (1992), mention is made that the production of chame in La Segua in 1991, in an average area of 3.75 hectares per family, was 30

boxes per family per year. The average sales price per box in December 1993 was S 100,000 (US\$ 51). This represented an average income of S 3 million (US\$ 1,530) per family per year. This profit is created by a secondary activity carried out extensively and on a small scale with minimum operational costs and maintenance because there is no feeding or pumping of water. This makes it possible for the families exploiting the chame to spend more time for other activities such as agriculture or ranching, which generate additional incomes of S 300,000-400,000 (US\$ 150 to US\$ 200) per month.

In La Segua, there are approximately 70 fishermen. In one session in winter (lasting 4 hours), a group of fishermen (eight to nine persons) can catch about 10 boxes of chame. The price per box varies according to the size of the fish. A box of chames 20 centimetres long (with approximately 240 fish) was sold in December 1995 for S 160,000 (US\$ 56) and a box of chames 30 centimetres long (about 70 fish) sold for S 240,000 (US\$ 84).

The tilapia (*Sarotherodon* spp.) is the most abundant fish in the marsh and is caught from small sizes (about 10 centimetres). In one session of fishing, fishermen can catch up to 20 boxes of tilapia. The price per box of tilapia is less than that of chame. In December 1995, it sold for S 40,000 (US\$ 14). The catch is sold to merchants who distribute it to the markets in the interior.

The crayfish (*Machrobrachyum* spp.) is another resource used by fishermen. In winter, a fisherman can catch up to 30 kilos of whole shrimp in one session. One kilo of shrimp sold in December 1995 at S 6,000 (US\$ 2) to traders in the town of Chone. Nonetheless, crayfish are almost always used by fishermen for personal consumption.

Because of the large demand for chame in the area, during the past several years landowners in the wetland have constructed ponds for ranching, but production has been affected by the intrusion of tilapia in the ponds. There are a large number of small tilapia in the ponds that compete for space and food with the chame. A scarcity of chame has produced changes in the habits of the people living in the wetland. They consume and sell very small chames, including lengths between 13 and 18 centimetres; the most common length found in the market in Chone. Fishermen in the marsh declare that the populations of other native species such as *vieja* (*Aequidens rivulatus*) and *guananche* (*Hoplias microlepis*) have also been affected by the introduction of tilapia.

Agriculture - In the marsh, short-cycle crops such as melon, watermelon (*Citrullus vulgaris*), tomato (*Lycopersicon esculentum*), maize (*Zea mays*) and rice (*Oryza sativa*) are grown. The same species as in the marsh plus cotton (*Gossypium barbadense*) and manioc (*Manihot esculenta*) are also grown on the hillsides opposite the highway in La Sabana. These products are sold primarily in the markets of Chone and Tosagua, although another part is sold outside of Manabí province (Guayaquil, Santo Domingo and Quevedo).

There are medicinal plants in the wetland such as *paico* (*Chenopodium ambrosioides*) and *llantén* (*Plantago major*), which have been introduced around houses. The medicinal plants are used as remedies. For example, the leaves of *paico* are used in an infusion against stomach parasites. The leaves of *llantén* are used to cleanse wounds and ulcerations. It can also be used with menthol for application to swelling, and its extract is used to treat stomach ulcers.

Birds - Aquatic birds are very important for the people of La Segua. They use the black-bellied whistling-duck (*Dendrocygna autumnalis*), fulvous tree-duck (*Dendrocygna bicolor*), *gallareta* (*Porphyryula martinica*) and *polla de agua* (*Gallinula chloropus*) for local consumption. The inhabitants of La Sabana declare that the populations of the fulvous tree-duck and black-bellied whistling-duck are slowly decreasing because of hunting in the wetland. They consider that it is harmful to hunt large quantities of birds and then leave them dead where they were killed. The decomposed bodies scare away the ducks that visit the marsh.

20. Land tenure/ownership of:

The La Segua marsh is private property. It is divided into 33 plots of varying sizes, some belonging to inhabitants around the wetland and others belonging to persons that do not live in the area. At the present time, the marsh belongs to 42 owners (Annex 1). The Dueñas and Mendoza families own the largest number of plots in the marsh. Owners do not usually directly exploit their property, renting them to others for fishing and agriculture.

Parts belonging to large farms located near San Antonio are used as pastures and for the grazing of cattle. The land located in La Segua is used primarily for fishing chame in winter and for agriculture in the summer. In La Sabana, the land is used primarily for agriculture, fishing and the ranching of chame.

21. Current land use:

Land in the marsh and especially the floodplain is important for owners because in the dry season when the water level is low it is used for:

Short-cycle crops - Maize, rice, tomatoes, melons and watermelons. These crops are grown primarily in La Sabana and La Segua.

Ranching - Large parts of the marsh near San Antonio are used for grazing and for raising and fattening dairy cows.

Fisheries - Near La Segua and La Sabana, ponds (known as *chameras*) have been constructed for ranching chame. At the present time, these *chameras* are not operated efficiently.

22. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land use and development projects:

At the site -

Use of pesticides: During the dry season, when the water level in the marsh begins to drop, leaving a layer of soil rich in nutrients that is used for short-cycle crops (maize, rice, watermelons, melons, tomatoes). In order to increase production, highly toxic pesticides are used that harm the native fauna (birds, fish, mammals and reptiles). Soil and water samples taken from the marsh by Velázquez et. al. (1997) showed low levels of Alpha and Delta isomers of HCH in the sediment. In Ecuador, HCH or lindano and all their isomers are prohibited in farming activities (Registro Oficial 649, 28 December 1983) because they are highly toxic and irritate the skin and eyes and are suspected to be cancerous. All of the isomers produce environmental contamination that is highly toxic for fish, bees and other species. In addition, the pollutants remain active for at least one year in the environment.

Use of fine-mesh nets for fishing: The heavy demand for chame in the area and its scarcity are the reasons that highly predatory non-traditional fishing techniques such as small mesh (a means that is non-selective in its capture) are used. Chames of approximately 15 centimetres are currently being caught a length at which the fish probably has not reached full maturity.

In the surrounding area -

Simbocal tidal dam: There is considerable loss of water from the marsh during the dry season because of the poor functioning of the tidal dam located in the town of Simbocal. This dam was constructed in order to avoid salinization of the higher land of the estuary of the Chone River and to store fresh water from the Carrizal and Chone rivers in summer for agriculture. Nonetheless, since 1988 the dam has stopped functioning fully and is now almost obsolete. In order to avoid loss of fresh water to the estuary, earth dikes (tapes) are constructed in the bed of the Chone River near Simbocal. This measure has created conflicts among freshwater users (shrimp ranchers, fishermen and farmers). The dikes prevent loss of fresh water and are harmful to the shrimpers located in the upper estuary, because their production is adversely affected by high levels of salinity. They resort to breaking the dikes, which, in turn, harms the fishermen and farmers, because the water level quickly drops in the marsh.

Cutting of the mangrove in the Chone River estuary: This is the main reason that the fishermen in the marsh claim causes the scarcity of chames. According to the fishermen, the chames migrate to the mangrove in the estuary to reproduce and feed. According to Bonifaz et al. (1985), migration of chame to the mangrove probably occurs in the winter months when the flow of the river increases, carrying fish downriver to water

of greater salinity. The increase in water salinity and the abundance of food in the mangroves favours reproduction of the chame.

The introduction of tilapia (*Sarotherodon* spp.) in 1983 for ranching: It is thought that this fish competes with the chame and probably with other species for food and space within the marsh.

The open garbage dump for solid waste of the town of Chone: It is located near the town of La Sabana, on the sides of the surrounding hills, at the foot of the Chone-Tosagua highway. The garbage dump has become a potential environmental and health hazard for the marsh and its inhabitants. It leads to a proliferation of insects, rodents and other vectors for disease. Decomposition of garbage generates toxic gases and liquids that easily seep into the marsh. This becomes evident especially in the winter with the arrival of heavy rains, deteriorating water quality in the wetland. Water is not only the means that sustains life in these environments but also the most valuable resource needed by users of the marsh for their activities (agriculture, ranching, fishing and raising of chames). Currently, herons living in the marsh feed on the garbage dump, which spreads disease.

The project "Multiple Proposal for Irrigation and Drainage Carrizal-Chone": There are plans for a Centro de Rehabilitación de Manabí (CRM), with infrastructure for irrigating approximately 14,000 hectares in the valleys of the Carrizal and Chone rivers, the area of the La Segua wetland. The project seeks to transform the La Segua wetland into a large lake of approximately 11 square kilometres and to use it as a site for the overflow of the Chone River to prevent flooding caused by the river in the town of Chone. The following engineering works have been planned:

- Construction of a new dam at Simbocal
- A drain or canal located near the town of San Antonio that will send excess water from the Chone River to the marsh in order to prevent flooding of the town of Chone
- Engineering works in the Carrizal River

23. Conservation measures taken:

During the period 1994-1997, the Programa de Manejo de Recursos Costero (PMRC) developed an environmental management plan for the La Segua marsh with local participation, in cooperation with the communities connected to the wetland. The results of this programme are summarised in the statement of eight basic conservation policies for the management of four key areas of the wetland: i) conservation of the wetland, ii) fisheries resources, iii) development of aquaculture in the wetland and iv) training and environmental education for the communities that use the wetland. The management plan was accepted and approved locally in March 1998 by the Comité Zonal of the Zona Especial de Manejo Bahía-San Vicente-Canoa, which is the geographical management area to which the La Segua wetland belongs and where the PMRC is working on

integrated coastal management. The Comité Zonal is composed of representatives of the communities in the Zona Especial de Manejo Bahía de Caráquez-San Vicente-Canoa with the power of decision over local planning and orientation of the management of coastal resources in the area. Within the context of the plan, the PMRC has begun to implement the following policies.

Policy 2. Introduction of farming techniques compatible with the marsh ecosystem and promotion of the use of nontoxic pesticides. This policy seeks to establish monitoring programmes for pesticides and to promote awareness and training of farmers. For implementation of this policy, PMRC has hired an agronomist to work with farmers in the towns of San Antonio, La Segua and La Sabana in order to establish practical pilot farming projects using agricultural techniques that do not harm the fauna and flora of the marsh, directly involving the community in these activities. The agronomist also leads workshops on the management of agrochemicals for short-cycle crops, the crops commonly planted in the wetland.

Policy 3. Prohibition of sport hunting of birds in the marsh and promotion of the international importance of the wetland as a resting site for migratory birds. The wetland will be given national or international protection status. The specific action that is being implemented is that required for declaration of the La Segua marsh as a protected area. In order to implement this policy and programme, the Programa de Manejo de Recursos Costeros (PMRC), the Ministerio del Ambiente and the World Conservation Union (IUCN) have signed an agreement to cooperate in order to reach an understanding with landowners in the wetland so that the government of Ecuador can request the Bureau of the Ramsar Convention to declare it of international importance, giving the wetland an important international status. The owners' support has been obtained through an agreement. Furthermore, during 1996-1997, the PMRC carried out a survey aimed at determining the number of birds that live in the wetland. The survey was carried out to learn whether La Segua complies with criterion 3a, thus making it possible to list and certify the wetland as being of international importance. The study confirmed that the wetland sustains a monthly population of about 20,000 birds, which means that it complies with this criterion.

Policy 8. To begin a process of public environmental education promoting the social, ecological and economic importance of the marsh and allowing the setting up of systems of global management of the wetland's resources based on participation. The PMRC has prepared educational materials (videos, pamphlets and guidebooks) to train school teachers in the communities surrounding the wetland.

24. Conservation measures proposed but not yet implemented:

As mentioned under the previous item, the La Segua marsh has a management plan, which includes eight policies and several measures for the sustainable management of the wetland. Among the policies planned, only those mentioned above have been

implemented partially or fully. The following policies have not been implemented:

Policy 1. Ensurance that the marsh maintains an area that is permanently flooded in order to provide for survival of the fauna and flora and to maintain sustainable fishing and farming activities during the two annual seasons.

Policy 4. Improvement of the hygiene and health conditions of the inhabitants of the marsh.

Policy 5. Establishment of policies and regulations for the management of fisheries in the marsh, with emphasis on regulating the exploitation of the chame.

Policy 6. Support for programmes of monitoring and recuperation of the mangrove in the Chone estuary.

Policy 7. Assurance that ponds used for growing aquatic species are not created at sites where there is natural circulation of water between the marsh and the Carrizal River. The use of native species such as the chame and crayfish will avoid introduction of exotic aquatic species to the marsh.

The main limiting factor in the promotion and implementation of these policies is a lack of funds.

25. Current scientific research and facilities:

Currently, no projects are being carried out.

26. Current conservation education:

There is no programme of environmental education specifically for La Segua. The PMRC under the programme and educational activities carried out in the Zona Especial de Manejo Bahía de Caráquez-San Vicente-Canoa (of which the marsh is a part) is working to train schoolteachers in the communities of San Antonio, La Segua and La Sabana about the importance of conservation in the marsh and about wise use. In support of the training, educational materials have been prepared: an educational video entitled "La Madre Ciénaga", which contains a teaching guide for its use; "La Segua: Un wetland de agua dulce, su encanto y utilidad"; and "Las ciénagas, humedales de agua dulce".

27. Current recreation and tourism:

Sport hunting of birds (October-November)

28. Jurisdiction:

The territorial jurisdiction of the La Segua marsh is the responsibility of the local government of the town of Chone represented by the mayor. It should be made clear that the marsh is private property belonging to 42 owners with varying amounts of land in the wetland. Administrative jurisdiction for conservation is the responsibility of the Direction de

Áreas Naturales y Vida Silvestre of the Ministerio de Ambiente.

29. Management authority:

Because these are private properties that are not part of the Patrimonio Nacional de Áreas Naturales (SNAP), the wetland is not under the jurisdiction of the Dirección de Areas Naturales y Vida Silvestre (DNANVS). The agency with direct jurisdiction over this area is the Ministerio del Ambiente (MA) and the Instituto Nacional de Meteorología e Hidrología (INAMHI). Although there is no direct jurisdiction, the Programa de Manejo de Recursos Costeros (PMRC) and the World Conservation Union (IUCN) are the only institutions together with the Ministerio del Ambiente working in the area.

30. Bibliographical references: