

Part 3: Wetland Ecological Management

**THE STUDY ON INTEGRATED MANAGEMENT FOR
ECOSYSTEM CONSERVATION OF THE ANZALI WETLAND**

**FINAL REPORT
Volume III Supporting Report**

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CHAPTER 1 ECOLOGICAL CONDITIONS OF ANZALI WETLAND

1.1 Introduction

A wetland generally consists of complex ecological interaction of (i) biological, (ii) physical and (iii) chemical components such as plants, animals, soils and water. It holds vital functions including wildlife habitats, water storage, flood mitigation, groundwater recharge and discharge, erosion control and water purification.

The Anzali Wetland is composed of diverse ecosystem including freshwater lagoons, extensive reed-beds, shallow impoundments and seasonally flooded meadows. Ecological components of the wetland interact in a complex manner, which provide important habitats for many fishes and wintering waterfowls (Scott, D.A. (ed), 1995). Ecological conditions of the Anzali Wetland are described in this chapter with literature review and the field survey that was conducted between 2003 and 2004 with the assistance of JICA Study Team.

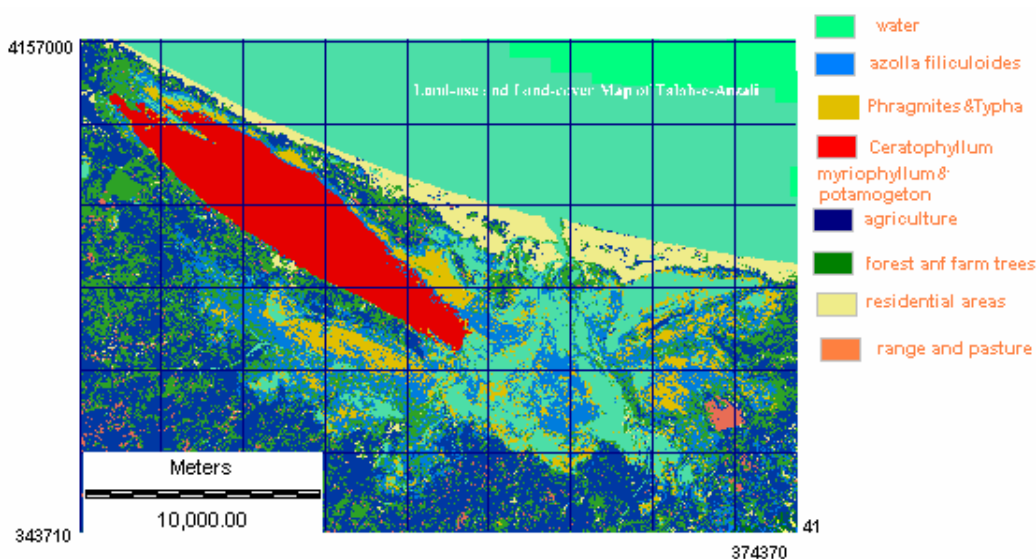
1.2 Biological Components by the Literature Survey

1.2.1 Flora

Plants have important roles in the wetland ecosystem. They are the producer in the ecosystem, and support the lives of other organisms. They also provide habitats such as spawning and nursery grounds for fish and nests for birds. The situation of plants in the Anzali wetland is described according to the literature survey in this section.

(1) Plant Community

Vegetative community of the Anzali Wetland is largely classified into (i) *Phragmites* community, (ii) submerged plants community, and (iii) *Azolla* community (Figure 1.2.1). The *Phragmites* community is largely distributed in the shallow area of the eastern wetland, and covers about a quarter of the wetlands excluding the lagoon. The submerged plants community covers almost the entire area of the lagoon. The *Azolla* community covers about a quarter of the Anzali Wetland except for the lagoon. It should be noted that the actual distributions of plants in the wetlands are much more complex. For example, submerged plants are distributed in many parts of the open water area in the wetland.



Source: Guilan University, 1999

Figure 1.2.1 Land Use and Cover Map in and around Anzali Wetland

(2) Species Composition

Plant species in the Anzali Wetland can be broadly classified into three groups: (i) submerged plants, (ii) floating plants and (iii) emergent plants. Main species of these three groups of plants in the wetlands and surrounded area are shown in Table 1.2.1. There are 9 species of submerged plants, of which *Potamogeton* with three species are widespread; 11 species of floating plants, such as *Trapa natans*, *Lemna* with two species and *Nelumbium capsicum*; 11 species of emergent plants, of which *Phragmite australis* and *Typha australis* are dominant.

Table 1.2.1 Typical Species of Four Groups of Plants in the Anzali Wetland

Submerged plant	Floating plant	Emergent plant
<i>Potamogeton crispus</i>	<i>Lemna minor</i>	<i>Phragmites australis</i>
<i>P. pectinatus</i>	<i>L. trisulcata</i>	<i>Typha australis</i>
<i>P. natans</i>	<i>Spirodela polyrrhiza</i>	<i>Sparaganium neglectum</i>
<i>Cerathophyllum demersum</i>	<i>Wolffia arrhiza</i>	<i>Solanum persicum</i>
<i>Myriophyllum demersum</i>	<i>Hydrocharis morsus-ranae</i>	<i>Iris pseudoacorus</i>
<i>Hydrilla verticillata</i>	<i>Hydrocotyle ranunculoides</i>	<i>Calystegia sepium</i>
<i>Valisneria spiralis</i>	<i>Trapa natans</i>	<i>Sagitaris trifolia</i>
<i>Najas major</i>	<i>Salvinia natans</i>	<i>Alisma plantago-aquatica</i>
<i>Chara fragilis</i>	<i>Nymphoides indica</i>	<i>Carex divulsa</i>
-	<i>Nymphaea alba</i>	<i>Scirpus lacustris</i>
-	<i>Nelumbium caspicum</i>	<i>Cyperus longus</i>

Source: Yekom Consultant, 1989

Six species are found in the Khamiran district section in the west part of the wetlands, where *Phragmites australis*, *Trapa natans* and *Spirodella polyrrhiza* are dominant. Eleven species

are found in the western part of the wetlands. In the South coast of the lagoon there are 15 species in the *Alnus* association. In the northern area of the wetlands in Galogah district, there are 10 species of hydrophytes. Five species including *Paspalum*, (which generates on dry land then comes into the water,) are found in the dry area of the north coast of the lagoon.

With regard to phytoplankton, some 132 genera and species of phytoplanktons have been reported in the area (Guilan University, 1999, Yekom Consultant 1988, Azad University of Rasht, 1992). They include: *Chrysophyta* with 60 genera and species, *Chlorophyta* with 46 genera and species, *Cyanophyta* with 22 genera and species, *Euglenophyta* with two genus and *Dinophyta* with two genera.

1.2.2 Fauna

(1) Avifauna

The total of 140 migratory bird species are known in Iran, which includes 63 breeding species, 62 wintering species, 13 transit species and 7 rare species (Yecom consultant, 1989). The record also indicates that 77 species of migratory birds (53% of all) fly to the Anzali Wetland. The main bird families are as Table 1.2.2.

Table 1.2.2 Main Birds Family and Their Adaptation Situation

Family	Number of species	Situation of adaptation
Anatidae	19 species	Winter birds
Laridae	10 species	Winter birds
Pelecanidae	1 species	Winter birds
Scolopaeidae	18 species	Most of them are winter birds
Ardeidae	9 species	Resident, summer and winter birds
Charadriidae	7 species	Resident, summer and winter birds
Rallidae	5 species	Resident, summer and winter birds
Podicipitidae	3 species	Resident and winter birds
Phalacrocoracidae	2 species	Resident and winter birds
Recurvirostridae	1 species	Summer bird
Glareolidae	1 species	Summer bird

Source: Yekom Consultant, 1989

The Anzali wetland is important for a wide variety of breeding, passage and wintering waterfowl. The wetlands support a large breeding colony of *Chlidonias hybridus*, small colonies of six species of Ardeidae, and a large resident population of *Porphyrio porphyrio*. The wetlands also support wintering concentrations of ducks, geese, swans and coots. The Anzali wetland is the most important wintering area in Iran for *Phalacrocorax pygmaeus*, regularly holding more than 500 in mid-winter. *Pelecanus onocrotalus*, *P. crispus*, *Botaurus stellaris* and *Anser erythropus* are occasional winter visitors in small numbers, while *Oxyura leucocephala*, *Charadrius asiaticus*, *Vanellus gregarious* and *Gallinago media* have been recorded on passage. *Scolopax rusticola* is a common winter visitor to the surrounding damp woodlands and scrub, while *Acrocephalus melanopogon* and *A. arundinaceus* are common breeding birds in the reed-beds.

The Anzali wetland is an important wintering area for birds of prey, holding up to 20 *Haliaeetus albicila*, 6 *Aquila heliaca*, 24 *A. clanga* and 6 *Falco peregrinus*, along with smaller numbers of *Falco cherrug*, *F. columbarius* and *Asio flammeus*. *Circus aeruginosus* is common throughout the year, with some 15-25 breeding pairs, up to 85 individuals in winter, and up to 130 during autumn passage. At least 144 species of birds have been recorded in Siakeshim protected area and at least 157 species in Selke wildlife refuge.

Among the main habitat of migratory birds in Anzali wetland, Selke wildlife refuge has high attraction for birds, followed by Siakeshim protected area as Table 1.2.3.

Table 1.2.3 Distribution of Birds among Five Important Parts of the Anzali Wetland

Name	Ratio (%)
Selke	29.4
Siakeshim	26.0
Central Part	14.0
Eastern Part	14.0
Western Part	16.6
Total	100.0

Source: Guilan University, 1995

Among the migratory bird species, *Anas crecca* with 47% has the highest population of migratory birds; *Fulica atra* with 19 % has the second position; and *Anas acuta* with *Aythya ferina*, each with 11% have the third population position. The main other migratory species populations are listed in Table 1.2.4.

Table 1.2.4 Census of the Main Important Migratory Birds in a Good Year in the Anzali Wetland

Scientific name of bird	Number	Percent
<i>Anas platyrhynchos</i>	10,000	2%
<i>A. crecca</i>	250,000	47%
<i>A. strepera</i>	7,500	1.4%
<i>A. Penelope</i>	30,000	5.5%
<i>A. acuta</i>	60,000	11%
<i>A. clypeata</i>	10,000	2%
<i>Netta rufina</i>	600	0.1%
<i>Aythya fuligula</i>	5,000	1%
<i>A. ferina</i>	60,000	11%
<i>A. nyroca</i>	100	0.2%
<i>Bucephala clangula</i>	150	0.3%
<i>Mergus albellus</i>	400	0.8%
<i>Anser anser</i>	500	0.1%
<i>Anser albifrons</i>	100	0.02%
<i>Cygnus olor</i>	500	0.1%
<i>Cygnus Cygnus</i>	150	0.03%
<i>Fulica atra</i>	100,000	19%
Total	535,000	100%

Source: Yekom Consultant, 1989

(2) Ichthyofauna

There are 49 fish species in the Anzali Wetland, of which 8 species are non-native and 39 are native species. Non-native species consist of *Carassius auratus gibelio*, *Ctenopharyngedon idella*, *Hemiculter leueisculus*, *Hypophthalmichthyes molitrix*, *Pseudorasbora parva*, *Anguilla anguilla*, *Hypophthalmichthyes nobilis* and *Gambusia holbrooki*. Among the 39 species of native fishes, 30 are found in the south district of the Caspian Sea, and the other 9 species are also found in other fresh waters of Iran.

Among the 30 native species at Anzali, there are 8 species *Alosa caspia knipowitschi*, *Barbus brachycephalus caspius*, *Leucaspis delineatus caucasicus*, *Perca fluviatilis*, *Scardinius erythrophthalmus*, *Nemachilus angorae*, *Proterorhinus marmoratus* and *Pelecus culteratus*, which are only found in Anzali Wetland and not in any other part of the southern Caspian Sea area (Abbasi *et al.*, 1999), thus these species are of biodiversity importance.

The annual fish catch was recorded between 5,400 and 5,700 tons during the years of 1932-1940. After that, the water level of the Caspian Sea decreased, and the fish harvested declined to about 75 tons due to a decrease in the water level of the Caspian Sea since the 1950s (Nezami, S. 1993).

(3) Mammals

It has been reported that 31 species of mammals in 14 families inhabit the Anzali watershed (Guilan regional watershed company, 1999). There is a population of *Lutra lutra* (Eurasian Otter) in the wetland (DOE pers. com.). *Lutra lutra* is listed as “Vulnerable” in the IUCN Red List, but the present ecological status of the species is largely unknown.

(4) Reptiles

It has been known that four species of snakes (*Natrix natrix*, *Oligodon taeniolatus*, *Coluber juglaris* and *C. najadum*) as well as five species of lizard distribute in the Anzali wetland (Soctt, D.A. (ed), 1995).

(5) Amphibian

Frogs in 4 families having 13 species distribute around wetland, of which two species (*Batrachuperus persicus*, *Rana macrocnemis* or *Rana pseudodalmatina*) are protected (Riazi, 1996; Baloch M. and Hajgholi K. 2000).

(6) Zooplankton and Benthos

There are 4 orders of zooplanktons in the Anzali Wetland; *Sarcodina*, *Flagellata*, *Porotozoa* and *Infuzoria*. Among zooplanktons, rotifers have 12 genera and in general they make up 60 percent of zooplankton species here, *Copepoda* with 9 species are 10 percent, and *Cladocera* with 8 species have the lowest percentage among the whole zooplankton.

The density of benthic organisms in 1992 was about 1,307 per m².

(7) Threatened species

DOE issued a Red Data List in 1999 for threatened birds, fishes, mammals, reptiles, amphibians, and crustaceans in Iran. In this list, species are categorized into two categories; endangered and protected. In Anzali Wetland 4 species of animals are designated as endangered or protected. Numbers of listed species based on the Red Data List in Iran and Anzali Wetland are shown in Table 1.2.5.

Table 1.2.5 Number of Listed Animal Species on the Red Data List
(Unit: no.)

Species	Iran		Anzali Wetland	
	Endangered	Protected	Endangered	Protected
Birds	20	43	4	16
Fishes	2	4	0	2
Mammals	10	12	0	1
Reptiles	2	11	0	2
Amphibian	-	2	0	1
Crustacean	-	2	-	-

Source: Red Data List for threatened birds, fishes, mammals, reptiles, amphibian, and crustacean in Iran, DOE, 1999, Guilan regional watershed company, 1999

In Anzali Wetland the birds *Phalacrocorax pygmenus*, *Cygnus columbianus*, *Aythya nyroca*, *Branta Ruficollis* and *Aythya marila* are endangered and *Pelecanus onocrotalus* and many birds are protected.

Barbus captio, *Barbus lacertacyri*, *Marbus mursa*, *Esox lucius* of fishes, *Felis chaus*, *Lutra lutra* of mammals, *Maruemys Caspian caspica*, *Emys orbicularis* of reptiles and *Rana macrocnemis* of amphibians are protected (Guilan Regional Watershed Company, 1999, Scott, D.A. (ed), 1995) .

1.3 Biological Components by Field Survey

1.3.1 Flora

In order to characterize the flora in the wetland, a macrophyte survey was conducted from August 2003 to October 2003 by the Caspian Sea Bony Fishes Research Center.

(1) Species Composition

The macrophytes shown in the following table were identified in the survey.

Table 1.3.1 Number of Identified Species Recorded from Field Survey
(Unit: no.)

Life Form	Western	Siakeshim	Eastern
Emergent Plants	5	3	6
Floating Plants	5	3	5
Submerged Plants	6	4	5
Others	3	0	1
Total	19	10	17

Source: Result of Field Survey made by Caspian Sea Bony Fishes Research Center (2004).

A total of 24 species was identified. This result shows that several aquatic plants grow throughout the whole of the Anzali Wetland. According to the net weight measurement, *Ceratophyllum demersum*, *Typha latifolia* and *Phragmites australis* have a large biomass. Net weights of *Ceratophyllum* and *Nelumbium* are mostly in the western part (lagoon). *Phragmites* and *Azolla* are mostly in the eastern part. The difference of distribution depends on the difference in water depth and water quality. The eastern part is largely shallow and water quality is more eutrophic. It accelerates the expansion of emergent plants, *Azolla* and some submerged plants such as *Ceratophyllum demersum* which are tolerant of the polluted water. The water depth of the western part is greater and water quality is relatively good. Several kinds of submerged plants therefore grow well in the western part.

(2) Threatened Species

The 24 species identified in the macrophyte survey were compared with the threatened species in the Red Data Book of Iran compiled by the Research Institute of Forest and Rangelands and the Red List of IUCN. No species was identified as threatened. Nevertheless, the following species are important from the ecological point of view: submerged plants such as *Potamogeton pectinalus*, *P. crispus* are important for fish spawning, as a refuge for fingerling fish and feeding for birds, and floating plants such as *Nelumbium capsicum* and emergent plants such as *Phragmites australis* are also important for birds and sightseeing.

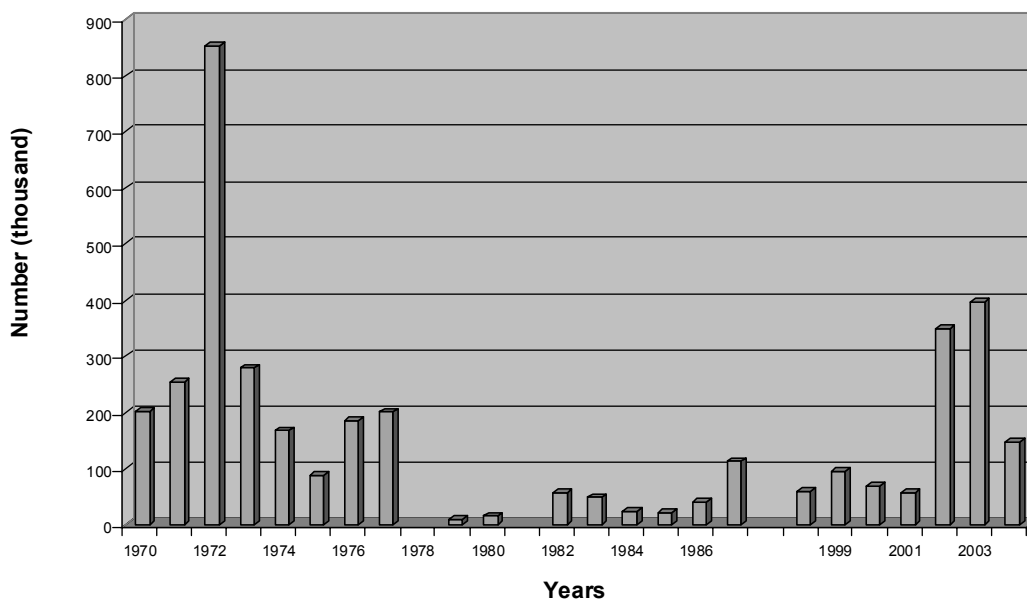
1.3.2 Fauna

Faunal composition comprises mammals, birds, fish, reptiles, amphibians, insects and other organisms. Above all, the birds and fish are well known and important elements. Those elements, therefore, are mentioned in this section.

(1) Avifauna

1) Bird Population

A bird population census has been carried out in the wetland since 1970, which shows large fluctuations in the number of migratory species (Figure 1.3.1). Human pressure due to uncontrolled hunting may be the most serious factor affecting the population record, but the reason for the increase in the migratory bird population during 2002 and 2003 is likely related to the Siberian weather which was relatively cold so that many birds have flown to Iran for survival. The reason for the decrease in 2004 is presumably because the Siberian weather was rather mild compared with the weather in 2002 and 2003.



Note: There is no data in 1978, 1981, between 1988 and 1997

Source: Yekom Consultant(1989), DOE(2004)

Figure 1.3.1 Number of Migratory Birds during Last 30 Years

In addition to the above census, a bird survey was conducted in the seven representative bird habitats of the wetland from 2003 to 2004 by DOE Guilan (Figure 1.3.2). The result is shown in Table 1.3.2 with the record of 89 species of migratory birds and 146,000 individual birds. The wintering waterfowl of 27 species and 110,000 individuals were identified. The population of *Anas crecca* (Common Teal) was 40% of all the birds recorded which showed the highest population of migratory birds followed by *Fulica atra* (Common Coot) of 30 % and *Anas querquedula* (Garganey) of 18%. These three species account for 88% of all the wintering waterfowl.

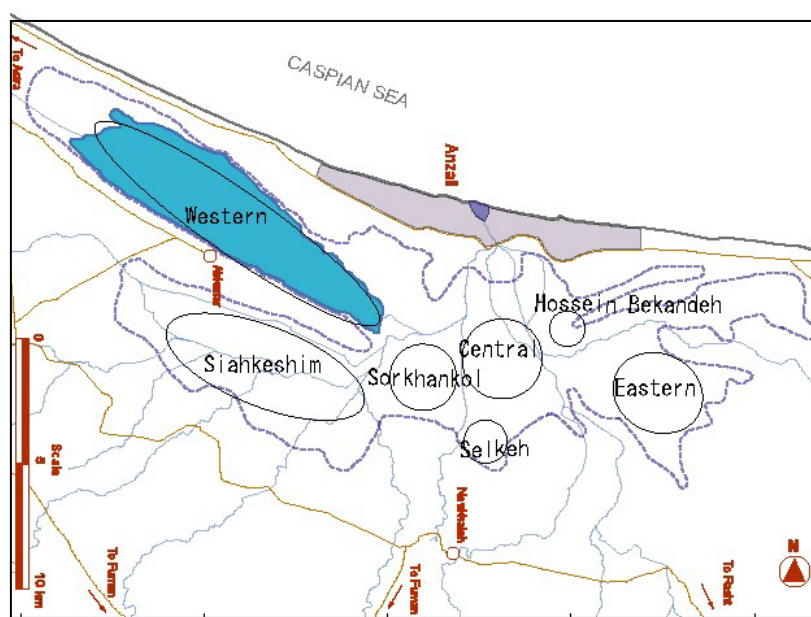


Figure 1.3.2 Field Survey Areas

Table 1.3.2 Number of Identified Species and Individuals Observed in the Field Survey
(Unit: no.)

Indicator	1	2	3	4	5	6	7
species/individuals	62/9,056	42/15,406	50/9,324	70/18,888	42/32,525	38/8,748	63/49,607

Note: 1: Eastern 2: Hosseinbekandeh 3: Central 4: Selkeh 5: Sorkhankol 6: Western
7: Siakheshim

Source: Result of Field Survey made by DOE Guilan (2004).

2) Feeding Behavior of Birds in Relation to the Ecological Feature of the Wetland

Birds have different feeding methods that are adapted to specific habitat types. Distribution of birds with the classification of feeding methods is likely to indicate a level of diversity in the ecological feature of the wetland. Birds with different feeding methods are classified in Table 1.3.3, and the bird population of each group is shown in Table 1.3.4.

Table 1.3.3 Feeding Methods of Waterfowl

Feeding methods	Feature	Main species
Surface feeding 1 -dabbling and sieving-	Sieving tiny food particles from water by pumping water	<i>Anas clypeata</i> , <i>Anas crecca</i> , <i>Anas platyrhynchos</i>
Surface feeding 2 -head underwater-	Upending to reach aquatic plants and other food items	<i>Anas penelope</i> , <i>Cygnus cygnus</i>
Diving underwater	Diving to eat fish, small water animals, and aquatic plants	<i>Aythya ferina</i> , <i>Anthya marina</i> , <i>Fulica atra</i>
Feeding on land	Feeding plants on land	Geese

Table 1.3.4 Number of Identified Waterfowl Species and Individuals Observed in the Field Survey

Feeding methods	1	2	3	4	5	6	7
Surface feeding 1 -dabbling and sieving-	5/55,288	5/25,558	4/16,142	6/17,615	5/31,981	4/9,351	5/76,997
Surface feeding 2 -head underwater-	4/1,369	2/644	2/1,137	5/1,792	5/2,019	4/336	5/2,382
Diving underwater	7/24,379	9/29,510	4/11,172	12/13,320	8/19,013	7/8,823	8/24,605
Feeding on land	1/125	1/125	0/0	2/268	1/14	1/7	1/35
Total	17/81,161	18/55,837	10/28,451	25/32,995	19/53,027	16/18,517	19/104,019

Note: Eastern 2: Hosseinbekandeh 3: Central 4: Selkeh 5: Sorkhankol 6: Western 7: Siakeshim

Number of species and individuals (in January) are shown as “species/individuals”

Source: Result of Field Survey made by Caspian Sea Bony Fishes Research Center (2004).

The birds classified into “Surface feeding 1” mainly feed plants that grow in the surface water. The Anzali Wetland is surrounded by the paddy fields, which are often used by these birds as feeding sites. The largest number of birds in this group was recorded in Selkeh so that this area with surrounding paddy fields may indicate an appropriate combination of resting and feeding sites for this group of birds.

A high percentage of “Surface feeding 2” species was recorded in Sorkhankol. This area holds a larger size of surface water compared with that of Selkeh so that the area is likely more suitable to the birds in this group with respect to the availability of aquatic foods.

The birds grouped in “Diving underwater” are abundant in Selkeh, Sorkhankol and Hosseinbekandeh while the birds in “Surface feeding 1” are distributed all over the wetland except for the western part. It suggests that these areas are deep enough to provide a suitable volume of submerged plants and small fishes.

The birds in the group of “Feeding on land” are mainly geese that distribute in Selkeh, Hosseinbekandeh and in the eastern part of the wetland. These areas are surrounded with paddy fields so that these areas may also be a suitable combination of feeding and resting sites for geese.

3) Threatened Species

Threatened¹ species of birds found in the field survey were listed in Table 1.3.5. There was a significant decrease in the population of *Anthya myroca* (Ferruginous Pochard) in the last two decades. Many species of raptors are threatened, of which there is only one breeding pair of *Haliaeetus albicilla* (White Tailed Eagle) is known around the Anzali Wetland (DOE pers. com.).

¹ Many common species are categorized as “protected” in the Red Data Book in Iran, and only the “endangered” species in the Red Data Book were selected as threatened species.

Table 1.3.5 List of Threatened Bird Species Observed in the Field Survey

No.	Scientific Name	A	B	Location						
				1	2	3	4	5	6	7
1	<i>Phalacrocorax pygmaeus</i>	EN	LR	○	○	○	○	○	○	○
2	<i>Aythya nyroca</i>	EN	LR		○	○	○	○		○
3	<i>Falco naumanni</i>	EN	VU	○		○	○			
4	<i>Falco pelegrinoside</i>	EN	-				○			○
5	<i>Falco peregrinus</i>	EN	-	○		○				
6	<i>Aquila clanga</i>	-	VU	○	○	○	○	○	○	○
7	<i>Haliaeetus albicilla</i>	EN	LR				○			○
8	<i>Pelecanus crispus</i>	EN	LR				○			
-	8	7	6	4	3	5	7	3	2	5

Note1: 1: Eastern 2: Hosseinbekandeh 3: Central 4: Selkeh 5: Sorkhankol 6: Western 7: Siakeshim

Note2: A: Red Data Book of Iran, (1999) DOE

EN: Endangered

B: 2003 IUCN Red List of Threatened Species (2003) IUCN

VU: Vulnerable NT: Near Threatened LR: Lower Risk

Source: Result of Field Survey made by DOE (2004).



Anthya nyroca



Haliaeetus albicilla

(2) Ichthyofauna

1) Fish Population

The fish survey was conducted from September 2003 to January 2004 by Caspian Sea Bony Fishes Research Center in association with JICA Study Team. The total of 34 species and 12,488 individuals including both native and exotic species of fish were identified in the survey (Table 1.3.6).

Table 1.3.6 Number of Identified Species and Individuals Observed in the Field Survey

(Unit: nos.)

Taxon	Western	Siakeshim	Central	Eastern
Clupeidae	1/1	0/0	0/0	4/6
Cyprinidae	14/539	14/4,680	11/493	17/4,672
Gobiidae	0/0	1/3	1/3	3/10
Others	4/52	4/419	5/201	4/611
Total	19/592	19/5,142	17/697	28/6,057

Note: Number of species and individuals are shown as "species/individuals"

Source: Result of Field Survey made by Caspian Sea Bony Fishes Research Center (2004).

Endemic species to Caucasus – Black Sea area, *Alburnus filippii* (Kura bleak), *Barbus capito* (Bulatmai barbell) and *Rutilus rutilus caspicus* (Roach) were found in the survey. Exotic species identified in the survey included *Carassius auratus gibelio* (Prussian carp), *Ctenopharyngodon idella* (Grass carp) and *Gambusia holbrooki* (Eastern mosquitofish). These exotic species are changing the ecological character of fish in the wetland. For example *Carassius auratus gibelio* and *hemiculter leucisculus* (Sharpbelly) are tolerant to the water pollution, and this might be the reason why they became dominant in the wetland.

The survey indicates that fish abundance is relatively high in Siakeshim and the eastern part compared with the western and the central part of the wetland. The high density of phragmites with a low water level of Siakeshim and the eastern part of the wetland make the primary habitats of smaller fish. In contrast, the western and the central parts have a large size of open area and deep-water areas (2 to 3 m depth). These different features of the wetland may be affecting the distribution of different species and size of fish.

2) Threatened Species

The total of 16 threatened species² was found in the survey, which is listed in Table 1.3.7. Many of these species were found in the eastern part of the wetland, but *Clupeonella cultriventris* (Black sea sprat), *Abramis brama orientalis* (Carp bream), *Rutilus rutilus caspicus*, *Perca fluviatilis* (European perch) and *Neogobius melanostomus* (Round goby) were found only one individual in the survey.



Abramis brama orientalis



Perca fluviatilis

² Many common species are categorized as Least Concerned and Data Deficient in the Red Data Book in Iran, and those species were excluded from the threatened species.

Table 1.3.7 List of Threatened Fish Species Observed in the Field Survey

No.	Scientific Name	1	2	Location
1	<i>Clupeonella cultriventris</i>	-	DD	Eastern
2	<i>Abramis brama orientalis</i>	VU	-	Eastern
3	<i>Barbus capito</i>	CD	-	Central, Siakeshim
4	<i>Carassius auratus gibelio</i>	NT	-	All parts
5	<i>Chalcalburnus chalcoides</i>	-	DD	All parts
6	<i>Cyprinus carpio</i>	-	DD	All parts
7	<i>Leucaspis delineatus</i>	CD	-	All parts
8	<i>Rutilus frisii kutum</i>	-	DD	Eastern, Siakeshim
9	<i>Rutilus rutilus caspicus</i>	NT	-	Eastern
10	<i>Scardinius erythrophthalmus</i>	CD	-	All parts
11	<i>Vimba vimba persa</i>	NT	-	Eastern, Western
12	<i>Esox lucius</i>	CD	-	All parts
13	<i>Perca fluviatilis</i>	VU	-	Central
14	<i>Neogobius kessleri</i>	-	DD	Eastern
15	<i>Neogobius melanostomus</i>	-	DD	Eastern
16	<i>Proterorhinus marmoratus</i>	VU	-	Eastern, Central, Siakeshim
-	Total: 16 species	10	6	-

Source: Result of Field Survey made by Caspian Sea Bony Fishes Research Center (2004).

Note: 1: Red Data List of Fish in Iran, (2002)

VU: Vulnerable CD: Conservation NT: Near Threatened

2: 2003 IUCN Red List of Threatened Species (2003) IUCN

DD: Data Deficient

1.4 Physical Components






1.4.1 Land Use around the Wetland




General land use pattern around the Anzali Wetland is shown in Figure 1.2.1. The wetland is surrounded with agricultural areas that are primarily paddy fields. There are also tree plantations with *Populus* spp. and alders. There are smaller areas of rangeland and pasture around the wetland, but these patterns of land use are common in the upland areas. These land use patterns may involve some seasonal differences since distribution of many livestock changes in season. Large industrial areas do not exist around the Wetland, and Bandar Anzali City is located between the shoreline of the Caspian Sea and the Anzali Wetland..

1.4.2 Main Features of Wildlife Habitats

Key elements of the major wildlife habitats in the Anzali Wetland include reed beds, aquatic beds, lagoon, rivers and others. The features of the major habitats are summarized in the following table (see Figure 1.3.2 for the locations of the habitats).

Table 1.4.1 Main Features of Major Habitats in the Anzali Wetland

Name	Main Features
<p>Eastern part</p> 	<p>Status: Not in the legally protected areas Structure: This area is shallow and mainly covered by <i>Phragmites</i>, but small open water spaces are dispersed. Condition: Since the area is far from human activities, artificial disturbance is small. Water quality is under the hyper-eutrophic. Function: Many organisms are able to inhabit relatively free from the direct artificial disturbance. Issue: Many threatened species require a low level of COD. Furthermore if <i>Phragmites</i> continues overgrowth, the habitat for waterfowl will be lost.</p>
<p>Hosseinbekandeh</p> 	<p>Status: Proposed no-hunting area Structure: This area is deeper than the eastern part and the density of <i>Phragmites</i> is lower. Condition: It was one of the main hunting areas. It is possible to approach by speedboat. Water quality is under the hyper-eutrophic. Function: The number of species is not so high, but the number of waterfowl is at the same level as Siakeshim. The density of birds is high and important as a wintering area. Issue: Illegal hunting</p>
<p>Central</p> 	<p>Status: Not in the legally protected areas Structure: There are open water areas. It is deeper than the eastern part. Condition: This area is located between Pirbazar River and Anzali Port. Many boats pass through this part and polluted water also flows into the central part. Function: The biodiversity is relatively low. However, some local fish such as <i>Abramis brama</i> spawn in this part. Issue: Spawning ground should be protected from boat use and water pollution.</p>
<p>Selkeh</p> 	<p>Status: Wildlife Refuge Structure: This area has a balanced condition. The density of <i>Phragmites</i> is suitable, and there is large amount of open water. Condition: This area is well protected by DOE. Function: Biodiversity is high. There are plenty of bird species and density is also high. Many of the threatened species inhabit the area. Issue: The problem which was observed by the Study Team is overgrowth of <i>Azolla</i>.</p>
<p>Sorkhankol</p> 	<p>Status: Wildlife Refuge Structure: There are large open areas. Water is deep (about 2 m). Condition: This area was a fishing area, and fishermen enter the area in spite of control. Function: The number of waterfowl species is large. This area is also important as the spawning ground for some fish such as <i>Abramis brama</i> and <i>Rutilus frisii kutum</i>. Issues: Illegal hunting and fishing.</p>

Name	Main Features
<p>Western</p> 	<p>Status: Not in the legally protected areas Structure: This area is a lagoon and the western end is marsh in which the density of <i>Phragmites</i> is suitable. The lagoon is a large open water area. Condition: Fishing and hunting are active. Many boats enter the area. Regarding the western end, artificial disturbance is low. Water quality is relatively high. Function: There are many adult fish inhabiting the lagoon. The marsh in the western end has high potential for waterfowl.</p>
<p>Siakeshim</p> 	<p>Status: Protected area Structure: <i>Phragmites</i> overgrows all over the area. Water depth is low. Condition: Water quality is relatively high. Function: This area includes many species of birds. Compared to Selkeh, the density is low. However this area is still very important because <i>Haliaeetus albicilla</i> inhabits the area, and some fish move to the river through Siakeshim for spawning. Issue: This area is put in danger of encroachment.</p>
<p>Rivers</p> 	<p>Status: Not in the legally protected areas Structure: Downstream of Rivers such as Kolesar, Masuleh and Siahdarbishan Condition: Fishing is active. Small dams for agriculture are constructed. Water quality is getting worse. Function: Rivers are important habitats as the spawning ground of some species such as <i>Rutilus frisii kutum</i> and <i>Vimba vimba persa</i>. Issue: There is little water in those rivers for irrigation in summer.</p>

1.4.3 Sedimentation

It is known that the Anzali Wetland was much deeper in the past and recently became shallower. However the annual amount of sediment is not large. The total amount of sediment inflow to the wetland was analyzed using a computer software package of the Surface-water Modeling System (SMS), which has a capability to model 2-dimensional hydraulic conditions and sediment transport/deposition in shallow marshy areas by the JICA Study Team. It was estimated that approximately 400,000 tons/year of sediment is produced from the upland where 110,000 tons/year (30%) of sediment deposits in the wetland but the rest (70%) of 290,000 tons/year of sediment flow out to the Caspian Sea. The sedimentation rate was found higher in the Anzali port, major junctions of channels and in the Siakeshim area. In the parts where water flow is slow and vegetation overgrows, rapid succession to dry land is progressing.

(See more details in Part 4)

1.4.4 Fluctuation in the Water Level of the Caspian Sea

In the 1960s, two channels were constructed in the north eastern section of the wetland, and roughly 5,000 ha were reclaimed for agriculture. In the 1970s to 1980s when the level of the Caspian Sea was low, the emergent part of the Anzali Wetland, including the western part of the Siakeshim, was converted to agricultural land, and DOE had to re-delineate the boundary of the Siakeshim Wildlife Refuge, and downgrade it to a protected area. As the water level started to increase in the late 1980s to 1990s, some of the illegal agricultural lands were flooded and abandoned.

Fluctuation of the Caspian Sea affects the wetland ecosystem as well as the land use pattern around the wetland. If the Caspian sea water level rise, fish habitat will expand, though fish habitat will reduce with the Caspian sea water level down. Plant composition will also be affected. Emergent plants will increase while submerged and floating plants will decrease with the Caspian sea water level down. It changes water quality including salinity of the wetland, which affect distribution of fish (Holčil and Oláh, 1992³). The impact to the bird with the fluctuation of Caspian sea water level is not clear.

1.5 Chemical Components

1.5.1 Water Quality

A water quality survey was conducted in the wetland three times between September and December, 2003. The results of the survey are shown in Table 1.5.1. High values of COD, T-N and T-P were recorded throughout the wetland, although the recorded values differ from point to point. According to the US EPA eutrophication criteria for COD, most of the wetland except for Siakeshim can be classified as highly polluted water (COD >30 mg/L). As for the T-P concentrations, the wetland is classified as completely eutrophic according to three international eutrophication criteria (Vollenweider : 0.03 - 0.1mg/L、US EPA: >0.02mg/L、OECD: 0.035 - 0.1mg/L).

Table 1.5.1 Water Quality in the Wetland Water

(Unit: mg/L)

Area	Eastern	Central	Estuary	Siakeshim	Lagoon	Average
COD	35	39	43	27	44	39
DO	7.8	7.1	7.3	7.6	8.3	7.7
T-P	0.32	0.20	0.30	0.17	0.09	0.21
T-N	2.0	2.2	2.7	2.0	2.5	2.4
Chl. <i>A</i>	3	9	28	16	31	21

Source: Result of Water Quality Survey made by DOE (2004).

Eutrophication probably has an indirect but more significant impact on the wetland ecosystem. The high levels of incoming nutrients, such as phosphorus and nitrogen, seem to be causing excessive growth of macrophytes, such as *Phragmites*, *Azolla*., various submerged plants such as *Ceratophyllum demersum* and phytoplankton in the wetland.

³ J. Holčil and J. Oláh, Fish, Fisheries and Water Quality in Anzali Lagoon and Its Watershed, FAO, UNDP/IRA/88/001, 1992.

Dead plants rapidly accumulate in the bottom sediment making the wetland shallower. Once the water depth becomes shallower than about 0.5 m, macrophytes, such as *Phragmites*, propagate quickly (see Figures 1.5.1 and 1.5.2)⁴. The decomposition of the plant detritus also depletes oxygen in the water, and results in fish kills in the wetland.

(See more details in Part 5)

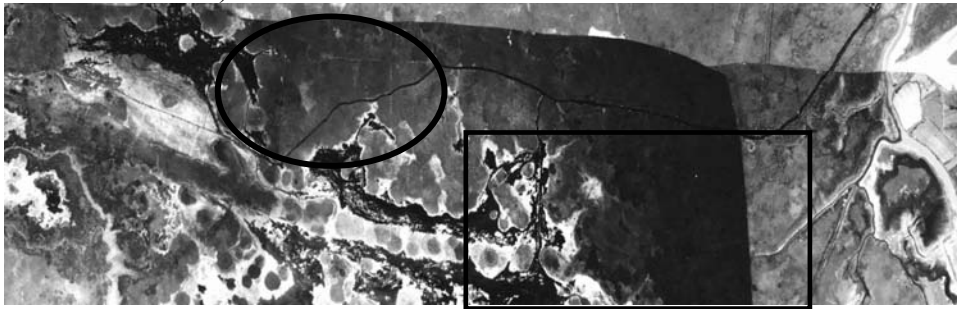


Figure 1.5.1 Aerial Photo of Siakeshim in 1982 (Caspian WL= -27.58m)

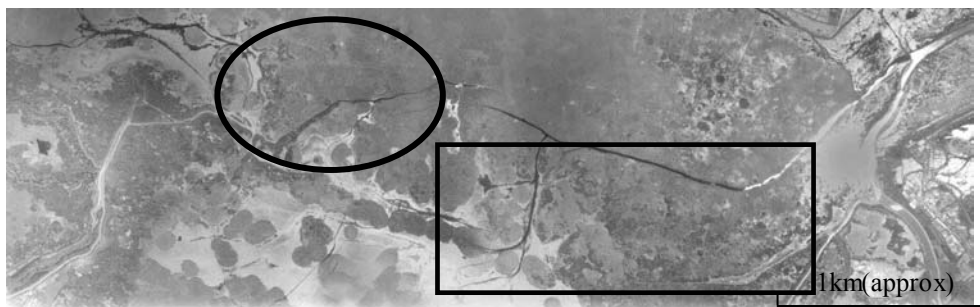


Figure 1.5.2 Aerial Photo of Siakeshim in 1994 (Caspian WL= -26.10m)

1.5.2 Source of Pollution

Inflow of polluted wastewater from domestic, industrial and non-point sources is the main cause of water pollution. The direct consequence of the inflow of the polluted water is organic materials. This problem is remarkable in the Pirbazar River downstream of Rasht and in a channel near the Anzali Port since untreated domestic wastewater flows into these waterways. In these water bodies, the level of COD is as high as 100 mg/L, which is similar to the level of raw sewage, and the DO level is low due to decomposition of organic materials in the water. In such waters, fish species that are tolerant to pollution such as carp become dominant.

Solid waste is another pollutant, and a large amount of garbage reaches the Anzali Wetland (see Figure 1.5.3). The amount of the solid waste dumped to the rivers is roughly estimated to be 66 tons/day⁵. Such garbage may contain hazardous chemicals and also detrimental to

⁴ This trend has been countered by the recent increase of the Caspian Sea level.

⁵ Because the solid waste that reaches the wetland is thrown illegally and indiscriminately, it is difficult to estimate the solid waste load to the wetland, and this estimate should be taken as a first cut estimate.

the landscape of the Anzali Wetland. The toxic substances contained in waste can directly cause negative impact on the flora and fauna of the wetland.

(See more details in Part 6)



Figure 1.5.3 Garbage Accumulated in the Anzali Wetland

1.6 Ecological Issues and Concerns

Biological, physical and chemical components of the Anzali Wetland are linked and interact each other in a complex manner. Ecological condition of the wetland is maintained based on the delicate balance of those components. The Anzali Wetland represents unique and significant ecological as well as economical values. However, there are some factors threatening the future sustainability of this nationally significant wetland. These values and threatening factors are discussed in this section as a basis of the needs of the wetland conservation.

1.6.1 Wetland Values

(1) Ecological Values

1) Characteristic Location in Flyways for Migratory Birds

Anzali Wetland has the peculiarity of belonging to two flyways, Africa-Eurasian flyways and Asia-Pacific flyways, as shown in Figure 1.6.1. Among other wetlands in the southern coast of Caspian sea which belong to two flyways similarly and are important as wintering areas of waterfowls (Table 1.6.1), Anzali Wetland occupies more than 10 %, and more than 1 % of populations of several species among the waterfowls which migrate to the Middle East. These facts indicate the value of Anzali Wetland.

Table 1.6.1 Important Ramsar Sites along the South Side of Caspian Sea

Name	Location	Area	Importance
Anzali Wetland	Guilan province, close to the Bandar Anzali city	19,200 ha	Provide habitats to several threatened species. Support over 1% of the regional Middle East wintering populations of several species of wildfowl. Important spawning and nursery grounds for several fish.
Kiashahr Lagoon	Guilan province, 15km northwest of Rasht	500 ha	Provide important habitat for <i>Phalacrocorax pygmaeus</i> . Over 1% of the regional wintering population of three species. Important breeding and nursery ground for various fish.
Amrkelayeh Lake	Guilan province, 60km east of Rasht	1,230 ha	Provides important habitat for <i>Phalacrocorax pygmaeus</i> . Over 1% of the regional Middle East populations of three species.
Fereydoon Kenar	Mazandaran province, 13km southeast of Babolsar.	5,427 ha	Provide wintering habitat to some species of threatened birds. Especially support the entire western population of <i>Grus leucogeranus</i> . Over 1% of the regional populations of some species
Miankaleh Peninsula	Mazandaran province, 2km west of the Turkeman city	100,000 ha	Provide wintering habitat to four species of threatened birds. Support over 1% of the regional Middle East breeding population of the wildfowl. Important spawning and nursery ground for various fish.
Gomishan Lagoon	Border with Turkmenistan, 4km north of the small town of Gomishan	17,700 ha	Support the vulnerable bird species. Support over 1% of the populations of the wildfowl observed within the site.

Source: Ramsar Information Sheet

Moreover, regarding the comparison with the wetlands belonging to each of Africa-Eurasian flyways and Asia-Pacific flyways which locations and scales are similar with Anzali Wetland, the large number of birds is indicated as shown in Table 1.6.2.

Table 1.6.2 Comparison among Wetlands

Item	Westerschelde en Verdrongen Land van Saeftinge	Anzali Wetland	Honghe
Flyways	Africa-Eurasian	Africa-Eurasian and Asia-Pacific	Asia-Pacific
Country	Netherlands	Iran	China
Area	19,500 ha	19,200 ha	21,836 ha
Number of Wintering Waterfowl Individuals	More than 20,000	More than 50,000	More than 30,000

Source: Ramsar Information Sheet

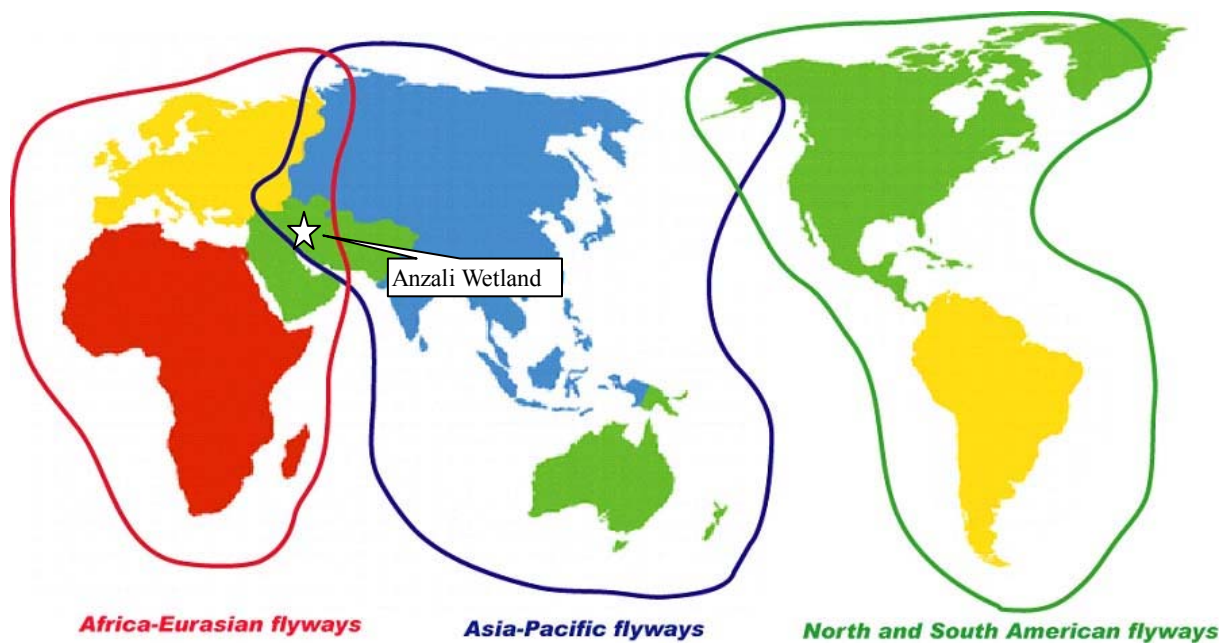


Figure 1.6.1 Location of the Anzali Wetland in Flyways

2) Distribution of Threatened Species

Distributions of threatened species are mentioned in Section 1.3. The Anzali Wetland is the breeding area of *Haliaeetus albicilla* and *Phalacrocorax pygmaeus* and wintering area of *Aythya nyroca* and *pelecanus crispus*. The wetland is also the spawning ground of *Vimba vimba persa*, *Chalcalbunus chalcoides* and *Perca fluviatillis*. One of the threatened mammals *Lutra lutra* still inhabits in the wetland. These threatened species rely on the wetland, the value of saving these threatened species is recognized to be high in terms of biodiversity conservation.

(2) Economical Values

Anzali is an important spawning and nursery area for fish which are of economic importance to the Caspian Sea fishery. The wetland itself also supports an angling fishery and a net fishery of local commercial importance, the latter based on 65 "abandans" rented by DOE to small private area for hunting and fishing during the winter.

A significant number of the local people are involved in fishing and hunting, which is of considerable importance to the local economy. The annual fish catch is about 400 t and potential market value is about 10 billion Rials (Table 1.6.3). Waterfowls are hunted about 100,000 in one season, and potential market value is approximately 3 billion Rials (Table 1.6.4)

Table 1.6.3 Market Value of the Fish of the Anzali Wetland

Species	Catch Weight (ton)	Price (Rials/kg)	Total Value (1,000 Rials)
Prussian Carp	192	25,000	4,800,000
Pike	73	40,000	2,920,000
Common Carp	38	10,000	380,000
Catfish	25	30,000	750,000
Total	328	-	8,850,000

Source: Caspian Sea Bony Fishes Research Center, 2004. Anzali Fish Market (2004).

Table 1.6.4 Market Value of the Waterfowl of the Anzali Wetland

Item	Hunted (nos.)	Price (Rials/bird)	Total Value (1,000 Rials)
Waterfowl	100,000	30,000	3,000,000

Source: DOE (2004)

The surrounding agricultural land is mainly used for the production of rice and vegetable crops, and some tea is also growing. Some of the marginal land around the wetland is now being used for small-scale commercial timber production and the pond culture of fish, particularly in the vicinity of Somehsara. Some people gather *Azolla* and sell it for cattle feed.

In summer, the wetland provides recreational activities for visitors to Anzali Wetland, including motor-boating and kayaking. The numbers of visitors to the wetland are about 40,000 per year. They usually use boats, and if five visitors use one boat which cost 250,000 – 500,000 Rials, visitors pay about 3 billion Rials per year in total. The tourism could be expanded to include sailing and wind-surfing. The wetland also has a great potential for ecotourism activities that are in a form of environmentally sustainable use of natural resources.

(3) Other Values

The ecological values of the Anzali Wetland can provide unique opportunities for scientific research and education. Similar to esthetic values of the Wetland, these values are also difficult to be quantified in a monetary term.

1.6.2 Threatening Factors

(1) International Recognition of the Wetland

The Anzali Wetland was listed in the Montreux Record of Ramsar sites in 1993, which suggests that the ecological conditions of the Wetland are not deteriorated. The process of this degradation is rather complicated, but the most serious factors affecting the ecological conditions of the wetland is human induced impacts. Key activities causing negative impact to the wetland need to be clearly identified and appropriate counter measures should be

implemented. The Montreux Record claims that the implementation of conservation actions in the wetland is an imminent requirement.

(2) Human Impacts

Human activities causing negative impacts to the Wetland is largely composed of activities in (i) the Wetland, (ii) Surrounding coastal and flat areas, (iii) forest and rangelands in the upland. Most of the activities with negative impacts change water quality and quantity of the Wetland, disturb natural habitats and harvest/kill excessive number of wildlife. Major human activities that need to be managed in a sustainable manner for the conservation of the Wetland are summarized as follows.

- 1) Activities in the Wetland
 - a) Commercial and recreational activities including boating, camping, bird watching, fishing, hunting and others
 - b) Introduction of exotic species particularly aquatic animals
- 2) Activities in the surrounding coastal and flat areas
 - a) Waste water (industry and domestic) and solid waste
 - b) Use of chemical substance in agriculture
 - c) Encroachment by farmers
- 3) Activities in the forest and rangelands in the upland area
 - a) Uncontrolled animal husbandry (over grazing)
 - b) Logging
 - c) Encroachment particularly in the areas with steep slopes

CHAPTER 2 PRESENT WETLAND ECOLOGICAL MANAGEMENT

2.1 Introduction

Wetland Ecological Management is implemented by DOE. There are many activities such as establishment of protected areas, arrangement of rangers, and environmental monitoring. Although those activities have achieved success, those are not systematic and the problems are included as shown below.

2.2 Relevant Laws

The Environmental Protection and Enhancement Act (1974, amended in 1992) and the Executive by-law on the Environmental Protection and Enhancement Act (1975, amended in 1995) are the main legislation governing environmental conservation in Iran. The Game and Fish law (1967, amended in 1996), the Executive by-law on the Game and Fish law (1967), and the Executive by-law on the Prevention of Water Pollution (1994) also contain important legislation for protection of the environment.

2.3 Protected Areas

The Environmental Protection and Enhancement Act and the Executive by-law on the Environmental Protection and Enhancement Act define protected areas. In these areas some activities are prohibited or limited.

In addition to these protected areas, DOE declares “No-hunting areas” to provide some areas free from hunting pressure based on the Game and Fish law. These protected areas and prohibited activities are shown in the following table.

Table 2.3.1 Classification of Protected Areas in Iran

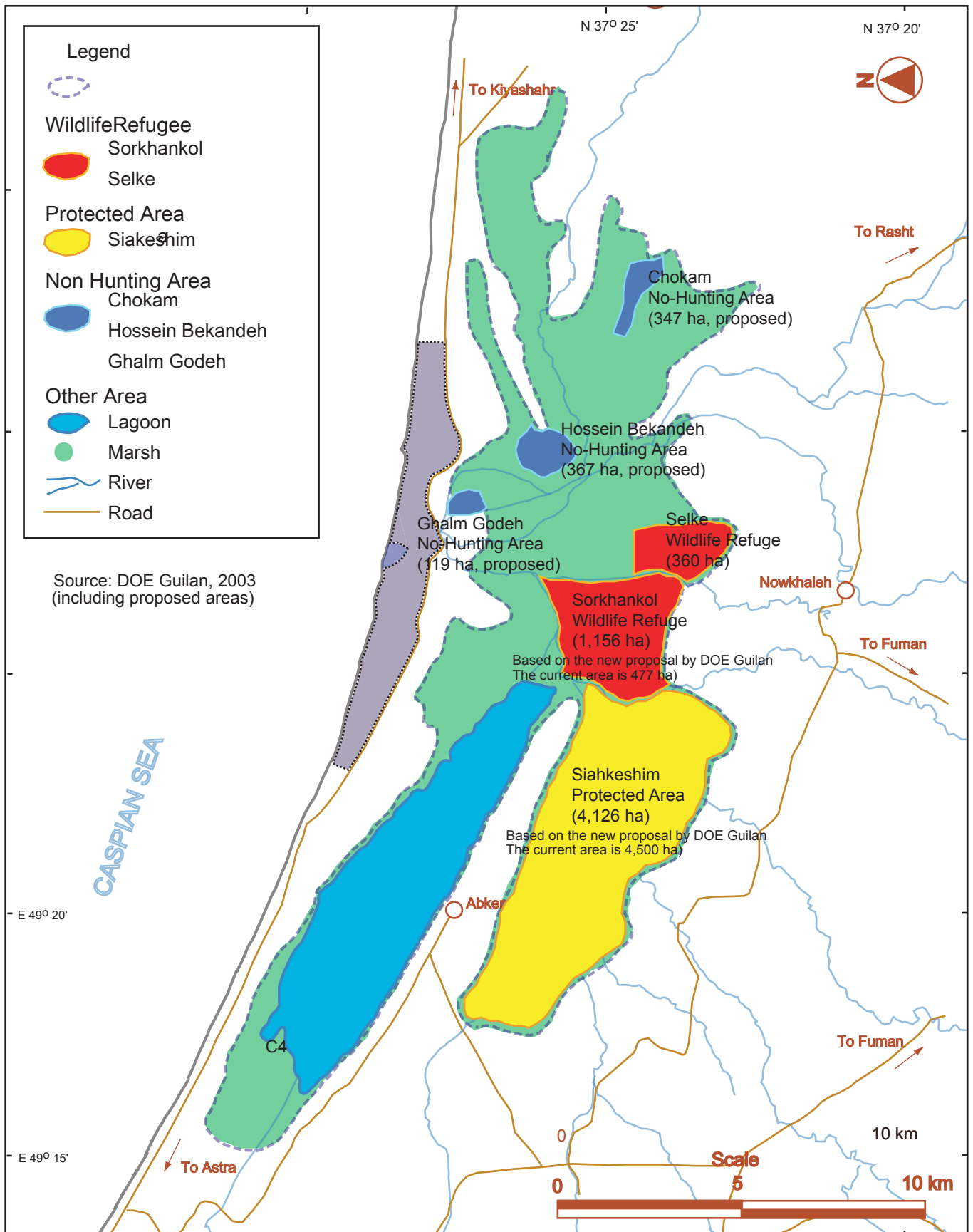
Type	Prohibited activities
National Park	<ul style="list-style-type: none"> •Grazing animals, felling trees, uprooting shrubs, encroachment upon or the destruction of the environment and, in general, any action that causes damage to and destruction of vegetation or leads to any form of alteration of ecosystems •Revision or renewal of permits issued for the exploration or exploitation of mines •Hunting and fishing
National Monument	<ul style="list-style-type: none"> •Grazing animals, felling trees, uprooting shrubs, encroachment upon or the destruction of the environment and, in general, any action that causes damage to and destruction of vegetation or leads to any form of alteration of ecosystems •Revision or renewal of permits issued for the exploration or exploitation of mines •Hunting and fishing
Wildlife Refuge	<ul style="list-style-type: none"> •Felling trees, uprooting shrubs, encroachment upon or the destruction of the living environment, cutting thistles, burning wood into charcoal and, in general, any action that may lead to the eradication of vegetation and alteration of ecosystems •Hunting and fishing
Protected Area	<ul style="list-style-type: none"> •Felling trees, uprooting shrubs, encroachment upon or the destruction of the living environment, cutting thistles, burning wood into charcoal and, in general, any action that may lead to the eradication of vegetation and alteration of ecosystems without acquiring needed permits •Hunting and fishing
No-Hunting area	<ul style="list-style-type: none"> •Hunting and fishing

Source: DOE (2004).

In the Anzali wetland three reserves such as Siakeshim, Selke and Sorkhankol have been established. The south western part of Siakeshim (4,500 ha) was first established as a Protected Area in 1967. The reserve was enlarged to 6,701 ha and upgraded to Wildlife Refuge in 1971 but reduced to its present size of 4,500 ha and downgraded to Protected Area in 1975. However, further encroachment has progressed in this area, and DOE Guilan is proposing to determine an adjusted boundary of the Siakeshim with the size of 4,126 ha.

Selke (360 ha) has been protected as a Wildlife Refuge since 1970. Sorkhankol (477ha) was designated as a No-hunting Area in 1991 and upgraded to Wildlife Refuge in 2002. DOE Guilan has recently plans to expand the size of Sorkhankol to about 1,156 ha.

DOE Guilan has recently submitted a series of proposals to establish no-hunting areas at Chokam (347 ha), Hosseinbekandeh (367 ha) and Ghalm Godeh (119 ha). The Supreme Council for the Environment is reviewing these proposals as of October 2004. The existing and planned protected areas are shown in Figure 2.3.1.



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Figure 2.3.1
Protected areas in the Anzali Wetland

2.4 Strategies and Plans for Wetland Conservation

Strategies and plans of the management of the Anzali Wetland are not properly documented by DOE Guilan. One of the main goals of the management by DOE is to control illegal activities in accordance with the Executive by-law on the Environmental Protection and Enhancement Act (1975, amended in 1995). In addition, DOE implements the following management activities for the conservation of the wetland:

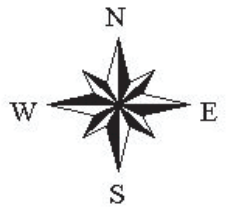
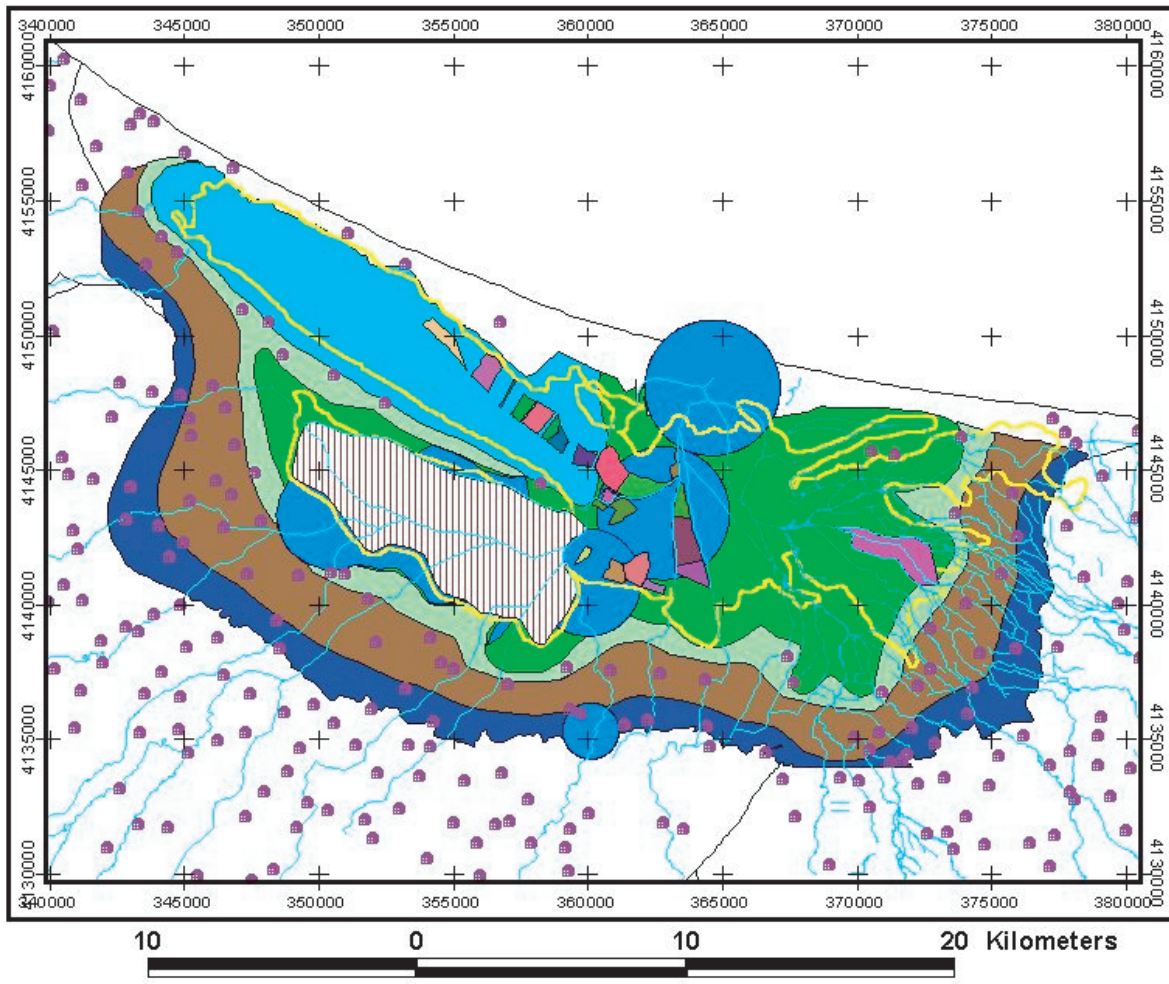
- Construction of a ditch around the wetland to clarify the boundary of the wetland,
- Establishment of buffer zones, and transition zone⁶ (Figure 2.4.1),
- Closure of the hunting season before the spring migration begins,
- Limiting the list of game species for hunting,
- Collection of data on hunting intensity and the number of animals harvested.

In 1995 DOE together with Guilan University and many other researchers launched a comprehensive study of the Anzali Wetland. This Study is now recognized by DOE as a guideline for the management of the wetland, though it has not been officially approved.

⁶ The zonation was developed by Guilan University (1999). It is currently used by DOE Guilan, in order to guide decisions on development permit applications, but it is not yet official and is not used by other central or local government institutions involved in planning and development control.

Figure 2.4.1
Present Zoning

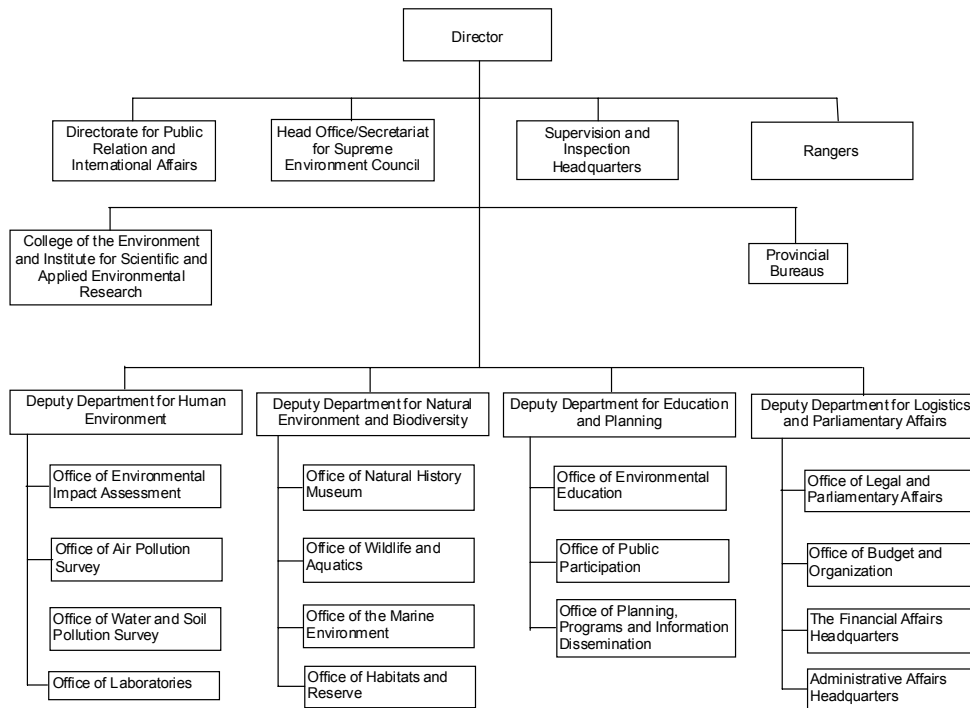
source: Guilian University, 1999



2.5 Organization for the Management

2.5.1 DOE Headquarters

Figure 2.5.1 shows the organizational structure of the Department of the Environment (DOE) headquarters in Tehran.



Source: DOE, 2002

Figure 2.5.1 Organizational Structure of DOE Headquarters

The headquarters of DOE is mainly responsible for policy making, development of laws and regulations, management of national projects, budget allocation to provincial bureau, and technical support to the provincial bureau.

2.5.2 Provincial DOE

Provincial DOE bureaux are responsible for environmental management at the provincial level. Figure 2.5.2 shows the organizational structure of the DOE Guilan.

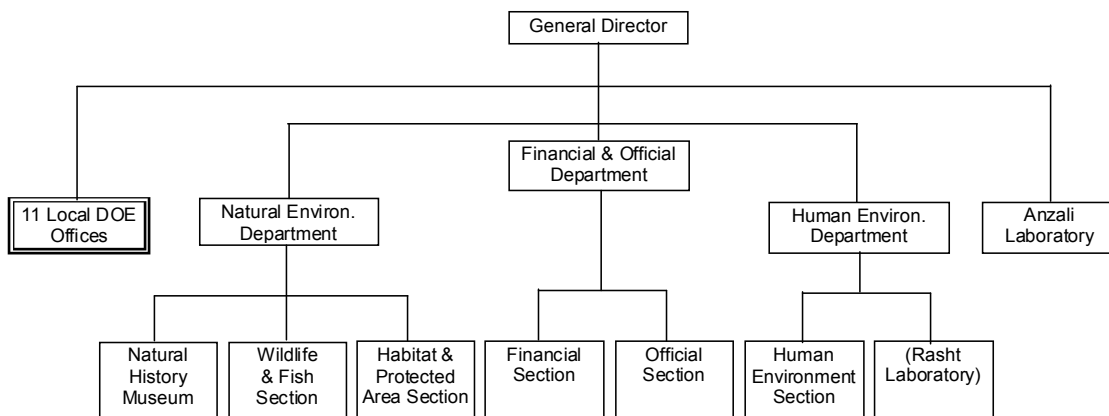


Figure 2.5.2 Organizational Structure of DOE Guilan Bureau

Detail of the organizational structure of DOE was unclear since there was no officially approved document describing the structure. There are approximately 300 staff in DOE Guilan, of which about 80 staff are stationed in the main office in Rasht. DOE Guilan has three major departments, namely Natural Environment and Biodiversity Department, Human Environment Department, and Financial and Official Department. Among them, the management of the Anzali Wetland is under the responsibility of the Habitat & Protected Area Section of the Natural Environment Department. The responsibility of the Human Environment Department is to control pollution and other aspects of environment related to human activities.

2.5.3 Local DOEs

The Provincial DOE Bureau also has 11 local offices in the following locations: Rodsar, Langrod, Lahijan, Astaneh, Siahkal, Rodbar, Fuman, Somehsara, Talesh, Astara and Anzali⁷. The activities of protection and patrol of the Anzali Wetland fall under the jurisdiction of the Anzali and Somehsara DOE offices. A typical organizational structure of a local office is shown in Figure 2.5.3.

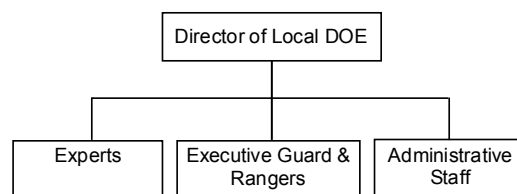


Figure 2.5.3 Organizational Structure of Local DOE

⁷ The local DOE office in Masal had been established in October 2004.

2.6 Present Activities

2.6.1 Environmental Patrol

Control of illegal activities is one of the major activities of DOE in the Anzali Wetland, particularly patrolling, which guard the wildlife refuges and protected areas. This is conducted by 21 rangers with three stations (Siahdarvishan, Ghalm godeh and Sorkhankol) of Anzali office and 10 rangers of Somehsara office with two stations (Selkeh, Esfand). The staff patrol three times a day for 7 days a week (morning, afternoon and night). The staff of DOE can confiscate fishing and hunting gears when they find illegal activities, and also they are authorized to arrest the violators. The following tables show the number of illegal hunting and fishing activities controlled by DOE.

Table 2.6.1 Illegal Hunting and Fishing Activities Controlled by DOE

(1) Illegal hunting during the last 4 years in Somehsara

Items	1999	2000	2001	2002
The number of hunters with no license	8	31	13	9
The number of birds hunted with no license	13	50	26	43

(2) Illegal hunting during the last 4 years in Anzali

Items	1999	2000	2001	2002
The number of hunters with no license	59	89	58	55
The number of birds hunted with no license	113	123	130	97

(3) Illegal fishing during the last 4 years in Somehsara

Items	1999	2000	2001	2002
The number of fishermen with no license	31	42	14	15
The number of fish trapped with no license	1003	779	2536	925

(4) Illegal fishing during the last 4 years in Anzali

Items	1999	2000	2001	2002
The number of fisher man with no license	110	65	87	59
The number of fish trapped with no license	1820	1100	1630	937



Figure 2.6.1 Control of Illegal Fishing Gear by DOE Ranger

2.6.2 Control of Encroachment

The wetland area is decreasing due to encroachment for agricultural activities, especially for conversion to paddy fields. In the 1960s, two channels were constructed in the northeast section of the wetland, and roughly 5,000 ha was reclaimed for agriculture. In the 1970 to 80s when the level of the Caspian Sea was low, the emergent part of the Anzali Wetland, including the western part of the Siakeshim, was converted to agricultural land, and DOE had to re-delineate the boundary of the Siakeshim Wildlife Refuge, and downgrade it to a protected area. As the water level started to increase in the late 80 to 90s, some of the encroached agricultural land was flooded and abandoned. Nevertheless, due to the ambiguous legal boundary of the wetland, it has been difficult to control encroachment. 100 or more hectares of wetland have been converted to the paddy fields in the past five years.

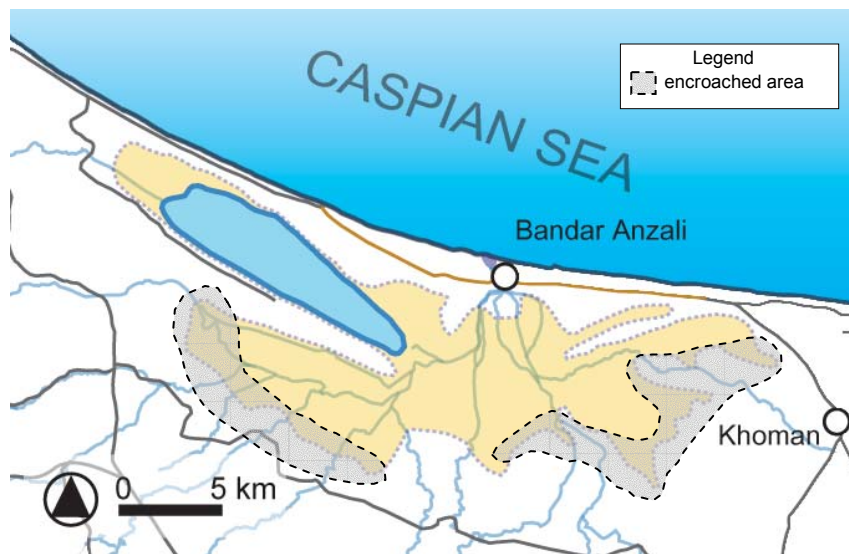


Figure 2.6.2 Areas with Encroachment Problems

The rangers are engaged in control of encroachment. This is initiated by reporting from local people or regular patrol activities of the DOE rangers. Once encroachment is spotted, the ranger reports it to the legal officer of the local DOE office. If the encroachment is located in a protected area or wildlife refuge, the matter is brought to the court directly. If the encroachment is located outside of a protected area or wildlife refuge, the matter is dealt by NRGGO.

2.6.3 Environmental Education

Educational and public awareness activities are carried out by the staff of the Natural Environment and Biodiversity section and by public relation experts of DOE. DOE prints and distributes bulletins and brochures about the protection of wetlands. Many students visit the wetland from schools and universities every year. In the year of 2001 “Migrant Bird Welcome Festival” was organized, and many people participated in this educational event.

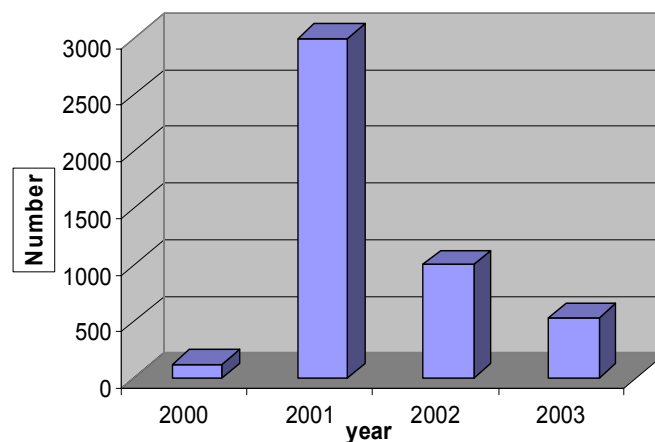


Figure 2.6.3 Number of Educational and Scientific Visitors to the Anzali Wetland

2.6.4 Water Quality Monitoring

Monthly sampling and analysis of waters in the wetland and rivers (estuary) such as the river of Goharroud (two sites), Zarjoub (two sites) and Pirbazar river (one site) has been conducted by the Laboratory of DOE Guilan.

2.6.5 Annual Bird Census

An annual bird census of migratory and resident species is carried out in January by the experts of Natural Environment and Biodiversity section in accordance with the methods of the International Waterfowl and Wetland Research Bureau (IWRB). In the wetland, the census is carried out in Eastern area, Western area, Central area, Sorkhankol, Selkeh, Siakeshim, Hossein Bakandeh and Chokam. The surveys of some species, such as the Pygmy Cormorant (*Phalacrocorax pygmaeus*), Whiskered Tern (*Chlidonia hybridus*) and Gray Heron (*Ardea cinerea*) are conducted during late June and July. Banding for chicks are implemented.

2.6.6 Issuance of Licenses for Hunting and Fishing

Table 2.6.2 shows the number of hunting and fishing licenses issued in the last three years.

Table 2.6.2 Number of Licenses Issued in the Last Three Years

Category	2001	2002	2003
Bird license (weapon)	986	1,042	988
Bird license (trap)	47	50	69
Bird license (abandan)	67	73	65
Fish license	3,186	2,902	2,577

Source: DOE (2003).

Permitted hunting days with weapon are 3 days in a week, Wednesday, Thursday and Friday. The number of permitted hunting with weapon is 6 pieces of no-protected birds per day and 20 pieces per day in abandon. The number of permitted hunting with trap is 10 pieces per day. Regarding fishing, only angling is permitted.

2.7 Management Issues and Concerns

2.7.1 Regulatory Status of the Wetland Areas

Large part of the Wetland is owned by NREGO (legal land owner), but its management is entrusted to DOE. According to the current regulatory framework, legal protection covers mainly protected areas, wildlife refuges and no-hunting areas. Main issues with respect to rules and regulations for management purposes are:

- Determination of clear area boundaries for legal protection.
- Regulation of encroachment into the wetland area.
- Law enforcement.

- Flexible adjustment of regulations to meet the specific management requirements in a given time.

2.7.2 Conflicts with Development Plans

DOE has been involved in the development process of a number of key urban development master plans, such as the urban development plans for Anzali, Rasht and Somehsara.

(1) Redevelopment of the city master plan

The master plan of Bandar Anzali City was prepared 15 years ago, and is completely outdated. For example, the construction of the Anzali Ring Road, which delineates the southern border of the city in the master plan, has been suspended. Thus the master plan has to be revised. In this process, the zoning plan for the Anzali Wetland discussed in Chapter 3, needs to be built into the new city master plan and subsequent detailed plans. Consultation with stakeholders, including DOE, NREGO, Mayor of Bandar Anzali City, MORT and MPO and local residents, are needed, along with an EIA study, before the city master plan is submitted to the central government for approval.

(2) Enforcement

For the time being, construction activities should be controlled by HUDO, Bandar Anzali City, and Committee No.5 in accordance with the current urban management regulation. The management of this area is important to the environment of the wetland and the coast and it is suggested that the DOE is given voting status in Committee No.5. Polluting activities in the area should be controlled by DOE.

2.7.3 Lack of the Management Policy

The current management of the Anzali Wetland is mainly based on the Executive by-law on the Environmental Protection and Enhancement Act (1995) and Game and Fish law (1996). Management activity is not currently focused in the areas of (i) promotion of public awareness and participation, (ii) sustainable use of biodiversity resources and (iii) integrated conservation. However, management policy specifically indicating general directions in the management of the Anzali Wetland is not clearly defined so that main issues in this area are as follows:

- Determine a clear policy over the Anzali Wetland: Application of adaptive management and wise use of natural resources should be considered.
- Proper documentation and authorization of the policy.

2.7.4 Lack of Wetland Management Plan

Current management of the wetland is carried out under the direction of the General Director of the DOE based on recommendations by experts and review of previous research data including the study carried out by the Guilan University from 1995. However, existing

management plans are not practical enough for imminent implementation. Specific issues in planning are as follows:

- Preparation of a practical management plan for imminent implementation.
- Collection of systematic data that can generate a basis of planning (monitoring).
- Wetland ecosystem is dynamic so that plans should be holistic and integrated.

2.7.5 Establishment and strengthening Institutional Framework

Management decision-making process for the Anzali Wetland should be flexible since the wetland ecosystem is highly dynamic. However, current institutional set up of DOE does not meet the requirements to implement systematic decision-making based on scientifically sound data. Furthermore, there seems to be a lack of knowledge on wetland ecology and management among many of the staff at DOE so that capacity building is also a key factor to be considered in planning. Main issues in this area are:

- Establishment/strengthening institutional set up to implement integrated management actions.
- Capacity building with respect to the implementation of management plans by the DOE staff.

2.7.6 Shortage of Budget

DOE is suffering from a chronic shortage of funds for environmental management activities. The Anzali Wetland has a potential to generate sufficient revenue for management from ecotourism, handicraft industry, tourism tax, fishery tax, hunting and fishery licenses, etc. The revenues from such local sources can be used locally for the management of the wetland in light of the User-Pay-Principle so that the main issue of securing budget is as follows:

- Secure enough allocation from the national budget.
- Self sustainable budget generation for the implementation of wetland management.
- Seeking for alternative sources of budget (i.e. international funding agency).

CHAPTER 3 ECOLOGICAL MANAGEMENT PLAN

3.1 Introduction

Present environmental status of the Anzali Wetland indicates considerable deterioration in its ecological condition but still holds nationally as well as internationally important values (Chapter 1). Diverse aspects of technical and administrative issues are associated with the mechanism of this wetland degradation. Human activity not only inside but also outside the wetland is the main factor accelerating this environmental change so that counter measures should involve a variety of technical sectors and topographic areas.

Due to the above background, this master plan employs a holistic and integrated approach of targeting the management of the whole watershed such as the Greater Anzali Ecosystem. From this point of view, ecological status of the wetland can be a general indicator of the entire ecosystem since changes in ecological condition elsewhere in the watershed are concentrated and accumulated within the wetland. Therefore, wetland ecological management is a core element of the M/P. This chapter focuses on management activities within the wetland, which consists of the following programs:

- Zoning and Ecological Management
- Conservation of Wildlife
- Conservation of Habitat
- Sustainable Use of Natural Resources

3.2 Objectives

As presented in Section 2.3, the Anzali Wetland holds ecological functions and significant ecological and economic values, which is supported by a delicate ecological balance between the biological, physical and chemical components. Livelihood of many people depends largely on natural resources of the wetland such as fish and other resources. Natural properties including the wetland functions and values are public assets, which should be maintained to secure well-being of people. For this purpose, the Wetland Ecological Management Plan aims to secure the ecological balance to maintain the natural properties of the Anzali Wetland as far as future generations.

3.3 Strategies

To achieve the objectives stated in the above, the following strategies of (1) Environmental Zoning, (2) Adaptive Management, (3) Wise Use and (4) Participatory Conservation are employed in this master plan.

3.3.1 Environmental Zoning

Ecological features and human activities vary in different places so that management plans should be developed with different strategies suitable to specific requirements. Zoning is one of the bases of this planning by clearly identifying boundaries of lands for different management purposes. DOE is aware of the importance of zoning as a management tool for the Anzali Wetland and has determined different zones based on a study by Guilan University (1999). However, this zoning has not been widely accepted or used since there are some difficulties associated with it. This existing zoning was, therefore, reviewed and revised in this master plan.

Zoning defined in the Ramsar Guidelines ⁸ does not include buffer zone but the zoning of this M/P consists of the following three zones: (1) core protected zone, (2) buffer zone and (3) transition zone with an application of the zoning concept of the Biosphere Reserve of the United Nations Educational, Scientific and Cultural Organization (UNESCO). Main concepts and features of this zoning is as follows (Figure 3.3.1):

- (1) Core Protected Zone : Core ecosystem for conservation with high ecological and economic values. Human activities are actively controlled.
- (2) Buffer Zone : Surrounding area of the core zone with the purpose of reducing negative impacts to the core zone. Human activities with minimum impacts are encouraged.
- (3) Transition Zone : Extending area surrounding the buffer zone containing human settlements, industries and others. Public acceptance on the land use pattern in this zone is critical.

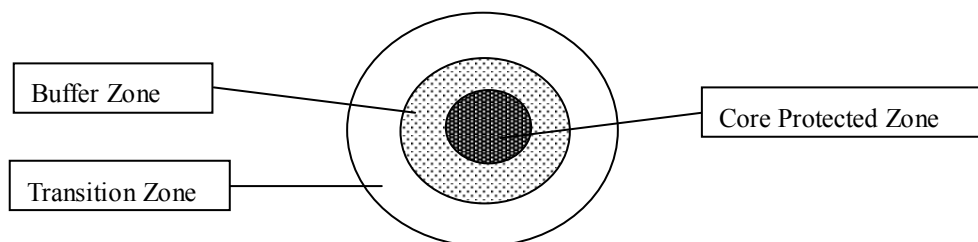


Figure 3.3.1 Conceptual Model of Zoning

3.3.2 Adaptive Management

Ecosystem is dynamic and naturally changes in time and space in a complex manner so that management actions should be adjustable with specific requirements at any given time. Therefore, the management decision-making process has to be as flexible as possible. For such a management process, it is critical to conduct a systematic monitoring, which provides scientifically sound data and evidence as a basis for making an appropriate decision. This

⁸ New Guidelines for Management Planning for Ramsar Sites and Other Wetlands (Resolution VIII. 14 of COP 8, November 2002)

flexible and systematic decision-making process based on sound data is regarded as the adaptive management.

In the case of Anzali, human activities such as encroachment with agriculture, over hunting, over fishing and introduction of alien species present a high risk of significant disturbance to the wetland ecosystem. The impacts from these human activities should be closely monitored and quantified to make suitable management actions regulating those activities. Institutional set up, which makes this management system functioned is critically important.

3.3.3 Wise Use

Wise use is one of the main concepts of the Ramsar Convention, which indicates attributes of resource use where natural resources are maintained in a long-term including future generations. It is inevitable that management actions regulating some human activities in the wetland be accepted by local people. However, it may be difficult if management actions largely restrict necessary economic activities. Since the Anzali Wetland holds economic values supporting livelihood of many people, economic activities should continue without over exploitation. Therefore, conservation and economic activity should be balanced to attain sustainability of natural resources with the use of those values under control.

3.3.4 Participatory Conservation

Public participation is generally required in a master plan according to the JICA's Guidelines for Environmental and Social Considerations (JICA, 2004). Public understanding and agreement are inevitable to carry out management actions; therefore, the public participation particularly by local people is critical and that the participatory conservation is also an important strategy of this master plan.

Stakeholders in the conservation of the Anzali Wetland include primarily hunters, farmers and fishermen living around the wetland. It is critical to understand the values of the wetland with those stakeholders since a clear understanding of the values can lead to practical directions in conservation. Stakeholder meetings gathering views and ideas of the local residents were conducted and incorporated into the master plan.

3.3.5 Integrating Wetland Management with Other Components of the Master Plan

Many environmental problems in the wetland, such as water pollution, eutrophication and solid waste inflow are caused by human activities outside of the wetland. It is therefore important to integrate wetland management with other components of the Master Plan, including those for the management of land, waste and water quality in the surrounding lands and in the wider catchment.

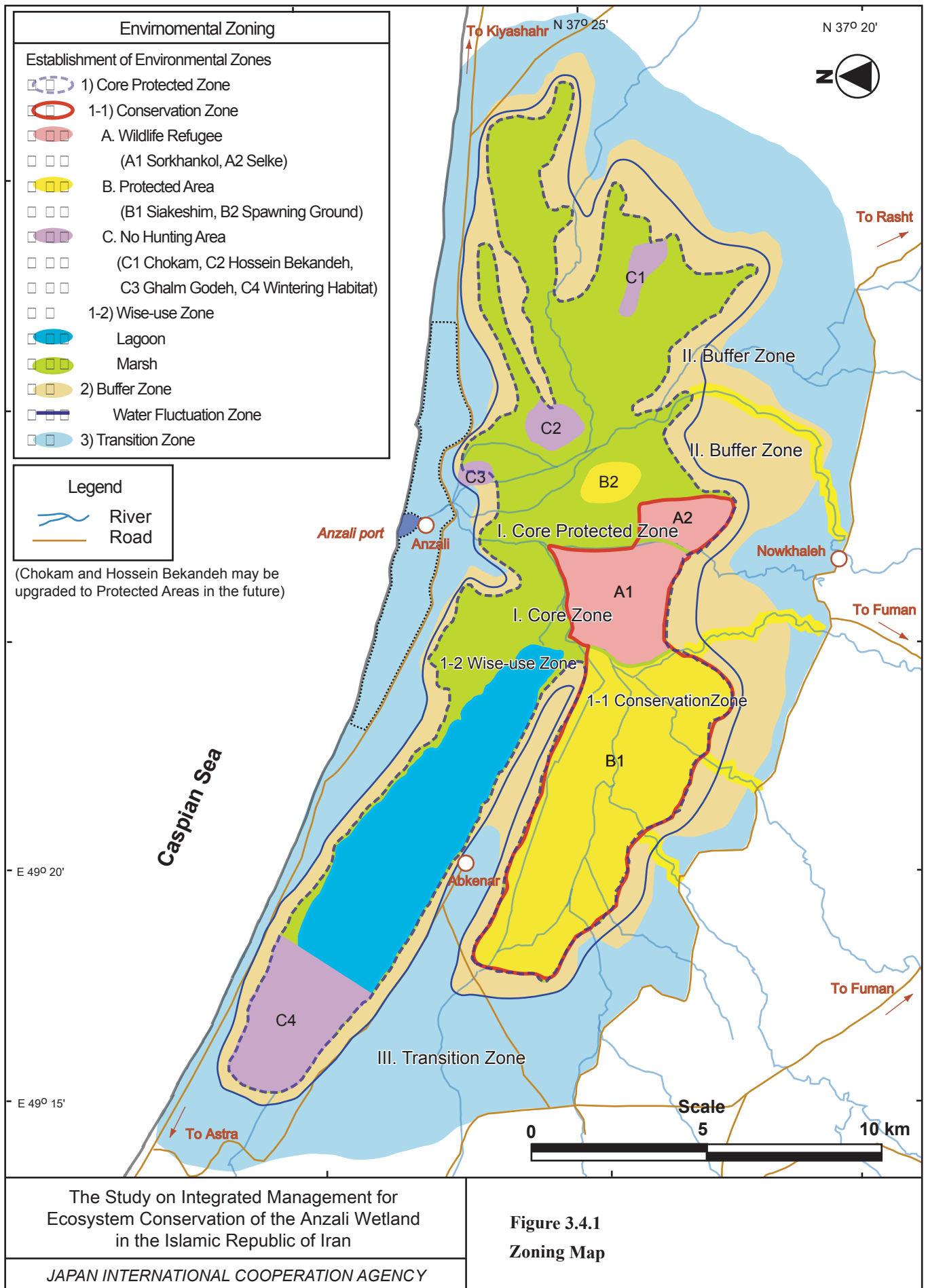
3.4 Zoning and Ecological Management

3.4.1 Proposed Zoning

Main policy and criteria for each zone are shown in Table 3.4.1. The entire Anzali Wetland is defined as the core protected zone, which is further divided into conservation sub-zone and wise use sub-zone using the status of legal protection. Width of the buffer zone and transition zone are determined with the ecological feature and the range of potential significant impact respectively. The proposed zoning is shown in Figure 3.4.1.

Table 3.4.1 Main Policy and Zoning Criteria

Zone	Main Policy	Zoning Criteria
Core Protected Zone a) Conservation Sub-Zone	Non-consumptive use of natural resources	Legally designated protected areas of the wetland (including proposed areas for legal protection): wildlife habitats with richer biodiversity and higher wildlife populations compared with those of the wise use sub-zone
b) Wise Use Sub-zone	Restricted consumptive use of natural resources	Not legally designated protected areas (areas other than the conservation sub-zone)
Buffer Zone	Reduction of impact on water quality of the wetland: Promotion of organic farming	Ecotone: A mixture of area where an ecosystem transfer to another, and such an area is often rich in biodiversity (edge effect). Ecotone for the Anzali Wetland is defined mainly as the water fluctuation zone that is 500 m from the border of the wetland.
Transition Zone	Restricted development avoiding significant impacts to the wetland	The range of area that can cause significant impact to the wetland: about 3 km from the boarder of the buffer zone.



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Figure 3.4.1
Zoning Map

3.4.2 Physical Description of Each Zone

(1) Core Protected Zone

The delineation of each zone is based on the analysis of recent satellite images and GPS-based site surveys by DOE on wetland vegetation and other wetland characteristics⁹. Core protected zone is divided into “Conservation Sub-Zone” and “Wise Use Sub-Zone.”

1) Conservation Sub-Zone

The conservation sub-zone consists of wildlife refuge and protected area. When the water level of the Caspian Sea rises, private lands within the buffer zone should be purchased by the Government since those areas will be considered as part of the core protected zone. Conversely, the size of the core protected zone will not be changed with the reduction of the water level of the Caspian Sea.

a) Wildlife Refuge

There is a gazetted wildlife refuge, Selke (360 ha), and a proposed wildlife refuge, Sorkhankol (1,156 ha¹⁰), under the Environmental Protection and Enhancement Act.

b) Protected Area

The Protected Area includes gazetted and proposed protected areas. Siakeshim (4,127 ha) is a gazetted protected area under the Environmental Protection Act. It provides spawning grounds for fish and nesting areas for bird species. In addition, it is proposed to include the following areas in the protected areas; the area between Selkeh and Hosseinbekandeh, the spawning ground of *Abramis brama orientaris*, *Esox lucius* and *Cyprinus carpio*, and the four rivers, Kolesar, Masuleh, Siahdarvishan and Pasikhan, are the spawning grounds of *Chalcalburnus chalcoides*, *Rutilus frisii kutum* and *Vimba bimba persa*. These proposed areas should also be included in the conservation sub-zone.

c) No-Hunting Area

No-hunting area occurs sporadically in the wise use sub-zone, but the area is under legal protection so that it should be considered as part of the conservation sub-zone. There are gazetted areas of non-hunting areas of Chokam (346 ha), Ghalm Godeh (119 ha) and proposed no-hunting area of Hosseinekandeh (367 ha) under the Game and Fish Law. In addition, it is proposed that the Cargon area, which is an important wintering habitat in the west of the lagoon, be protected as no-hunting area. Chokam and Hossein Bekandeh may be upgraded to Protected Areas in the future.

⁹ Majority of the area designated as wetland belongs to either NREGO or DOE, though it seems there are abandoned private lands and or land illegally occupied and then transferred to other owners. Due to unclear land tenure, it has been difficult to clearly identify the ownership of the lands in the wetland.

¹⁰ Part of Solkhankol (477 ha) has been gazetted as a wildlife refuge. Proposed expansion has not been approved.

2) Wise Use Sub-Zone

There is no legally designated protected area in this sub-zone, but some rules and regulations such as hunting and fishing regulations are still applied. It comprises marshes and lagoons.

a) Marsh

Marsh is the area covered by the emergent plants and the floating plants. It has spread especially on the eastern part of the wetland.

b) Lagoon

Lagoon is the open water area which spreads out in the west part of the wetland. This is a main area for fishing and a variety of aquatic sports.

(2) Buffer Zone

This zone covers the range of water fluctuation due to changes in the level of water in the Caspian Sea. This type of ecosystem is usually considered as an ecotone, which holds rich biodiversity but in the case of Anzali, the wetland is mainly surrounded by tree plantations and agricultural areas primarily rice fields (Chapter 2). Chemical fertilizers and agricultural chemicals are used in these areas so that the effluent and drainage from this zone is likely contaminated, which is a direct source of wetland degradation.

(3) Transition Zone

This is the surrounding area of the buffer zone in which sustainable use is promoted. The boarder of this zone is roughly the road from Kohman to Rezvanshahr. This area is almost covered with paddy field, and some tree plantations, industries, factories and townships are included in this zone. The width is determined referring to the feeding area of waterfowl¹¹ and spawning ground of anadromous fish. The city of Bandar Anzali and small towns in Somehsara are included in this transition zone.



Feeding of Waterfowl

¹¹ *: The amount of energy consumption of a waterfowl = 400 kcal/day = 100 g of Rice

The amount of food supply per ha of paddy field in winter

= 3000 kg/ha x 0.03 = 90 kg/ha = 900 days of food for a waterfowl

If it assumes that a waterfowl stays for 90 days in winter, one hectore of paddy field feed ten waterfowls.

If the number of waterfowl which feed on land is assumed to be 100,000 birds,
the required feeding area = 100,000 / 10 = 100 km²

3.4.3 Regulatory Framework in Each Zone

Different regulations should be imposed according to the management aims of each zone, which are involved with land tenure, restrictions over development projects and other human activities. Under the current procedures, the proposed zoning plan including the designation of protected areas needs to be approved by the Supreme Council for the Environment¹². However, before submitting a proposal to the Council, the following proposed regulations should be discussed and agreed upon among the stakeholders including DOE, MOJA/NRGO and PSO. This involvement of stakeholders is particularly important in the buffer zone and transition zone since there are many privately owned lands in both zones.

(1) Core Protected Zone

Considerable part of the core zone (approximately two thirds of the wetland) is not legally protected, which makes the management of human activities in the wetland difficult. It is, therefore, proposed that the whole area of the wetland be clearly designated as a management area of DOE. With regard to this management in the legal status of the wetland, two important issues should be addressed.

First, there has to be a general agreement among the stakeholders, including those involved in wise use activities such as ecotourism and controlled fishing and hunting, so that a sustainable use of the wetland resources for conservation and wise use is achieved. Another management issue is the difficulty in resolving and transferring the land tenure of privately owned lands within the wetland. Any private lands within the core protected zone should be transferred to the government so that regulations can be imposed and observed properly.

Regulations in the Conservation Sub-zone prohibit any consumptive use of natural resources by harvesting any vegetation and wildlife. However, it is proposed that entering this area be allowed for the purpose of ecotourism. This is based on the wise use concept, and restricted ecotours particularly in October to December would take advantage of natural resources without causing serious impact on migratory birds.

Regular hunting and fishing are allowed in the wise use sub-zone, but the regulations should be strictly observed. Proposed hunting and fishing regulations in the wise use zone are described in Section 4.6.2. Bag limit for hunting and fishing should be regulated with the concept of adaptive management. It is, therefore, proposed that the bag limit and species for harvest be examined and determined based on the annual monitoring data.

(2) Buffer Zone

Majority of this zone is agricultural area so that it is proposed that the use of pesticides and fertilizers be reduced with the Integrated Pest Management (IPM) and organic agriculture be promoted in this zone.

¹² Supreme Council for the Environment (Environmental High Council) is headed by the President of Iran, it is the most senior decision-making body for environmental matters in Iran.

Furthermore, waste water treatment facilities should be installed in all houses and commercial and industrial enterprises. River banks are proposed to be covered by vegetation to purify wastewater. New development should be prohibited in the buffer zone in accordance with the existing zoning regulation of DOE¹³.

(3) Transition Zone

For the last two years, DOE has regulated rural development in this zone, and it is proposed that DOE continue this policy. As for the present commercial and industrial enterprises, water treatment facilities should be installed with subsidies. When any development projects are proposed within this zone, any potential negative impact to the wetland should be carefully analyzed in an environmental impact assessment (EIA). In this assessment, indirect impact from all proposed development projects should be analyzed with the aspect of maintaining the ecological balance of the Anzali Wetland in a long-term.

3.4.4 Necessary Arrangements in the Implementation of the Proposed Zoning

(1) Boundaries

It is important to clearly mark the boundaries of the proposed zoning to introduce different regulations. However, fencing is not practical since it hampers movements of wildlife and that placing signboards on the borders of between zones is suggested.

(2) Mechanism of Low Enforcement

In order to practice different regulations in each zone, collaboration between MOJA/NRGO, the provincial government and lower administrative divisions (e.g., municipalities), HUDO, the governor's engineering office, agricultural cooperatives, and DOE is essential. In order to ensure the implementation of the zoning plan, it should be approved by the Supreme Council for the Environment with representatives of all related government bodies. If this is difficult, at least a local ordinance should be issued by the Provincial Government.

(3) Periodical Review of Zoning

The proposed zoning plan should be reviewed according to the changes in the water level of the Caspian Sea. The boundaries should be reviewed once in 5 years based on monitoring.

3.5 Conservation of Wildlife

Wildlife conservation plan mainly consists of conservation of threatened species and control of alien species. Protection of threatened species and control of alien species are part of biodiversity conservation, which is to maintain natural balance of the wetland ecosystem.

¹³ For the last two years, DOE has announced the zone as the regulated area and been refusing permits for any development within this zone.

3.5.1 Conservation needs of the Threatened Species

Threatened species targeted in this plan are listed with current ecological status in Table 3.5.1.

Table 3.5.1 Status and Conservation Needs of the Threatened Species

Species	Status and Conservation Needs
<i>Haliaeetus albicilla</i> (White-tailed Eagle)	Status: Main diets of the eagle include fish and waterfowl. Only one pair of this species is left in Anzali Wetland. Conservation Needs: It builds a nest on a large tree in March. The pair of <i>Haliaeetus albicilla</i> uses a large poplar tree at present. The tree should be protected, and no one should be allowed to go near the area especially during the nesting and breeding season. A substitute tree is needed in case the tree dies, and if it is difficult, artificial breeding should be considered.
<i>Aythya nyroca</i> (Ferruginous Pochard)	Status: Main habitat of the species is shallow (1 to 2 m) and well-vegetated areas. Conservation Habitats with abundant submerged plants, fish and benthos should be protected. Improvement of water quality and maintenance of water depth is necessary. Habitats in Selkeh and Sorkhankol should, therefore, be protected.
<i>Vimba vimba persa</i> (Baltic Vimba)	Status: The fish inhabits the western part especially in summer. It requires highly dissolved oxygen and enters lower reaches of rivers for spawning in May to July. Spawning takes place upstream on gravel. Conservation Needs: It enters the rivers through the Siakeshim, and enough depth of water is necessary to move during the spawning season. Linkage of different rivers is indispensable for the movements so that any obstacles such as a barrage should be avoided downstream of the rivers.
<i>Lutra lutra</i> (Eurasian Otter)	Status: Carnivorous mammal species which is in the highest position in Anzali Wetland ecosystem. It feeds fish and frogs. Although the animal is protected as a non-game species, it is still hunted for high quality fur. Conservation Needs: It inhabits Sorkhankol and Selkeh, and enters rivers and the Caspian Sea. Hunting of the animals should be strictly prohibited.

3.5.2 Conservation Programs

(1) Protection of Sensitive Areas

Impact on the sensitive areas should be minimized, and areas to be protected for the threatened species are:

- Siakeshim: nesting area of *Haliaeetus albicilla* (on the large *Populus* tree) and *Phalacrocorax pygmaeus* (on the *Salix* tree).
- Selkeh: wintering area of *Aythya nyroca* and hunting area of predatory birds.
- Sorkhankol: spawning ground of the threatened wildlife such as *Abramis brama orientaris* and *Rutilus frisii kutum*, and feeding area of *Lutra lutra*.

(2) Installation of Signboards

Signboards should be installed especially in the above-mentioned sensitive areas, indicating the ecological status of the targeted species and their conservation needs.

(3) Control of Illegal Activities

Illegal activities including hunting, fishing and any other forms of harvest are detrimental and should be strictly prohibited for the conservation of the threatened species. Education of

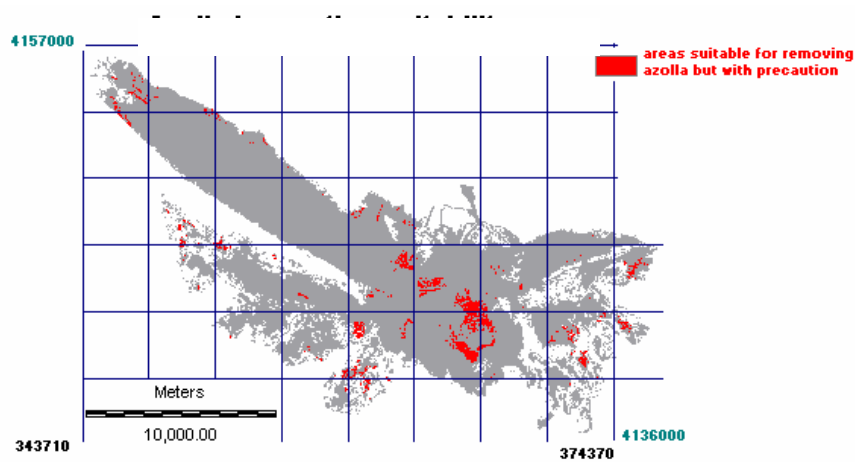
hunters and fishermen is required so that it is proposed that hunting and fishing handbooks be distributed with license, and a lecture also be held when a license is issued by DOE. Penalty including fines and imprisonment for illegal hunting and fishing should be presented in the lecture in order to uplifting the public understanding of the importance of conservation.

3.5.3 Control of the Alien Species

Azolla is a type of alien floating water fern, which is nuisance in the Anzali Wetland. It has recently overgrown in the open water and distributed in the wetland. The removal of thick mats of the *Azolla* should be carried out in order to reduce its adverse effects on water quality and habitats. Suitable areas for the removal of *Azolla* are proposed in reference to the study conducted by the Guilan University (Figure 3.5.1).



Azolla sp.



source: Guilan University (1999)

Figure 3.5.1 Areas to Remove *Azolla*

A pilot activity was undertaken to examine the use of *Azolla* as fertilizer by composting in this M/P. According to the study by the Guilan University, distribution of *Azolla* in the wetland is roughly estimated at 1,000 ha. The wet weight of *Azolla* is about 30 to 80 t/ha so that 30,000 to 80,000 ton of *Azolla* exists in the wetland. Approximately 4 tones of *Azolla* (wet weight) are required to be used as compost for one hectare of paddy field. It is, therefore, estimated that the potential total compost made out of *Azolla* from the wetland can cover about 7,500 to 20,000 ha of paddy field. However, it is difficult to remove a large amount of *Azolla* so that introduction of machinery to remove *Azolla* is recommended. One machine “Aquatic Plants Harvester” can remove about 0.8 ha per hour. It is proposed that at least 30% of *Azolla* be removed from the wetland as a means of the environmental restoration.

Except for *Azolla*, *Hemiculter leucisculus*, *Gasterosteus aculeatus*, *Liza aurata* (fish) and Comb jellyfish inhabit the wetland as alien species. These species have not shown apparent negative consequences in the wetland ecology at present, but this is probably due to a lack of data. Distribution and abundance of native wildlife are often negatively affected by alien species so that prevention of the release of alien species as well as control of existing alien species is recommended when the impact is not in a serious level.

3.6 Conservation of Habitats

Anzali Wetland maintains rich ecosystem, abundant wildlife and beautiful landscape. Conservation of wildlife habitats is as important as the conservation of threatened species. The regulation and rehabilitation are, therefore, proposed as conservation measures to maintain the ecological balance of the wetland.

3.6.1 Strengthening of Regulations

(1) Construction of Guard Station

DOE has reported that there is a dramatic reduction in poaching where guard stations are established¹⁴. It is likely that construction of guard stations is effective to reduce poaching. Ten years ago, four guard stations were constructed at Ghalam Godeh, Selke, Siahdarvishan and Esfand and are still in use. Four other wooden guard stations were constructed at Sorkhankol, Siakeshim, Abkenar and Hosseinbekandeh, though only Sorkhankol functions at present. One additional guard station was constructed at Cargon in 2003.

In order to regulate illegal activities up to a sufficient level, it is proposed that three further guard stations be constructed at important locations such as Chokam (newly announced no-hunting area), the southern side of the lagoon (to regulate the illegal activities in the wide lagoon) and within the eastern part (it is difficult to approach from other guard stations and necessary to regulate the illegal hunting).

(2) Capacity Development of Rangers

Capacity development is required for rangers. In addition to the knowledge on wetland ecosystem including names of species, ecological features of wildlife, status of wetland ecosystem, understanding the importance of the management system that is based on a linkage between monitoring and decision-making process is inevitable. Seminar and workshop should be held at least once a year to strengthening the management capacity of DOE.

¹⁴ Summery report of natural environment activity DOE of Guilan (Hossein Esmaily, 2003)

(3) Regulation of Motorboats

The noise of motorboats in the wetland is considered as a disturbing influence on birds and other wildlife. Moreover, the “wash” caused by fast boats cause bank erosion and damages fish spawning sites. It is, therefore, necessary to control the size or power of engines and/or introducing a speed limit. DOE is currently investigating the technical feasibility of introducing quieter engines (possibly electrically driven). Given the large number of boats with high power engines that is already in use, the control of engine size or type could only be introduced gradually over time. In this circumstance, it is proposed that a speed limit of 8 knots be applied by PSO for the important bird habitats and fish spawning areas at the eastern side of Sorkhankol.

3.6.2 Rehabilitation and Maintenance of Habitat

Active manipulation of habitats can be a management tool. However, an ecosystem is dynamic and changes over time so that physical management measures (i.e. rehabilitation and maintenance of habitats) should, therefore, be based on sound data. Management activities including creating deeper pools for fish or small islands, partially cutting dense stands of *Phragmites* (reed) and *Typha* (bulrush), planting trees and extending areas of open water for waterfowl are identified as potential management tools at present, and those should be implemented according to scientific data. Systematic monitoring should be carried out to analyze ecological consequences.

(1) Rehabilitation of Habitat

Reed beds provide valuable habitats for many fish species, and provide the nest and cover for birds. On the other hand, excessive distribution of reed beds can reduce open water that provides feeding sites of birds and fish. In the middle of Siakeshim, there is a decrease in the waterfowl habitats and hunting space of *Haliaeetus albicilla*. In 1982, aerial photos indicated that more than 10 ha of open water were distributed in Siakeshim. Most of this is now covered with reed beds, therefore, it is proposed that reed bed in the two areas of 200 m x 200 m and 400 m x 400 m be removed. The ecological response to this management action should be monitored, and adaptive measures should be taken when required.

It is also proposed that new channels be established to improve the flow of water in the stagnating areas in Siakeshim. DOE has obtained an approval and funding to establish such a channel along the southern boundary of Siakeshim to restrict public access to this protected area. However, there are some risks associated with the plan including physical disturbance, mobilization of pollutants, and the disposal of a large volume of dredging so that an EIA should be conducted before implementation.

(2) Prevention against Solid Waste Inflow

Rubbish entering the wetland is not collected at present. The collection and proper disposal of garbage should be carried out in the wetland and rivers. Considerable amount of the

rubbish enters the wetland with the Pirbazar River. It has been proposed that waste disposal in the catchment must be improved, and two pilot projects are being implemented to stimulate that improvement. However, in the meantime, floating waste (plastic bottles, etc.) could be intercepted by placing a floating boom at an angle of 45 degrees across the Pirbazar River, near its entrance to the wetland. Rubbish accumulated at the downstream ends of the boom would need to be removed each week. The boom should be inspected periodically and made adjustments such as the angle (i.e. 45 degrees) and location.

3.7 Sustainable Use of Natural Resources

The Anzali Wetland has a high potential of generating sustainable benefits to the local society. Anzali is one of the major sightseeing spots in Iran so that ecotourism is an effective means of achieving the promotion of incentives and sustainable use of natural resources with the application of the wise use principle. In order to maintain fishing and hunting, harvesting pressure should be controlled in the Anzali Wetland. Furthermore, beneficial use of other natural resources such as *Azolla* and *Phragmites* is also promoted in the wetland.

3.7.1 Development of Ecotourism

(1) Ecotourism Resources

Anzali Wetland has been used for small-scale tourism, mainly motorboating. However, the ecotourism in the wetland has not been fully developed, and there is some development potential with sustainable use of natural resources. Potential resources for the ecotourism are, therefore, identified and presented in Figure 3.7.1.

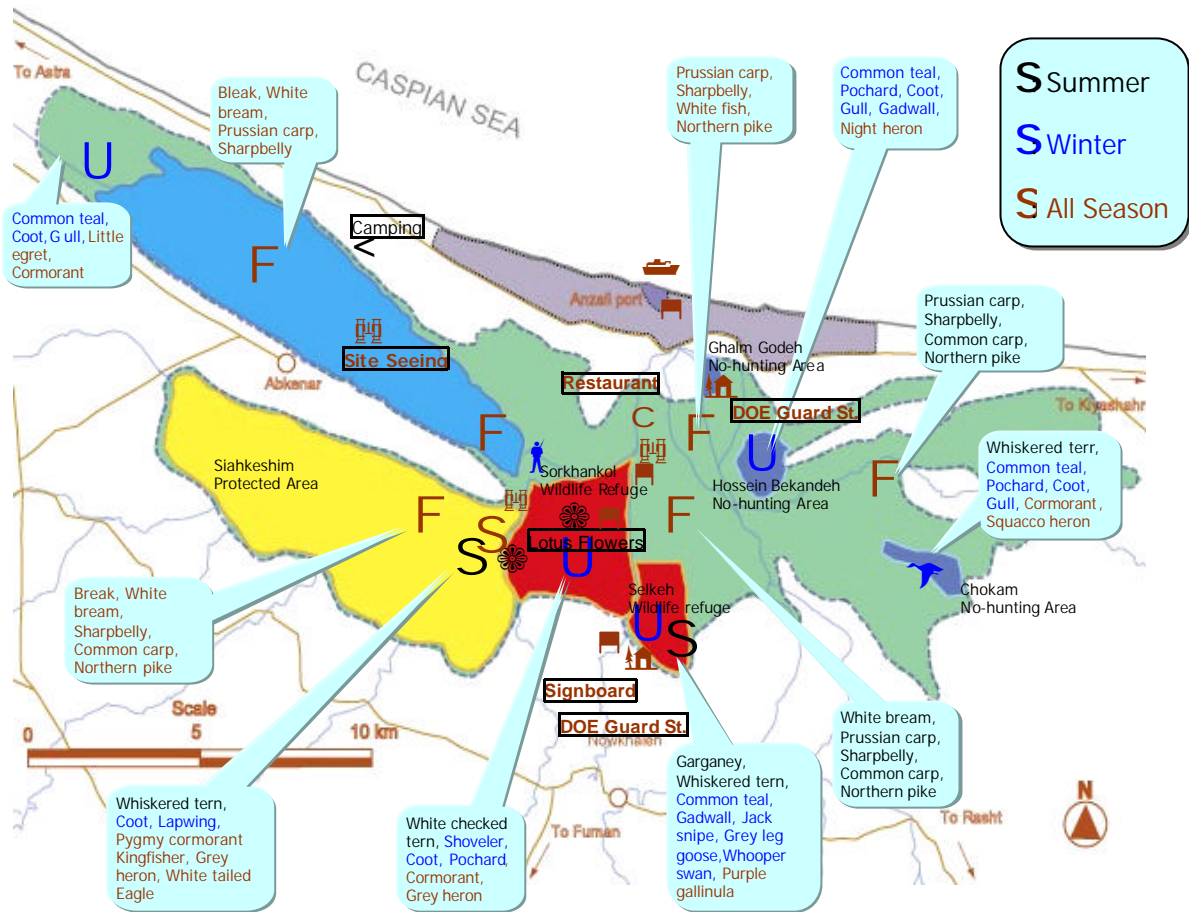


Figure 3.7.1 Ecotourism Resources

1) Birds

Abundant birds are observed in winter (November to March) and in summer (May to August). More than 50,000 wintering birds inhabit the Anzali Wetland, and mainly congregate in Selke, Sorkhankol, Chokam, Hosseinbekandeh, and Corgan. Selke has a high concentration of wintering birds especially in early morning. Breeding birds such as terns and cormorants are observed in summer. Selke, Siakeshim and Chokam are large-scale and important breeding areas. Resident birds such as egrets and cormorants are observed throughout a year. Pygmy cormorants and White-tailed eagle which are threatened species are found in Siakeshim, Sorkhankol and Selke.

2) Fish

There is a list of 34 species and 11,190 specimens of fish in a survey conducted in 2003. Lagoon is suitable for fishing, but it is necessary to ensure that regulations to maintain sustainability of the populations should be carefully observed.

3) Plants

Lotus flower is one of the most popular plants among the tourists. Many tourists visit the wetland to observe flowering Lotus from July to September. Large Lotus communities locate in Sorkhankol, and DOE permits entering the area by tourists in this season. It is proposed that Lotus communities in other parts of the wetland be identified and used as resources for the ecotourism.



Lotus flower

4) Watching Tower, Bird Hide and Signboards

Some facilities such as a watching tower, a bird hide and signboards were constructed in the pilot activity of the master plan. The watching tower and bird hide were constructed at Selkeh so that it is proposed that these facilities be fully utilized in the ecotours. Signboards are installed at Selkeh, Sorkhankol and Anzali port, which should also be used in the ecotours for the purpose of tourist education.

(2) Ecotourism Approach

Based on the availability of natural resources, it is proposed that the following activities be developed as ecotourism in the Anzali Wetland.

- Structuring of Ecotourism Network
- Nature interpreter training
- Preparation of infrastructure
- Programming the ecotour
- Implementation of the ecotour

1) Structuring of Ecotourism Network

Implementation of ecotourism is the responsibility of tour organizers, but it is suggested that DOE support the development of the ecotourism in the wetland. It is, therefore, that DOE should act as the center of the ecotourism network involving a variety of stakeholders. The membership of the network and its benefits are presented in Figure 3.7.2.

DOE, CHTO and travel agencies were assembled, and the pilot activity “Ecotour” was implemented as part of the M/P. Local nature interpreter was trained and coordinated the ecotour. This small network functioned well in the pilot program so that it should be developed further to involve other stakeholders as well.

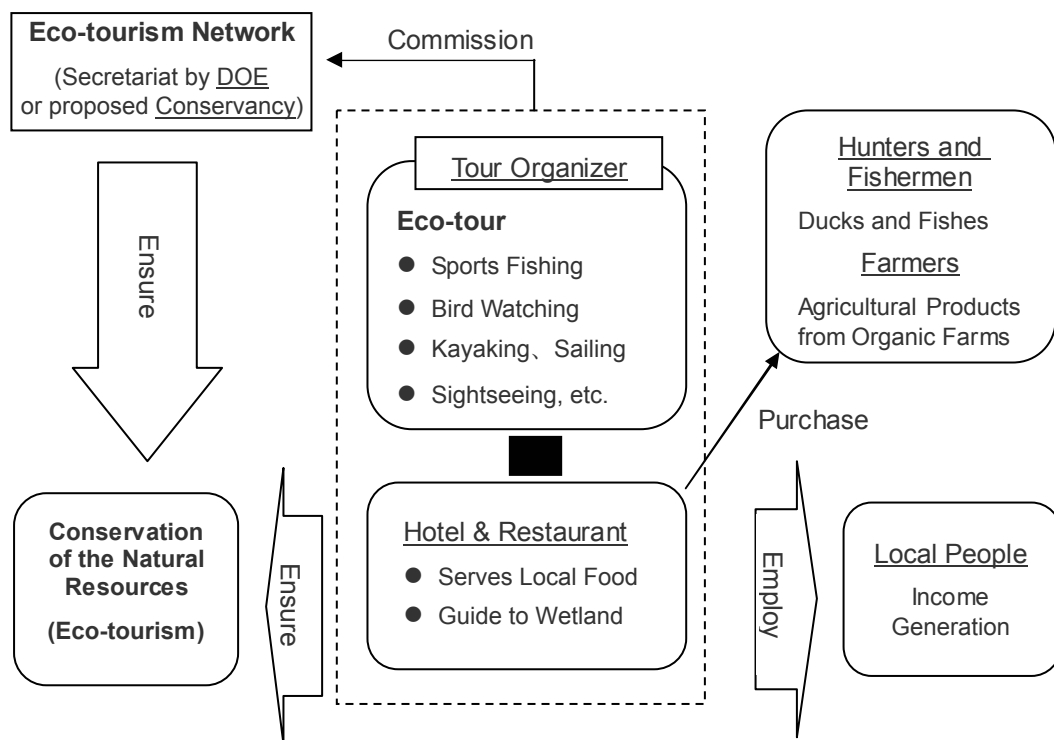


Figure 3.7.2 Network of Ecotourism

2) Nature interpreter Training

Ecotourism requires nature interpreters who can explain how to experience nature and culture of the area. Candidates for ecotourism nature interpreters are DOE staff, tour guides and the people who are interested in the conservation of the wetland and ecotourism. The ecotourism nature interpreters should be familiar with wetland ecology and have strong leadership and nature interpretation skills. Training fishermen and hunters as nature interpreters is also recommended. The number of nature interpreters initially required is about 5 to 10 persons based on the implication made by the pilot study. A pilot activity “Ecotour” prepared including a textbook and training of two nature interpreters.

3) Preparation of Infrastructure

It will be provided essential infrastructure for tourists, which includes wetland information facility, bird watching hides / towers, low-impact paths to areas for ecotourism, board-walks, appropriate accommodation, toilets, litter-bins, car parks, visitor center, access route, etc. Some of the infrastructure facilities (environmental education center, watching tower, walking path and signboards) were constructed as part of the pilot activity during the course of the master plan. It is proposed that facilities developed in the M/P be further elaborated. These public facilities should

be maintained by DOE while private facilities such as boats, canoes and fishing rods should be prepared by tour organizer.

a) Visitor Centre

The Visitor Centre in the Anzali Wetland should be used as the center of ecotourism as well as research, monitoring, and environmental education. Based on the local discussions among DOE, NREGO and other stakeholders, Hosseinbekandeh is the candidate site for this facility. This would be accessible by boats (new jetty required) and vehicles.

b) Access Routes

Access routes to the key areas and facilities for ecotourism and environmental education need to be improved. The routes that require improvement include:

- Access road to the Selke area including parking,
- Access road to the proposed new Visitor Centre,
- Routes for environmental education and ecotourism (e.g. boat routes),
- Construction of jetties enabling boats to link with paths,
- Establishment of a bicycle track around the wetland.

All of the above facilities need to be carefully constructed so as not to disturb the wetland ecosystem. The use of wood and compacted gravel is recommended.

c) Jetty

Jetties are necessary at the visitor center (Hosseinbekandeh) and the park (Abkenar) for access. It is important to secure easy access for tourists.

d) Bike Track

The bicycle road race was held around the Anzali Wetland in 2003 as part of the pilot activity, and it was successful to have about 50 participants. It is recommended that two bike tracks be constructed at Pilalibagh and the southern shore of the lagoon. Pilalibagh is close to the city. The dike is now constructed at Pilalibagh, and the top of the dike can be prepared as a bike track. The southern shore of the lagoon has a fine view.

e) Watching Tower

One watching tower was constructed at Selkeh in the pilot activity "Ecotour". Tourists can look out over the wetland from this tower. It is recommended to construct another tower in the wetland at the site of an old research center that is no longer used at the border of Sorkhankol and Siakeshim in the wetland.

f) Hide

Using a hide for bird watching is effective, and abundance of birds and land regulations are considered to determine candidate sites for the construction. It is recommended that a hide be constructed at Hosseinbekandeh, Chokam and Pilalibar.

g) Park

Camping and walking are popular in Guilan province. Western part of Abkenar is proposed for the construction of a park because the area is mainly covered by forest and surrounded by the wetland.

4) Programming the Ecotour

Ecotourism needs tour programs that are based on available natural resources. The following resources should be considered in planning:

- Participation by local nature interpreters and stakeholders,
- Based on field reconnaissance,
- Ecotourism network.

The number of participants in ecotourism should be adjusted to control the negative impacts to the wetland. A total of about 50 persons are acceptable per day (e.g. bird watching: 30 persons for sports fishing: 10 persons for kayaking) in order to keep the silent condition for the wildlife. Fishing is regulated with licenses. It is necessary that DOE issues the one day license for tourists to promote fishing activity in the ecotour. The ecotour route should be established mainly out of the protected area although some observation points can be located in the protected area, such as Selke, Sorkhankol and Siakeshim for bird and plant (lotus) observation and experience the nature while disturbance to wildlife is minimal (in order to minimize the disturbance, routes and season should be limited). The proposed ecotour program is shown in the Figure 3.7.3.

5) Implementation of the Ecotour

Implementation of the ecotour should be arranged by the ecotourism network, and each ecotour is managed by the tour organizer. However, it is difficult to charge the whole beneficial tour fee because:

- Constructions of facilities and training of nature interpreters take several years.
- Tourists cannot understand the value of ecotour in the early stage.

The tour fee is approximately estimated by the result of the pilot activity as follows.

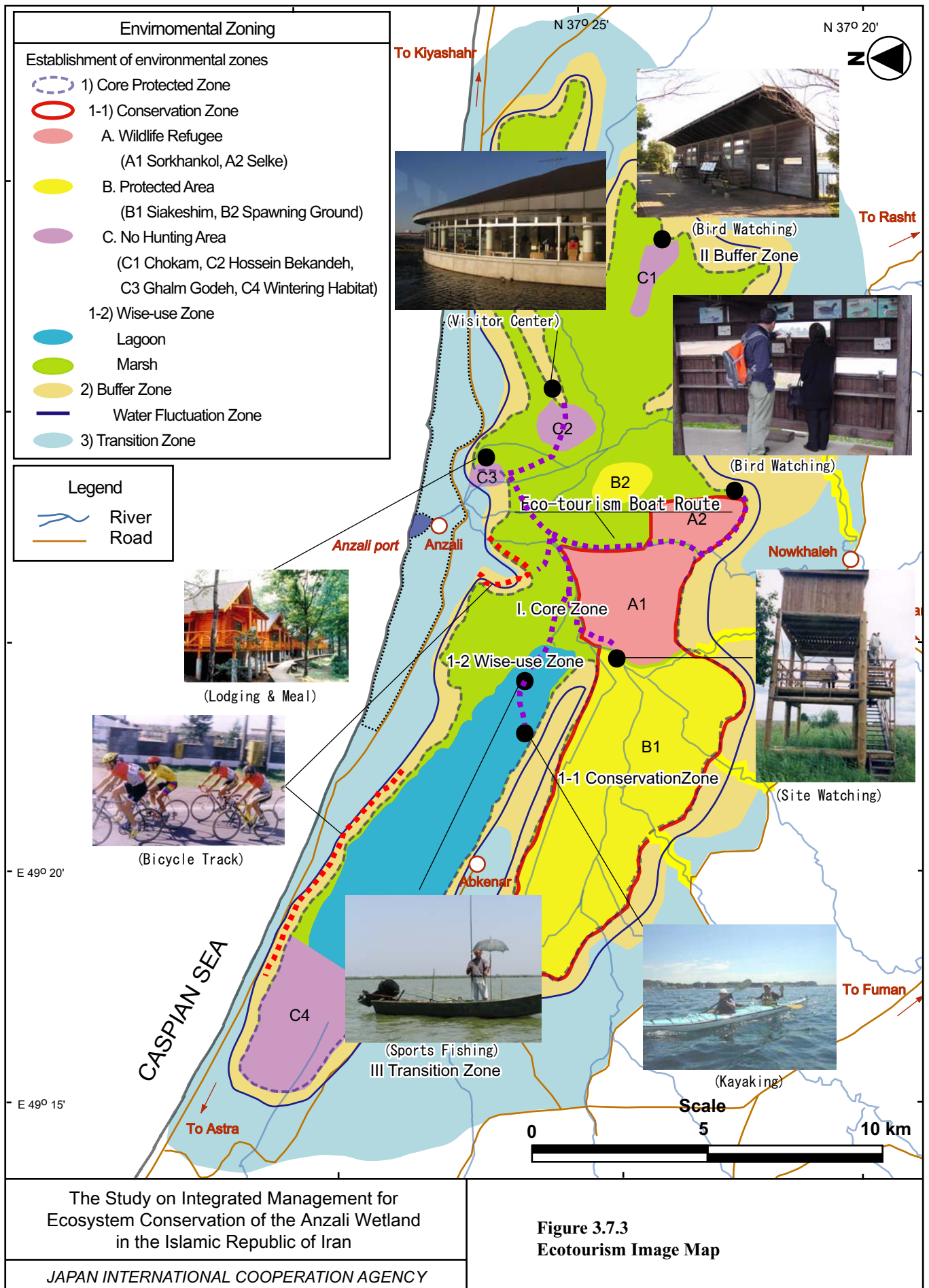
Expense for 15 tourists

Boat	1,200,000 Rials
Nature interpreter	348,000 Rials
Lunch	675,000 Rials
Miscellaneous	300,000 Rials
Total	<u>2,523,000 Rials</u>

Tour fee for a tourist

$$(2,523,000 + 504,600 (20\% \text{ of expense})) / 15 = 201,840 \text{ Rials}$$

Implementation of the eco-tour is, therefore, treated as a trial activity until the constructions of facilities. The subsidy should be provided during the trial period and the tour fee should be minimal. Ecotour programs are examined, and evaluation and revision of the program should be implemented.



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JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 3.7.3 Ecotourism Image Map

3.7.2 Sustainable Hunting and Fishing

Sustainable hunting and fishing is indispensable to maintain wildlife populations, which can also be beneficial to the stakeholders. The appropriate number of hunting and fishing licenses are decided annually by DOE Guilan, and this should be determined by research and monitoring on the availability of resources. The license fees and bag limits should also be evaluated and revised annually. Preliminary revised management plan is shown in Table 3.7.1.

Table 3.7.1 Present and Proposed Management of Hunting and Fishing

License	Proposed
Regular hunting license (weapon)	6 birds/day for 3 days/week 80,000 Rials
Trapping license	10 birds/day for 3 days/week 500,000 Rials
Rent license	20 birds/day for 3days/week (weapon and trap) 1,500,000 Rials
Fishing license (hook)	Unlimited 12,000 Rials

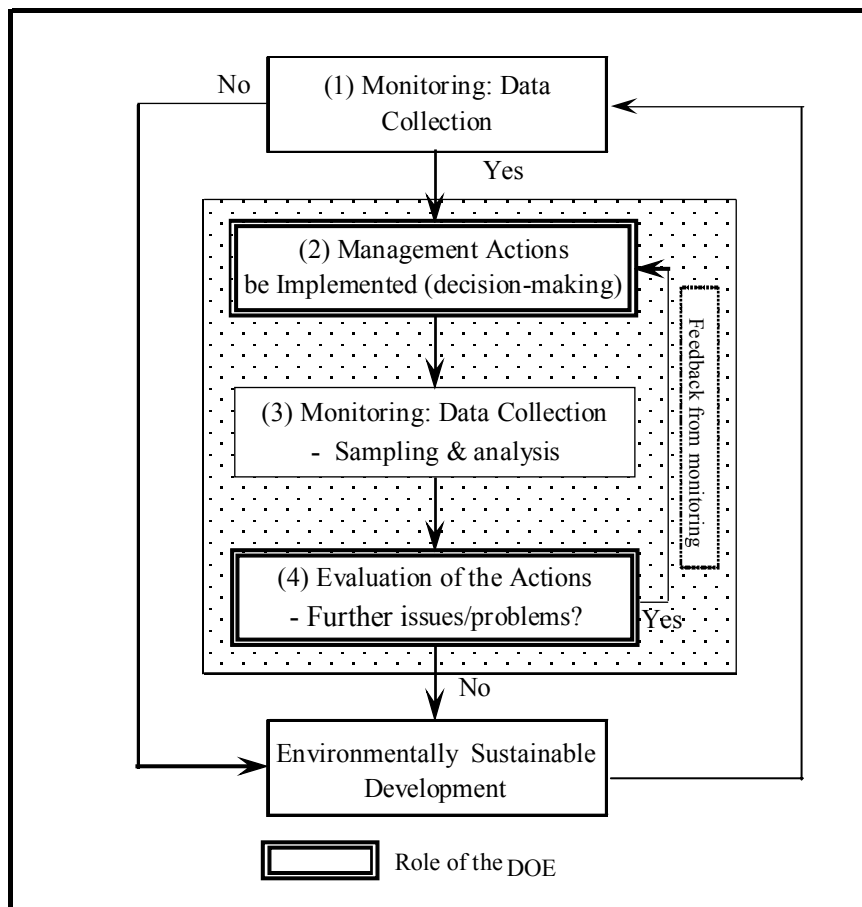
Except for the above licenses, Fishery department issues about 350 licenses which permit to use net fishing gears. Those licenses are issued to the people who have vested rights with the Fishery department. Those licenses should be reduced. Licenses for sports fishing is proposed as a separate category of license to encourage ecotourism. Daily fishing license should be issued at DOE, and the license fee should be about 1,000 Rials/day.

3.7.3 Beneficial Use of *Azolla*

As presented earlier, alien species can be detrimental to ecosystem so that they should be removed from the wetland. *Azolla* can be used for agriculture as fertilizer and for livestock industries and aquaculture as feed. The result of the pilot activity “Beneficial use of *Azolla*” showed that grain yields were not so different between the application of chemical fertilizer and composted *Azolla*. Therefore, *Azolla* is planned to be used as compost and applied especially to the paddy field in the buffer zone (more than 2,000 ha).

3.8 Environmental Monitoring

Scientific data are insufficient at present for making appropriate management plans. Therefore the improvement of monitoring activities is critical so that it is proposed that adaptive management having a system where a decision is made based on monitoring data with feedback (Section 3.3.2). The model of adaptive management is shown in Figure 3.8.1.



Note: (1) Monitoring: Bird population, fish population and fish catch, and etc.
 (2) Management decision: Hunting regulation, fishing regulation and etc.
 (3) Parameters: Same as (1) but an additional survey is to be conducted upon requirement
 (4) Management decision: Evaluation of to make management decisions

Figure 3.8.1 General Flow of Adaptive Management for the Anzali Wetland

3.8.1 Regular Environmental Monitoring

The wetland ecosystem is dynamic and is affected by numerous factors such as the incoming pollution and sediment from streams and changes in the water level of the Caspian Sea. In order to manage the Anzali Wetland, the ecological dynamics of the wetland including flora and fauna should be studied and that the following five environmental monitoring programs are proposed.

- Wetland ecological census (every 5 years),
- Annual ecological monitoring program,
- Ecotourism monitoring program, and
- Environmental monitoring by universities.

(1) Wetland Ecological Census

Monitoring program is shown in Table 3.8.1. These surveys should be conducted every 5 years, and management activities should be evaluated with the monitoring results. The evaluation should also be used to revise the management activities such as the boundary of different zones, the number and location of guard stations and conservation methods of the threatened species.

Table 3.8.1 Wetland Ecological Census Program – every 5 years

Organization	DOE and Bony Fish Research Center
Monitoring Program -Birds -Plants -Benthos & Plankton -Fish -Satellite Image/ Aerial Photo Analysis	Species/Distribution; Every month; Analysis of important habitats Species/Distribution of emergent, floating, submerged and others plants; 3 times (Spring, Summer, Fall) Biomass of selected species (Azolla, Reed); 1 time (summer) + satellite image analysis Species/Distribution, 4 times (Spring, Summer, Fall, Winter) Species/Distribution/Size, 4 times (Spring, Summer, Fall, Winter) Wetland boundary, open water area, encroachment, others; 1 time; satellite/aerial photo image analysis
Analysis and Storage of Information	The results are analyzed by specialists from DOE and Bony Fish Research Center and an environmental census report (technical) is prepared.
Dissemination of Information	The prepared report is to be distributed among DOE, MOJA, Bony Fish Research Center, Universities and other interested parties as technical information about the ecological condition of the Anzali Wetland.
Evaluation and Feedback	The ecological condition is evaluated and fed back to the management activities. DOE and relevant organizations review the management activities.

(2) Annual Ecological Monitoring Program

Monitoring program is shown in Table 3.8.2. The information is recorded every year to indicate changes in the wetland condition and used to review the ecological management plan with the result of 5 year census. The information is also used to determine the number of license for hunting and fishing every year.

Table 3.8.2 Annual Ecological Monitoring Program

Organization	DOE and Bony Fish Research Center
Monitoring Program -Birds -Fish -Water Quality -Sediment Quality -Water Level	Species/Distribution; January and July Species/Distribution/Size; 4 times (Spring, Summer, Fall, Winter) General Parameters (Temp., DO, BOD, COD, salinity, T-N, T-P, SS, chlorophyll a, transparency, E.Coli), 15 locations, 4 times (spring, summer, fall, winter) Toxic Parameters (heavy metals, pesticides); 20 locations; 4 times General parameters (depth, texture, organic carbon, T-N, T-P), Toxic parameters (heavy metals, pesticides); 5 locations; 1 time; Water levels: 5 gauging stations including the Anzali Port; weekly
Analysis and Storage of Information	The results are analyzed by specialists from DOE and Bony Fish Research Center, and an annual ecological monitoring report is prepared by DOE. Also electronic data bases of the results are created to store the results. The results of the 5-year census data are also stored in these data bases.
Dissemination of Information	The prepared report is to be distributed among DOE, MOJA, Bony Fish Research Center, Universities and other interested parties as technical information about the ecological condition of the Anzali Wetland.
Evaluation and Feedback	The ecological condition is evaluated and fed back to the management activities. DOE and relevant organization review the management activities (especially annual activities such as the issue of fishing and hunting licenses).

(3) Ecotourism Monitoring Program

Monitoring program is shown in Table 3.8.3. The information is used to develop ecotourism programs and investment plans for facilities of the ecotour. The monitoring is especially implemented during the trial activity (Section 3.7.1).

Table 3.8.3 Ecotourism Monitoring Program

Organization	DOE and ITTO
Monitoring Program Ecotourism	Questionnaire to tourists; general information about tourists, impression about the wetland, satisfaction with ecotourism program, suggestions for improvement, others; regular distribution to tourists + surveys in summer and winter
Analysis and Storage of Information	Every year, DOE and ITTO are to compile the results into a short report.
Dissemination of Information	The report is to be distributed to ITTO, tourism companies, DOE, and other interested parties.
Evaluation and Feedback	The ecotourism activities are evaluated and fed back to the activities such as ecotour program, facilities and arrangement of ecotour.

(4) Environmental Monitoring by Universities

Monitoring program is shown in Table 3.8.4. It is suggested that the research implemented in the wetland be presented to the universities, and to seek for an opportunity to collaborate using advanced knowledge and technology of the universities. The result should be made available to the wetland management by DOE. The collected information should be recorded in a format that can be used by DOE, enabling the wetland management system to be amended if necessary.

Table 3.8.4 Environmental Monitoring by Universities

Organization	DOE, Ministry of Education, Universities
Monitoring Program Monitoring by Student	A special program is developed for the specific purposes.
Analysis and Storage of Information	The results are analyzed by university students and professors, and the report is prepared. Also electronic data bases of the results are created to store the results. The results are compiled with the 5-year census and annual ecological monitoring data.
Dissemination of Information	The prepared report is to be distributed among DOE, MOJA, Bony Fish Research Center, Universities and other interested parties as technical information about the ecological condition of the Anzali Wetland.
Evaluation and Feedback	The ecological condition is evaluated and fed back to the management activities. DOE and relevant organization review the management activities.

3.8.2 Environmental Research

Scientific data on the Anzali Wetland and information on its use are still incomplete. Collecting scientifically sound data is a critical factor in the efficiency of the wetland management and the effectiveness of environmental education. It is, therefore, proposed that the following research programs be developed:

- Basic ecological status of fauna and flora including habitat requirements,
- Formation of the Anzali Wetland system,
- Potential for algal blooms,
- Bioaccumulation of pesticide in Anzali Wetland,
- Damage to *Nelumbium maciferum* caused by diseases and harmful insects,
(Indicated from the top in order of priority)



Damage to *Nelumbium maciferum*



Algal blooms

Biological indicators are the parameters of the wetland condition. *Vimba vimba persa*, *Alosa caspia* and *Perca fluviatilis* are sensitive to changes in water quality. *Alburnus filippii*, *Barbus capito* and *Rutilus rutilus caspicus* are endemic species (Caucasus-Black sea area), and monitoring of these species can indicate a level of degradation in the wetland ecosystem. Revision of the wetland management should be carried out through the monitoring and feedback.

Lutra lutra occupies the top of the food web in the wetland ecosystem and that changes in the ecological condition of the wetland including abundance of fish and water quality can seriously affect the population dynamics of the species. *Lutra lutra* is, therefore, considered as a suitable biological indicator.

As the number of individuals is decreasing recently (DOE pers. com.), monitoring and measures are required. Detailed ecological studies on the species involving a radio-tracking study emphasizing on movements and feeding behavior should be carried out. Furthermore, an individual of *Lutra lutra* is caught in a fish net, it should be brought into the laboratory to take necessary measurements. When a carcass of the species is secured, chemical concentration in liver and kidney should be measured. Biological concentration of chemical substances can be an outstanding biological indicator of water quality in the wetland.

Predatory birds such as *Haliaeetus albicilla*, *Falco peregrinus* and *Aquila clanga* can also be analyzed for chemical concentrations. Breeding status of *Haliaeetus albicilla* should be closely monitored, and special actions and care such as artificial breeding should be provided to the species upon requirement.

3.9 Environmental Education

The wetland provides opportunities for teaching environmental science, biology, hydrology, etc., and use of facilities should be optimized (see Part 7 Environmental Education Program). In order to promote the wetland ecological management plan, public awareness is indispensable. Even if the plan is prepared, it does not work without the understanding of local people. Hunters and fishermen need to distinguish threatened species and its importance, farmers need to know the impact of agricultural chemicals on the wetland, and people need to know that their life such as detergent use makes an impact on the wetland, and biodiversity of the wetland contributes to their life. Environmental education programs for schoolchildren and adults are being developed. There should be a program to teach the above knowledge. In order to implement education and various measures, capacity development of stakeholders is required. It is required to carry out workshops, seminars, and trainings periodically.

3.10 Institutional and Organizational Arrangement

In order to implement wetland management, DOE needs to enact the detailed rules of zoning, control of illegal activities, etc., under discussion with relevant authorities. In Part 9, the establishment of an independent body or “conservancy” for integrated management of the wetland is also recommended. This is currently under consideration by the provincial authorities.

As mentioned in the above sections, illegal activities should be controlled, and therefore the present number of DOE staff could be used more efficiently in the management of the wetland under current arrangements. Furthermore, the number of staff should be increased

in future. It is noted that the existing ecologist has retired and has not been replaced. It is therefore especially recommended that this position should be replaced by two specialists, an ornithologist and a wetland conservation specialist.

Institutional and organizational aspects of implementation of wetland management are addressed in Part 8.

For implementation of adaptive management, the committee for decision making is required. It is thought that nature conservancy is able to play the role. Since the relevant organizations and related regulations are different for each project such as zoning, conservation and ecotourism, it is necessary to establish subcommittees in the committee. The committee must have decision right legally and decision making and proposing the amendment of regulations should be possible.

CHAPTER 4 SUMMARY OF PROPOSED WETLAND ECOLOGICAL MANAGEMENT PLAN

The wetland ecological management plan comprise 1) environmental zoning, 2) conservation of wildlife, 3) conservation of habitat, 4) sustainable use of natural resources, and 5) monitoring and feedback. These proposed project are summarized and shown in Table 4.1.1.

Table 4.1.1 Summary of Proposed Wetland Ecological Management Plan

Sub-component	Summary	Organization
Environmental Zoning	<ol style="list-style-type: none"> 1. Review of environmental zoning 2. Land Acquisition 3. Installation of signboards at the boundary 	DOE, HUDO, MOJA DOE, HUDO, MOJA DOE
Conservation of Wildlife	<ol style="list-style-type: none"> 1. Protection of sensitive areas 2. Control of alien species 3. Control of illegal hunting and fishing 4. Installation of signboards 	DOE, PSO DOE DOE DOE
Conservation of Habitat	<ol style="list-style-type: none"> 1. Strengthening the regulations <ol style="list-style-type: none"> (1) Construction of guard station (2) Capacity development of rangers (3) Regulation of motorboats 2. Rehabilitation and maintenance of habitat <ol style="list-style-type: none"> (1) Rehabilitation of habitat (2) Prevention against solid waste inflow 	DOE DOE DOE, PSO DOE DOE, MOE
Sustainable Use of Natural Resources	<ol style="list-style-type: none"> 1. Development of Ecotourism <ol style="list-style-type: none"> (1) Structuring of ecotourism network (2) Nature interpreter training (3) Preparation of infrastructure (4) Implementation of ecotour 2. Sustainable use of natural resources 	DOE, CHTO, PSO DOE, CHTO DOE DOE, CHTO DOE, MOJA
Monitoring and Feedback	<ol style="list-style-type: none"> 1. Establishment of adaptive management system 2. Monitoring and feedback activities 	DOE, MOJA, CHTO DOE, MOJA, CHTO

CHAPTER 5 COST ESTIMATE

5.1 Basic Conditions for Cost Estimate

5.1.1 Conditions for Cost Estimate

The following conditions / assumptions are used for estimating costs of the wetland ecological management plan.

- The project costs in the project period from 2005 to 2019 are estimated based on June 30th, 2004 constant prices in the Iranian Rials
- The exchange rate used is USD1 = IRR 8,652 = 79.55.
- Tax and fee: The value added tax (VAT) for all cost components and import tariffs for imported equipment are included in the cost estimation.

5.1.2 Cost Components

The project costs are composed of the following cost components.

1. Construction Cost
2. Land Acquisition
3. Purchase of Facilities
4. Expenses
5. Personnel Cost
6. Administration Cost (5% of 1.)
7. Engineering Cost (10% of 1.)
8. Physical Contingency (20% of 1. to 5.)

The operation and maintenance costs are estimated based on the personnel expenses and other expenses

5.1.3 Estimated Basis

The project (investment) and operation and maintenance (O&M) costs are calculated based on rough cost estimates of similar projects provided by relevant organizations.

5.2 Cost Estimate

5.2.1 Project Costs

The proposed measures to require project costs are Environmental Zoning, Conservation of Wildlife, Conservation of Habitat, and Promotion of Wise Use. The total project cost is estimated at 30,811 million Rials. Each project cost is shown in the following tables.

Table 5.2.1 Project Cost of Zoning and Ecological Management

(Unit: Thousand Rials)

Cost Item	Unit	Unit Price	Quantity	Amount
1. Construction Cost				
1.1 Signboard		865	150	129,750
2. Land Acquisition	ha	30,000	500	15,000,000
3. Administration Cost (5% of 1.)	ls			6,488
4. Engineering Cost (10% of 1.)	ls			12,975
5. Physical Contingency (20% of 1. to 2.)	ls			3,025,950
Total of 1. to 5.				18,175,163

Source: JICA Study Team

Table 5.2.2 Project Cost of Conservation of Wildlife

(Unit: Thousand Rials)

Cost Item	Unit	Unit Price	Quantity	Amount
1. Construction Cost				
1.1 Signboards		865	150	129,750
2. Purchase of Facility				0
2.1 Weed Harvester		1,730,000	1	1,730,000
3. Administration Cost (5% of 1.)	ls			6,488
4. Engineering Cost (10% of 1.)	ls			12,975
5. Physical Contingency (20% of 1. to 2.)	ls			371,950
Total of 1. to 5.				2,251,163

Source: JICA Study Team

Table 5.2.3 Project Cost of Conservation of Habitat

(Unit: Thousand Rials)

Cost Item	Unit	Unit Price	Quantity	Amount
1. Construction Cost				
1.1 Guard Station		143,000	3	429,000
1.2 Open Water		242,000	1	242,000
1.3 Floating Booms		10,000	9	90,000
2. Purchase of Facility				
2.1 Boat		44,000	3	132,000
3. Administration Cost (5% of 1.)	ls			38,050
4. Engineering Cost (10% of 1.)	ls			76,100
5. Physical Contingency (20% of 1. to 2.)	ls			178,600
Total of 1. to 5.				1,185,750

Source: JICA Study Team

Table 5.2.4 Project Cost of Wise Use

(Unit: Thousand Rials)

Cost Item	Unit	Unit Price	Quantity	Amount
1. Construction Cost				
1.1 Jetty		102,000	2	204,000
1.2 Visitor Center		4,060,000	1	4,060,000
1.3 Access Route		130,000	7	910,000
1.4 Bike Track		87,000	10	870,000
1.5 Watching Tower		202,000	1	202,000
1.6 Hide		43,000	3	129,000
1.7 Park		287,000	1	287,000
1.8 Signboards		1,730	60	103,800
2. Expences				
2.1 Training of Nature Interpreter	ls	3,000	6	18,000
3. Personel Cost				
3.1 Trainner		6,000	6	36,000
4. Administration Cost	ls			338,290
(5% of 1.)				
5. Engineering Cost	ls			676,580
(10% of 1.)				
6. Physical Contingency	ls			1,363,960
(20% of 1. to 3.)				
Total of 1. to 6.				9,198,630

Source: JICA Study Team

5.2.2 Operation and Maintenance Cost Estimate

The total operation and maintenance cost is estimated at 15,256 million Rials as shown in Table 5.2.5. Environmental monitoring and operation of ecotourism activities are the components that require relatively large amount of operation costs among the projects and programs proposed in the Wetland Ecological Management Plan.

Table 5.2.5 Operation and Maintenance Cost for Wetland Ecological Management (1)

Cost Item	Unit	Unit Price		(Unit: thousand Rial)																Total
				Year 1 2005	Year 2 2006	Year 3 2007	Year 4 2008	Year 5 2009	Year 6 2010	Year 7 2011	Year 8 2012	Year 9 2013	Year 10 2014	Year 11 2015	Year 12 2016	Year 13 2017	Year 14 2018	Year 15 2019		
1. Zoning and Ecological Management																				
(1) Personnel Cost																				
a) Wetland Conservation Expert	MY	72,000	Quantity	0.59	0.59	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	5.08	
			Amount	42,480	42,480	21,600	21,600	21,600	21,600	21,600	21,600	21,600	21,600	21,600	21,600	21,600	21,600	21,600	365,760	
b) Ornithologist	MY	72,000	Quantity	0.59	0.59	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	5.08	
			Amount	42,480	42,480	21,600	21,600	21,600	21,600	21,600	21,600	21,600	21,600	21,600	21,600	21,600	21,600	21,600	365,760	
Sub-total				84,960	84,960	43,200	43,200	43,200	43,200	43,200	43,200	43,200	43,200	43,200	43,200	43,200	43,200	43,200	731,520	
2. Conservation of Wildlife																				
(1) Personnel Cost																				
a) Wetland Conservation Expert	MY	72,000	Quantity			0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	1.82	
			Amount	0	0	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	131,040	
b) Ornithologist	MY	72,000	Quantity			0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	1.82	
			Amount	0	0	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	131,040	
2.1 Removal of Azolla																				
(1) Personnel Cost																				
a) Operator for removal	MM	3,000	Quantity			2	2	2	2	2	2	2	2	2	2	2	2	2	24	
			Amount	0	0	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	72,000	
b) Assistant	MM	3,000	Quantity			6	6	6	6	6	6	6	6	6	6	6	6	6	72	
			Amount	0	0	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	216,000	
(2) Expenses																				
a) Fuel and oil for removal	L.S.	1,000	Quantity			1	1	1	1	1	1	1	1	1	1	1	1	1	12	
			Amount	0	0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	12,000	
b) Parts for removal	L.S.	10,000	Quantity			1	1	1	1	1	1	1	1	1	1	1	1	1	12	
			Amount	0	0	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	120,000	
Sub-total				0	0	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000	420,000	
Sub-total				0	0	20,160	55,160	55,160	55,160	55,160	55,160	55,160	55,160	55,160	55,160	55,160	55,160	55,160	55,160	682,080
3. Conservation of Habitat																				
(1) Personnel Cost																				
a) Wetland Conservation Expert	MY	72,000	Quantity			0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	1.82	
			Amount	0	0	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	131,040	
b) Ornithologist	MY	72,000	Quantity			0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	1.82	
			Amount	0	0	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	131,040	
Sub-total				0	0	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	262,080	
3.1 Guard Station																				
(1) Personnel Cost																				
a) Ranger	MY	36,000	Quantity			6	6	6	6	6	6	6	6	6	6	6	6	6	72	
			Amount	0	0	216,000	216,000	216,000	216,000	216,000	216,000	216,000	216,000	216,000	216,000	216,000	216,000	216,000	2,592,000	
(2) Expenses																				
a) Consumables	L.S.	10,000	Quantity			1	1	1	1	1	1	1	1	1	1	1	1	1	12	
			Amount	0	0	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	120,000	
Sub-total				0	0	226,000	226,000	226,000	226,000	226,000	226,000	226,000	226,000	226,000	226,000	226,000	226,000	226,000	2,712,000	
3.2 Open Water																				
(1) Personnel Cost																				
a) Worker	MM	3,000	Quantity				20			20				20				20	80	
			Amount	0	0	0	60,000	0	0	60,000	0	0	0	60,000	0	0	0	60,000	240,000	
(2) Expenses																				
a) Consumables	L.S.	10,000	Quantity				1			1				1				1	4	
			Amount	0	0	0	10,000	0	0	10,000	0	0	0	10,000	0	0	0	10,000	40,000	
Sub-total				0	0	0	70,000	0	0	70,000	0	0	0	70,000	0	0	0	70,000	280,000	
3.3 Floating Boom																				
(1) Personnel Cost																				
a) Garbage collector	MY	36,000	Quantity				1		1	1		1		1		1		1	10	
			Amount	0	0	0	36,000	0	36,000	36,000	0	36,000	0	36,000	0	36,000	0	36,000	360,000	
(2) Expenses																				
a) Consumables	L.S.	5,000	Quantity				1		1	1		1		1		1		1	10	
			Amount	0	0	0	5,000	0	5,000	5,000	0	5,000	0	5,000	0	5,000	0	5,000	50,000	
Sub-total				0	0	0	41,000	0	41,000	41,000	0	41,000	0	41,000	0	41,000	0	41,000	410,000	
Sub-total				0	0	20,160	246,160	316,160	287,160	287,160	357,160	287,160	287,160	357,160	287,160	357,160	287,160	357,160	287,160	3,664,080

Table 5.2.5 Operation and Maintenance Cost for Wetland Ecological Management (2)

Cost Item	Unit	Unit Price		(Unit: thousand RiA)																Total		
				Year 1 2005	Year 2 2006	Year 3 2007	Year 4 2008	Year 5 2009	Year 6 2010	Year 7 2011	Year 8 2012	Year 9 2013	Year 10 2014	Year 11 2015	Year 12 2016	Year 13 2017	Year 14 2018	Year 15 2019				
4. Promotion of Wiseuse																						
(1) Personnel Cost																						
a) Wetland Conservation Expert	MY	72,000	Quantity	0	0	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	3.64	
			Amount	0	0	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	262,080
b) Ornithologist	MY	72,000	Quantity	0	0	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	3.64	
			Amount	0	0	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	20,160	262,080
4.1 Jetty																						
(1) Personnel Cost																						
a) Worker	MD	180	Quantity					50	50	50	50	50	50	50	50	50	50	50	50	50	550	
			Amount	0	0	0	0	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	99,000
(2) Expenses																					0	
a) Consumables	L. S.	1,000	Quantity					1	1	1	1	1	1	1	1	1	1	1	1	1	11	
			Amount	0	0	0	0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	11,000
Sub-total				0	0	0	0	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	110,000
4.3 Visitor Center																						
(1) Personnel Cost																						
a) Manager	MY	72,000	Quantity							1	1	1	1	1	1	1	1	1	1	1	9	
			Amount	0	0	0	0	0	0	0	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	648,000
b) Regular staff	MY	36,000	Quantity							3	3	3	3	3	3	3	3	3	3	3	27	
			Amount	0	0	0	0	0	0	0	108,000	108,000	108,000	108,000	108,000	108,000	108,000	108,000	108,000	108,000	108,000	972,000
(2) Expenses																					0	
a) Fuel and electricity	L. S.	1,000	Quantity							1	1	1	1	1	1	1	1	1	1	1	9	
			Amount	0	0	0	0	0	0	0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	9,000
b) Consumables	L. S.	27,000	Quantity							1	1	1	1	1	1	1	1	1	1	1	9	
			Amount	0	0	0	0	0	0	0	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	243,000
Sub-total				0	0	0	0	0	0	208,000	208,000	208,000	208,000	208,000	208,000	208,000	208,000	208,000	208,000	208,000	1,872,000	
4.4 Access Route																						
(1) Personnel Cost																						
a) Maintenance supervisor	MD	360	Quantity							44	44	44	44	44	44	44	44	44	44	44	440	
			Amount	0	0	0	0	0	0	15,840	15,840	15,840	15,840	15,840	15,840	15,840	15,840	15,840	15,840	15,840	15,840	158,400
b) Maintenance assistant	MD	180	Quantity							44	44	44	44	44	44	44	44	44	44	44	440	
			Amount	0	0	0	0	0	0	7,920	7,920	7,920	7,920	7,920	7,920	7,920	7,920	7,920	7,920	7,920	7,920	79,200
(2) Expenses																					0	
a) Consumables	L. S.	3,240	Quantity							1	1	1	1	1	1	1	1	1	1	1	10	
			Amount	0	0	0	0	0	0	3,240	3,240	3,240	3,240	3,240	3,240	3,240	3,240	3,240	3,240	3,240	3,240	32,400
Sub-total				0	0	0	0	0	0	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	270,000	
4.5 Bike Track																						
(1) Personnel Cost																						
a) Maintenance supervisor	MD	360	Quantity									28	28	28	28	28	28	28	28	28	224	
			Amount	0	0	0	0	0	0	0	0	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	80,640
b) Maintenance assistant	MD	180	Quantity									28	28	28	28	28	28	28	28	28	224	
			Amount	0	0	0	0	0	0	0	0	5,040	5,040	5,040	5,040	5,040	5,040	5,040	5,040	5,040	5,040	40,320
(2) Expenses																					0	
a) Consumables	L. S.	1,880	Quantity									1	1	1	1	1	1	1	1	1	8	
			Amount	0	0	0	0	0	0	0	0	1,880	1,880	1,880	1,880	1,880	1,880	1,880	1,880	1,880	1,880	15,040
Sub-total				0	0	0	0	0	0	0	0	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000	136,000	
4.6 Park																						
(1) Personnel Cost																						
a) Manager	MY	72,000	Quantity										1	1	1	1	1	1	1	1	7	
			Amount	0	0	0	0	0	0	0	0	0	0	0	72,000	72,000	72,000	72,000	72,000	72,000	72,000	504,000
b) Regular staff	MY	36,000	Quantity											1	1	1	1	1	1	1	7	
			Amount	0	0	0	0	0	0	0	0	0	0	0	36,000	36,000	36,000	36,000	36,000	36,000	36,000	252,000
(2) Expenses																					0	
a) Consumables	L. S.	22,000	Quantity										1	1	1	1	1	1	1	1	7	
			Amount	0	0	0	0	0	0	0	0	0	0	0	22,000	22,000	22,000	22,000	22,000	22,000	22,000	154,000
Sub-total				0	0	0	0	0	0	0	0	0	130,000	130,000	130,000	130,000	130,000	130,000	130,000	130,000	910,000	
Sub-total				0	0	40,320	40,320	50,320	77,320	285,320	302,320	432,320	432,320	432,320	432,320	432,320	432,320	432,320	432,320	432,320	432,320	3,822,160

Table 5.2.5 Operation and Maintenance Cost for Wetland Ecological Management (3)

(Unit: thousand Rial)

Cost Item	Unit	Unit Price		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Total	
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019		
5. Monitoring and Feedback																				
(1) Personnel Cost																				
a) Research Manager	MY	54,000	Quantity	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	30
			Amount	108,000	108,000	108,000	108,000	108,000	108,000	108,000	108,000	108,000	108,000	108,000	108,000	108,000	108,000	108,000	108,000	1,620,000
b) Wetland Conservation Expert	MY	72,000	Quantity	0.41	0.41	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	2.64
			Amount	29,520	29,520	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	190,080
c) Ornithologist	MY	72,000	Quantity	0.41	0.41	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	2.64
			Amount	29,520	29,520	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	10,080	190,080
(2) Expenses																				
a) Wetland Ecological Census	L.S.	240,000	Quantity			1					1					1				3
			Amount	0	0	240,000	0	0	0	0	240,000	0	0	0	0	240,000	0	0	0	720,000
b) Annual Ecological Survey	L.S.	156,000	Quantity			1	1	1	1	1	1	1	1	1	1	1	1	1	1	14
			Amount	0	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	2,184,000
c) Ecotourism Monitoring	L.S.	4,000	Quantity			1	1	1	1	1	1	1	1	1	1	1	1	1	1	13
			Amount	0	0	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	52,000
d) Environmental Monitoring by University	L.S.	100,000	Quantity			1	1	1	1	1	1	1	1	1	1	1	1	1	1	14
			Amount	0	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	1,400,000
Sub-total				167,040	423,040	628,160	388,160	388,160	388,160	388,160	388,160	628,160	388,160	388,160	388,160	388,160	628,160	388,160	388,160	6,356,160
Total				252,000	508,000	752,000	773,000	853,000	851,000	1,059,000	1,386,000	1,206,000	1,206,000	1,276,000	1,206,000	1,446,000	1,276,000	1,206,000	15,256,000	

Note: Wetland Conservation Expert and Ornithologist are divided into 5 projects depending on the relative importance.
Source: JICA Study Team

CHAPTER 6 IMPLEMENTATION PROGRAM

6.1 General

This section presents the Institutional and Organizational Arrangement for the implementation of the proposed measures, and the priority for each measure.

6.2 Executing Organizations

Wetland Ecological Management will be implemented by DOE in collaboration with other organizations as follows.

- Zoning and Ecological Management: DOE, MOJA, HUDO and municipalities.
- Conservation of Wildlife: DOE, PSO
- Conservation of Habitat: DOE, PSO and MOE
- Sustainable Use of Natural Resources: DOE, ITTO, MOJA and PSO
- Monitoring and Research: DOE and MOJA

6.3 Implementation Schedule

Implementation schedule is shown in Table 6.3.1. The wetland ecological management plan is shown in Figure 6.3.1.

Table 6.3.1 Proposed Implementation Schedule of Wetland Ecological Management Plan

Proposed Measures		Fourth 5-year Plan Period					Fifth 5-year Plan Period					Sixth 5-year Plan Period						
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019		
1. Environmental Zoning																		
(1)	Establishment of Environmental Zones	■																
(2)	Enforcement of Zoning			■		■					■							
2. Conservation of Wildlife																		
(1)	Conservation of the Threatened Species			■		■					■							
(2)	Control of Alien Species			■		■					■							
3. Conservation of Habitat																		
(1)	Strengthening of Regulations																	
1)	Construction of Guard Station			■														
2)	Capacity Development of Rangers			■		■					■							
3)	Regulation of Motorboats			■		■					■							
(2)	Rehabilitation and Maintenance of Habitat																	
1)	Rehabilitation of Habitat			■		■			■		■			■				
2)	Prevention against Solid Waste Inflow					■												
4. Promotion of Wise Use																		
(1)	Development of Ecotourism																	
1)	Structuring of Ecotourism Network	■																
2)	Nature Interpreter Training			■		■												
3)	Preparation of Infrastructure			■		■												
4)	Implementation of Ecotour			■		■					■							
(2)	Sustainable Use of Natural Resources			■		■					■							
5. Monitoring and Feedback																		
(1)	Environmental Monitoring for Adaptive Management	■		■					■					■				
(2)	Environmental Research			■		■					■							

Proposed Projects/Measures

1. Environmental Zoning

(1) Establishment of Environmental Zones

- □ 1) Core Protected Zone
- □ 1-1) Conservation Zone
- □ □ A. Wildlife Refuge
- □ □ (A1 Sorkhankol, A2 Selke)
- □ □ B. Protected Area
- □ □ (B1 Siakeshim, B2 Spawning Ground)
- □ □ C. No Hunting Area
- □ □ (C1 Chokam, C2 Hossein Bekandeh, C3 Ghalm Godeh, C4 Wintering Habitat)

(1-2) Wise-use Zone

- □ Lagoon
- □ Marsh
- □ 2) Buffer Zone
- □ Water Fluctuation Line
- □ 3) Transition Zone

(2) Enforcement of Zoning

2. Conservation of Wildlife

(1) Conservation of Threatened Species

(2) Control of Alien Species

3. Conservation of Habitat

(1) Strengthening of Regulations

- □ Guard Station (Proposed)
- □ Guard Station (Existing)

(2) Rehabilitation and Maintenance of Habitat

- □ Floating Boom
- □ Open Water (New habitat)

4. Promotion of Wise Use

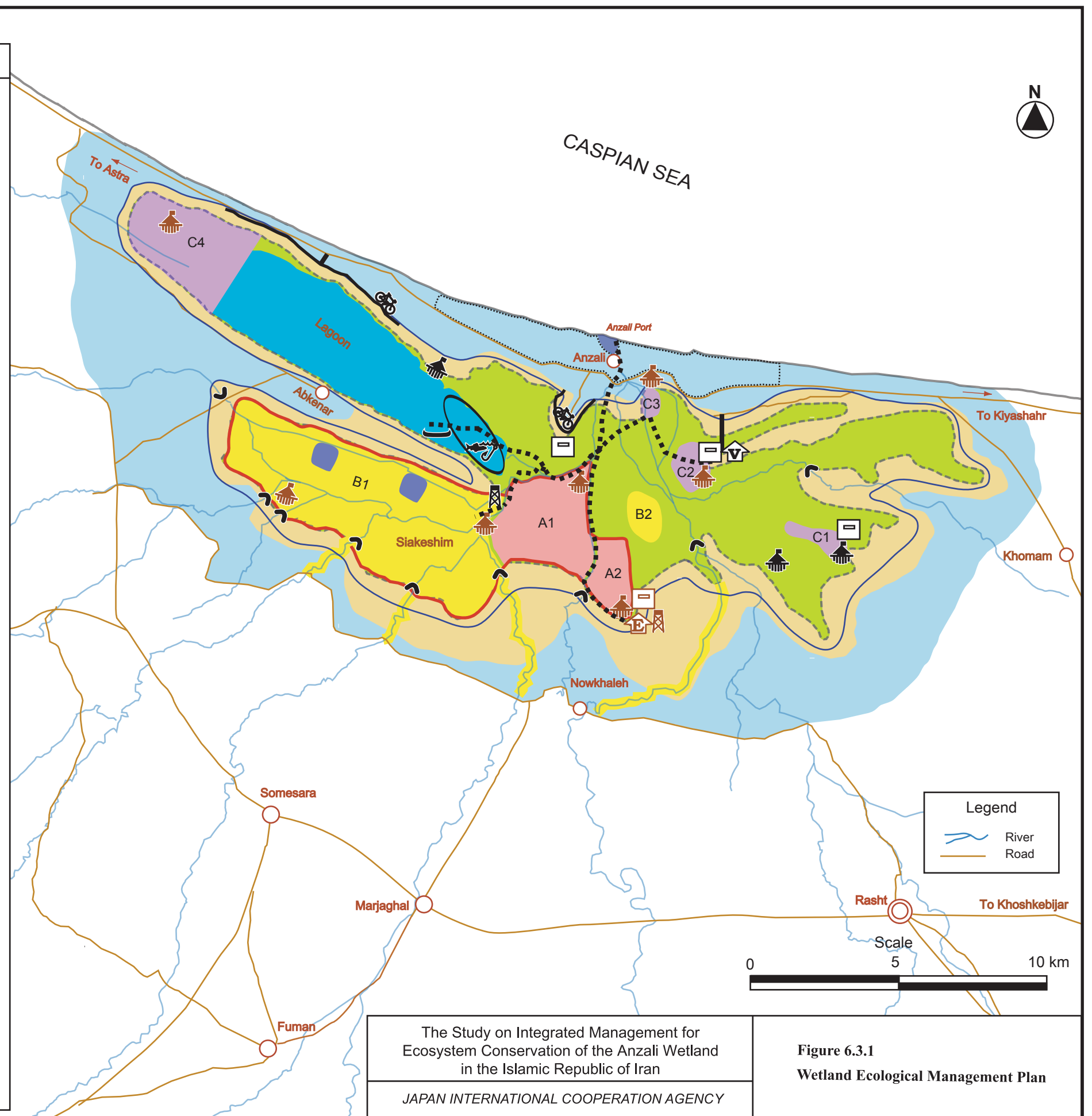
(1) Development of Ecotourism

- □ Eco-tourism Boat Route
- □ Bicycle Track
- □ Access Road
- □ Education Center (existing)
- □ Watch Tower (proposed)
- □ Watch Tower (existing)
- □ Visitor Center
- □ Bird Hide (proposed)
- □ Bird Hide (existing)
- □ Sports Fishing Area
- □ Kayak Station

(2) Sustainable Use of Natural Resources

5. Monitoring and Feedback

- (1) Environmental Monitoring for Adaptive Management
- (2) Environmental Research



The Study on Integrated Management for
Ecosystem Conservation of the Anzali Wetland
in the Islamic Republic of Iran

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 6.3.1
Wetland Ecological Management Plan

Chapter 7 PRIORITY PROJECTS

7.1 Prioritization of Proposed Measures

7.1.1 Criteria for Prioritization

Criteria for prioritization are listed below.

- Effect: Wetland Ecology, Wetland Sustainability, and Income Generation
- Urgency
- Efficiency
- Conformity with National Policy
- Response by Executing Organization
- Required Level of Environmental Awareness
- Project Maturity
- Required Capacity of Executing Organization
- Investment Cost

7.1.2 Evaluation of Proposed Measures for Prioritization

Priority of proposed measures is evaluated in Table 7.1.1. Each project is ranked A, B or C and scored. According to the evaluation, differences of scores among the projects are small, therefore, priority was examined taking account feasibility and breakup of cost for 15 years.

Priority measures are Establishment of Environmental Zones, Structuring of Ecotourism Network, and Monitoring and Research. Zoning is the base of wetland ecological management and it is necessary to complete it first. It is also necessary to start monitoring soon so that management plan can be reviewed every five years.

Short-term measures are Enforcement of Zoning, Conservation of the Threatened Species, Control of Alien Species, Construction of Guard Stations, Capacity Development of Rangers, Regulation of Motor Boats, Rehabilitation of Habitats, Nature Interpreter Training, Preparation of Infrastructure for Ecotourism, Implementation of Ecotour, Sustainable Use of Natural Resources, and Environmental Research.

Mid-term measures are Land Acquisition and Prevention of Solid Waste Inflow. Most of measures are continued in Long-term, however those are to be reviewed with monitoring results as adaptive management.

Table 7.1.1 Evaluation of Proposed Measures for Prioritization

Criteria Project	Effect		Urgency	Efficiency	Conformity with National Policy	Response by Executing Organization	Required Level of Environmental Awareness	Project Maturity	Required Capacity of Executing Organization	Investment Cost	Total Score
	Wetland Ecology	Wetland Sustainability									
1 Environmental Zoning	A	A	A	A	B	A	B	B	B	B	B(25)
(1) Establishment of Environmental Zones	A	A	A	A	B	A	B	B	A	A	A(27)
(2) Enforcement of zoning	A	A	A	A	B	B	B	B	C	C	B(22)
2 Conservation of Wildlife	A	B	B	A	A	B	B	B	B	A	B(22)
(1) Conservation of the threatened species	A	B	A	A	A	B	B	B	B	A	B(23)
(2) Control of Alien Species	A	A	B	A	A	A	B	B	B	B	A(25)
3 Conservation of Habitat	A	A	B	A	B	A	B	B	B	C	B(23)
(1) Strengthening of Regulations	A	A	B	A	B	B	B	A	A	B	B(25)
1) Construction of Guard Station	A	A	B	A	B	A	B	A	A	C	B(25)
2) Capacity Development of Rangers	A	A	B	A	B	B	B	A	A	B	B(25)
3) Regulation of Motorboats	A	B	B	A	B	B	A	B	B	B	B(21)
(2) Rehabilitation and Maintenance of Habitat	B	A	B	B	B	A	B	B	B	C	C(18)
1) Rehabilitation of Habitat	B	A	B	B	B	A	B	B	B	C	C(18)
2) Prevention against Solid Waste Inflow	B	B	B	B	B	B	B	B	B	B	C(15)
4 Promotion of Wise Use	B	A	A	A	A	A	A	A	A	B	A(26)
(1) Development of Ecotourism	B	A	A	A	A	A	A	A	A	B	A(26)
1) Structuring of Ecotourism Network	B	A	A	A	A	A	A	A	A	B	A(26)
2) Nature Interpreter Training	B	A	B	B	A	A	A	A	A	B	B(23)
3) Preparation of Infrastructure	B	A	B	B	A	B	A	A	A	B	B(22)
4) Implementation of Ecotour	B	A	B	A	A	A	A	A	A	B	B(25)
(2) Sustainable use of natural resources	B	A	B	A	A	A	B	A	A	B	B(24)
5 Monitoring and Feedback	A	A	A	A	B	B	A	B	A	B	A(26)
(1) Environmental monitoring for adaptive management	A	A	A	A	B	B	A	A	B	A	A(27)
(2) Environmental research	A	A	B	A	B	B	B	B	B	B	B(23)
Weight	3	3	1	2	1	1	1	1	1	1	-

Note: Score A=2, B=1, C=0

Overall evaluation A: above 26, B: 25 - 21, C: below 20

7.2 Priority Measures

Among the projects/measures to be implemented in the first five year, that is, Forth 5-Year Development Plan period, the projects/measures to be commenced immediately are selected as a priority project. The priority projects in the proposed Wetland Ecological Management Plan are selected as follows:

- 1) Environmental zoning
- 2) Development of ecotourism
- 3) Environmental monitoring for adaptive management