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Chapter 1:
The Physical Environment

1.1. Geographical Scope and Boundaries

The southern reaches of the Caspian Sea border three of Iran's beautiful and scenic northern provinces; namely Gilan, Mazandaran and Golestan provinces, situated from west to east respectively. Gilan Province measures 14,819.5 km^2 (approximately 0.9% of the country's area), Mazandaran 24,091.3 km^2 (1.4%) and Golestan with 20,380.7 km^2 (1.3% of the national area). The total area of these provinces encompasses 3.46% of Iran's territory (***Figure 1***, ***Figure 2***, ***Figure 3*** and ***Figure 4***).

The region contains important water bodies as well as land areas. The waters include the Caspian Sea, lagoons, wetlands and supplementary basins. The land areas comprise of plains, foothills and mountainous regions. The plains have an altitude of less than 100 meters, foothills between 100 to 500 meters and the mountainous region more than 500 meters.

The plains are divided into the coastal area and the Great Plains. The coastal area is a narrow strip along the Caspian where its width varies from several meters at the shores of Ramsar city to several hundred meters in the vast sand hills of Port Anzali.

In addition to these natural divisions, Iran's shoreline is divided into six regions, with each region having its own geographical characteristics. These regions are:

1. Western Gilan Region: includes the cities of Astara and Talesh located in the highlands covered with condensed forests.
2. Central Gilan Region: includes five cities of Fooman, Soume'e-Sara, Anzali, Rasht and Roodbar. These areas incorporate forest covered mountainous regions and significant plains that are utilized to cultivate most of Iran's rice crop.
3. Eastern Gilan Region: includes the cities of Lahijan, Astaneh, Langerood and Roodsar. There is a vast plain area in this region and the foothills are the source of the preponderance of the national tea crop.
4. Western Mazandaran Region: includes the cities of Ramsar, Tonekabon, Chaloos, Nowshahr and Noor. The mountainous area covered with scenic forests is significant as the coastal area is at its narrowest width here. Given the mountainous area - seashore juxtaposition – is a very attractive tourist and recreational area. Most of this region is covered with citrus groves.
5. Eastern Mazandaran region: includes the cities of Amol, Babol, Babolsar, Ghaem-shahr, Sari and Beh-shahr. Here there are also vast plain and foothill areas.

6. Golestan Region: its major cities are Kord-kuy, Bandar-e Torkaman, Gonbad and Gorgan. Major parts of this region are covered with plains that are cultivated for cereals and cotton.

These geographical specifications make these provinces one of the most prosperous areas in the country. Approximately, 8.5% of national agricultural lands are situated here although it only covers less than 4% of the country's area. Hence, agriculture is the mainstay of the population.

The natural scenery and recreational areas also attract millions of tourists every year. On the other hand, the industry has also been developed extensively here and there, such as Anzali and Rasht. The combination of these provinces' characteristics has resulted in an excessive population concentration, especially at the coastal areas. The region's entire water resource and watershed volume is used to irrigate farmlands and has to pass through residential and industrial areas, before emptying into the Caspian Sea. Consequently, a large amount of industrial wastes and contaminated discharges enter the Caspian Sea (***Figure 5***).

1.2. Physical Geography

1.2.1. Geology

1.2.1.1. Evolution of the Caspian Sea

The Caspian Sea was separated from the Black Sea with which it had formed the single Sarmatian Sea during the Pliocene (in Cenozoic, about 2-3 million years ago). The formation of the Caspian basin was completed in upper Pliocene.

At the end of the Pliocene and in Quaternary Period, the Caspian body of water was isolated from the world's oceans by the regional tectonic movements. After the separation, the global climatic variations affected the regime of the Caspian Basin.

1.2.1.2. Geology and geomorphology of the Caspian Basin

The main geomorphologic element of the sea floor is in the south Caspian trough with an uneven floor relief and maximum depth. The western part of the middle Caspian and the entire south Caspian belong to an alpine geosynclinal system. The southern trough of the Caspian with the adjacent lowland forms a large inter-mountain megadepression bounded by folded mountain formations to the west, south and the east. The south Caspian trough is a region of young tectonic movements and of active mud volcanism not only on dry land, and in the shallows, but also deep within the trough. A so-called granite layer, proper to typically oceanic regions, is absent from a considerable area of the trough. The South Caspian in the geological past was a part of the Tethys Sea, and therefore the floor devoid of the granite layer maybe considered a relic of the sea that ceased to exist in the Cenozoic.

1.2.1.3. Stratigraphy of the southern coastline

The Mesozoic range and tertiary foothills of Alborz mountain range south of the coastal plain in Mazandaran Province, strike northwest, towards the seashores of Alamdeh-Nowshahr. This reduces the coastal plain in this area. This is the nearest approach of Alborz to the Caspian Sea. They are eroded along old cliff lines of the Caspian Sea and are probably displaced along a flexure line in the narrow coastal plain. In the south of Chaloos, the range is formed by course of the Jurassic Formation (Shemshak), Cretaceous limestone, sand tuff and volcanic units (Chaloos Formation), and by upper Cretaceous marl limestone and shale. South of Babol, the coastal range exposes upper Cretaceous-Paleocene marls, which are covered by the marine Caspian Neogene (Vindobonian-Sarmatian), and continental coarse clastic units, in thickness of 2000 to 3000 meters, increasing towards the coasts to more than 4,000 meters. This Caspian Neogene foothills zone with cores of upper Cretaceous marls gradually turns east of Talar river to the eastern Mazandaran embayment, striking E-to ENE between the main northern thrust of the Paleozoic range and the south Gorgan uplift. The marine Neogene units change into littoral and continental coarse clastic beds, and give way to exposures of upper Cretaceous marls and Jurassic-Neocomian limestone cores.

The south Gorgan uplift of pre-Cambrian metamorphic rocks is covered by a thin, lower Jurassic shale and sandstone and by a massive Jurassic limestone (Lar formation), which form the boundary between Neka valley and the coastal plain. At Neka, the Lar limestone cover of the south-Gorgan uplift plunges under the coastal alluvium but continues in the subsurface as gravity high (spur of Neka to Dasht-e-Naz).

The upper part of Atrak valley and the hills near Iran-Turkmenistan border north of Hezarcheh contains continental coarse clastic and red beds of the Neogene.

The western plunge of the fold belt has on-lapping Pliocene littoral Caspian deposits and is covered by an extensive Pleistocene loess blanket of up to 30 meters in thickness, which makes an excellent soil for mechanized, dry farming wheat production.

Dasht-e-Gorgan, between Gorgan River and Atrak is a flat steppe with less than 30 cm of annual rainfall; covered by loess terraces and partly alkaline soils (Solonchak) which are below the sea level, west of the Gorgan-Tangeli road.

The marine mud and clay deposits and fossil beach sands cover a sequence of young Neogene marine Caspian strata, which increases in thickness from the east to the west; to the Caspian Sea shore to more than 4,000 meters (***Figure 6*** and

Figure 7).

1.2.2. Geomorphology and landscape

The southern part of the Caspian shores is a narrow coastal plain with an average width of about 50 km, created by the "regional regression" of the sea, which probably once extended as far as the foot of the Alborz Mountains. A large number of rivers originate in the northern foothills of Alborz, but they are mainly short rivers (especially on the western side, i.e. Gilan Province) and cover small distances before they enter the sea. Alborz and its associate mountains range form a continuous wall along the north of Iran. This system consists of parallel ranges, increasing in elevation from the north and the south.

The geographical territory of the region consists of terrestrial and aquatic ecosystems. The aquatic ecosystems consist of marshes, wetlands and other bodies of water. The terrestrial ecosystem comprises high mountains, foothills and the plain adjacent to the mountains and the hills. The plain has two major parts one of which forms the coastal region and the other forms the plains away from the sea. The coastal strip is a narrow piece of land a few meters, in some places and a few kilometers in other areas. These strips are usually covered by sand dunes (Anzali coastal region) along the sea. The coast is generally flat, except a mountain around Ramsar, which is in the plain adjacent to the sea. The southern coasts of the Caspian Sea have fewer bays than the other coastlines. To the east of the coast, mountains are drawn away from the sea and vast plain of Gorgan exhibits a continuous flat plain, reaching Bandar-e-Torkaman. The eastern coast also possess sandy deserts void of vegetation cover, in which the temperature is usually higher than the other places. From Ramsar to the west, the coastline gets wider because mountains are drawn to the south where the vast Delta of Sefid-rood River expands. This region comprises the coastal plain of the southern coast of Caspian Sea. This coastline is almost 2800 km^2 and is formed by alluvial sediments. In the west, the Talesh Mountains approach the Caspian basin; the width of the shore decreases and becomes narrow again. The important coastal features along coastlines include Anzali marshes in the west, Sefid-rood Delta (cape) in the middle and Gorgan bay in the east. This bay is separated from the sea by Miankaleh peninsula. Intensive geological and tectonic investigations reveal vulnerability of all these mountainous areas to the seismic dangers. Existence of active faults in the western and southern regions also adds to the vulnerability of the region to tremor. These regions include Astara fault, Talesh fault and the fault in the southern coast of the Caspian Sea.

The narrowest part of Caspian (southern) coastal plain is located between Tonekabon (in the west of the Mazandaran province) and Roodsar (in the east of Gilan province). The coastal plain of the Caspian has beautiful landscape with resort and recreational areas such as Ramsar with fine sand beaches. In the Sefid-rood River Delta and Rasht area on the west, the coastal plain widens to 33 km. This area is densely populated and is covered mostly by rice paddies; tea plantations and citrus orchards are

cultivated on the lower foothills. The Anzali lagoon, which is rich in. wildlife resources, is located in this area. The outlet to the Caspian Sea on the sand spit has developed into the Bandar-e-Anzali harbor.

A. Coastal Sand Dunes

Sand dunes are one of the prominent features along he coastal regions of Mazandaran and Gilan, some as high as 20 meters. These dunes are made of small sandy particles and fragments of shells and are parallel to the seashore. Occasionally these parallel dunes are translocated by wind blows and affect the shorelines. Distribution of these dunes is more prevalent in the eastern part of the coastline.

B. Coastal Sediments

These sediments constitute the upper parts of the coastline (Supratidal) and are generally made of uniform sand particles (like Anzali beach), which favor the bathers and swimmers who come to the region for this purpose.

C. Deltatic Sediments

These sediments are formed at the river mouth, where they flow into the sea and are distinguished by their triangular shape. Since they are formed in the gentle slope, they are usually made of uniform particles. The most important delta in the Caspian Sea is the Sefid-rood Delta, which forms a vast coastal plain in the southeastern region of the Caspian Sea. Sediments of this delta are carried up to 5 km into the sea. The terrestrial part of this delta forms an asymmetrical delta on which small harbor of Kiashahr is situated. Vast areas of this delta consist of paddy fields.

D. Wetland Sediments

These include sediments associated with the Caspian Sea wetlands having an average depth of 5 meters. The two major areas are the Anzali wetland and the Gorgan Bay. The sediments of these areas mainly consist of silt and clay grains associated with high amount of organic matter originating from the lush vegetative growth.

E. Marine Sediments

There is a special pattern in the distribution of particles types and depths of sediments in the Caspian Sea. In the Southern Caspian, which is also the deepest part of the sea, silt and clay with some carbonates cover a major part of the deep sea floor. Fine sand on the other hand, covers the shallower parts; where as sand and silty sediments cover the floor of bays and estuaries (***Figure 8***). Almost 50 % of the sea floor with depth of more than 50 meters in southern and central parts is covered by fine particles of silt and clay, while in the rest of the sea floor in the shallower parts, sand and silt are prevalent. The carbonate compounds are more or less found in all sediments of middle southern Caspian region.

1.2.2.2. Coastal topography and erosion

The slope of the Southern Caspian Sea varies in different parts of the shoreline. Considering the coastal land slopes from the land towards the sea starting from Astara in the west to Gomishan-tappeh in the east, the beaches can be grouped into three major types:

1. Beaches with high land slope, 0.5% or more.
2. Beaches with moderate land slope, 0.1% to 0.5%.
3. Lowland beaches with gentle slope, less than 0.1%.

Most of the beaches with high and moderate slopes are sandy, mixed with coarse or medium gray sand and the waves can easily disperse them. Beaches type 1 and 2 are subject to erosion. Most of these types of beaches are located in the west (Astara to the west or Bandar-e-Anzali), and in the middle parts (east of Sefid-rood estuary to the west of Bandar-e Gaz) of Caspian coastline.

1.2.2.3. Mineral resources

There are two major types of mines present in the Caspian region, sodium sulfate and hydrocarbon. Both reserves are being utilized commercially in some parts. The sodium sulfate mine is in Qara-boghaz Bay, which is situated, in the central part of the eastern coastline. According to the latest data, the continental shelf's hydrocarbon resources of the Caspian Sea are one of the largest in the world and it is estimated that there are more than 40 billion barrels of oil under the sea floor.

The exploration for offshore oil in Iranian Caspian waters started in 1980 and since then, a number of 16 exploration wells have been drilled in the eastern, middle and western part of the shelf. So far, none of these wells have encountered oil, but a few have shown signs of gas.

In the past, sand mining was common throughout the shoreline, but law due to its environmental hazards prohibited it, but at present sand mining along the rivers is developing extensively, and adversely affecting both the riverine and the marine ecosystems.

1.3. Atmosphere and Climate

1.3.1. Wind

The wind patterns of the Caspian are greatly affected by the Earth's main air masses. There are cyclones in the southern and central parts of the sea with an immense general influence. The force of the wind is greater in the winter than in the summer throughout the region. In the Iranian coastal areas, there is a northwesterly prevailing wind known as the "*Gilehva*" as well as a group of winds originating in the northwest plains. Both of these currents can create storms along the Iranian shoreline. There is also a southern hot wind current known as the "*Garmich*" (hot wind) that usually blows in the winter and sometimes is very strong.

In addition to these currents, there are local winds affected by the general dynamics of Earth-atmosphere interaction. Given the varying elevations of Golestan province, wind currents adhere to no systematic patterns. They are, however, usually affected by two factors. (1) Wind currents blow primarily along the high elevations and valleys near this area. (2) In the coastal areas, they generally blow vertical to the shoreline. The major wind currents are (A) Northeastern Wind that blows in spring, summer and autumn. In the first half of the year, it is considered an important wind and in the second half of the year heralds rainfall. (B) Caspian Wind originates from the north and northwest and is cold and stormy. (C) Southern Wind comes in from the Alborz Mountains to the plains in the fall and winter. A warm wind raises temperatures and is a factor in crating conditions for forest fires. Maximum wind speed in this province is 18 km per hour.

The diversity and extent of wind currents in Mazandaran province is less than Gilan province, but the wind patterns in Gilan province prevails in this province as well. In the central and western parts of Mazandaran, there are two major currents. **(1) Moist Western Winds**, which are warm and usually cause rainfall. They do not blow in winter. **(2) Eastern and** the **Northeasterly Winds** that decrease the temperature and precipitate snowfall

1.3.2. Precipitation and climate

The Caspian coastal region more water resources than any other region in Iran. The close proximity of the Alborz Mountains to the Caspian Sea provides a unique climate with frequent snow and rainfall and hence a great concentration of water in this area. These waters are either absorbed by the underground layers and create a rich underground water source or join the rivers and streams and eventually enter the Caspian Sea.

The Caspian shorelines have three types of rainfall. First, the rainfall created by the passing of humid Mediterranean, Red Sea and Sea of Oman fronts in the fall, winter and early spring. Second, the rainfall created by the Atlantic Ocean fronts in the spring and summer. This air front gains in humidity when it crosses the Caspian and causes rainfall in August and September. Third, the rainfall created by the humidity of the Caspian Sea itself as the result of cold air masses moving across the warm sea. Therefore, this has made the Caspian region the most humid area in the country (***Figure 9***).

The annual rainfall in the Caspian watershed basin is estimated as 437 mm. Based on the same statistics, 90% of the watershed basin area has more than 200 mm of rainfall and 10% enjoys over 800 mm of rainfall annually (***Figure 10***)

Precipitation increases from east to west. The cities of Gorgan and Gonbad-e Kawus have an average rainfall of 400 to 500 mm annually in the east, and the cities of Rasht and Anzali have an average rainfall of 900 to 1000 mm annually in the west. However, the rainfall decreases as we move toward the city of Astara. Thus, the average annual rainfall of the western sections is 2-3 times the rainfall in the eastern sections.

The maximum rainfall occurs at the south of Port Anzali with an average annual rainfall of 2,000 mm. The Caspian coastal regions are divided into five rainfall categories as it is shown in ***Figure 11*** The maximum rainfall along the shoreline occurs in autumn and winter. Nevertheless, there is continuous rainfall throughout the year. Considering the scarcity and irregularity of rainfall in the rest of the country, we can conclude that the Caspian coastline has the most stable and predictable annual rainfall patterns in the country (***Figure 12***).

The difference for rainfall in the eastern and western regions can be traced to the number of rivers in each section. Mazandaran province has the largest number of rivers, but the rivers in Gilan province supply the greatest volume of water to the Caspian Sea. The rivers in Gilan have the highest annual current and flow rates and the largest number of seasonal rivers in the northern region.

Gilan Province has the highest rate of humidity because the Alborz Mountains in the south trap the humidity and create considerable rainfall throughout the year. However, the rate of precipitation is different in various parts of the province. For example, Port Anzali has the highest rate and Roodbar and Loushan (in the south) has the least amount of rainfall. The fluctuation for one year to another is mild and reveals the presence of a readily discernible system for the region. The average annual rainfall at the Gilan shoreline is 1,500 mm that increases from west to east. There are two distinct climates in the Mazandaran Province, namely plain and mountainous. The maximum annual rainfall in the mountainous region is 1,200 mm (***Figure 13***).

1.3.3. Wave regime

In southern Caspian, the dominant wind direction in the western part is from north and northeast, and in the eastern part, it is from north and northwest (***Figure 14***). In this area, the sea is rough and stormy most of the time and the stormy period is about 170 days, mostly during the wintertime. The maximum wave height near the shore is 3-5 meters, which increases to 9 meters to offshore and deeper waters.

1.3.4. Air temperature

The Caspian coastal region has distinct climatic divisions. The total area of this region is 108,584 Square Kilometers and contains three major sections: (1) Sefid-rood, Talaab and Talesh (2) Coastal region (3) Gorgan and Dasht. This area covers 6.7% of the national coastal area. This region

could be divided into two climatic basins. The first one is the Safid-rood basin (except the coastal region) and the second includes the entire Caspian shoreline up to the water division line in the Alborz Mountains. The elevation difference in these two basins as well as the humidity of Caspian and non-Caspian regions has created a broad spectrum of climatic diversity in this area.

In general, dry climates are not observed in this region and the M4 Type (warm type) is not evident. Other climates, however, are present. ***Table 1*** provides the land distribution and areas affected by each climate. The table shows that the broadest climate in our study is the semi-dry climate. This accounts for the basic prevailing weather in the Sefid-rood basin.

Table 1: Land distribution and areas affected by each climate in Iran

Main Climate Type	High Overcold (M1)	Moderately Cold (M2)	Cold (M3)	Warm (M4)	Total Area	Main Regions
Over-dry (A1.1)	--	--	--	--	--	--
Dry–Desert	--	667	504	--	1,171	Sepidrood Dam, Miyaneh, Manjil and Lushan regions
Semi-dry (A2)	21,116	11,105	3,305	--	35,526	All Southern Alborz regions, such as Roodbar
Mediterranean (A3)	11,317	2,848	1,215	--	15,380	Small part of Sepidrood Valley
Semi-humid (A4)	7,515	3,109	2,838	--	13,462	Taleghan, Khalkhal, Bimar, Ghidar regions and the highlands above these regions
Humid (A5)	6,706	5,042	3,766	--	15,514	From Taleghan to Astara
Very humid (Type 1, A6)	7,379	8,438	6,578	--	22,395	Eastern highlands of the basin, such as Masuleh, Lashtnesha, Hashtpar and Astara
Very humid (Type 2, A7)	1,903	1,255	1,978	--	5,136	West of Lashtnesha, Pilambara, Anzali
Total Area	55,936	32,464	20,184	--	108,584	

The smallest climatic basin is the extremely dry, desert like weather, which only covers 1% of the region's area. From the thermal climates or sub-climates perspective, the broadest climate belongs to the cold or elevated climates at 51%, cold climates 30% and moderate climates 19%. The main sources of rain and humidity in the northern region of Iran and the Caspian are the humid air masses coming from the Atlantic Ocean and Mediterranean Sea. The temperature changes in Gilan and Mazandaran Provinces (west and center) are slight. The average temperature in the hottest month of the year is 27?C and in the cldest month of the year is 25?C. Usually, the temperature never exceeds 37?C. The temperature

reaches 44?C in the eastern region in cities like Gorgan. Generally, the eastern region has a dryer climate than the western sections.

Mazandaran province features two opposite climates. One is characterized by the plains at the vicinity of the sea and the other the mountains in the elevated areas of the province. The plain climate has moderate weather while the mountainous climate brings cold weather, snow and frost. In general, the climate of Mazandaran is moderate and humid. The winds blowing from the west are warm and bring rainfall and the winds blowing from the east and northeast are cold and precipitate snowfall.

The climate of Gilan province is also moderate and humid, but the extent of the temperature fluctuation is smaller and the humidity is higher than in Mazandaran.

Golestan features a primarily moderate and humid climate similar to the Mediterranean. Nevertheless, given the closeness of its northern reaches to the Qare-qom desert in Turkmenistan, it has dryer weather. The overall climate of this province is dryer than the other two provinces, but it has greater climate diversity with substantial natural resources and potentials.

1.3.5. Air pollution

Air pollution poses a serious threat to human health, particularly as the causal factor in higher prevalence of respiratory diseases. More than five million tons of pollutants were released into I.R. Iran's atmosphere in 1996 (about 5% in Caspian coastal Provinces), 65% of which came from motor vehicles. Another major source of air pollution is the combustion of various fossil fuels for domestic, industrial, agricultural and other uses. In 1995, domestic and commercial consumption of fossil fuels was equivalent to 211,6 million barrels of crude oil (about 5% in Caspian coastal provinces), with oil derivatives accounting for 55% of this total, natural gas 33.1%, electricity 10.6% and solid fuels 1.3%.

TaTable 2 shows the amount of emission of air pollutants from consumption of oil derivatives by immobile sources in 1995. The leading industrial sources of air pollution are cement factories, steel foundries, non-ferrous metal foundries, chemical industries, brick kilns, lime furnaces and asphalt production facilities.***Table 3.*** shows the natures of the pollutants emitted by these industries.

Energy consumption by vehicles and the domestic, commercial and industrial sectors are among the major sources of pollution and are particularly responsible for increasing levels of carbon monoxide, carbon dioxide, sulfur, sulfur dioxide, nitric oxides, hydrocarbons and halogens.

Air pollution, especially from motor vehicles normally exceeds the standard set by the World Health Organization and the World Bank, particularly the pollutants such as SO_2, CO and Total Suspended Materials (TSM).

Chlorofluorocarbon (CFC) emissions Green House Gases (GHG) and CO_2 also threaten air quality.

Table 2: Emission of air pollutants from oil derivatives (immobile sources), 1995

Source	Consumption (1000 m^3)	Pollutants (tons)				
		SO_2	Particles	NO_2	HC	CO
Fuel Oil	14,828	815,540	40,777	88,968	7,858	7,414
Gas Oil	11,082	188,394	19,947	88,656	2,773	5,541
Kerosene	10,484	24,113	14,677	15,726	2,096	4,193
Total	36,394	1,028,047	75,401	193,318	12,724	17,147

Source: National Plan of Action for the Protection of the Environment, Department of Environment, 1999

Table 3: Major industrial activities causing air pollution

Industry	Pollution
Steel foundries	CO, SO_2, particles
Non-ferrous metal foundries	CO, SO_2, particles
Chemical industries	CO, HC, Particles, SO_2, particles
Casting industries	Particles
Cement factories	CO, HC, SO_2, NO_2
Brick kilns and lime furnaces	CO, HC, SO_2, NO_2, Fluorine, Particles
Asphalt production	SO_2, Particles

Source: National Plan of Action for the Protection of the Environment, Department of Environment, 1999

The increasing level of CO_2 emissions in particular calls for the adoption of special measures - especially on energy consumption and transportation to prevent pollution.

The main sources of air pollution along the Southern Caspian coastlines are industrial units, as well as transportation activities, using fossil fuels. The industrial activity is the most important source of air pollution. Existing plants, have not observed standards set by law, such as installation of the special filters to collect dust, soot and other polluting particles created by

the combustion of different fuels, therefore they pollute the air through various emissions causing numerous environmental problems in the area.

The industrial units are divided into three categories:

1. Units which emit suspended particles into the air, e.g. cement, chalk, lime, rock powder, asbestos, motor car lent break, flour, fish and poultry meal, rock crashers using river sands or rock, asphalt, rice separation units.
2. Units which pollute the air by producing fuel residues and emission of gases, asphalt, glasses and crystals, textiles, fossil fuel units, wood products, breaks, vegetable oils, plastic materials.
3. Factories that emit unpleasant odors into the atmosphere, e.g. meal factories, soaps, pesticides and medicines.

A. Mazandaran and Golestan provinces

The number of air polluting industrial units in these provinces exceeds 780 in 1996. Among these units, rice threshing factories (32% of total units) are the most polluting ones, and aluminum factories (0.1%) at the least polluting industrial units if this province. Transportation is also responsible for air pollution. Vehicles (petrol and gasoline consuming engines) emit pollutants such as: CO and CO_2, and hydrocarbons (HC), suspended particles and sulfur oxides. There were 7,750 vehicles, out of which 6,812 used petrol and 938 used gasoline (diesel engine). A total of 176,415,000 liters of gasoline and 136,182,000 liters of petrol fuel were consumed in these provinces.

The amount of annual consumption of fuel used by different industrial units is presented in ***Table 4***.

B. Gilan Province

Different large factories are responsible for 33.3% of air pollution in Gilan Province, which cement factories are the most polluting units. They cause serious air pollution and threaten the health of the people. Iron units, asphalt making factories and shell crushing factories also contribute to the existing air pollution largely. Rice threshing factories (1800 units) also add to the problem of air pollution.

In Gilan Province, there were 150,000 vehicles on the road in 1996, which at least doubles during the New Year periods and summer holidays. Total daily fuel consumption based on the average of 15 liters per day for each vehicle is about 1,575,000 liters. This figure too, is doubled during holidays.

It should be mentioned that continuous rainfall and wind currents throughout the year, reduces the observed air pollution and it is not as serious as the other major towns in the country. Although, they are usually

washed away, unfortunately most of the pollutants find their final way into the sea.

Table 4: Fuel consumption by the industrial units in Mazandaran and Golestan Provinces

Types of Activities	Coal (ton)	Gas (ton)	Petrol (1000 lit.)	Gas Oil (1000 lit.)	Mazot (1000 lit.)	Crude Oil (1000 lit.)	Light Oil (1000 lit.)
Food, tobacco and drinking	0	321	2,593	8,613	0	7,129	728
Textile and leather	198	830	4,93	6,302	627	32,787	2,056
Wood and products	0	5	3,102	11,145	0	7,348	88
Paper, cardboard and printing	0	-	-	2	0	0	5
Chemical product	0	5	184	788	5	0	60
Non-metallic mineral product	6,976	20	289	7,971	150	107,849	245
Metallic product	0	1	3	30	0	0	3
Equipment, machinery	0	39	141	799	41	60	20

1.4. Hydrology

1.4.1. Quality and quantity for groundwater

According to the latest available data, in 1995-6, the total surface water volume of the country has been estimated at 110 billion m^3. This is distributed in the five major watersheds of the country as follows:

1. Caspian Basin 19.4 billion m3
2. Persian Gulf and Sea of Oman 60.0 billion m^3
3. Lake Urumieh 4.8 billion m^3
4. Central Basin 22.2 billion m^3
5. Hamoon and Sarakhs 3.3 billion m^3

There has been an 8.2% increase in present surface water levels compared to the data of the last 30 years. Gilan, Mazandaran and Golestan provinces contain only 3.5% of the country's surface area but receive about 10% of total precipitation, or some 40 billion m3 per year. About 30% of the aggregate water, resources of the region are found in rivers. After being used for agriculture or other purposes, these waters reach the sea. The other two-thirds evaporate and sink into ground water reservoirs. The total groundwater resources in three littoral provinces of Caspian Sea are estimated to be about 4.23 billion m^3, 0.72 billion m^3 in Gilan (17%), 2.16

billion m^3 in Mazandaran (51%) and 1.35 billion m^3 (32%) in Golestan province.

Groundwater is accessed in a number of ways, including wells, Qantas (manmade underground irrigation channels) and springs, the amount of each is shown in ***Table 5***.

Table 5: Groundwater sources and their utilization (million m^3)

Type	Deep wells		Semi-deep wells		Qanats		Springs		
Province	No	Yield	No	Yield	No	Yield	No	Yield	Total Yield
Gilan	2,334	160	6,178	117	64	27	4,642	294	598
Mazandaran & Golestan	12,688	865	69,579	732	318	77	7,190	1,523	3,197
Total	15,022	1025	75,757	849	382	104	11,832	1,817	3,795

Accordingly, from a yearly total consumption of about 3.8 billion m^3 of groundwater, about 48% of the total is taken from springs, 27% through deep wells and 22% via semi-deep wells or 49% and the remaining 3% is utilized through Qanats. Groundwater is primarily used for agriculture (87%) industrial (1%) and drinking water (12%).

Wells provide a primary source of drinking water for human consumption. They are also used for agricultural and industrial purposes and contribute about 50% of the total water supply.

Well waters used for human consumption are generally shallow, therefore subject to various pollutant leakages entering the ground, and hence water sources. Among these, pesticides are the most important source of pollution. Extensive and even illegal use of these substances pollutes surface and groundwater. Since groundwater is found close to the surface, the water table can easily be contaminated by polluted surface waters.

Domestic sewage is another source of contamination for groundwater. This type of pollution is threatening the quality of groundwater in villages and cities. The gentle slope of the land and low natural drainage potential has created vulnerable ecosystems. This is particularly true of Gilan province. A large proportion of sewage is carried by rivers to the sea. Cesspools containing polluted waters leak into underground water sources and the water table. As a result, epidemic intestinal disease is particularly prevalent in villages and small urban areas.

The pollution of water by nitrogen compounds is caused by various point and non-point sources including chemical fertilizers, animal manure and effluent from factories. Sewage containing human feces and effluent carrying a variety of household detergents eventually find their way into

the groundwater. Unfortunately, drinking water is also contaminated in the process and is the origin of a number of diseases.

Expansion and over population of cities and rural areas, lack of adequate environmental protection policies, as well as a lack of water conservation schemes only accelerate water source pollution both on land, at the surface and underground.

1.4.2. Rivers and streams

1.4.2.1. Distribution

The southern Caspian Sea watershed is one of the largest water basins in the country. It extends as a narrow strip from the northeast of Azerbaijan Province to the northeast of Khorasan Province.

The Sefid-rood River basin is the only basin that extends south to the Zagros Mountain. This basin comprises areas whose waters empty into the Caspian, and contains about 864 large and small rivers and streams. Most of these rivers, originate in the northern slopes of Alborz mountain range, are short with small watersheds and are characterized by mountainous, meandering and steep courses, interspersed with several waterfalls and deep valleys. Their water source during the summer and autumn are rain and natural springs and during the winter and spring melting snow.

The southern Caspian watershed covers an area of 177,000 km^2 (11% of the total national land area) and consists of 7 main basins and 11 sub-basins. The different provinces' shares in the Caspian watershed are shown in ***Table 6*** and ***Figure 15***. The total watershed of the Caspian is estimated to be 3.6 million km^2.

Table 6: Watershed area of the northern part of Iran

Province	Province Coverage (%)	Basin (%)
Gilan	100	8
Mazandaran & Golestan	100	26
East Azerbaijan	70	25
West Azerbaijan	20	4
Kurdistan	50	8
Zanjan	100	20
Hamedan	--	1
Khorasan	5	9

The annual surface water flow in this watershed has been calculated at 14,650 million m^2 (from statistics over a 24-year period) and is 21% of the country's total annual water flow.

Thirteen large rivers, with a basin area of more than 1000 km^2, and 24 small rivers with a basin less than 1000 km^2 are in this catchment. The Sefid-rood River with an annual average of water volume equal to 5,200 million m^3, is the outstanding source and accounts for 30% of the whole southern Caspian water flow. In ***Table 7***, the specification of the main rivers and their basins is shown. The descriptions of the most important rivers along the Caspian coastline from west to east are as follows:

A. Gilan Province Rivers

Astara River: Originates from the heights of the Republic of Azerbaijan, is 30 km long and enters the Caspian through the city of Astara.

Gorgan-rood River: Originates from Talesh Mountain, enters the sea through Hashtpar city, is 72 km long with an average annual flow of 217.5 million m3.

Sefid-rood River: The largest and most important river in the Southern Caspian basin with many tributaries is the major spawning ground for many commercial migratory fish (except salmon). It is 780 km long with a basin of 65,000 sq. km. After passing many cities and urban areas, it enters the sea at Kiashahr city at an annual average of 154 m3/sec. Construction of three dams during the past years has decreased the amount of biogene material in the water. This has also blocked the fish migration route for spawning upstream, especially sturgeon and white fish. As this river passes many populated areas, it carries a considerable amount of pollutants into the sea, particularly urban sewage and agricultural outflows.

Pol-rood River: The most important river on the east side of the province with a basin of 1800 km2, 80 km long and an annual average flow of 400-500 million m3.

Anzali Lagoon rivers: 12 rivers with a capacity of 2 billion m3 per year enter this lagoon, all through very high dense populated areas (rural, urban and industrial). They carry a considerable amount of pollutants into the lagoon and then into the sea. These rivers are considered the most polluted rivers along the southern Caspian coasts.

B. Mazandaran Province Rivers

Hazar River: Originates from Lar Mountain and enters the sea through the city of Amol. This river is the best-nourished river in the eastern side of the province. Its upstream course runs through a very deep and steep valley, which is covered by a dense forest and is regarded as one of Iran's leading tourist attraction sites. Its length is about 185 km with a basin area of 4,100 km2 and an average water flow of 1072 million m3 per year. It is frequently given to flooding and has destroyed Amol on its estuary several times.

Neka River: Originates from Shah-Koh Mountain and enters the sea through Neka city. It is one of the important and nourishing rivers. Its

length is about 180 km with a basin area of about 3000 km2. It is a permanent river with an annual average flow of 148.2 million m^3.

Tajan River: Originates from Tizabad Mountain and after receiving many other small rivers (e.g. Lajim, Garmab-rood, Farim River,) passes through the city of Sari (the center of the province) and then enters the sea through Farahabad city. It is about 170 km long and is one of the most important rivers of Mazandaran province. Its catchment area is about 4,000 km2 with an annual average water flow of 207.4 km2.

Babolrood and Sajadrood rivers: They originate from the Alborz mountains near the Haraz Heights. They join at Babolsar and enter the sea.

C. Golestan Province Rivers

Gorgan River: One of the most important rivers the southeast of the Caspian for agricultural purposes. It runs through the Gorgan Plain and Voshmgir Dam, which has been constructed for increasing the potential of water resources in the area. The length of this river is about 350 km with a basin of 12000 km2. It considered a permanent river. Although the river dries out during the hot season and dry years, it runs for at least 10 months per annum. The average water flow of this river is about 447.8 million m3 per year.

Ghareh-su River (Ooghan River): This River is one of the main branches of the Gorgan river that originates from the Gorgan Plain and flows mostly through the plain. Its length is 73 km with a basin of about 400 km2 and an annual average flow of 29.2 million m3. The Ghareh-su River is a very important river from the fishery point of view and is a spawning ground for migratory fish species, such as sturgeon and white fish.

1.4.2.2. Water quality

From the standpoint of water quality, the concentration of suspended matter in water fluctuates according to the season. Water quality depends primarily on the following factors: water flow intensity, distance from its origin, type of bedrock, presence of salts on its course, basin type and finally on the nature of ground water. As a rule, the more distant from its origin and the slower it flows, the amount of anions CO_3H^- and CO_3^- would be reduced but the amount of Cl^- would increase.

Regarding observed measurements done by the Ministry of Power, the quality of surface waters along the Caspian coast is suitable and there are no restrictions in using it for different purposes.

In ***Table 8***, the water quality of some major rivers is presented.

Table 7: The specification of the main rivers and their basins

No.	Basin	River	Length (km)	Basin (km^2)	Water flow 10^6 m^3/sec	Average yearly flow 10^6 m^3	Sedimentation (tons)
1.	Talesh	Aras	1,070	40,800	--	5,765	
2.		Astarachay	36	180 (In Iran)	3.18	100	
3.		Shafarood	55	350	5.80	1,925	420,000
4.		Havigh	24	110	2.32	72.5	
5.		Harehdasht	28	250		34.6	
6.		Navrood	50	390	5.09	64	
7.		Gorgan-rood	70	550	6.90	2,175	
8.	Anzali Wetland	Ghorobas	65	280	4.31	107	
9.		Shakhazar	54	230	10.23	120	
10.		Ghaleh Roodkhan		144	3.44	108	
11.		Passikhan	66	840	13.76	434	
12.		Khalkaei	54	230	3.75	120	
13.		Cha-frood	60	210	2.26	72.5	
14.	Sefidrood	Sefid-rood	800	67,000	141.7	4,000	
15.		Polrood	80	1650		78	
16.		Shaliman	54	390		222	
17.		Disam		124	4.57	149	
18.		Sham-rood		98	4.73	147	
19.		Tonekabon		424	4.07	128	
20.		Tarik-rood		167	3.87	122	
21.	Coastal Region of Caspian	Shalman-rood		390	7.27	229	
22.		Shard-rood		1,557	15.22	480	
23.		Shin-rood		184	3.97	125	
24.		Cheshmegileh		720	11.98	378	166,714
25.		Valam-rood		158	3.72	117	64,227
26.		Neka	180	3,000	2.52	1,482	152,082
27.		Doogh		1,668	1.56	49	31,062
28.		Gorgan-rood	350	12,600	1.42	448	1,335,568
29.		Chaloos	180	1,550	12.73	372	407,490
30.		Babol-rood	170	1500	6.62	250-600	245,585
31.		Haraz	185	4100	32.82	1,072	2,060,400
32.		Talar	150	2,850	8.93	118	1,553,330
33.		Kajoor					
34.		Kasilian		343	3.56	112	66,375
35.		Sardab-rood	67	430		4,305	
36.		Tajan	172-192	2,350-4,000	5.2	2,074	373,135
37.	Eastern Coastal Region	Atrak	54	450			

1.4.2.3. Sediment load

Regarding the water fluctuations of rivers, the amount of suspended matter changes accordingly, but apart from seasonal changes, the amount of sediment load increases in wet years and decreases in dry years. Besides suspended sediment load in the water column, some suspended solids also are carried away on the riverbed as bottom load. Its amount is estimated about 10% of the suspended matter. In ***Table 9.***, the calculated suspended solid load of several important rivers is provided.

Table 8: Water quality of major rivers in Caspian basin

River	Flow M^3/sec	Dissolved Matter (mg)		Conductivity		SAR		PH		Vilox Classification	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Sefidrood	<5	490	1000	790	1620	7.41	8.20	7.4	8.2	C3S5	C3S2
(Roodbar st.)	>200	510	660	810	1100	7.5	8.06	7.5	8.0	C3S5	C4S2
Haraz	Up 20	375	480	580	740	0.47	0.69	7.1	8.2	C2S1	C2S1
(Garsang st.)	>100	240	285	360	430	0.26	0.28	7.1	7.6	C2S1	C2S1
Babolrood	Up 5	212	455	325	700	0.22	3.2	7.2	8.3	C2S1	C2S1
(Gharan-Talar st.)	>10	160	265	260	390	0.17	0.64	7.2	8.8	C2S1	C2S1
Tajan	Up 11	405	472	625	720	0.60	1.80	7.2	8.2	C2S1	C2S1
(Rig-Cheshmeh st.)	>11	335	430	520	670	0.36	1.00	7.4	8.2	C2S1	C2S1
Neka (Alboo st.)	Up 16	240	405	465	625	0.23	1.48	7.1	8.7	C2S1	C2S1
Gorgan	Up1.5	440	1050	660	1600	1.8	6.05	6.9	8.3	C2S1	C2S1
(Tamr st.)	1.5-10	235	680	395	1060	0.8	3.0	6.9	9.5	C2S1	C3S1
Ghareh-su	2-10	430	845	670	1270	1.8	4.3	6.8	8.0	C2S1	C3S1

Source: JAMAB (Consultancy Engineers Company), 1990

Table 9: Estimation of suspended solid load of some main rivers in the Caspian basin

No.	River	Station	Sediment load (tons)	Average concentration (kg/m^3)
1	Sefidrood	Bebanloo	1,500,000	2.87
2	Sefidrood	Pol-Doktar	14,771,000	8.62
3	Shahrood	Lowshan	12,238,000	10.3
4	Cheshmeh-Guileh	Herabtar	177,000	0.44
5	Tajan	Rig-Cheshmeh	481,280	1.36
6	Babolrood	Babol	339,200	0.83
7	Neka	Abloo	178,039	1.21
8	Gorgan	Tamr	184,194	4.11
9	Ghareh-su	Araz-Kooseh	362,740	1.84

1.4.3. The Caspian Sea

1.4.3.1. Caspian Sea basin

The Caspian Sea, the largest lake of the world, is located in an inland depression (between 47?07? and 36?33?N, and 45?43? and 54?50?E). Although the Caspian Sea is thousands of kilometers away from the world's open waters and by the geographical definitions, it could be called a Lake, but it possesses many marine characteristics: a large water surface area and volume, a specific hydro chemical regime; heavy gales; etc. The Caspian Sea accounts for more than 40% of the over all volume of the global lacustrine waters. The area of the Caspian Sea is 386,400 km^2. This area may fluctuate by 10-20%, as the sea level rises or falls. The coastline of the Caspian Sea is about 7250 km extending approximately 1,200 km from north to south, and is 200-450 km wide.

The drainage basin of the Caspian Sea is estimated to be of 3.1 million km^2. The Caspian basin area exhibits an uneven pattern of water distribution and could be differentiated into three sub-areas:

1. The Northern Caspian (80,000 km^2)
2. The Middle Caspian (138,000 km^2)
3. The Southern Caspian (168,400 km^2)

The Northern Caspian is relatively shallow (average depth is 5-6 m and maximum depth is 15-20m) and possesses many islands, banks and troughs. There are as many as 50 islands with a total area of about 350 km^2. The Middle Caspian having the maximum depth of 788 m is located in the Derbent Depression or Basin. It holds about 34% of the entire Caspian water volume. The average depth of the Middle Caspian is 190 m. The Southern Caspian holds more than 65% of the entire Caspian water and its maximum depth is of 1,025 m. The average depth of the shelf of the Caspian Sea is about 180 m. The natural boundary between the Northern and the Middle Caspian is the Mangyshlak Bank and between the Middle and Southern Caspian is Apsheron Bank, both of which are tectonic elevations.

Five countries share the 7,250 km Coastline of the Caspian Sea: the I.R. Iran, with approximately 1,000 km (15% of the total coastline), and the Azerbaijan; Kazakhstan; Russia and Turkmenistan, with approximately 6,000 km (85% of the total coastline).

The freshwater inflows to the Caspian Sea are from the Northern and southern Caspian. There is no freshwater inflow from the east. The Volga, Ural and Terek rivers contribute 88% of the freshwater flows in to the Caspian Sea. Azerbaijan and I.R. Iran respectively contribute 7% and 5% of the freshwater flows into the Caspian Sea.

1.4.3.2. Oceanography

The physico-chemical characteristic of the Northern, Middle and Southern Caspian Sea are very different. The chemical characteristic of the Southern Caspian Sea is as follows:

The water temperature of this region along the Iranian coast is highest compared to that of Northern and Middle Caspian Sea. The temperature range in southern Caspian Sea is between 3.5? C and to 28? C.

There is an increase in water temperature by approximately 4? C, from west (Astara port) to east (Torkaman port). In spring, there is a temperature difference between the coastal region and the open sea (0.5? C). The warming of the sea surface creates thermoclines between 30-40 m of depth, in the Southern Caspian Sea. During the summer, the surface temperature is 25-26 ?C in the southern part. In autumn, with decrease in water temperature, the thermocline becomes less defined, and by winter, it disappears. During the winter, the open sea surface temperature decreases to 16?-17?C in the southern Caspian Sea, while the bottom water temperature through out the year is constant, 4.5 ?C (***Figure 16*** and ***Figure 17***).

In the Southern Caspian Sea salinity level ranges from 12.5-13.5%. The salinity however, decreases to its lowest level in the estuarine rivers (i.e. mixing of fresh and brackish waters). The salinity level like temperature increases from west to east. The phenomenon of halocline has been observed with decrease in depth, where salinity tends to increase. The Caspian Sea is identified to be brackish water lake (***Figure 18***).

The average dissolved oxygen (DO) of water in the Caspian (southern basin) is estimated to be 8.7 mg/lit. The dissolved oxygen level decreases, from the west (Astara port) to the east. This is due to an increase in temperature and salinity of water, as we move in this direction and therefore the level of oxygen tends to decline there is also a decrease in the oxygen level by depth.

The pH level in the Southern Caspian Sea is higher than oceanic waters due to the presence of high concentration of ionic HCO_3^- and CO_3^{2-} (its pH is 0.3 times higher than oceanic waters).

Except the temperature, salinity, dissolved oxygen and pH all exhibit unique patterns of fluctuation, as their amount decrease from the west coast (port of Astara) towards the east coast (Bandar-e Torkaman).

1.4.3.3. Current

The Caspian Sea has two types of cyclonic eddy currents (anti-clock wise) in central and southeastern regions (***Figure 19***). In the coastal regions of the Southern Caspian, the average currents are directed towards the northwest, north, southeast and south. Current speed is 20-40 cm/sec reaching a maximum of 50-80 cm/sec. Baroclinic, Seiches and inertial currents play an important role in the local circulation pattern. The average

speed of the current along the western shores is estimated to be 30 m/s, which decreases to 10 m/s along the eastern shores.

1.4.3.4. Water level fluctuations

One of the most striking phenomena in the Caspian Sea is the sea level rise. Sea level fluctuation is primarily due to climatological changes; regional precipitation and water evaporation from the sea, wind stresses/ surges; alteration in atmospheric transport pattern as well as human activities such as construction of dams on the major rivers. Between the year 1829 and 1929 the sea level was maintained at about-26m, this level was considered perennial or secular average. However, the sea level dropped by nearly 2 meters in 1941; interrupted by two short-term rises in 1946-48 and in 1956-58. The lowest registered level was - 29.02 m., in the year 1977, which was the lowest level in the past 200 years.

The recent sea level rise (2.1 m, since 1978) could be attributed to: river flow; surface precipitation and decrease in evaporation rates. It has also been claimed that the recent sea-level rise is tectonic in origin, and attempt has been made to predict the sea level fluctuation in the future. However, due to uncertainties in the climatic fluctuation and in the Caspian basin evaporation and precipitation, levels it is not yet possible to predict the sea level fluctuation accurately.

Better meteorological studies of the Caspian Sea region as well as more advanced watershed and ocean modeling must be used in order to predict the sea level fluctuation with optimum accuracy.

The average perennial value for the sea level rise is 40 cm, the seasonal fluctuation as well as the wind - induced surges have a significant impact on the Caspian Sea level fluctuation. Wind- induced surges can increase the sea level for a period of up to few days and causes inundation of vast areas of the coast causing heavy economical losses to the Caspian littoral states. The maximum wind-induced surges appear in the Northern Caspian, while in the middle and southern parts they are smaller. Wind induced surges of 1.5 to 3 m. high has been observed in the Caspian Sea within the past few decades.

In the North Caspian, the wind-induced surges may even penetrate up to 20-30 km inland and remain in the shore depressions up to 15-20 days.

The Caspian Sea level rise has been exerting considerable damages to the Caspian states, i.e., human habitation, industry, and navigation. It causes damages to the flora and fauna habitats. It increases the soil salinity and causes the rise in the ground water. Sea level fluctuation has both positive as well as negative impact on the environment of the Caspian Sea and its coastal states.

The rise of water level in the Caspian Sea during the past two decades has caused serious damages in the southern coastal shores of this great lake.

Although each of the pertinent organizations including the Ministry of Power has tried to prevent the expansion of possible damages by conducting studies, implementing national-regional projects and especially constructing breakwaters, the rise of water level and its expansion toward the shorelines (regardless of its halt or retreat in the past few years) is a continues source of anxiety for the coastal settlers.

The Water Resources of the Caspian Sea Research Center has been established to monitor the water level fluctuations during successive annual hydrological cycles in order to fulfill its organizational goals and objectives. This center monitors these trends and eventually publishes a report on the water level fluctuations annually. For instance, the analysis of the results of data collected from Anzali Station for the annual hydrological cycle of 1999-2000 is presented here.

The water level in the Caspian Sea has started its rising trend from the annual hydrological cycle of 1977-1978 and by the end of annual hydrological cycle of 1994-1995 (according to the revised curve), it has risen more than 2.32 meters. During the annual hydrological cycle of 1995-1996 and 1996-1997, the water level decreased temporarily. But, in the following hydrological cycle of 1997-1998, an increase in the water level was observed. Meanwhile, the average water level in hydrological cycle of 1999-2000 shows a decline in comparison to the water level of the previous year. Although most of the researchers believe that the increase in the Caspian Sea's water level is due to the climatic changes and have presented facts to support this theory, the other possible causes of this phenomenon are not over-ruled in the scientific and technical articles.

Therefore, recognizing the type of climatic phenomena taken place and their subsequent effects on the water level fluctuation as well as investigating the other possible sources of sea water input are included in the work plan of the research centers stationed in the littoral states and as well as the international research centers.

The researchers at the CASPI Research Center in Russian Federation have presented their views and predictions for the water level changes in the next two decades in the "CASPI Technical & Economic Report". Although different conditions were studied (removal of various amounts of water from the annual incoming flow), their analysis was made upon one possible condition (removal of 35-40 Cubic Kilometers of water per year). In this condition, it is predicted that the water level will continue its increasing trend until 2010 and eventually will reach the elevation of 24.92 meters. This elevation in comparison with the reference year (1992) indicates an increase of 1.46 meters (1.49 meters higher than the average water level in the hydrological cycle of 1999-2000).

In view of the above and considering the ever-increasing scope of the scientific research and studies performed on this vast body of water, the Water Resources of The Caspian Sea Research Center is conducting its

research in compliance with the activities of the researchers. This center prepares data and information in various fields including the water level fluctuations in several stations in order to pave the way for more comprehensive studies of Caspian Sea parameters and conditions.

This center in addition to its ongoing research projects and collection of data and information in its various stations has included the establishment of meteorological stations (on-shore and off-shore stations) in its work plan. This center with the collaboration of the Regional Water Organizations of Gilan and Mazandaran provinces established three Fluctuation Recording Stations in the Astara, Amir-Abad-e-Neka and Bandar-e Torkaman (Ashouradeh) ports last year. All three stations are equipped with Limnograph and are presently functional. The general characteristics of the monitoring stations are as follows:

A. Anzali Station

The Anzali Fluctuation Recording Station belongs to the Ports & Shipping Organization and it was established in 1926. This station is equipped with fluctuation registration devices and daily inspections are made at 8 AM, 12 PM and 6 PM. The statistics collected by this station is sent at the end of each month to the pertinent research centers and organizations.

B. Ghazian Station

This station was established by the Regional Water Organization of Gilan Province and it was equipped with fluctuation registering devices last year. Two direct inspections are made daily at this station.

C. Astara Station

This station was established by the Water Resources of The Caspian Sea Research Center with the cooperation of the Regional Water Organization of Gilan Province. Last year, it was equipped with fluctuation registering devices and two inspections are made daily now.

D. Nowshahr Station

Nowshahr Fluctuation Recording Station belongs to the Ports & Shipping Organization. It is one of the active stations in the region. Never the less, its statistical activities were halted for two years, due to renovation and completion of its equipment. Now, this station has recommenced its activities.

E. Babolsar (Khezer-Shahr) Station

According to the report prepared by the authorities of the Mazandaran Regional Water Joint-stock Company, the registration devices of this station have performed satisfactorily during the past annual hydrological cycle and the inspections are made at appropriate intervals. It is important to point out that the inspections are made at 8 AM and 4 PM every day.

F. Amir-Abad-e-Neka Station

This station was established by Water Resources of The Caspian Sea Research Center with the cooperation of the Mazandaran Regional Water Organization. It is equipped with the fluctuation registering devices and has two daily inspections now.

G. Bandar-e-Torkaman (Ashouradeh) Station

This station was established by Water Resources of The Caspian Sea Research Center with the cooperation of Mazandaran Regional Water Organization. It is equipped with the fluctuation registering devices and has two daily inspections now.

The procedure for statistical analysis is presented bellow:

First by utilizing the statistics reported by the Anzali Station, a chart indicating the daily changes in the water level is drawn and then the external factors that have affected directly or indirectly the registering devices or the inspections are determined. Since they produce inaccurate and unreal registered data, they are studied and eventually the curves will be altered accordingly.

Table 10 includes the water level fluctuation specifications for the first and the second half of annual hydrological cycle according to the reported data. ***Figure 20*** and ***Figure 21*** show the water level changes in two consecutive annual hydrological cycles (1998-1999) and (1999-2000) respectively as well as the long-term changes in the water level from 1971 to 1999.

From the information and data gathered from these stations for the last few years, the following results can be drawn:

- In the annual hydrological cycle of 1999-2000, the water level was extremely disturbed and its seasonal fluctuations were more asymmetric than the previous year.
- The seasonal retreat of the water in the Caspian Sea started at the beginning of the annual hydrological cycle of 1999-2000 and it reached its minimum level at the beginning of winter. Meanwhile, its seasonal expansion started in early summer.
- The average water level elevation during the annual hydrological cycle of 1999-2000 according to the modified curve was 26.41 meters that shows a decrease of 6 centimeters in comparison to the previous annual hydrological cycle.
- In the annual hydrological cycle of 1999-2000, the difference between minimum and maximum elevation according to the modified curve was 25 centimeters, which was 7 centimeters lower than the one in the previous annual hydrological cycle.
- The instantaneous maximum and minimum elevations observed were 25.89 and 26.91 meters respectively. The time of their occurrences was November and January respectively. The range of changes in these two conditions was 102 centimeters, which in comparison with the previous annual hydrological cycle of 1998-1999 shows an increase of 37 centimeters.

Table 10: Caspian Sea water level fluctuations in one hydrological cycle (1999-2000)

Period	Type of Report	Elevation (m)	Date	Hour		
				8 AM	12 PM	6 PM
Sep 22-Oct. 21	Instantaneous Maximum	-26.09	22.09.1999	+	+	
	Instantaneo us Minimum	-26.53	14.10.1999			+
	Average for the Month	-26.39				
Oct 22 – Nov.20	Instantaneous Maximum	-25.89	09.11.1999		+	
	Instantaneous Minimum	-26.63	15.11.1999			+
	Average for the Month	-26.35				
Nov. 21 – Dec. 20	Instantaneous Maximum	-26.37	26.11.1999	+		
	Instantaneous Minimum	-26.66	20.12.1999		+	
	Average for the Month	-26.50				
Dec 21 – Jan 19	Instantaneous Maximum	-26.29	06.01.2000		+	
	Instantaneous Minimum	-26.91	17.01.2000			+
	Average for the Month	-26.49				
Jan 20 – Feb 18	Instantaneous Maximum	-26.29	27.01.2000		+	
	Instantaneous Minimum	-26.75	30.01.2000	+		
	Average for the Month	-26.47				
Feb 19 – Mar 20	Instantaneous Maximum	-26.22	28.02.2000	+		
	Instantaneous Minimum	-26.59	18.03.2000	+		
	Average for the Month	-26.40				
Mar. 21 – Apr. 19	Instantaneous Maximum	-26.32	25.03.2000			+
	Instantaneous Minimum	-26.58	07.04.2000	+		
	Average for the Month	-26.44				
Apr. 20 – May 20	Instantaneous Maximum	-26.20	04.05.2000	+		
	Instantaneous Minimum	-26.51	12.05.2000			+
	Average for the Month	-26.41				
May 21 – Jun. 20	Instantaneous Maximum	-26.05	10.06. 2000	+		
	Instantaneous Minimum	-26.43	16.06.2000		+	
	Average for the Month	-26.33				
Jun. 21 – Jul 21	Instantaneous Maximum	-26.10	23.06. 2000		+	
	Instantaneous Minimum	-26.44	07.07. 2000		+	+
	Average for the Month	-26.33				
Jul. 22 – Aug. 21	Instantaneous Maximum	-26.23	06.08. 2000	+		
	Instantaneous Minimum	-26.44	29.07.2000	+		
	Average for the Month	-26.39				
Aug. 22 – Sep.21	Instantaneous Maximum	-26.22	31.08.2000		+	
	Instantaneous Minimum	-26.59	16.09.2000	+		
	Average for the Month	-26.40				

Chapter 2:
The Biological Environment

2. 1. Species

2.1.1. Zoogeographical Realms

The modern Caspian was originated as part of an ancient, brackish pontic lake-sea since 5-7 million years ago. Thus, the oldest living organisms in this region are among the group of autochthonous, brackish water organisms. Among this group, there is a high percentage of endemic species and even genera. The rest of modern assemblage of organisms in the Caspian is derived from the following three major origins:

1. The Mediterranean Complex
2. The Arctic Complex,
3. The Freshwater (riverine) Complex

The zoogeography of land animals and plants are discussed in relevant chapters.

2.1.2. Phytoplankton

Caspian phytoplankton has been studied by many authors, but mostly for North and Middle Caspian. According to Ghasemov (1987), there is a total of 499 phytoplankton species in the Caspian Sea, including: Chrysophyta with 111 species, Cyanophyta with 102 species, Chlorophyta with 127, Phyrophyta with 27, Chrysophyta with 1 and Euglenphyta with 5 species. Accordingly, the diversity of phytoplankton according to the sub region of Caspian is as follow:

North Caspian	414 species
Middle Caspian	225 species
South Caspian	71 species

As a whole, the diversity decreases from north to south, mainly because of a decrease in freshwater species. On the other hand, the number of marine species shows an increase towards the south so as everything comprise 9% of the total species in the North, 18% in the Middle and 31% in the South. In whole Caspian, marine species are 47, brackish water 16 and freshwater 210 and rest 52 species.

According to the latest research carried out by Fisheries Research Centers of Iran along the Caspian coasts, following results have been obtained.

Collectively, 146 species of phytoplankton were recognized along the southern Caspian in Iranian waters. These species belong to two main groups of Chrysophyta (mainly diatoms) and Pyrrophyta with 120 and 26 species respectively, showing that the first group is dominant throughout the year, except during the spring. The main density of Chrysophyta is from surface to the depth of 20 meters with dominant species of Rhizosolenis calcar-avis. Pyrrophyta species are abundant in coastal

waters, but have a considerable density down to 100 meters showing that they are even found beneath the euphotic zone, which is not the case for the Crysophyta. Among the Pyrrophyta species, Exuvialla Cordata is the dominant species and alone, blooms during the spring time and outnumbers the Chrysophyta density during the season.

The maximum density of phytoplankton has occurred to two numbers of 68,625 thousand per cubic meters. The density of all species is more on the central part of the southern coast. The maximum density occurs during the spring and other seasons have more or less the same density.

In *Annex 1* a list of major groups and species has been provided.

2.1.3. Forests

A. Nature of Iranian forests

The Iranian forests belong to the European-Siberian growth region in the Holartic Region. This region includes parts of Europe and Northern Asia. The climate varies from cold to moderately warm weather. From the flora perspective, this region could be divided into the sub-regions of Northern, Atlantic, Central Europe and Pontic.

The Pontic sub-region in the Middle East are presented by Acscino-Hircany Province. This sub-region includes northern Turkey's mountains, the northern slopes of the Alborz Mountains and the coastal areas in its vicinity. This is well adapted for the growth and expansion of forests and its annual rainfall is more than 1,000 mm. A part of this region enjoys summer rainfall as well. The flora of this region consists of 40% European-Siberian species, 22% Mediterranean-European-Siberian and 8% Iranian-Turanian.

One of the most notable features of this region is its suitable environment for those groups of flora that were in danger in Europe at the expansion phase of cold weather in the later years of the Third Period (Newgeon Period). This grouping of flora expanded rapidly in this region and became part of the endemic species. There are other sub-provinces called the Hyrcanica that has less richness, but still enjoys a variety of tree species. It is divided into three groups. One of these groups is the Alnetea Hyrcanica, which includes various species like the forests of the Caspian coastal area.

Iranian forests can be categorized ecologically as consisting of the following biomes, out of which Caspian region is discussed:

- Caspian broadleaf deciduous forests
- Arasbaranian forests
- Zagrosian forests

Caspian forests

These forests belong to the broadleaf deciduous biome, which is widely distributed from North America to Europe and Asia. These forests receive considerable precipitation, between 750 – 2,200 mm. Temperatures are moderate but there are four well-distinguished seasons. Temperatures during the winter often drop to below 0? C making the winter months the season one of vegetation dormancy for trees. The average annual maximum temperature during the warmest months ranges from 28?-34? C and the average annual minimum temperature during the coldest month ranges from 1?-2? C. The absolute minimum temperatures are between 1?-10? C.

There are close similarities in the physionomic and taxonomic aspects between Caspian forests and European and American deciduous forests. The following genera are common between North American, European and Caspian Forests:

Beech (*Fagus*)
Hornbeam (*Carpinus*)
Oak (*Quercus*)
Chesnut (*Castanea*)
Ash (*Fraxinus*)
Persimmon (*Diospyros*)
Alder (*Alnus*)
Maple (*Acer*)
Linden (*Tilia*)
Walnut (*Juglans*)
Yew (*Taxus*)
Poplar (*Populus*)
Sweet Cherry (*Cerasus*)
Elm (*Ulmus*)

However, North America has some exclusive genera such as Hickory (*Carya*), Tulip tree (*Liriodendron*), Sweetgum (*Liquidambar*), Witch hazel (*Hammamelis*), etc. There is more similarity between European and Caspian forests. Many species are common, especially the *Herbaceous* species. The following species are common to both Caspian and European forests:

Acer cappadocicum
Acer platanoides
Carpinus betulus
Castanea sativa
Taxus baccata
Cerasus avium
Diospyros lotus
Fraxinus excelsa
Sorbus torminalis

The following species are found exclusively in Caspian or Hyrcanian forests:

Parrotia persica
Acer hyrcanum
Alnus subcordata
Quercus castaneifolia
Fagus orientalis
Albizia julibrissin
Gleditschia caspica

The Caspian forests have high moisture content, so forest trees are host to many epiphytes such as mosses, ferns, lichens, mistletoes and some flowering plants. Soils are productive and rich in minerals and organic

matter. There are many well-known communities in these forests, the most important ones being:

1. *Populus caspica* – This species covers sandy moist soils of lowland areas and is sometimes found with *Alnus glutinosa.*
2. *Quercus castaneifolia – Buxus hyrcana*. This community was the main vegetation cover of the lowlands that were transformed into paddy fields, citrus orchards, tea gardens, villages and cities. The primary accompanying species are *Zelkova carpinifolia, Gleditschia caspica, Albizia julibrissin, Acer cappadocicum* and *Tilia caucasica*. In many areas, due to the removal of the gigantic Caspian oak trees, box trees remain as patches of green space. There are also climbers such as *Smilax excelsa, Periploca graeca* and *Hedera pastuchowii*.
3. *Parrotia persica – Zelkova carpinifolia*. This community is well developed on the upper limit of the oak-box community.
4. *Parrotia persica – Quercus castaneifolia*
5. *Parrotia persica – carpinus betulus*
6. *Fagus orientalis – Buxus hyrcana*
7. *Fagus orientalis – carpinus betulus*
8. *Fagus orientalis – Ruscus hyrcanus*
9. *Fagus oreintalis – Taxus baccata*
10. *Fagus orientalis – Laurocerasus officinalis*
11. *Fagus orientalis – Vaccinium arctostaphyllos.* This community is on the acid soils at high elevations between 1,200 – 1,800 meters at Asalem and Noshahr.
12. *Quercus macranthera – Q. iberica*
13. *Quercus macranthera – Carpinus oreintalis*
14. *Quercus macranthera – Acer hyrcanum*

The last three communities cover the top of high mountains or the zone between the timberline and sub-alpine grasslands. There are some relics of *Betula pendula* forests on the high mountains of Taleqan, Shahrestanak and Semnan of the Alborz range.

Stratification in forest structures is well developed. The main commercial trees, *Fagus orientalis* or Caspian beech make a canopy as high as 40 m. Subdominant, medium and shrub strata exist if there is adequate light which penetrates from the canopy. When the canopy is tightly closed and there is no more than 1%-2% of light, there will be no herbaceous strata. With a light intensity of more than 2%, some characteristic species of beech forests can be found on rich moist soils, such as:

Epimedium pinnatum
Sanicula europaea
Asperula odorata (Galium odoratum)
Euphorbia amygdaloides
Circaea lutetiana
Mercurialis perennis

These species are the same as those in European forests. With increasing light intensity, especially when it is more than 10% -15%, other species of "light-seekers" can be found.

In beech forests, some important commercial trees are present in very low density. These include *Ulmus glabra*, *Acer velutinum* and *Acer cappadocicum*. They are not, however, climaxing communities.

The Caspian forest areas are among the most unique and splendid biomes of the world. Serious efforts should be made to save these areas from devastation, a danger that intensifies year by year. Over-exploitation is an increasingly serious threat to this biome.

According to an estimate made by the Forest and Range Lands Organization, the total area of the Caspian forest in 1963 was 3,420,487 ha . In 1980, a new inventory was made which estimated the total forest area at 1,900,000 ha. During the last 13 years, there has been a continuing degradation of forest area, so much so that today the total area of the Caspian forest is approximately 1,800,000 hectares. If the areas that receive more than 500 mm of precipitation are considered forests, the total area would be about 3,600,000 ha.

In addition to dimensional degradation, the forest's standing crop or biomass is also being destroyed. Before destructive exploitation, the average biomass of the Caspian forest was about 300 tons per ha. Today the average is less than 100 tons per ha. In altitudes lower than 600 meters, the areas have been almost completely cleared of valuable timber. The situation is similar in high altitudes where the inhabitants of sub-alpine pastoral areas have devastated the sub-alpine forests by selective removal and later by complete removal of vegetation.

B. Forest distribution and specifications

Golestan Province

The entirety of the southern and southwestern areas as well as parts of the eastern regions of the Gorgan plain is covered with forest, totaling an area of 421,373 ha in 1998. There are three forest parks totaling 1,224 ha and there is 2,930 ha of artificial forests. The total production from these forests is estimated at 269,022 cubic meters.

The main species in these forests are:

Quercus castaneifolia, Fagus orientalis, Carpinus betulus, Alnus subcordata, Ulmus glabra, Acer insingne, Zelkova carpinifolia, Prunus caspica, Punica granatum, Diospyrus lotus, Tilia platyphyllus, Taxus baccata, Prunus avium, Berberis vulgaris, Ficus carica, Pyrus cordata, Cerasus avium and *Morus alba*

Mazandaran Province

The total area of the forest in this province is estimated at 965,000 ha which is mainly comprised of broad leaf trees. The forests in the east of the province are connected to the Minoodasht and Golestan forests and are distributed at two major regions, Sari (645,000 ha) and Nowshahr (320,000 ha).

The main communities in these areas are:

Quercus castaneifolia, on the highs of Mianland
Zelkova carpinifolia, on mid-highs
Parrotia persica on very low highs
Alnus subcordata, in humid valleys and brook sides
Buxus sempervirens (evergreen), in some areas of Mianband
Acer insingne, Ulmus campestris, Tilia platyphyllus, Fraxinus excelsior, Quercus castaneaefolia and *Fagus orientalis*

From these forests, 487,195 ha are used commercially, 184,000 ha are protected and the rest are regarded as forestlands or over-used forests.

There are 11 forest parks totaling an area of 5,494 ha and 29,877 ha of artificial forests. The total of the forest woods used in this province is estimated at 770,551 cubic meters.

Gilan province

There were 567,524 ha of forests in Gilan province in 1998 out of which, the Astara area with about 80,000 ha ranks first in the region. These forests are graded 1-2-3 with an area of 107,894; 182,758 and 211,972 ha respectively.

The main species are:

Carpinus betulus, Tilia platyphyllus, Alnus subcordata, Alnus subcordata, Acer insingne, Fagus orientalis, Fraxinus excelsior, Sorbus torminalis, Populus alba, Zelkova carpinifolia, Acer velutinum and carniferous.

The area of artificial forests in 1998 was estimated at 1,062 ha, there are also 16 forest parks totaling 5,394 ha, and five forest biospheres totaling 2,373 ha.

The commercial and non-commercial utilization is 310,375 cubic meters (184,202 cubic meters for commercial and 126,173 cubic meters for non-commercial use).

C. Importance and condition of Iran's commercial forests

Now, only 1.3 million hectares of forests in the Caspian Sea region are commercially exploited. The remaining areas have been nearly totally degenerated, destroyed or have been designated as protected areas.

According to climatic and ecological conditions, the potential annual growth is estimated to be about seven cubic meters per ha (Dorostkar, 1988), or a total of approximately nine million cubic meters per year [1.3 million * 7 = 9.1 million] . However, given the socioeconomic condition of the local population, at present, there is an actual maximum annual growth of only three cubic meters, translating into a harvest of about four million cubic meters per year [1.3 million * 3 = 3.9].

According to studies carried out in 1987 in the Hyrcanian forests in northern Iran extending from Astara in the west to Golidaghi at the northeast end, there are 103 watershed areas (98 primary and five secondary areas). The total forested land in the watershed areas is 1,900,000 ha. Of this, 77,842 ha are shrub land in need of afforestation.

The general situation of the forest areas can be described as follows:

- Forests that have been degraded to such an extent that they cannot regenerate naturally and where the forest stand is less than 100 cubic meters. The total area covered is 495,858 ha or 27.1% of the total national forest area.

- Forests where destruction has taken place and are mostly covered by young masses of saplings and whose stand is between 100-200 cubic meters measure 479,823 ha or 27.2% of the total area of the Caspian forests. Operations to rehabilitate and replant these forests are needed.

- Good and high quality forests. The stand exceeds 200 cubic meters. Thick trees with high age classifications are the general norm. These forests cover 856,443 ha and comprise 46.7% of the total forest area.

In terms of slope, approximately 544,529 ha of forest areas have a slope of less than 15?and 882,584 ha have slopes between 15?-30?. About 124,989 ha have slopes between 30?-50?and 7,636 ha have slopes of over 50?. The minimum altitude in forest areas is 20 meters (in basin areas 2 and 4) and the maximum is 3,808 meters (in basin area 40 A).

The existing area of commercially usable forest stand is estimated at 260 million cubic meters. Because commercial forests are limited, the *per capita* commercially usable forest in 1991-1992, with respect to a population of about 60 million, was 0.02%. Thus, the commercial northern forests of the country are extremely important in providing the raw materials for the wood industry and the wood and lumber needed for workshops nationwide.

The important species of trees on commercially usable forests are:

Beech	*Fagus orientalis*
Hornbeam	*Carpinus betulus*
Oak	*Quercus castaneifolia*
Alder	*Alnus subcordata*

Maple	*Acer velutinum*
Linden	*Tilia caucasica*
Persian iron wood	*Parrotia persica*

In ***Annex 2***, a list of typical wood plant species is presented.

D. Forest users

According to statistics from 1987, in the northern forest regions, there are 4,316 populated areas, of which, 60% has one to 20 families and the rest over 20 resident families. 3,401 of these population areas are located inside the forests and the rest on the outskirts of the forest areas. The total population inside the forests is 464,562. The total number of families in permanent dwellings in 1987 was 165,071 and their total population was 1,061,391. In the entire northern watershed areas, there are 33,107 livestock units with 4,370,516 head of livestock. In terms of herding methods, the ratios are as follows:

- 34.4% migratory herders
- 36.2% semi-migratory herders
- 29.4% sedentary herders.

Regarding the number of animals, 78.4% of the herding units had less than 200 head of sheep and goats or 40 head of cattle. The remainder of the units had greater numbers of livestock. In addition to these animals, there are 1,427,030 livestock units for domestic (*katool*) animals in the watershed area dwellings.

The work force of the livestock units is 50,054 people, of whom, 32,258 breed animals and 17,796 are shepherds. About 40% of the breeders are above 50 years of age, while 48% of the shepherds are between 10-18 years old.

The annual consumption level of fuel wood by animal husbandry units totals 2,875,815 cubic meters and 84,690 cubic meters of wood were cut for use in stables.

The total number of animal husbandry camping groups inside forest areas is 28,521 and 57,042 ha of forests have been cleared to make room for these places.

The major destruction inflicted on forests in the north region includes:

- Revised grazing by livestock that endangers regeneration of trees.
- Grazing of livestock from main branches of trees.
- Transformation of forest to agriculture land and gardens.
- Transformation and destruction of forests for use as range lands.
- Use of forest wood for fuel. The annual consumption of fuel wood in this region amounts to 4 million cubic meters.

2.1.4. Rangelands

A. Area and description

According to available data and estimates, the Iranian rangelands is 90 millon ha which is approximately 55% of the total area of the country.

The national rangeland's can be divided into the following three vegetation groupings (*Figure 22* and *Figure 23*).

1. Grass ranges with good to average condition cover 14m ha. These are primarily located in mountainous regions and climatically good areas.
2. Shrub-land ranges with weak to average conditions cover an area of 60m ha and are found mostly in semi-steppe regions with rainfall of less than 200 mm.
3. Desert ranges covering an area of 16 million ha. are found in areas with rainfall of less than 100 mm.

Table 11 summarizes the condition and forage production of Iranian rangelands and Table 12 provides a distribution of rangelands according to province.

Table 11: Situation of Iranian rangelands and forage production

Types of rangelands	Area		Average production of dry forage (kg)	Annual production	
	Million ha	%		1000 tons	%
Grassy rangeland (Good to average)	14	15.56	290	4,060	40.6
Shrubland range (Average to weak)	60	66.66	92	5,520	55.2
Desert or destroyed range (Weak to very weak)	16	17.78	25	420	4.2
Total	90	100.00	111	10,000	100.0

Source: Technical Bureau of Rangelands, Forests and Rangelands Organization

Table 12: Rangeland distribution in Northern provinces

Province	Area (ha.)	Good	Average	Weak
Gilan	224,512	--	--	--
Mazandaran	924,000	--	--	--
Golestan	1,331,675	150,000	2,000,000	981,675
Total	2,480,187	--	--	--

B. Rangeland classification

Iran's vegetation cover is divided across various geographical areas with respect to climate factors and other ecological conditions. They are:

1. Khazar (Caspian or Hyrcanian) Flora
2. Baluchian Flora
3. Irano – Turanian Flora

Khazar (Caspian or Hyrcanian) flora

This foliage enjoys humid conditions throughout the year according to the prevailing climatic factors. There is no dry period for this flora, or if there is, it is of very short duration. These areas have forests or trees, or forest saplings bearing autumn leaves. In this verdure three ground levels can be discerned: lowland, medium-land and upland.

In the lowland area, with the exception of a narrow coastal strip where special annual rangeland plant species grow, there is no significant rangeland or grazing ground growth.

Annual Graminae (especially *Oplismenus undulatifolius*, *Setaria spp.*) are much more common than perennial Graminae. Of the latter, the following plants can be mentioned: *Andropogonischaemum glomerata*, *Brachypodium pinnatum* and *Poa spp. Dactylus*.

In very dry valleys and slopes are found Aristella bromodes and varieties of Melica, phleum Boemeri spp., Festuca ovina and Stipa spp. Cereal family plants are very low in number while particularly prominent are species of clover, annual or perennial Trifoloium, and several kinds of the perennial genus Onobrychis. Medium lands with altitudes of between 800 to 2,000 meters enjoy the maximum suitable atmospheric heavy rainfall, and in the areas receiving direct sunlight, rich varieties and species of perennial plants are produced including: *Dactylis glomerata*, *Brachypodium sylvaticum, Poa spp., Bromus spp., Melica spp, Agropyron Panormitanum, Aristella bromoides, Festuca montana and phleum bocmeri*.

Forage plants of the cereal family are very rare and include the following species: red clover, *Trifoloium pratense*, and white clover *Trifolium repens* and *lotus corniculatus* and *Coronilla spp.*, and *Cypress Onobrychiss spp*. In very high altitude regions, it is possible to find thorny Astragalus which is one of the elements of Irano-Turanian flora.

High elevations (from altitudes of 200 to about 2,700 meters have a very dry and very cold climate and and resemble semi-steppe high-altitude ranges.

Grass growth everywhere is very rich, but differs according to the level of precipitation, soil and general conditions of the land.

Gray perennial Graeminas consist of Dactylis glomerata, Bromus persicus and Festuca spp., Trisetum spp., Poa spp., and Agropyron spp.Forage cereals are almost the same as those mentioned for the previous region but Astragalus is much more abundant.

In very dry or eroded regions, hemispherical vegetation related to the high-altitude Irano-Turanian mountains such as Onobrychis cornuta and Astragallus spp.proliferate. In fact, the range area of this region is greatere than its forest region, particularly at the upper heights. Grazing grounds and ranges located above 2,700 meters are of the steppe, or Alp type, and are generally considered part of the Irano-Turanian region.

C. Variety of Users

Users of rangelands can be divided into the following three main groups:

1. Nomadic herders
2. Semi-sedentary herders
3. Rural herders

1. Nomadic herders

Nomadic herders are those range managers or livestock owners who during various seasons migrate between summer and winter ranges for feeding their animals. This group is further sub-divided into two classes:

a) Migratory nomadic herders

This group is part of the migratory herders, but due to special social conditions, they have a distinct nomadic system and hierarchy, and differ from other non-sedentary herders. The group is inter-related through specific clan, tribal and sub-clan relations, and in the past, they trekked as a group from winter to summer ranges. Ranges were specific, separate and limited for each sub-clan or clan but, in general, the tribal land of any single tribe was specific during an historic era. This group controls about 30 m ha of the country's rangelands. Most of the tribes migrate limited distances, but there are some, which move from region to region, or even

between provinces. In this system most of the tribal families move along with their livestock and their main profession is herding and livestock breeding.

b) Migratory Non-nomadic Herders

This group also migrates for feeding its livestock and uses summer and winter quarters. They do not have however a special tribal social structure and sometimes they trek between winter and summer quarters individually or very rarely in groups. This group is probably the remants of settled nomads of the past, or peasants who copied the ways of the migratory nomads by adapting to ecological conditions.

2. Semi-sedentary herders

This group of headers only migrates in one season and usually resides in rural or semi-urban areas. In this season they take their livestock to the winter or summer quarters with the entire family sometimes moving with the herd. In some cases, only parts of the active herding force migrate with the livestock and they spend the rest of the season working in their place of residence. Their main profession is herding but farming is a complementary activity.

3. Rural herders

This group's main form of livehood is agriculture while herding is a complementary activity. They rarely have more than 100 head of livestock and move them by way of seasonal co-operation to neighboring villages. Usually they employ a shepherd to herd their livestock.

D. Nomadic tribes and traditional rangeland management techniques

In view of its ancient history and land topography, Iran was one of the first regions to become populated by nomadic tribes. There are known records indicating that circa 700 BC, the Persian population was divided into six sedentary tribe dwelling villages and towns and two nomadic tent-dwelling tribes who were the ancestors of a number of the present nomadic tribes in Iran. These people took their livestock to the Middle East to sell their cattle, sheep and goats and to trade their surplus production of meat, wool and hides on the flourishing markets of the Middle East.

These nomadic tribesmen were the first to saddle the horse. They selected seeds of alfalfa from wild plants and planted them extensively around their tents. The Chinese took alfalfa and other fodder crops with them to China on the horses bred and trained by the nomadic tribes of Persia. Nomadic tribes were the ones to discover the medicinal value of many herbs and plants.

They were also the first to develop industrialization of crops and learn how to use alizarin and terebinth. Nomadic tribes believed that migration was a

source of revitalization and a factor contributing to their prosperity. Hence, they were never attached to a sedentary mode of life and never stayed in one area all year round. They believed that livestock and rangeland were the two determining factors in their life and tried their utmost to preserve and develop them.

These migratory pastoralists were very resourceful and were the first to dig wells and use the wheel to bring water to the surface for their animals. These virile, proud and independent nomads lived in harmony with nature and came to terms with its irregularities. Through practical experience, they learned a great deal concerning the principles of natural and environmental sciences. They continued to enrich their experiences and hand them down to their descendants for furthering the harmonies methods of treating the environment. The following section deals exclusively with these nomadic people's experience in the field of rangeland management.

2.1.3. Animals

2.1.3.1. Zooplankton

Zooplankton constitutes the secondary production in all water bodies. As a whole, the Caspian Sea is not rich in species diversity of zooplankton and therefore their number is limited relative to the area of the sea.

There are different reports concerning the zooplankton diversity in the Caspian, such as: Ghasemov (1987) mentioning 315 species and Bagherov (1983) with 235 species. Among these marine species are dominant and comprise 72.1% of the total species. If some fresh water species of Ural and Volga rivers were included, then the total number would exceed 315 species. From the origin point of view, they are endemic, Arctic and Mediterranean. The endemic and Arctic species are more abundant in deeper waters while the Mediterranean species are found almost throughout the sea and regarded as Euryhaline species.

In the south Caspian, Copepoda are dominant during the year. In spring and summer, they comprise 98.4% and 68.1% respectively.

The second abundant group belongs to Celadocera and the third are invertebrates. In winter, different kinds of Calanipda, Hydritemora and Galicilcopes are abundant in coastal waters. Others including Cladocera, Molluscan larvae, Mysids and Gammarids also exist but in small number.

The average biomass of zooplankton in the west of the south Caspian has been reported at 0.13 gr/m^3. In winter, the average biomass is 0.025 gr.m^3 in the west and 0.046 gr/m3 in the east. In the central parts, Copepoda and Mysids are dominant during the winter with an average biomass of 0.097 gr/m^3.

In summer, average biomass increases to 0.97 gr/m^3. The Balanus larvae are the most abundant species of the biomass even more than Copepoda.

In the Caspian's central reaches, the biomass is about 1 gr/m3 and most of which are Larvae of crabs and crustaceans.

In autumn, biomass increases but not in offshore waters. In such a way, the biomass in near shore waters is 0.25 gr/m^3 while in 50m depths is only 0.017 gr/m^3.

Generally, among the all diversities and biomass, Copepoda are the most abundant group of which Eurytemora Grimi, that constitutes 80-90% of the kilka's food regime, is the most abundant species.

A list of 34 zooplankton species available in southern Caspian is presented in ***Annex 3*** and comprises of Cladocer (20 species), Cirripedia (2 species), Ostracoda, Protozoa, Rotatoria, Foraminifera, and Caelenterata.

According to a new survey carried out for Copepoda of the southern Caspian waters, three sub-orders including Calanoida, Cyclopoida and Harpacticoida have been recognized. Calannoids are the main group with five species (*Acartia clausi*, *Limnocalanus grimaldii*, *Calanipeda aquae dulcis*, *Eurytemora grimmi*, and *E. minor*). In spring, Copepoda are the main population. In 1996, the total number of zooplanktons was between 4.8 to 20,143 (0.025 mg/m^3) in spring, 7,812 to 65,742 (0.04-0.4 mg/m^3) in summer, 10,850 to 34,406 (0.06-0.2 mg/m^3) in autumn, and 4,510 to 20,576 (0.02-0.1 mg/m^3) in winter.

Ecologically, *acartia* belongs to the Black Sea and Calanipeda is a Mediterranean species. *Limnocalanus* is an Arctic species and *Eurytemora* is an endemic to the Caspian. *Acartia*, which has been transferred to the Caspian since 1980, has been dominant in the coastal waters since 1996.

The seasonal changes in the density and distribution of acartia, copepoda, zooplankton and eurytemora along the Southern Caspian coast is presented in ***Figure 24, Figure 25, Figure 26, Figure 27, Figure*** 28***, Figure 29, Figure 30, Figure 31, Figure 32, Figure 33, Figure 34, Figure 35, Eurytemora Biomass*** in the Southern Caspian Sea (Autumn 1996)

Figure 36***, Figure 37, Figure 38 and Figure 39***, respectively.

2.1.3.2. Zoobenthos

The Caspian Sea benthos fauna is divided into four geographical divisions comprising endemic, Mediterranean, Arctic and freshwater species. They consist of micro benthos and macrobenthos.

Ghasemor (1978) estimates that the total Caspian benthos species number 885, out of which uni-cellar, nematodes, mollusks and crustaceans are the

main groups. Accordingly, ciliata have 305 species, nematodes 52, mollusks 116, amphipods 74 and ostracods have 46 species.

The number of species is most abundant in coastal waters (0-50 m) and in deep waters (500-1,025 m) the Arctic crustacean species are found.

Bagherov (1983) holds that the total number of benthos in the Caspian is 795 species, out of which microbenthos are 367 species and forms (16 foraminifers, 305 infauna and 46 ostracods) and macrobenthos are 428 species.

He estimates that the number of macrobenthos in the southern Caspian is 145 species (193 middle and 90 north) among which endemic species are predominant.

According to Ghasemov (1987), there are about 589 species of benthos out of which 47% (279 species) are ciliata. On the west coast, there are 223 species mostly living in depths of 10-50 m. The dominant species are bivalves (mytilaster, abra and dresisena) which comprise about 70% of the total benthos. The second group belongs to crustaceans among which balanuses (68.3%) and crabs (25.1%) are dominant.

The first investigation of zoobenthos along the Iranian coasts of the south Caspian was carried out by Vladimir Sekaya in 1973. He investigated coastal areas of a depth of 0-30 m in the western end of the sea and found many major groups including foraminifers, nereis, nematodes, oligochaetes, ostracods, balanus, comacean, gammarids, crabs, abra, mytilaster, hypania and snails. The highest number was found at a depth of 19 m with 64.1 gr/m2 and at a depth of 24m with 49.2 gr/m2. The lowest number was found in Morghal Bay with 3.1 gr/m2. From a biomass point of view, abra with 40.4 gr/m2, then, cerastroderm with 7.6 gr/m2, crustaceans with 13.2 gr/m2 and nereis with 7.2 gr/m2 were the most dominant species. The biomass of oligochaetes was 0.6, balanus 0.1, comaceans 0.3 and amphartids was 0.8 gr/m2.

He calculated the average biomass of zoobenthos in the whole of the southern Caspian as 18.24 gr/m2; the number specimens at 7,995 /m2; and the total biomass from shore to the depth of 100 m, equal to 49250 tons. The most abundant groups were (1) amphartida, (2) abra, (3) comaceans, (4) nereis and (5) cerastoderm respectively.

From that, 85.7% were Mediteranean and Atls fauna (crustaceans) and only 14.3% were endemic.

Another research was carried out in 1989-1990 by Gilan Fisheries Research Center. This focused on the Sefid Rood estuary down to a depth of 100 m., the following groups were recognized: nereis worm (average 21.09 gr/m^2), tobifax worm (18.13), gammarusc (1.18), chraphium (1.65) hypania (1.13), cardium (148.26), abra (46.29) and mysis (6.8 gr/m^2).

The benthos average biomass was measured 30.61 gr/m^2 which is much greater compared to Sekaya's study. The average biomass in the central part of Babolsar was 15.4 gr/m^2 and 8.6 gr/m^2 in the eastern coasts in Gomishan and the Torkman fishing area. Therefore, the benthos biomass decreases gradually from west to east.

The investigation of Ghasemov (1987) shows that the biomass of benthos in the whole Caspian decreases from the south Caspian to middle and then to the north. The biodiversity of the south Caspian is also more than upper parts of the sea shows these results (***Table 13***).

Table 13: Benthos biomass in different part of the Caspian Sea

Region	Biomass (gr/m^2)	Total Biomass (Million tons)	Annual Production (Million tons)
North Caspian	29	2.4	4.8
Mid Caspian	66	10.6	21.2
South Caspian	121	19.0	38.0

Source: Ghasemov, 1987

In the latest research on determination of species richness and biomass of benthos, the following results have been obtained:

Some sixty species belonging to major taxa including bivalves (5 species), crustacean (47 species), polychaetes (4 species) hyrodinea (1 species) and other groups (balenus, chironomidae, oligochaeta and nematoda).

Polychaetes comprise 38.5% of all benthos and then amphipoda (26%), oligochaeta (16%), cumacea (15.3%), bivalves (3.2) and others 13.4%. The maximum numbers were observed in spring (7,354 /m2) and the minimum in autumn (4,309 /m^2). The amount of biomass increases from west to east and a decrease from shallow to deeper depths. The average biomass for the whole area was equal to 10.8 gr/m^2 (min. 7.6 - max. 14.4 gr/m^2) that is less in comparison to other parts of the sea.

In ***Annex 4***, the list of species identified to date by different researchers are represented. In addition, in ***Figure 40***, the distribution of benthos biomass is shown.

2.1.3.3. Mollusks, crustaceans and others

Mollusks, especially bivalves and gastropods are among the major groups of mollusks in Caspian Sea. Several studies have been carried out to investigate and identify their biodiversity, distribution and biomass along the southern coasts, since they are regarded as one of the main food sources for many fish species, especially sturgeon fish.

So far, at least 50 species of bivalves belonging to 19 genera, and at least 86 species of gastropods belonging to 18 genera have been identified in Iranian side more research is underway to thoroughly investigate them. The list of these aquatics along with other organisms such as amphipods and decapods are provided in ***Annex 5***.

2.1.3.4. Fishes

In the Caspian Sea, some 100 fish species have been identified which is less diverse in comparison to open waters. As an example, there are 540 and 180 fish species in the Mediterranean and Black Sea. From the Caspian fishes, Clupeidae, Cyprinidae and Gobidae are the most abundant group and constitute more than 70% of the total. The endemic species belong to Clupeidae and Gobidae.

The first origin of Caspian fish is different. Some such as Clupeidae and Gobidae are saltwater in nature and the others are originally freshwater species, such as Acipenseridae, Salmonidae, Cyprinidae and Percidae (perch and pikeperch). Acipensers are found all over the sea and there is an established fishery for them in all Caspian littoral countries.

Many exotic fish species have been introduced to the Caspian ecosystem, such as mullets and atherinids.

In the south Caspian (the Iranian coastal zone), more than 85 fish species exist, a list of which is presented in ***Annex 6***.

Among the different Caspian fish species, Acipensers are regarded as a protected species and their utilization is severely controlled by fishery regulations imposed by the government. This consists of size control; fishing reason, tackle restrictions, etc. There is also an intense artificial breeding program for the rehabilitation of the population. A fingerling release scheme has been in place for the past decade. It is an established and important routine for fisheries management in Iran. In ***Table 14*** statistics for different species are represented, which include kutum, acipensers, salmon, roach, etc.

In spite of the fingerling release program the salmon population has yet been not recovered and is still regarded as a rare and over-fished species. The white fish population has been revived and has led to a catch increase since the beginning of program. This is also the case for other species, e.g. sea bream, pike- perch and roach.

2.1.3.5. Birds

According to statistics, there are 9,648 bird species in the world, out of which 497 species are found in Iran and 30 of these species have been reported only once or twice in the country. Therefore, it is certain that Iranian bird species are at least more than 460 species. From these, 140 species are endemic and 95 species are migratory. They leave the country

with the onset of autumn and move to warmer regions in other countries, especially Africa. Hundred other species are semi-migratory species. From 100 migratory species, 80 migrate to Iran in autumn, especially to the Caspian region, only for wintering. The other 20 species fly over the country and do not remain during winter.

It is estimated that there are about 200-250 bird species in the Caspian region, some are native, some migratory or semi-migratory. According to the IUCN checklist, some of these birds are rare or endangered and are protected by law. The Department of the Environment of Iran has accordingly provided a regulatory list for the hunting of birds, especially protected migratory species.

The list of at least 250 bird species is provided in ***Annex 7***. This list has been prepared according to the areas they have been found. These areas are protected; therefore, it doesn't mean that these birds are not found somewhere else.

Table 14: The catch trend of Caspian fisheries (kg)

Species	1989	1990	1995	1998
White fish	14,016	15,627	11,792	14,336
Acipensers	3,149	4,343	9,125	2,455
Salmon	-	155	800	510
Bream	-	66	11,220	1,379
Pike - perch	-	118	227	361
Roach	-	-	-	14
Marine carp	7,117	-	-	2,394
Total	24,282	20,309	33,164	21,449

Source: Iranian Fisheries Statistics 1993-1998, 1999.

2.1.3.6. Mammals

The Caspian seal, Phoca *(Phoca caspica)*, is the only mammals in the Caspian Sea, and the only representative of the order pinnipedia, family phocidae, genus phoca. The Caspian seal is distributed throughout the entire Caspian Sea. They generally prefer resting on the gently sloping shorelines or islands, avoiding reedy and populated areas. North Caspian accomodates large number of seals in the autumn and winter, where they give birth to their children and molt. In the spring and summer, healthy seals move to the middle and south Caspian to forage. Caspian seal have been observed in small groups in the south (Iranian part) during the spring and summer. During autumn, the seals return to the North Caspian.

Density of seals in the North Caspian during the winter is in average 13-14 individuals per km^2, occupying a habitat of 1700 km^2. Breeding takes place both in the western and eastern North Caspian region.

The Caspian seal occupies the highest trophic level in the food chain and feeds on fishes that have little or no commercial value i.e. clupeidae, siluridae and crustaceans.

In the 19th century, the seal population was more than one million individuals but at present, it has been estimated to be of 500-600 thousands only. Exploration of oil and water pollution is possibly main contributors to the decline of the seal population.

A few other species of mammals have also been seen in the coastlines including otter, *Lutra lutra,* marten (*Martes sp.*) and shrew.

2.2.Ecosystems

2.2.1. Critical habitats and biotopes

The most important habitats of the southern regions of the Caspian Sea are situated in two main areas. Firstly, Anzali Complex which is a coastal lagoon, and secondly, Gorgan Bay which is a coastal bay. Some detailed information is given herewith.

2.2.1.1. Anzali Wetland

Anzali Complex is the most important wetland in the southern Caspian region. This wetland is of great importance due to its diversified habitats. Selkeh and Siahkeshim totaling 4860 ha are protected and 15000 ha of the area are designated as an International Wetland according to Ramsar Convention. This wetland also provides spawning ground for the most favorite fish of the Caspian Sea including kutum *(Rutilus frisi kutum)*. 2.3. shows the situation of the Anzali wetland.

Anzali Complex is in fact a coastal lagoon in the southwestern parts of the Caspian Sea and is situated in the south of Anzali town. Average length of this complex is about 30 km and its average width is about 3 km, sometimes exceeding 12 km. Area of this complex is subject to seasonal variations of water. About 60 years ago, it covered an area of 259 km^2. Now, it is only 100 km^2. The depth of Anzali is also subject to changes. The average depth is about 3 meters. This lagoon has a passage to the sea with the width of 426 meters. Total precipitation is about 1500 to 2000 mm / year and 11 tributary rivers flow into Anzali Complex. The complex is also connected to the sea by means of five river streams. Anzali marshes could be divided into three sections: the central section (in the east including Sheyjan), the western section (west wetland) and the southern section (Siahkeshim). All these three water bodies form one unit wetland and although apparently they bear some similarities, they have distinguished specific differences. One of the most specific characteristics of Anzali complex is the presence of numerous islands in the complex namely Shalom-goddess, Mian-poshte, Nover, Galugah, Tardarya and Torab-godeh.

The total amount of sediments carried to the wetland is estimated to be 390 tons/year. The waterbed of the complex is covered by sandy sediments and occasional shingles, which are mixed with rich mineral and organic matter. A total of 4898 tons of nitrogen and 378 tons of phosphorus is estimated to be transported to the complex each year, out of which only 40 % remains in the wetland and the rest are carried to the sea. These minerals are used up by multi-cellular plants of the marshes. In the Anzali wetland occurrence of marsh bloom represents eutriphication. Average temperature of the Anzali wetland is about 16?C, which ranges from 4.5?C in February to 27.5?C in August. The concentration of dissolved oxygen in the water depends on the depth of water flow of water and the amount and type of vegetation cover. The dissolved oxygen ranges from 1 to 13 mg/l., COD ranges from 13.8 to 176.4 units, pH is also variable and ranges from 7.82 to 9.16. The alkalinity is reduced as distance from the shore toward the open sea increases. The amount of hardness of water (Ca^{++} and Mg^{++}) is estimated to be 390.24 and increases approaching the seawater.

The salinity of Anzali wetland has been recorded in different seasons and the following figures have been obtained.

1. Siahkeshim, salinity 0.23 ppt
2. Sheyjan, salinity 0.43 ppt
3. Western wetland, salinity 0.7 – 25 ppt
4. Channels salinity 1.57 – 2.1 ppt

About five different phytoplankton phyla have been identified in Anzali wetland, of which Cyanophytes are dominant. During autumn and winter, highest population density of phytoplanktons has been observed. In addition, the average amount of Chlorophyll a, considered as an index of primary production, is equivalent to 8.98 ?g/l. Its concentration changes with seasonal and locational variations. Ten different zooplanktons have also been identified in Anzali complex among which arthropoda, rotatoria and protozoa are the most dominant zooplanktons. The tubificidae and chironomidae are the most abundant families of benthose contributing to (97%) of the population density of the benthos. There are also some other organis ms including bivalves, crustaceans, insects and worms.

Anzali wetland and its tributaries are habitat of 12 families, 34 genus and 41 species of fishes, some of which are migratory. Three species of amphibians and some reptiles including snakes and lizards have also been identified in the region and a total of 150 species of birds have been listed as inhabitants of the Anzali wetland as well. A few species of mammals have also been seen in the coastlines including Otter (*Lutra lutra*) Marten (*Martes sp.*) and Shrew.

Vegetation cover of the wetland could be divided into four major groups:

The swamp plants forming the marginal vegetation of the Anzali wetland, e.g. *Almus glutionsa* ; *Gledischia caspian*; *Pterocarya fraxinifolia*

The emerging plants that are rooted in the bottom sediments with their lower part submerged in water but their leaves and flowers emerged out of water. These plants have an important role in sheltering local water birds, e.g. *Phragmites sp* ., *Carex sp*., *Juncus sp.*; *Thypha sp.*

The submerging plants, which are fully under the water and only the flowering parts, may be seen on the surface water. These plants are important food source for fishes, e.g. *Batrachium sp., Najas sp.*

The floating plants, which are rooted in the bottom sediments and have their leaves floated on the surface water. These plants are important not only because they reduce the light penetration in the water column but also help in bottom sedimentation e.g. *Lemma sp., Salvinia sp.*

2.2.1.2. Gorgan Bay

This bay is situated in the southeastern part of the Caspian Sea (***Figure*** 41), and forms a cape running into the sea for a distance of 60 km. covering an area of 40000 ha. The width of the bay varies from 4 km in the west to 12 km in the east and covers an area of 40,000 ha. The depth of the bay varies in different parts, from 0.3 to 3.4 meters. This bay contains 550,000,000 m^3 of water and is connected to the sea by a passage of about 600 meters wide with 2.5 meters of depth. This bay is surrounded by land in three sides. The Miankaleh Peninsula is situated at the northern part of the Gorgan bay. Water of this bay is more saline than the Caspian Sea and the pH is alkaline. The shelter that the bay has provided for the wildlife has rendered this bay prominent natural habitat for a large number of waterfowl. This area is therefore designated a Wildlife Refuge Center and is well protected. This bay also is an International Center for the Conservation of Waterfowl, and in 1976, it was designated as a Natural Biosphere Reserve, and it happens to be the only reserve in the northern coast of Iran.

Bandar-e-Torkaman is the only active harbour of this bay. Bandar-e-Gaz in the south of the bay, and Ashura Deh, in Miankaleh are two important towns in the region. There are, however, some other small villages in the region whose main activities include fishing and animal husbandry.

A number of fresh water rivers, (permanent or seasonal) flow into the Gorgan Bay. The volume of water carried into the bay is estimated at about 76.5 million m^3 per year. The sum of 229.5 million m^3 should be added to the above figure as direct precipitation. Hence total volume of water carried to the Gorgan Bay exceeds 360 million m^3. Average annual evaporation from the bay is estimated at 420 million m^3, which makes the total balance of the bay negative in the first half of year and positive in the second half. Each year about 249 million m^3 of water enters the bay from the sea and 135 million m^3 of water leave the bay towards the sea.

Therefore, the total volume and level of the water in the bay is almost constant.

The average surface water temperature in Gorgan Bay is 19.1?C and the amount of oxygen in the water varies from 11.1 to 2.4 mg/l., pH of the water is 8 to 8.5, and TDS has direct relation with conductivity of water. The maximum TDS in March equals to 15052 mg/l and its minimum is 11.23 mg/l in February. The average TDS is around 213.4 units.

Water of the Gorgan Bay is hard and the hardness increases during the warm seasons. Concentration of Nitrates (NO_3) vary between 0 to 2.6 mg/l and Phosphate, PO_4, varies between 1.1 to 2.65 mg/l. Major groups of phytoplankton identified in the waters of the bay include: Cyanobacteria and golden & brown algae. Diversity of plankton is far greater than zooplankton. June is the most fertile month for the phytoplankton of the bay. Zooplanktons of Gorgan Bay belong to nine groups and species of fresh water. The Zooplankton population density is highest in July.

The vegetation in this bay could be divided into two groups of marginal species, dominated by fragmites and the floating species. About 17 species of invertebrates, four species of crustacean, and a number of worms have been identified in the bay. Fifteen different species of fish have also been identified including mullet, carp, kutum (*Rutilus frisi kutum*), pike-perch and etc. Kutum (*Rutilus frisi kutum*) is the rarest fish and mullet (*Liza auratus* and *Liza saliens*) the most prevalent ones. Gorgan Bay is also important as a spawning ground for certain types of fish. In Gorgan Bay and the adjacent areas, there are 260 species of birds out of which 90% are migratory species. Caspian seal also resides in the bay. Otter and some species of Shrew and Jackals are also common in the shores of the Bay.

2.2.2. The coastal protected areas and biosphere reserves

The coastal provinces of I.R. Iran comprises of 59,263 km^2 of land and only 4% of which is under 15 environmental protection management projects including: One National Park, three National-Natural Monument, eight Wildlife Refuge, and two Protected Areas. Protected regions include three Wildlife Refuges, one Protected Area, and one National Natural Monument with an area of 749 km^2 located on the Caspian coastline (***Table 2.5.***). The protected coastal areas (***Table 2.6***) are refuges. ***Figure 41*** and ***Figure 42*** shows the coastal protected areas in the south of Caspian Sea. About 283 species of birds, which constitutes 62% of the total bird species of the country, have been identified in these coastal areas. Approximately 90% of the water bird species are seasonal migrants and only 10% of them are permanent resident of the protected areas.

Moreover, these protected coastal areas are the only habitat, for the temperate-type forest plains existing in the entire Caspian region. These forest plains are the habitats for several rare and endangered coastal plants e.g. Lavandevil Wildlife Refuge and the Khoshkedaran National-

Natural Monument. The above-mentioned protected coastal areas are under the direct influence of hydrological patterns, environmental stresses and pollution of the Caspian Sea.

Table 15: Status of Protected Areas on the Northern Provinces of Iran

				Protected Region							
				National Park		National Natural Monument		Wildlife Refuge		Protected Area	
Province	Area of Province (Km2)	Protected Areas (Km2)	Percent of Protected Areas	Area (ha)	No.	Area (ha)	No.	Area (ha)	No.	Area (ha)	No.
Gilan	14,711	401	2.7 %	--	--	1.2	2	2,539	3	37,550	2
Mazandaran	44,552	1,994	4.5 %	91,895	1	227.0	1	76,640	5	30,600	1
Total	59,263	2,395	7.2 %	91,895	1	228.2	3	79,179	8	68,150	3

In the last decade, sea level fluctuation has caused drastic damages to the coastal areas. Illegal hunting; bush and tree cutting; over grazing, sand and gravel mining and land reclamation are some of the other most important problems of the areas.

Different management systems are required for different protected coastal areas, based on the physical and biological features of the area. It may be possible to utilize protected coastal areas for a specific goal within the limits determined by the proper managing plans and within the tolerance level for that area. In the Iranian Caspian coast an important Biosphere Reserve exists for which no environmental protection measures or management is developed.

Management of the protected coastal areas is based on types of the protection (National Park, Wildlife Refuge, etc.) and bio-physical characteristics of the area. Each protected coastal area is governed by different regulations. However, the basic, of the management for all the protected areas is the same and is based on the proper zonation and an environmental assessment to achieve an adequate use of the area. For example, part of a protected coastal area or wild life refuge could be utilized for grazing, provided it is done within the area's pastoral capacity and condition and through a proper management.

Moreover, recreational use of these areas is not prohibited provided it has harmony with the condition and environment of the area.

Preservation of parks, reserves and other protected areas are necessary if the natural heritage of mankind is to be protected. The habitats and bio-resources of the Caspian Sea have to be protected through a proper management implemented by all the Caspian states in their respective coastal areas.

Table 16: Protected coastal regions in the Iranian side of Caspian Sea

Region		Province	Latitude	Longitude	Area (ha)	Type of management	Vulnerable animal community	Identified bird species	Migratory bird species	Vulnerable plants community	Threats
1	Lavandevil	Gilan	38° 18'- 38° 23'	48° 51'- 48° 53'	949	Wildlife Refuge	Grebe, Cormorant, Faisan, Pintail	163	91	Black Alder Caspian honey locust Caucasian Walnut.	Illegal hunting, Tree Cutting, Bush Extraction, Reclamation Sand Mining, Over grazing Roadways
2	Selkeh	Gilan	37° 28'- 37° 29'	49° 40'- 48° 45'	360	Wildlife Refuge	Dalmatian Pelican	154	84	Brackish water marshes	Illegal hunting, Bush Extraction, Reclamation, Overgrazing.
3	Siahkeshim	Gilan	49° 17'- 49° 25'-	37° 22'- 37° 27'-	4,500	Protected Area	Cormorant, Grebe, White-fronted goose, Pintail, whooper swan	149	85	Brackish water marshes	Illegal hunting, Bush extraction, Reclamation, Over grazing.
4	Khoshkedaran	Mazandaran	36° 44'	51° 04	227	National-natural monument	Herons	29	62	Black alder Caucasian walnut	Tree cutting, Power lines
5	Miankaleh	Mazandaran	36° 46'- 36° 49'	53° 30'- 54° 02'	68,800	Wildlife refuge	Pelican White-fronted goose, Gray lag goose, Faisan, Greater flamingo, White-headed duck	260	89	Brackish marshes	Illegal hunting, Tree cutting, Reclamation, Over grazing, Sand mining, Bush extraction.

2.2.3. Important wetlands and their status

Despite the extensively rugged terrain and a climate of great extremes, Iran is one of the most important wintering areas of waterfowl birds from the northern Asian continent including Siberia. The most important wintering areas for waterfowl border the Caspian, notably at Anzali wetland and the bay of Gorgan, with the Miankaleh Peninsula bordering the north. According to the Ramsar Convention, there are 3 sites designated as Ramsar sites, a summary of which are as follows:

2.2.3.1. Anzali Wetland Complex

A. Location

The Anzali Wetland complex (37?23?-37?37?N - 49?35' E), is situated on the south - west shore of the Caspian Sea north-east of Rasht and adjacent to Bandar-e-Anzali town on the northern boundary in Gilan province, northern Iran. The area of the Anzali wetland complex is 15,000 ha (including Anzali wetland 10,990 ha, Siahkesheem marsh lands 3,650 ha and Selkeh Ab-bandans 360 ha).

B. Degree of protection

It is mainly government owned, with some private Ab-bandan (reservoirs). The wetland is administered by a council under the supervision of the Department of the Environment (DOE). Anzali wetland is not officially protected, although Siahkesheem has been protected as a wildlife sanctuary since August 1967, and Selkeh since 1970. However, during 1978-83 even these areas could not be effectively protected and was designated as a Ramsar Site at the time of ratification on 23 June 1975.

C. Site description

The designated area comprises of the Anzali wetland, which is a coastal lagoon, the associated Siahkesheem marshlands and the semi -natural flood plain and marshes of the Selkeh Ab-bandans (reservoirs). Anzali wetland is a large shallow eutrophic freshwater lagoon fed by several rivers, streams (including tributaries of the Sefid-rood River), rainfall and run-off from the high lands of Rasht. It is separated from the Caspian Sea by an established dune system with only a narrow drainage channel flowing into the sea just east of Anzali port. Moderate seasonal fluctuations in water level (autumn/ winter) sometimes result in flooding of the Siahkesheem marshes and nearby pastures. The abundant floating and submerged vegetation includes species of duckweed *(Lemna)*, pondweeds (Potamogeton), (*Elodea)*, milfoil (*Myriophyllum)*, hornwort (*Ceratophyllum)* and arrowhead *(Sagitaria)*. The lake is fringed by reed-beds of *Phragmites communis* and *Typhas spp.*, with rushes *Scirpus spp.* and *Cyperus spp.*, willow and alder *(Salix spp., Alnus spp.)* on drier ground. The adjacent Siahkesheem eutriphic freshwater marshlands are fed by numerous rivers (including the Hohambar, Chakoor, Siahdarvishan and Nargestan), irrigation channels and rainfall. It drains into the lagoon to the northwest, and is periodically flooded when rainfall is heavy. The marshland

vegetation is similar to that of the lagoon, with the lack of species of *Ceratophyllum, Alnus* and *Scirpus* absent but presence of species of water chestnut *(Trapanatans)*, sedges (*Carex)* and rushes *(Juncus)*. The Selkeh Ab-bandans comprises of a semi- natural flood plain and eutriphic marsh with constructed along the northern edge for water storage.

They have flooded herbaceous vegetation, with algal growth during summer, some reed-beds *phragmites communis* in the north and stands of rushes *(Juncus spp.)* and damp grassland in the south. The wetland is surrounded by cultivated land (rice), sand dunes, numerous small reservoirs and patches of forest to the south. Several small settlements border the area, and the town of Bandar-e-Anzali is on the northern shore of the lagoon. Mean annual rainfall is 1,000-2,000 mm and temperature range from 11?to 30 ?C.

D. International and national importance

Wetlands are important feeding and resting station for breeding, migrating and wintering birds. The nesting birds in the lagoon or in the Siahkesheem marshes include great crested grebe *Podiceps cristatus*, black-necked grebe *P. nigricollis*, purple gallinule *Porphryio porphyrio*, herons *(Ardeidae)*, rail *(Rallidae)*, pygmy cormorant *Phalacrocorax pygmaeus* and a large colony of whiskered tern *(Chlidonias hybrida)*. Apart from coot *(Fulica atra)*, few duck *(Anatidae)* breed in the wetland but in winter it is a very important refuge for surface-feeding and diving ducks, swans *(Cygnus spp.)*, herons and coot. Many herons, ducks and grebes pass through the wetlands on their migration rout. Selkeh reservoirs are of particular importance as a feeding and resting area for birds coming more disturbed Anzali lagoon.

E. Changes in ecological character

The lagoon area is highly disturbed by commercial fishing, hunting of wildfowl, livestock grazing, reed cutting along the edges, and considerable boat traffic (port Anzali). The fluctuations in the water level in the Caspian Sea will undoubtedly affect the wetland habitat in long term (Reed-beds of *Phragmites communis* are spreading into open water areas).

F. Management practices

Hunting of wildfowl is prohibited in the Selkeh Ab- bandans reservoire , which are used as waterstorage. Reed cutting and grazing are permitted on the Siahkesheem marshes.

2.2.3.2. Bandar-e-Kiashahr Lagoon and the mouth of Sefid-rood River

A. Location

Bandar-e-Kiashahr is located at 37?25?N ,49?19?E. It is situated in north-northwest of the city of Rasht (15 km far from Rasht), and east of Anzali

complex wetland (Ramsar Site) of the Caspian Sea in Gilan Province, northern Iran (Fig.6). It covers an area of 500 ha.

B. Degree of protection

It is government owned, and is administered by the Department of the Environment. Unprotected except for Ramsar designated as a Ramsar site at the time of ratification on 23 June 1975.

C. Site description

The designated area comprises of the lagoon, the mouth of the Sefid-rood River and associated marshes and grassy dunelands. The shallow freshwater coastal lagoon and swamp are fed by two streams diverting from Sefid-rood River to the west, and they drain northward through a narrow channel into the Caspian Sea. The freshwater input is supplemented by seepages and rainfall, and (although fluctuations in water level tend to be less) there can be some flooding in winter. The lagoon bottom is a mixture of sand and mud, and the water is predominantly oligotrophic except at the marshy western extreme. Reed-beds of *phragmites communis* and *Typhas spp.* predominate in the west, with stands of rushes *(Juncus spp)*, in the eastern and southern marshy areas. Scrub and dune vegetation predominates on the higher ground in the north and northwest, with grasslands subject to periodic flooding along Sefid-rood River. There are several settlements to the south of the lagoon, surrounded by cultivated land with patches of woodland. The two streams from Sefid-rood River are used for supplying local irrigation schemes.

D. International and national importance

The site is of major importance as a wintering area for waterfowl, including grebes *(Podiceps spp.)*, dalmatian pelican *(Pelecanus crispus)*, greater flamingo *(Phoenicopterus ruber)*, herons *(Ardeidae)*, greylag goose *(Anser anser)*, shelduck *(Tadorna tadorna)*, gulls *(Laridae)* and some wades *(Limicolae)*. It is a breeding site for cormorant *(Phalacrocorax carbo)* and several species of heron *(Ardeidae)*. It is of less importance as a resting station with moderate numbers of passage species.

E. Changes in ecological character

A new fishery has been established on the lagoon. There is serious hunting and over-grazing pressure in the area and the level of disturbance is increasing with as the sport and recreational activities increases.

F. Management practices

Traditional reed-cutting, livestock grazing and commercial fisheries.

2.2.3.3. Miankaleh Peninsula, Gorgan Bay, Lapoo-Zaghmarz reservoirs

A. Location

It is located at 36?50? N, 53?17? E. Situated on the southeast shore of the Caspian Sea, in Mazandaran Province (Fig. 6). It has an area of 40,000 ha (designated as 100,000 ha in 1975).

B. Degree of protection

It is owned by the government of I.R. Iran. Miankaleh Peninsula and Gorgan Bay (about 4,000 ha) lie within Miankaleh Wildlife Refuge (81,180 ha), which is part of Miankaleh Protected Region (97,200 ha) established in 1970. The wildlife refuge is administered by the Department of the Environment. About 68,800 ha were approved as a Biosphere Reserve in 1976. Lapoo-Zaghmarz reservoirs to the west are not included in any protected area. Designated as a Ramsar Site at the time of ratification 23 June 1975.

C. Site description

The designated site is 18-25m below sea level and comprises of the open shallow saltwater (10-12%) of Gorgan Bay, the dunes of Miankaleh Peninsula, which virtually cut the bay off from the Caspian Sea (there is a 12 km wide channel in the east), the mud flats and seasonal brackish marshes surrounding the bay, and Lapoo-Zaghmarz Ab-Bandans (reservoirs). The saltwater bay has a sand and mud bottom and is oligotrophic. The extensive marshes along the southern and eastern shore, which are flooded in autumn and winter, are eutrophic due to inflow from numerous freshwater streams, agricultural run-off and irrigation channels. The nuddy-bottomed freshwater lakes and marshes are fed by irrigation, run-off and rainfall. Vegetation fringing the bay is predominantly glasswort *(Salicornia sp.)*, sedges *(Carex spp.)* and rush *(Juncus sp.), w*ith some small reed-beds of Phragmites *Communis* and *Tamarix sp.* There is a strip of vegetated sand dune along Miankaleh Peninsula, with some pomegranate *(Punica sp.), and* scrub. Lapoo-Zagmarz reservoirs are characterised by extensive reed-beds *(Phragmites communis)*, with stands of reedmace *(Typha sp.)* willow *(Salix sp.)*, *Ribes sp., Rubus sp.,* and pomegranate and abundant submerged vegetation. Grasses of the genera *Agropyron, Bromus, Dactylis, Cynodon* and *Festuca* are predominant on higher land, with a shrub layer of hawthorn *(Crataegus sp.)*, pomegranate, buckthorn *(Rhamnus sp.)* and *Rubus sp.* Cultivation bordering the bay in the south is predominantly wheat and cotton. There are several small villages along the southern and eastern edge of the bay linked by road and rail. The area has variable annual rainfall (200 mm-1000 mm), and a temperature range of -6? to 34?C.

D. International and national importance

This coastal area is of great value as a wintering ground for over a quarter of a million birds, including dalmatian pelican *Pelecanus crispus*, greater flamingo *(Phoenicopterus ruber)*, greylag goose *(Anser anser)*, lesser white fronted goose *(A. erythropus)*, swans *(Cygnus spp.)*, red-breasted merganser *(Mergus serrator)* and the rare white- headed duck *(Oxyura leucocephala)*. The number of breeding birds is greatest in year of high summer rainfall, and includes heron *(Ardeidae)*, pratincole *(Glareola pratincola)* in large colonies, Kentish plover *(Charadrius alexandrinus)*, little tern *(Sterna albifrons)* and a large colony of whiskered tern *(Chlidonias hybrida)*.

E. Changes in ecological character

Considerable areas are used for livestock grazing; the unprotected Lapoo-Zaghmarz reservoirs have been subjected to heavy hunting pressure; and nearby irrigation, schemes may reduce the flow of fresh water into the bay system.

F. Management practices

The wildlife refuge is managed as a nature reserve. A major programme for wildlife management was outlined in 1974 but there is no recent information on its implementation. There is reed cutting and fishing by the local population in the protected area, and considerable areas are used for livestock grazing.

Chapter 3:
Socio-economic Environment

3.1. Demography

3.1.1. Populations

3.1.1.1. General trend of the country

The sharp demographic change in the Islamic Republic of Iran in recent decades has had significant economic and social consequences. It is important to carefully review this topic in order to assess the future impact it will have on various aspects of national life, especially on the environment

In the 1976 national census on population and housing, Iran's citizenry numbered 37.7 million and had grown at an average rate of 2.7% per year since 1966. By 1986, the annual growth rate of inhabitants soared to 3.9%, and reached 49.4 million (*Table 17*). In the following years, this increase continued and the natural annual growth rate stood at no less than 3.2%, which was still very high. By 1996, Iran's population had risen to 60.05 million but the annual population growth rate had slowed to 1.47%.The most important reason for this considerable reduction was a corresponding reduction in fertility. It is expected that by 2006, the populace would be 70.34 million with 67.2% living in urban areas.

Table 17: Changes in the population size and growth rate

Year	Population (1000)	Growth rate (%)
1976	33,708	-
1986	49,445	3.91
1991	55,837	2.46
1996	60,055	1.47

It is projected that by 2006, 27.63% of the population will be under 15 years of age, 67.67% will be in the 15-65 age group, and 4.7% will be over 65. It is expected that the annual population growth rate will rise slightly to 1.59%. During this decade, the percentage youth of the population will decline as the median age increases to 24.05 years.

Because of the growth rate expansion from 1976 to 1986 and its subsequent decline from 1986 to 1996, the median age fell slightly from 17.4 years in 1986 and then climbed to 19.4 years in 1996. These demographic shifts mean that the country's potentially active population, having jumped from 25.4 million in 1986 to 33.7 million in 1996, will likely reach around 47.6 million in 2006 (*Chapeter 3:*

Figure 43 and *Figure 44*). This substantial increase in the workforce will soon translate into a high demand for jobs. Thus creating

employment will be one of the greatest challenges the country has to face (*Figure 45*).

3.1.1.2. Population growth, urbanization and the environment

From 1976 to 1986, as the population growth rate surged, urbanization also gathered momentum, with the urban population increasing up to 5.4% annually-compared with only 2.4% in rural areas. The unprecedented scale of urbanization translated into the number of urban centers in Iran nearly doubling from 373 in 1976 to 615 in 1996.

Rapid and uncontrolled population growth, along with expanded urbanization, has clearly had a destructive impact on the country's environment and ecosystem. This is especially true in the case of the Caspian region, where marine and forest resources are already under pressure and this burden will be enhanced in future. In addition, soil erosion and deforestation have caused heavy floods in recent years in coastal areas accompanied by enormous destruction. Noise pollution and air pollution are rising. Oil, toxins and other pollutants are freely flowing into the sea. Indeed, the ever-expanding burden of population in its various forms and degrees are arguably the most serious problems facing the coastal zone as well as other parts of the country .

3.1.2. Social structures and cultural resources

The following pages outline the most important population characteristics and the challenges facing the Caspian coastal zone on a province-by-province basis.

A. Gilan Province

The population of Gilan Province in 1996 was over 2,241,896 that included 512,102 households. There are 1,115,391 men (49.7%) and 1,126,505 women (50.3%) in this province. The total area of Gilan is 14,711 square Kilometers. 56% of the population resides in the urban areas and 47% in the rural regions.

The number of registered natality in 1998 was 35,578 (1% of the province's total population) and the number of mortality was 11,280 (0.5% of the province's total population). The urban population allocates 52% of the newborn babies. According to the 1996 Census, the mortality rate in the Gilan Province is 6 per every 1000 inhabitants. There is a reduction in the mortality rate in comparison to the similar census conducted in 1986, which showed 8.5% for this index.

In 1998, the number of marriages was 24,390 and the number of divorces was 1,239. It is interesting to point out that 67% of the marriages and 91% of the divorces were registered in the urban areas.

The population structure of the province reveals a declining trend in population growth along with the reduction of youth coefficient from 41.3% in 1986 to 34.5% in 1996. This index is 5.1% less than the

national rate of 39.6%. Never the less, the age group of 15 to 64 years that is the most productive part of the population, has increased from 55.4% in 1986 to 59.8% in 1996. This index is 3.7% greater than the national rate of 56.1%. The rate of elderly group has increased from 3.3% in 1986 to 5.7% in 1996. This index is 1.4% greater than the national rate of 4.3%.

According to the 1996 data, the rate of pregnancy was 2 children per woman. This index was 4.8 children per woman in 1986 (national rate is 3.3). The Gross Natality Rate has decreased from 34 in one thousand to 14.2 in one thousand. The main reasons for this reduction in the provinces are:

1. Increase of the babies' survival rate and consequent reduction in pregnancy rate of women.
2. Usage of birth control devices.
3. Improvement of women's knowledge.
4. Inflation and high prices that consequently creates unsuitable economic conditions for the family.

Considering the above factors, the natural population growth rate of the province in 1996 was 0.94%, which is smaller than the national rate of 1.8%.

From 1986 to 1996, over 104,807 have migrated to Gilan Province. In the same period, 120,515 have left the province. Therefore, there is a negative balance of migration in Gilan Province.

According to the latest National Geographical Divisions, Gilan Province has an area of 14,711 Square Kilometers including 16 townships, 36 cities, 40 districts and 106 rural districts. The total number of villages is 2901, where 202 villages are deserted. The Rasht and Roudbar townships each possess 6 cities. Roudsar has 401 villages. The townships include Astara, Astaneh Ashrafeyeh, Amlash, Anzali Port, Talesh, Rasht, Rezvan-Shahr, Roudbar, Roudsar, Seyahkal, Shaft, Somehsara, Fouman, Lahijan, Langeroud and Masal.

B. Mazandaran Province

According to the 1996 census, its population after the separation of the Golestan Province was 2,602,008 including 568,816 households (270,409 urban households and 298,407 rural households). There are 1,296,841 men (49.8%) and 1,305,167 women (50.2%). In another word, there are 99 men for every 100 women. 45.9% of the population resides in the urban areas and 54.1% in the rural regions.

36.33% of the total population is in the 15 and under age group, 58.9% in the 15 to 64 age group, 4.69% in the 65 and over age group. The age of the rest of the population was unknown. The average age of the population was 25.46%. The biggest percentage belonged to the

age group between 25 and 64 years with 38.96% of the total population.

The number of notality and mortality registered in 1998 were 41,953 (1.6% of the population) and 12,659 (0.49% of the population) respectfully. 52% of the newborn babies were registered in the urban areas and 48% in the rural regions. In the urban areas, 51.7% were boys and 48.3% were girls. In the rural regions, 50.7% were boys and 49.3% were girls. In addition, 49.5% of the total number of mortality was in the urban areas and 51.5% in the rural regions.

In 1998, the number of marriages was 28,257 (50.8% was registered in the cities and 49.2% in the villages) and there were 1,830 cases of divorce, which 78.1% were registered in the cities.

From the religious point of view, 99.66% of the population is Moslem, 0.02% is Zoroastrian, 0.01% is Christian and the rest is negligible.

From 1986 to 1996, there were 182,288 cases of migration to or from this province that 120,112 (65.9%) migrated to the other provinces. The highest number of migration belonged to the Sari Township with 18%. Therefore, Mazandaran Province has a negative rate of migration.

According to the latest National Geographic Divisions, the area of Mazandaran Province is 23,756.4 square Kilometers (1.46% of the national territory and is the 18th biggest province in the country), which includes 15 townships, 36 cities, 38 districts, 104 rural districts and 3,549 villages.

Babol Township with 640 villages has the most number of villages. The townships located in this province are Behshahr, Neka, Sari, Ghaemshahr, Jouybar, Pol-e-Sefid, Babol, Babolsar, Amol, Mahmoudabad, Noor, Noshahr, Chalous, Tonekabon and Ramsar.

C. Golestan Province

According to the 1996 census, the population of Golestan Province is 1,426,288, which 710,287 are men (49.8%) and 716,001 are women (50.2%). The total area of this province is 20,311.6 Square Kilometers.

In 1996, about 41.3% of the population was residing in the urban areas. The population growth rate between 1986 and 1996 was 2.22%.

In 1996, there were 268,849 households in the province, where each household consisted of 5.3 individuals. 44.4% of the above-mentioned households resided in the cities.

In 1998, the number of registered notality was 26,893, from which 39.7% was in the cities and 60.3% in the villages. The rural regions show a 20.3% increase of this index in comparison to the urban areas. There is one newborn girl for every 1.07 newborn boy.

In 1998, the number of registered mortality was 5,382 from which 50.7% were reported in the cities and 61.7% of the total mortality was related to men.

In 1998, the number of registered marriages was 12,047 and the registered divorces were 479 cases in the province. About 78.1% of the marriages and 95% of the divorces were registered in the urban areas.

Table 18 shows the population distribution according to the various age groups:

Table 18 : Year-class distribution in Golestan Province

Year Class	0-10	10-20	20-30	30-40	40-50	50-60	+ 60
Percentage	29	27	16	11	7	4	6

According to the above table, the biggest age group is between 0 to 10 years and the population under 20 years of age includes more than half (56%) of the total population. The population under 50 years of age includes 90% of the total population. As a general trend, the percentage of the youth population has decreases in comparison to the elderly in each decade.

From the religious point of view, from the total population of 1,426,288 in the province, almost all of them are Moslems except 333 Zoroastrians, 169 Christians and 5 Jews.

The migrants to the province from 1976 to 1986 were 148,603 that the number of men was slightly greater than the number of women. From the above group, 68% chose to reside in the cities.

The total area of Golestan Province is 20,311.6 Square Kilometers and includes seven townships of Turkman, Aliabad, Kurdkouy, Gorgan, Gonbad, Minodasht and Bandar-e-Ghaz, 16 cities, 16 districts and 43 villages. The Gonbad-e-Kavous Township, which is comprised of 5 cities, 5 districts and 12 villages, is the most densely populated region in the province.

The total area of the three provinces located at the southern shorelines of the Caspian Sea is 58,779 Square Kilometers (3.6% of the national area). Among these three provinces, Mozandaran Province with the

area of 23,756.4 Square Kilometers covers 40% of this region. Golestan Province with the area of 20,311.6 Square Kilometers, which covers 34.5% of this region, is the second biggest province located in the east. Gilan Province with the area of 14,711 Square Kilometers covers 25% of this region. It is the smallest province and is located in the west.

In 1996, the total population of this region was 6,270,192. The national population in the same year was 60,055,484. Therefore, 10.4% of the national population resided in this region. The population concentration is 106.7 persons per Square Kilometer. The national average for this index is 36.82 persons per Square kilometers, so this region is three times more densely populated than the national average and the coastal areas are considered one of the most densely populated regions in the country. Within this region, Gilan Province with 152.4 persons per Square Kilometers has the highest density, followed by Mozandaran and Golestan Provinces with 109.5 and 70.2 persons per Square Kilometers respectively. Therefore, the population density decreases from west toward east. The most densely populated areas are the regions from Anzali Port to Lahijan in the Gilan Province. In addition, the areas from Sari to Amol in the Mazandaran Province have high population density. Although the rural habitats along the coastal areas of the Caspian Sea are similar to the distribution of population in the other rural areas of the country, they are much closer to each other. This kind of habitat has resulted from cultivation in small pieces of land. The residential units in these villages are relatively close to each other. These villages are dispersed along the entire northern plains especially the territories adjacent to the coastline. The rural residential units are less dispersed in the forest covered mountains and the narrow plains of the slopes of Alborz facing the sea or the valleys.

In comparison of the populations of the 27provinces in the country, 18 provinces have population over one million, nine provinces over 2 million, 6 provinces over 3 million and only two provinces are over 4 million (Tehran and Khorasan). Therefore, Gilan and mazandaran provinces are among the nine provinces with 2 million population and Golestan Province is among the 18 provinces with over 1 million population.

46.7% of the total population of this region is residing in the urban areas and 53.3% in the rural regions. The rate of urban settlement decreases from west to east and instead the rate of rural settlement increases. Meanwhile, the highest rate of urban settlement is in the Gilan Province with 53% and the lowest rate of urban settlement is in the Golestan Province with 41.3%.

61.3% of the region's population is residing in the cities and 38.3% in the villages, which shows a much lower rate of urban settlement and a

much higher rate of rural settlement in comparison to the rest of the country.

There is a growing trend of urban settlement in the country. The average rural settlement in the country was 45.2% in 1986. This trend is continuing in the country as well as this region.

The average natality rate in the region (coastal area) is 34,808 per year, which is 1.7% of the total national number. This index is 1.6% for the Mazandaran and Gilan Provinces and 1.9% for the Golestan Province.

The average annual mortality rate in the region is 0.47% of the total regional population. This index for the Gilan Province is 0.5% (the highest in the region) and 0.37% for the Golestan Province (the lowest in the region). This index for the Mazandaran Province is 0.48%.

The gender ratio for the region is almost equal, 50% are male, and 50% are female. The fluctuations in this index in these provinces are negligible and the ratio of women to man is slightly higher. In contrast, at the national level, there are 100 women for every 103.3 men.

The population growth rate for the period of 1986 to 1996 was equal to 1.5%. In the same period, the average population growth for the three Northern provinces was 1.5% as well. But, the lowest population growth belonged to the Gilan Province (0.94%) and the highest population growth was in Golestan Province (2.22%). The above characteristics are shown in ***Table 19.***

Table 19: Population characteristics of Caspian coastal provinces in Iran

Province	Area Km^2	Population	Density	Population (%) Urban	Rural	Birth	Mortality	Growth	Male %	Female %
Gilan	14,711	2,241,896	152.4	53.0	47.0	35,578	11,280	0.94	49.7	50.3
Mazandaran	23,756.4	2,602,008	109.5	45.9	54.1	41,953	12,659	1.35	49.8	50.2
Golestan	20,311.6	1,426,288	70.2	41.3	58.7	26,893	5,382	2.22	49.8	50.2
Total or Average	58,779.0	6,270,192	106.7	46.7	53.3	34,808	6,440	1.5	49.8	50.2

Figure 46, *Figure 47*, *Figure 48*, *Figure 49*, *Figure 50*, *Figure* 51, *Figure 58*, Figure 59, Figure 60, Figure 61, Figure 62 and Figure 63 illustrate different aspects of the population issues in the Islamic Republic of Iran.

3.2. Health, Education and Recreation

3.2.1. Health statistics

The overall improvement in health care and delivery of health services over the last 20 years has been one of the main reasons for the progress in human development in the Islamic Republic of Iran. The expansion of health facilities, particularly primary health care, has greatly contributed to a longer life expectancy that is one of the three components of the Human Development Index (HDI).

Life expectancy in Iran increased as much from 1988 to 1997 as it did in the three previous decades because of the provision of public health services. *Figure 52* shows the growth in life expectancy for men and women between 1988 and 1997. Life expectancy in Iran stood at 61.1 years in 1988 had risen to 69.5 years in 1997. For Gilan provinces, it is 67.4 years, which is more than the national average in Gilan and less in Golestan and Mazandaran provinces.

The most important factor in increasing life expectancy over the past 10 years was the decline in the mortality rate among children under five years from 85.3 per 1,000 live births in 1988 to 37.3 per 1,000 live births in 1997. Other factors contributing to longer life expectancy included a decline in infant and maternal mortality. Cardiovascular diseases and cancer are now the main causes of death while the spread of AIDS and tuberculosis is beginning to cause alarm.

According to Iranian constitutional law, good health is a basic right and the government is obliged to provide the facilities needed to make this right a reality. At the macro level, the health network is the foundation of the country's healthcare system.

The principle underlying it is the reduction of disparities among different groups, particularly people in poor and rural areas and those who are vulnerable, notably women and children. Accordingly, the expansion of the health network as a decentralized system was adopted down to the district level. Their organizational structure is shown in *Figure 53*

Urban and Rural Health Centers and Health Houses meet the primary health care needs of people in the community they serve. Health Houses are the health care facilities closest to the people and provide primary health care in villages. Specialized care is provided by university-affiliated hospitals in provincial capitals.

The creation of the health network means that 100% of the urban population and around 85% of the rural population now have access to primary health care. The parallel expansion of a universal health insurance system has been another major factor in improving the public's health, as has the growth in the number of doctors. In 1988, there were 49.9 doctors per 100,000 people in Iran. This had increased to 107.9 by 1997.

As the government scales down its presence in the economy, however the private sector is expected to play a greater role in providing health care services special medical services in particular. Reproductive health, immunization, prevention and control of endemic illnesses and treatment of endemic diseases are among the special services being provided by the PHC in recent years.

Table 20 as well as ***Figure 54***, Figure 55, Figure 56 and Figure 57 summarize different aspects of the health indices in the northern coastal provinces of I.R. Iran.

3.2.1.1. Nutritional Safety

A sound diet is a leading factor in good health. An examination of households and individuals food security and health reveals their nutritional status in both quantitative and qualitative terms.

According to the latest data available, from 1991-1995, a typical Iranian consumed 128 kg of bread, 44.2 kg of rice, 7.7 kg of cereals, 25.5 kg of sugar, 171 kg of vegetables and fruits 41 kg of various kinds of meat and eggs, 61 liters of milk and dairy products, and 14.2 kg of fats.

This diet amounts to 2,665 kilocalories of energy, 73.8 grams of protein, 616 milligrams of calcium, 31.4 milligrams of iron, 603 micrograms of vitamin A, one milligram of riboflavin and 90.4 milligrams of vitamin C - 120% of the recommended dietary allowance. The only deficiencies are in riboflavin (75% of the body's requirement) and particularly in rural areas where the deficiency is very severe vitamin A. Other Iranians are getting their basic need and more. These data could be extended to cover coastal provinces as an indicator of the nutritional index, because specific data are not available for this region. Nevertheless, it should be mentioned that the per capita consumption of fresh vegetables, rice and fish meat is more than the country's average. In addition, rural people consume less meat and fruits than city dwellers. ***Table 21*** outlines food security in selected areas.

Table 20: Health indices of Iranian Caspian provinces (1998)

Items	Gilan	Mazandaran	Golestan	Total or average
Hospitals	26	31	19	76
Hospital beds	2,974	7,765	2,884	13,623
Clinics		100	147	
Radiology centers	45	58	25	128
Medical labs	135	154	56	345
Pharmacies	179	237	102	518
Physiotherapy centers	41	54	21	116
Health Houses	1,063	978	480	2,521
Doctors	558	2,245	973	
Dentists	218	366	120	704
Pharmacists	272	244	139	655
Paramedics	7,501	7,708	2,840	18,049
Health insurance coverage		67.63%		
Access to clean water in rural areas		72.8%		
Infant mortality (per 1,000)		20		
Health House per capita 1,000		1,398		
Doctors per capita	4,017	1,159	1,465	
Hospital beds per capita			1,258	
Dentists per capita			12,419	
Pharmacy per capita			14,611	
Radiology per capita			59,614	
Physiotherapy per capita			70,969	
Vaccination coverage		99%		

Table 21: Food security by selected areas

	Daily per capita Consumption of energy		Daily per capita Consumption of protein		Daily per capita Consumption of calcium		Daily per capita Consumption of iron		Food consumption as total percentage of household consumption
	Total (calorie)	Index	Total (gr)	Index	Total (gr)	Index	Total (gr)	Index	
Country (Iran)	2,888	100.0	79	100.0	561	100.0	37	100.0	44.5
Tehran	2,684	92.9	75	93.8	559	99.7	34	91.0	29.1
Gilan	2,810	97.3	71	88.9	427	76.0	34	92.7	43.0
Mazandaran & Golestan	2,689	93.1	74	93.3	518	92.3	34	93.2	38.6

Source: Human Development Report of I.R. of Iran, 1999

Improvement of national public health in the last 20 years has been a leading factor in the human development growth indices in the Islamic Republic of Iran. Expansion of health facilities, particularly primary healthcare, has greatly contributed to longer life expectancy that is one of the three components of the human development index (HDI).

Life expectancy in Iran increased as much from 1988 to 1997 as it did in the three preceding decades, because of the provision of public health services. In previous figure, the upward trend in life expectancy for men and women between 1988 and 1997 has been presented. Life expectancy in Iran that stood at 61.1 years in 1998 had risen to 69.5 years in 1997. For Gilan province, it is 67.4 years, which is higher than the national average. The figure for Gilan is lower than in the other two provinces under consideration.

The most important factor in increasing life expectancy over the past decade has been the decline in the mortality rate among children under five years of age from 85.3 per 1,000 live births in 1988 to 37.3 per 1,000 live births in 1997. Other contributing factors included a decline in infant and maternal mortality. Cardiovascular diseases and cancer are now the main causes of death while the spread of AIDS and tuberculosis are becoming sources of genuine concern.

According to the Iranian Constitution, good health is a basic right. The government is obliged to provide the facilities needed to make this

right a reality. At the macro level, the national health network is the foundation of the country's healthcare system.

The major principle underlying the systems' policy is the reduction of disparities among different income and social groups, particularly people in poor and rural areas and those who are vulnerable, notably women and children. Consequently, the expansion of the health network as a decentralized system was adopted down to the district level.

Urban and Rural Health Centers and Health Houses meet the primary health care needs of people in the community they serve. Health Houses are the health care facilities closest to the people and provide primary health care in villages. Specialized care is provided by university-affiliated hospitals in provincial capitals.

The creation of the health network has meant that 100% of the urban population and around 85% of the rural population now have access to primary health care. The parallel expansion of a universal health insurance system has been another major factor in improving public health, as has the growth in the number of doctors. In 1988, there were 49.9 doctors per 100,000 people. This increased to 107.9 by 1997.

As the government scales down its presence in the economy however, the private sector is expected to play a greater role in providing health care services, special medical services in particular. Reproductive health, immunization, prevention and control of endemic illnesses and treatment of endemic diseases are included in the special services provided by the PHC in recent years.

3.2.2. Environmental health

A precondition for human development is the creation of a safe and healthy environment, undertaken in the specific context of efforts to protect and improve public health. In the human development approach, environmental protection is the basis of sustainable human development.

In the face of challenges posed by unbridled economic growth, the need to treat the various environmental dimensions of development has emerged as a major national issue. This is of special importance in the Northern provinces, where the environment is both fragile and burdened with rapid human development.

The fast population growth over the last 20 years has dramatically changed the composition of urban and rural populations, resulting in accelerated urbanization. This progress has harmed the environment in a number of ways, particularly in large cities. These adverse effects are readily observable in many areas of quality of life indices including air

and water characteristics, human settlements, noise levels, energy consumption, communications and the state of natural resources.

The outstanding threat to the environment is the urban population that has doubled in 20 years from 17.85 million to 23.24 million. In the same period, the number of cities and towns leaped from 375 to 616. This increase has naturally hindered the adoption of measures to protect the urban environment.

The resulting deficiencies are most clearly noticeable in relation to water pollution in coastal areas, especially rivers that pass through populated and industrial areas. The most conspicuous example of this phenomenon is the Zarjab River that enters the Anzali lagoon and carries the pollution load of numerous factories and towns (particularly the city of Rasht), into this water body. Many other rivers also empty their pollution loads into the Caspian Sea.

Because insufficient attention has been given to the environmental impact of water-borne effluent, implacable urbanization and the industrialization associated with it have become the leading threats to the environment of the Caspian region in urban and industrial centers. It is estimated that there are 500 and 473 large industrial units in Mazandaran and Gilan provinces respectively. Many of these facilities are constructed in close proximity while some industrial regions have hundreds of factories. The Rasht Industrial Center is the leading example in this respect.

Although government policy in recent years has been to move factories to the outskirts of urban areas in order to reduce industrial pollution and increase environmental health, the implementation of this scheme faces a series of obstacles. The increasing volume of toxic industrial effluent continues to be a significant environmental concern for the region. A brief description of the comprehensive nature of the pollution problem is discussed in the relevant chapters.

3.2.3. Education

Education is arguably the cornerstone and outstanding single element in human development. The expansion of knowledge paves the way to a magnification of human choices, thus providing improved standards of living through greater access to employment opportunities, enhanced health and healthcare. Learning also affords a better understanding of our environment and surroundings. This cluster of closely connected factors has prompted the government of Iran to underscore the qualitative growth of education over the last two decades.

Two of the most important indicators in the improvement of human development levels in Iran from 1988 to the present were the

improvement of the adult literacy rate from 57.1% to 75.5% and the increase in the combined school enrolment ratio from 65.6% to 75%. Accordingly, the gross enrolment ratio at the secondary level went up from 52.7% to 77.5% (15.2%) and at the tertiary level jumped from 6.89% in 1988 to 18.17% in 1997. The principal impetus for this expansion was largely due to efforts for furthering education and employment opportunities. On the other hand, the ratio at the primary level declined from 122.5% in 1988 to 119.2% in 1997 (3.6.).

According to ***Table 22***, in 1976, the total number of students nationwide was about 18.5 million. In the coastal provinces, the figure was about 1.9 million, or some 10% of the national figure. The highest number of students is registered in Mazandaran province (43%) then Gilan (34%) and finally Golestan (23%). According to provincial population statistics, the ratio of students to population size is 29.5% in Gilan, 31% in Mazandaran and 30% in Golestan which are all within a similar range. For the entire coastal region, this figure is 30.5%. Over the last 20 years, the country's population has doubled but the number of students has increased 2.5 times. Comparing this figure to the 5.2 times for the corresponding period of 1956 to 1976, a reduction in the ratio of students to the population increase rate is noticeable but it is estimated that the present rate would be more or less stable in the coming years.

Table 22: No. of students in Caspian coastal provinces (1998)

	Gilan	Mazandaran	Golestan	Total
Preschool	6,313	9,246	8,557	24,116.0
Primary	268,357	330,612	217,008	815,977.0
High School	192,897	243,407	122,302	558,606.0
Secondary High School *	166,351	188,982	76,731	432,064.0
Technical Vocational	10,639	22,012	3,140	35,791.0
Pre university	16,865	21,426	7,290	45,581.0
Adult education	11,326	16,475	7,905	35,706.0
Other	1,253	3,175	1,255	5,683.0
Literate (%)	72.2	80.79	71.1	224.1
Higher education	35,017	67,424	18,401	120,842.0
Population > 6 years (%)	89.1	80.8	76.97	246.9
Total students**	709,018	902,759	462,589	2,114,264

** Including pre-university, technical and vocational*
*** Except adult and higher education*

At the tertiary level (universities and colleges), there is a significant increase in the number of universities and institutions of higher education. The growing involvement of the private sector in this area explains the situation.

Another important reason for the rise in enrolment at the tertiary level is that attainment of higher education is widely perceived to have economic advantages. In the coastal provinces alone there are 120,842 students or 19% of the population. More than 51% of the aggregate attend private institutions. Disregarding Tehran province, Mazandaran ranks third (5.2%) nationwide in the number of students pursuing higher degrees.

In the last 10 years establishing fisheries, marine and environmental science courses have increased. Today in all these provinces there are several private and governmental colleges and universities providing such education. The main institutions are Gilan University (environment); Tarbiat Moalem University in Noor-Mazandaran (providing courses in marine biology, fisheries and environmental sciences at the MSc. and Ph.D levels; Azad University in Lahijan - Gilan (offering fisheries and environment courses at the B.Sc. and M.Sc. level; Azad University in Babulsar – Mazandaran (offering B.Sc. fisheries courses); Gorgan University – Golestan (fisheries and environmental sciences at the B.Sc. and M.Sc. levels).

There are also at least four vocational high schools in the Northern provinces that provide courses in fisheries navigation, marine engineering (marine engines), commercial navigation and marine electronics and communication.

In 1997, the Islamic Republic of Iran's education index stood at 0.75 compared with 0.85-0.99 in countries with higher levels of human development, indicating there remains substantial room for improvement. All measures to increase literacy and boost enrolment at different educational levels would improve Iran's education index and, as a corollary, raise its level of human development.

A comparison between men and women's educational status is also important from a human development perspective. From 1988 to 1997, the adult literacy rate for women rose from 46.3 % to 67.0% while the rate for men increased from 67.1% to 81.9%. It is worthy of note that although the age composition of the population indicates more men having an opportunity to become literate, women have shown a greater interest in literacy.

Table 23, which outlines female enrolment indices at various education levels, reveals that the index for the number of female students in higher education increased from 100 (the base figure) in 1988 to 322 in 1996. In the same period, the index for female secondary enrolment rose to 189, and the index for female primary enrolment went up to 125.

Table 23: Female enrolment indices, 1988-1996

Level	1988	1992	1996
Primary	100	112	125
Secondary	100	138	189
Tertiary	100	200	323

Ref: Human Development Report of the I.R. of Iran, 1999.

In 1988, 60.5% of students were concentrated in urban areas with the remainder in rural areas. Of all the enrollees covered by the Literacy Movement, 56.8% were in urban and 43.2 in rural areas.

In 1996, of the I.R. Iran's 26 provinces, Tehran, Sistan and Baluchestan had the highest and lowest adult literacy rates, 84.7% and 48.0% respectively. In 1998, the figures for Gilan, Mazandaran and Golestan provinces stood at 79.2%, 80.8% and 76.97%. For the entire region the average is 78.98%. ***Figure 64***, Figure 65, Figure 66, Figure 67, Figure 68, Figure 69, Figure 70 and Figure 71 illustrate the present education and literacy situation the Northern Coastal Provinces of Iran.

3.2.4. Community activities

3.2.4.1. Social and cultural activities

In the Islamic Republic of Iran, besides formal public institutions such as schools and universities, there are non-governmental institutions that impact on the society's educational environment. Cultural centers such as libraries, cinemas, theaters, cultural and art complexes, mosques, and other sports and entertainment facilities are among these institutions. This also includes mass media such as radio and television, press and other print media. All make an impression on the country's educational environment. Thus, it is important to assess the role of these institutions and mass media in public education.

A. Libraries

Available data indicate that there were 486 public libraries in Iran in 1988. Growing at an annual average rate of 10%, the number of public libraries in 1997 has more than doubled to 1,147. In the Caspian coastal provinces, there are 114 public libraries with more than half a million books, in excess of 1.5 million users, and 72,857 regular members (about 55% women) annually.

The expansion of public libraries has played a remarkable role in improvement of the country's educational indicators, particularly for guidance and high school students. For students who have no suitable place to study at home, expansion of the public library system will meet an important need.

B. Cinemas

Cinemas, theaters and other cultural and art centers have also played an important role in creating an improved educational environment and contributed to human development. The quantitative expansion of programs offered by such centers is an indication of their impact on learning and education. However, according to available data, the number of cinemas has not increased significantly: There were 260 in 1988 and only 295 in 1996. In the coastal provinces, there are 53 cinemas, mostly in Gilan and Mazandaran provinces.

C. Cultural Centers

The establishment of cultural and art complexes was one of the initiatives launched by the government. In 1997, 70 cultural and arts centers and 36 cultural houses were active in the country's urban and rural areas. Apart from these centers, there is also cultural centers and youth clubs in almost all cities. These venues provide a unique atmosphere for youths to spend their leisure time as well as to participate in cultural activities through attending different classes and courses, such as painting, singing, music, carpet weaving, theater, etc. In 1998, there were at least 44 cultural centers in the coastal provinces.

D. Mass media

The country's mass media have also played an important role in creating a live educational atmosphere. Television programs produced in the country registered an average annual growth rate of 22.9% from 1989 to 1997. Production of radio programs by IRIB (Islamic Republic of Iran Broadcasting) recorded an average annual growth of 22.9% from 1989 to 1997. Production of radio programs by IRIB made a gigantic leap from 45,530 hours in 1989 to 146,019 hours in 1997.

The northern Caspian provinces have also benefited from this development process during the last 10 years. The whole region is under the umbrella of radio broadcasting services from national and local programs. There are 20 radio stations in the region and five radio channels that broadcast 11,481 hours of local programs on different subjects, mainly focused on moral issues, entertainment, and information on science and technology.

The number of print media grew at an average annual rate of 23.8%, with the highest increase in dailies at 27.5% and the lowest in monthlies at 19.3%. Momentous social developments, a higher level of

public awareness, and government support in the recent years were the primary factors for the remarkable growth of the print media. More than 40 local publications are being published in the coastal provinces.

From 1994 to 1997, the print media circulation grew at an average of 20.6% annually, which indicates an impressive increase of the print media on rising awareness of the region's different social groups, particularly the youth. It is foreseen that in the coming years, the press will have an even stronger impact on public education and advancement of human development.

E. Sports and historical places

In 1998, it is estimated that 2,047 sport centers were operating in the Caspian provinces. The range of sports activities is quite wide and includes football, volleyball, basketball, swimming, boxing, wrestling, table tennis, gymnastics, weight lifting, track and field and martial arts Football, swimming and wrestling are the most popular.

The private and governmental sport centers include stadiums, gymnasiums, pools, and open playgrounds.

The coastal provinces enjoy several historical monuments and ancient places including holy places, mosques, castles, bridges, public baths, palaces, minarets, caravanserais, historical buildings, tombs, etc. It is estimated that about one million people visit these sites every year.

F. Site seeing and tourist attractions

The coastal provinces have a unique climatic condition, with relatively a mild weather and lots of rain. These factors make the area green with a dense tree cover that creates many beautiful and interesting places for people living there, as well as for domestic and foreign tourists. The most important attractions of these provinces are the beach resorts that extend along the entire Caspian coastline. These locations attract thousands of people every year. These areas accommodate people in a large number of villas along the resort areas.

Some of the important resort beaches are:

Mazandaran and Golestan provinces: Khazar-Abad, Mahmood-Abad, Nour, Alamdeh, Nowshahr, Abbas-Abad, Nashtarood, Tonekabon, Katalem, and Sadat-Mahaalleh

Gilan Province: Astara, Anzali, Rudsar,

In these resorts, swimming and boating are very popular sports, especially during late spring and summer (May-September)

3.3. Economic Activity

3.3.1. Employment

From 1976 to 1986 and from 1986 to 1996 the proportion of Iranians aged 10 years and over grew at an average annual rate of 3.6% and 3.3 % respectively, while the economically active population increased 2.7 % and 2.3 % respectively. The difference in the growth rates of these two population groups resulted in a decline in the labor participation rate from 42.6 % in 1976 to 39% in 1986 and 35.3 in 1996. In 1996, the labor participation rate in Iran among the population aged 15 and over was 43.1 %.

This compares very poorly to the industrial countries ranging from 58.5% (Spain) to 77.1% (USA) Furthermore this indicator has experienced a steady downward trend since then.

In ***Table 24***, the actively employed population 10 years of age and over by type of activity is presented for the Caspian coastal provinces. A comparison with figures nationwide shows the entire coastal population comprises about 11 percent of the total while Mazandaran province alone constituted 40% of the entire work force.

Among the different activities, agriculture, hunting, forestry and fishing are the largest contributors to employment comprising about 38% of all activities, this represents only about 23% of these activities nationally. The second major employment sector in the region is services (including health and education) accounting for 17.7 % of these provinces' total workforce (or 10.8% for the country).

The third and forth ranks are credited to mining with 13.4% (country=0.8%) and to sales, hotels and restaurant with 12.4% (country=0.13). These figures show that first of all the utilization of natural resources (e.g. agriculture and mining) and mining play an important role in employment and consequently in the economics of the coastal provinces. Secondly, they are at wide variance with the national average.

In ***Table 25*** and Table 26 below, the number of employed and unemployed population and the difference between the actual market demand for employment and the number of people seeking it are presented. ***Figure 72***, Figure 73, Figure 74, Figure 75, Figure 76, Figure 77, Figure 78, ***Figure 79***, Figure 80, Figure 81, Figure 82, Figure 83, Figure 84, Figure 85, Figure 86, Figure 87, Figure 88, Figure 89, Figure 91, ***Figure 112, Figure 113, Figure 114, Figure*** 115***, Figure 116, Figure 117*** and ***Figure 118*** idicates different aspects of the employments situation and economic activities in the Northern Coastal Provinces of I.R. Iran.

Table 24: Employed population 10 years of age and over by activities

Province	Agriculture hunting and forestry	Mining Industry	Manufacturing	Electricity Gas Water	Construction	Sales Hotel Restaurant	Transport Storage Communication	Finance	Services Health Education	Others	Total
Total country	3,318,536	119,884	2,551,962	150,631	1,650,481	1,927,067	972,792	152,872	-	-	10,844,225
Gilan	249,198	91,543	-	6,549	31,240	8,1431	27,576	10,311	112,585	9,806	620,239
Mazandaran	202,318	85,197	-	6,314	62,725	84,556	41,560	12,383	139,778	11,426	646,257
Golestan	160,825	40,584	-	1,615	27,390	35,082	16,044	27,317	35,723	3,590	348,170
Total Northern provinces	612,341	217,324	-	14,478	121,355	201,069	85,180	50,011	288,086	24,822	1,614,666

Table 25: Employment of 10 years of age and over, 1997

		Total	Employed	Unemployed
Gilan	Total	1,782,457	631,520	97,813
	Urban	840,074	273,112	40,225
	Rural	942,383	358,408	57,588
Mazandaran	Total	2,049,662	646,257	68,542
	Urban	944,442	293,334	31,746
	Rural	1,105,220	352,923	36,796
Golestan	Total	1,419,156	345,486	38,135
	Urban	588,985	134,099	14,818
	Rural	830,171	211,387	23,317
Grand Total		5,251,275	1,623,263	204,490

Source: Provincial Statistical Books, 1997

Table 26: Percent of employed population -1997

		Employed	Unemployed
Gilan	Total	86.6	13.4
	Urban	87.2	12.8
	Rural	86.1	13.9
Mazandaran	Total	46.91	5.80
	Urban		
	Rural		
Golestan	Total	33.38	3.66
	Urban	30.12	3.33
	Rural	35.82	3.93
Grand Total			

3.3.2. Heavy and light industry

In the Caspian littoral provinces, after agriculture, industrial activities play an important role in the economy.

According to the 1998 statistics, there were 13,904 industrial workshops and factories in the country, of which 1,132 workshops were in the Caspian provinces. The national industrial labor force numbered 875,528 of which 81,592 were in the Caspian provinces.

The added value of these workshops for the whole of country stood at 36,961,339 rials and for Caspian units 2,026,689 rials (5.5% of the national added value). In ***Table 27***, the provincial distribution of these units and the labor force are represented. In ***Figure 90.***, the

countrywide rank of the Caspian littoral provinces based on number of workshops is shown.

Table 27: Manufacturing units, type of ownership and employment

Description	Country	Gilan	Mazandaran	Golestan	Area total
Manufacturing units (M.U.)	13,904	490	444	198	1,132
M.U. (10-49 workers)	11,403	362	332	165	859
M.U. (50-99 workers)	1,149	48	56	18	122
M.U. (>100 workers)	1,352	80	56	15	151
M.U. (private)	12,797	437	394	170	1,001
M.U. (public)	1,107	53	50	28	131
No. of workers	875,528	32,414	41,552	7,626	81,592
Value-added (million Rials)	36,961,339	956,317	868,505	201,867	2,026,689

Source: Iran Statistical Yearbook, 1998

In 1998, 6,866 permits for establishing workshops were issued in the country of which 1,075 relate to the Caspian provinces: 488 workshops in Gilan, 487 in Mazandaran, and 100 workshops in Golestan.

In Mazandaran the units that have more than 10 workers, account for 40,000 jobs that include 93% men and 7% women. The largest single employer (about 20.7%) was the textile industries. The rest were employed in food, the beverage, and tobacco industries.

The benefit of the large provincial workshops in 1998 was 800,000 rials. The food, beverage, and tobacco industrial group with 41% employees have allocated more than 44% added value of these workshops to itself. Textiles, clothes, and the leather industries with more than 36% of total employees have allocated about 23% of the benefit to themselves.

Generally, the industrial aspect of the agricultural sector in the province is not so good and it stands in 8th place nationwide. A listing of the main factories and their number is shown in ***Table 28***.

In Golestan province, the industry sector has not developed properly like in Mazandaran, so it ranks 16th in the county. Regarding the current agricultural activities and existing potentials, there is room for expansion and development of agro-industry in this province. Statistics on industrial units in the province has been displayed in the table on Mazandaran.

Table 28: Manufacturing units in Mazandaran Province

Manufacturing Establishment	Total Number of units	%
Food, beverages, and tobacco	116	20.7
Textile, clothing & leather	61	36.76
Wood and products	47	16.66
Paper, print & publication	13	0.95
Chemical, coal, plastic & rubber	31	4.6
Non-metal minerals	77	7.2
Metals	11	2.14
Machinery and equipment	87	10.74
Others	1	0.25

Source: Economical and Sociological Report of Mazandaran Province, 1998

In Gilan, compared to the two other provinces, industry is more developed and ranks 5th in the country. In 1998, 490 industrial workshops with more than 10 workers were active in the province. The different types of these units are shown in ***Table 29.***

The bulk of these workshops' activities focus on non-metal minerals, food industry, pharmaceutics, machinery and equipment. Total number of these units stands at 1,986.

Rural industries, which are active in Gilan, include hand-woven carpets and handicrafts. Many people are employed in this sector (1,486 people from a total number of 2,828 people).

Tea production in the country is located in Gilan Province and its related industrial units are found in Lahijan, Roudsar, and Langarood. In 1998, there were 119 tea factories (including 102 governmental and 17 private units) with a capacity of 274,427 tons per day in the region.

3.3.3. Mining

In the terms of mineral materials, due to its vast area and presence of various geological structures, Iran is a major exporter of several raw materials like oil, gas, lead, zinc, iron, copper and coal. Meanwhile, there are other minerals including chromate, manganese, bauxite, sand & gravel, decorative stones, rubble stones, ballast, gypsum, limestone, kaolin, dolomite, barite, salt, silica, feldspar, talcum, asbestos, turquoise in this country.

Table 29: Manufacturing units in Gilan Province, 1998

Manufacturing establishments	No. of units	No. of workers
Food and medicine	352	10,368
Textile and leather	163	18,152
Wood	288	4,797
Paper and publication	62	1,121
Chemical products	130	3,072
Non-metal minerals	435	6,692
Metal minerals	113	2,327
Power and electronics	71	6,104
Motor vehicles and spare parts	314	1,965
Moulding	26	361
Total	1,954	54,959

Source: Statistic Yearbook of Gilan Province, 1998

In 1998, the total export of mineral materials was 9,323,221 tons in amount of 1,029,555 million Rials. The main importers of these products were Azerbaijan, Armenia, Turkmenistan, Kazakhstan, Ukraine and Russia. The amount of their imports was 3,275,292; 211,815; 179,614; 51,759; 29,076 and 63,771 million Rials respectively. The sum of the above items was 3,874,468 million Rials, which was about 4% of country's entire export of mineral materials. The main portion of these materials was transported on the ground from the city of Astara in Gilan Province.

From 2,575 mines in the country, 226 of them are located in the Caspian coastal provinces (8% of the total national mines). The mines in the coastal provinces are either public or privately owned. There are 135 private and 91 public mines in the region, which have employed 8,164 workers. The total value of these mines is 213,542 million Rials (9.6% of the total value of the mines in the country). ***Table 30*** contains the number mines, average employment and the value of products in each province and at national level.

A. Gilan Province

The estimated mining reserves of the province are 106,686 thousand tons and 1,509,350 tons with the value of 49,635 million Rials were produced in 1998. The major mines in this province include limestone, rubble stone, decorative stone, coal, mica, kaolin, feldspar rubble, silica and shell mines.

Table 30: Number of Mines, Employees & Production Value, 1997

Province	Total	Types of Management		Production line				Value of production (Million Rials)
		Private	Public	Total	Skilled	Unskilled	Others	
Country	2,575	2,102	473	56,515	28,753	12,504	15,259	2,232,885
Gilan	69	41	28	1,417	777	640	299	44,636
Mazandaran	121	72	49	3,564	3,139	425	1,223	113,252
Golestan	36	22	14	1,072	583	489	589	55,654
Total	226	135	91	6,053	4,499	1,554	2,111	213,542

B. Mazanadaran Province

The estimated mining reserves of the province are 491 million tons and 15,808 tons with the value of 1,522,800 US$ were exported in 1998. The major material exported was Barite. The annual production was 1,896 thousand tons in the same year. Meanwhile, 85% of the workers in this business are employed in the coalmines. Mazanadaran Province has the most diverse collection of mining in the region. The most important mines include chalk, rubble, limestone, kaolin, granite, marble, ores slag, conglomerates, silica, barite, coal, fluorine, bauxite, lead and zinc mines.

C. Golestan Province

The diversity of mining materials in this province is less than the other two provinces in the region. Its major mines include limestone rubbles, bauxite and coal. In 1997, a total of 178,793 tons with the value of 10,720 million Rials were produced. Coalmines with the production of 142,243 tons (almost 2/3rd of the total output) were followed by limestone and bauxite mines.

3.3.4. Primary industry

3.3.4.1. Agriculture

In addition to the suitable climatic conditions of the Iranian coastal provinces of Gilan, Mazandaran and Golestan, this region enjoys a very fertile soil excellent for agricultural purposes. Therefore, this region has a special and prominent status in the country. In the plain region of Gilan, due to the wet climate, most of the soil is sedimentary with small grains. Also there are wet grassy and semi-wet soils as well. The sedimentary soils with small grains are the most appropriate kind of soil for agricultural purposes. This type of soil has covered vast areas of the central plains of Mazandaran, which is considered as one of the most fertile parts of this region. In the plains of Gonbad and Gorgan in the Golestan Province, due to the extensive evaporation and presence

of semi-arid lands especially in the northern part of the province, there are vast salty and marshy lands without any agricultural value. Never the less, in the southern part of this province, near the Gorgan and Gonbad region, there are arable lands that are considered as the main center for cultivation of grain, cotton and oily seeds. The soil in the mountainous region of this province, due to the sharp slope of the mountains and the shallow depth of the soil is not very suitable for cultivation.

In the agricultural year of 1997-8, the cultivation lands of the coastal provinces were more than 1,158 thousand hectors that is about 1.5% of the total agricultural lands of the country. In this region, the maximum amount of land is present in the Golestan province. Mazandaran and Gilan Provinces hold the second and third places. 62% of the agricultural lands in the region are irrigated by water and 47% is cultivated by rain fed farming.

78%, 58% and 46% of the Gilan, Mazandaran and Golestan Provinces are irrigated by water respectively. Golestan Province with 54% and Gilan province with 10% rain fed farming are the biggest and smallest users of this method in the Caspian coastal region.

3.3.4.2. Non-fruit and fruit trees

There are 1,848 and 117 thousand hectors of fruit trees and non-fruit trees in the country respectively. Meanwhile, there are 182 thousand hectors of various fruit trees in the coastal region (10% of the national total amount), where Golestan Province with 10 thousand hectors and Mazandaran Province with 103 thousand hectors have the smallest and biggest orchard lands in the region respectively. The littoral provinces also have 29 thousand hectors of non-fruit trees (25% of the national total amount). Most of these types of trees are located in the Gilan Province. ***Table 31*** provides useful information about the agricultural lands in these provinces. ***Table 32.*** shows the main agricultural crops in the littoral provinces. ***Table 33*** and ***Table 34.*** indicate the amount of chemical fertilizers and pesticides.

One of the most important aspects of coastal provinces is their significant contribution in production of certain crops in the country like rice (more than 90% of the country's production), tea, olive, cotton and citrus crops. In addition, production of oily seeds, vegetables and summer crops are the other major products of the region.

In the animal husbandry sector, in view of Caspian coastal area's suitable climate and reach resources, these provinces are very active in this field.

Table 31: Distribution of main agricultural products in coastal provinces (1000 ha. & 1000 tons)

Item	Country Total	Gilan	Mazandaran	Golestan	Total area	Area (%)
Wheat						
Total Cultivation Land	6,180	20	47	226	293	100
Irrigated	2,229	4	12	92	108	40
Rain fed	3,951	16	34	134	184	60
Total Production	11,955	23	116	860	999	100
Irrigated	7,631	0.7	38	393	431.7	44
Rain fed	4,324	16	78	467	561	56
Barely						
Total Cultivation Land	1,825	8	136	29	173	100
Irrigated	706	--	12	1	13	7.5
Rain fed	1,119	8	124	28	160	92.5
Total Production	2,301	8	238	42	288	100
Irrigated	2,111	---	30	2	32	11
Rain fed	1,189	8	209	40	257	89
Cotton						
Area Cultivated	233	---	100	76	176	---
Production	475	---	32.5	155	---	---
Sunflower						
Area Cultivated	79	0.6	---	---	---	---
Production	53	0.5	---	---	---	---
Soybean						
Area Cultivated	84	---	37	65	---	---
Production	138	---	---	93	---	---
Tea						
Area Cultivated	35	30	4	---	34	---
Production (Green leaves)	278	259	24.5	283.5	---	
Tobacco						
Area Cultivated	20	---	7	5	---	---
Production	22	---	---	7	---	---
Citrus Fruits	230					
Area Cultivated	7.3	84	---	---	---	---
Production	3,484	104	1,852	---	---	---
Olives						
Area Cultivated	24	2.4	---	---	---	---
Production	26	7.7	---	---	---	---
Rice						
Area Cultivated	615	230	36	496	81.0	---
Production	2,771	1,208	1,336	165.5	2,709.5	98.0

Table 32: Agricultural land distribution in coastal provinces (1997-78)

Item	Country (1000 ha)	Gilan (1000 ha)	Mazandaran (1000 ha)	Golestan (1000 ha)	Total Area (1000 ha)
Agricultural land	14,302	354	522	592	1,468
Land under annual crop	12,337	259	417	582	1,158
Irrigated	6,022	203	244	269	716
Rain fed	6,314	56	173	312	541
Land under fruit trees	1,848	69	103	10	182
Sapling	315	2	7	4	13
Productive	1,533	67	95	6	168
Land under Non-Fruit Trees	117	27	2	--	29
Sapling	21	--	--	--	--
Productive	97	27	1	--	28

Source: Iran Statistical Yearbook, 1998

Table 33: Distribution of fertilizers by type (ton)

Item	Country Total	Gilan	Mazandaran	Golestan
Total	1,942,849	73,648	88,384	91,585
Urea	1,048,202	41,203	49,449	49,371
Ammonium Phosphate	371,646	5,139	17,948	25,949
Ammonium Nitrate	160,999	1,720	2,768	
Ammonium Sulphate	24,878	830	2,552	286
Triple Super phosphate	198,245	3,967	8,768	7,925
Potassium Phosphate	76,787	3,249	5,603	6,305
Potassium Chloride	52,444	17,238	732	541
Micro Element	9,650	305	566	586
Total		147,299	176,768	183,171

Source: Iran Statistical Yearbook, 1998

Table 34: Distribution of pesticides, 1998 (tons)

Item	Country Total	Gilan	Mazandaran	Golestan
Total	23,032	3,572	--	1,820
Insecticides	12,017	2,731	--	1,282
Acaricides	790	29	--	62
Fungicides	2,864	100	--	146
Herbicides	4,976	664	--	331
Rodenticides	108	10	--	--
Molluscocides	29	--	--	--
Others	2,250	38	--	--

Source: Iran Statistical Yearbook, 1998

For example in 1998, there were 9,228 thousand head of domesticated animals in the region. Sheep is the main domesticated animal with approximately 6 million head (65% of the all domesticated animals) followed by cow, goat and other species. Mazandaran Province possesses the most number of domesticated animals (39%). Golestan Province (33%) and Gilan Province (28%) are in the second and third place. The number of animal husbandry farms in the region is 1,399 that 70% of them is situated in the Golestan Province. The meat production in this province has been more than 168 thousand tons, (half of it has been red meat and the other half white meat). The total production of eggs has been 30 thousand tons, from which 57% belonged to the Golestan, 50% to the Mazandaran and the rest to the Gilan Province. This region also has a prominent role in number of production units for breed of layer type as well as breed of broiler type in the country and provides most of the required productive hens and chickens of the poultry farms in the country. In the mean time, Gilan Province is ranked number one in production of silk in Iran and was able to produce 3,069 tons of silk in 1998.

Figure 92, Figure 93, Figure 94, Figure 95, Figure 96, Figure 97, Figure 98, Figure 99, Figure 100, Figure 101, Figure 102, Figure 103 and Figure 104 show the different kind of agricultural activities in the Northern Coastal Provinces of I.R. Iran.

On the other hand ***Table 35*** and ***Figure 122***, ***Figure 123*** and ***Figure*** 124 provide the major animal husbandry activities in each province.

3.3.4.3. Forest utilization

The total forests of the country were over 12,400,000 Hectors in 1995 (*Figure 121*). The forest area in the coastal provinces was 1,912,000 Hectors in 1998 (15.4% of the national forests). Mazandaran Province possesses 50% of the forests in the region followed by Gilan Province (30%) and Golestan Province (20%).

Table 35: Major Statistics on Husbandry, Poultry and others, 1998

Item	Gilan	Mazandaran	Golestan	Total
Sheep (1000 heads)	1,253	2,203	2,573	6,029
Goats (1000 heads)	324	245	168	737
Cows & calves (1000 heads)	814	934	299	2,047
Buffaloes (1000 heads)	30	8	2	40
Camels (1000 heads)	---	---	5	5
Horses, donkeys & mules (1000 heads)	130	218	22	370
Total cattle	2,551	3,608	3,069	9,228
No. of cattle farms	95	318	986	1,399
Red meat (1000 tons)	31	33	22	86
Poultry meat (1000 tons)	36	22	22	80
Hen eggs (1000 tons)	8	15	17	30
Whole milk (1000 tons)	246	283	180	709
No. Of hatchery units				
Breed of Broiler	1	12	---	13
Breed of Layer Type (1996)	1	2	---	3
No. of layer chicken farms (1996)	7	---	34	41
No. Of broiler chicken farms (1996)	408	1,495	---	1,903
Honey (tons)	3,094	1,860	261	5,215
Silk worm (tons)	3,069	---	---	3,069

Source: Statistical Yearbook of Gilan, Mazandaran & Golestan Provinces, 1998.

Although only 15% of the national forests are located in the Northern provinces, these coastal provinces provide the major portion of the national forest products. In 1997, this region produced 1,476,000 square meters of forest products, which more than 50% belonged to the Mazandaran Province, 29% to the Gilan Province and 16% to the

Golestan Province. The Commercial productions of the northern forests exceed 61% of various outputs of these jungles.

The excessive commercial exploitation of the northern forests during the previous years has reduced the forests in this region considerably. Therefore, a wide scale reforestation program had to be implemented in this region as well as the whole country. In order to achieve the above goal, 24,095 Hectors of forests was replanted in the country in 1988, where 7,978 Hectors were located in the northern region (approximately 33% of the national program). The Mazandaran Province had the biggest share (43%), followed by Golestan Province (37%) and Gilan Province (20%). There were 52,310,000 seedlings at the national level, which 24 million (46%) were allocated for the Northern provinces (50% in the Mazandaran Province, 29% in the Golestan and 21% in the Gilan Province).

The Aforestation Program was conducted with the cooperation of public and private sectors, but only the state-owned sector provides the seedlings for this program now. ***Table 36*** shows the related information for the exploitation of forests in the northern region.

Table 36: Forestation and forest utilization in the Caspian coastal provinces

	Country	Gilan	Mazandaran	Golestan	Total Area
Forest cover (ha.)	12,400,000[1]	569,000[2]	964,000[3]	379,000[2]	--
Wood Production (m^3)	--	425,000	819,000	232,000	1,476,000
Commercial Production (%) [3]	--	59	58	66	61
Afforestation (ha.)	24,095	1,600	3,448	2,930	7,978
State-owned A.	5,857	900	648	630	2,178
Private-owned A.	18,238	700	2,800	2,300	5,800
Seeding Production (1000 Seedlings)	52,310	5,000	12,000	7,000	24,000
State - Owned S.	52,310	5,000	12,000	7,000	24,000

1- 1996 2- 1998 3- 1997

Source: Iran Statistical Yearbook, 1998 & Provinces Statistical Books, 1997

3.3.5. Tourism

Iran, regarding its historical and traditional characteristics, is considered as one of the seven important countries in the world in view of tourism attractions. But because of some issues, Iran has enjoyed very small number of tourists in comparative to world statistics. So that in 1997, 1007597 tourists traveled to Iran that comparing to 1986 with 85801 tourists and 1992 with 249103 tourists, the number of tourists has increased considerably. These tourists were from different countries and mainly including: 18,000 Central Asian people (from Uzbekistan, Tajikistan, Turkmenistan, Kyrgyzstan, and Kazakhstan), 255,000 South East Asians, and the rest were about 96,000 tourists from Middle East, and 220,000 European tourists. 115,925 foreigners have entered the country were not tourists.

Statistics of tourists distribution in every province is not available, but the majority of tourists who want to visit Iranian historical places and tourism attractions, mainly travel to central provinces like Esfahan, Fars, Kerman, Yazd.

For instance, in 1998, the number of foreign travelers who have been resided in hotels of Golestan Province were 829, so that if we added this to the number of tourist who traveled to the two other northern provinces, the total hits at about 5000-10,000 which is not so considerable.

Instead, every year thousands of Iranian people travel to these coastal provinces to enjoy their natural attractions.

From the total number of tourists who visited Iran in 1998, 57% by land borders, 41% via air borders and the rest have been entered Iran by sea. The number of tourists who arrived in Iran from Central Asia and Caucasus by land, air and sea were 236, 169, 8 respectively.

In 1998, 302574 tourists from Azerbaijan Republic visited Iran. 182267 Azeri tourists has entered Iran by land, 120257 tourists via air and merely 50 people by sea.

Iran has received 10024 tourists from Armenia, 16466 tourists from Belarus and Russian Federation and 583 tourists from Kyrgyzstan.

Majority of the Central Asian tourists have entered the country by land border of Astara in Gilan Province and who traveled to Iran via air have arrived in Tehran.

3.3.6. Transport

The history of road transportation in Iran begins in about 400-500 B.C. Since then, it has always been regarded as an important and vital aspect of national infrastructure. Today transportation constitutes a major part in development of the economy's economy and it conjures

up memories of the heyday of the Silk Road commercial route of 1,000 years ago. For these reasons, the government in recent years has paid great attention to enhancing the national transportation capacity and has devised a comprehensive scheme on the basis of five year development plans, encompassing, land, sea, and air transportation.

A. Roads

Roads are defined as following:

1. **Freeways:** refers to a 2-lane motorway with each lane measuring 3.65 meters in width. In 1997, there was 712 km. of freeways in the country.
2. **Highways:** refer to a double 2-lane motorway 4-line. By the end of 1997, there were 2,176 km. of highways in the country.
3. **Wide main roads:** refer to a two-lane highway motorway, with at least two 3.65-m wide lanes and a 1.85m wide shoulder on each side. In 1997, there was 4,031 km of this type in the country.
4. **Ordinary main road:** refers to a 7-meter wide motorway, with a one-meter wide shoulder on each side. In 1997, there was 18,455 km of this category of road in the country.
5. **By-road:** refers to a two-way road which connects population and production centers of a region as a part of the domestic network. In 1997, there were 9,808 km of this type road in the country.
6. **First rate by-road:** refers to a two-way surfaced motorway, with at least 3.25 meter wide lines and shoulders on each side. In 1997, there was 15,951 km of this type road in the country.
7. **Second rate by-road:** refers to a two-way motorway with two 5.5 meter-wide lines and shoulders on each side. In 1997, there was 7,278 km of this road in the country.

In ***Table 37.*** below the types of roads in coastal provinces are provided. According to these data, total roads in the whole region were 5,954 km. In 1998 which was about 8% of the country's total of 74,349 km. Out of this figure about 36% of the totals are main roads, 39% asphalt by-roads and 15% graveled by-roads from other adjacent provinces.

According to an approved plan, the construction of a highway from Tehran to the north is underway. The project would do a great deal to facilitate transportation between these two areas. Great concerns have been expressed towards the environmental consequences of this motorway. It will cut through the protected area of Central Alborz and increase the noise and air pollution, disturb wild life, contribute to deforestation and create population centers around the motorway.

Regarding the number of and type of vehicles there was a total of about 4,000 vehicles in the coastal provinces. In ***Table 38***, the breakdown, according to the vehicle type and province are

represented. The total number of passengers transported within the province was some 5,239 thousands.

Table 37: Types of roads within the Caspian coastal provinces, 1998

Type of Roads	Gilan	Mazandaran	Golestan	Total
Freeways		14		14
Highways	29	48	48	115
Wideways	92	17	496	605
Ordinary roads	384	776	349	1,509
Asphaltic by-road Wide road	306	63	135	504
First road	672	516	177	1,365
Second road	79	371	-	450
Graveled by-road				
Wide	-	90	-	90
First rate	63	98	83	244
Second rate	93	260	0	353
Others	8	53	146	207
Total	1,890	2,807	1,663	5,945

Table 38: Number of registered motor vehicles and motorcycles by type

Type	Gilan	Mazandaran & Golestan	Total
Passenger car	1,905	3,547	5,451
Bus	5	14	19
Minibus	7	45	52
Pick up & light truck	171	1,184	1,420
Truck	139	354	493
Trailer	2	44	46
Motorcycles	506	1197	1,703
Total	2,735	6,385	9,120

B. Railroads

Another means of transportation within the Caspian region is the train. At present the railroad system covers only the eastern parts of the area and is a branch of the Tehran- Mashhad main railroad with a length of 496 km that passes through Sari (center of Mazandaran Province) to Behshahr and Bandar-e-Torkaman and then ends in Gorgan (provincial capital of Golestan province). It is estimated that by 2021, the railroad will cover Gilan province from Tehran up to Astara through Rasht. The Mazandaran railroad will also be expanded to service the eastern areas of Caspian Sea in Golestan province.

C. Airports

Up to 1997, there were 58 airports in the country, four of which are in Rasht, Ramsar, Nowshahr and Sari. Construction of an airport at Gorgan is under study. In ***Table 39*** the number of flights, passengers and cargo are represented.

Table 39: Number of domestic passengers in Caspian cities

City	Arrival(1000)	Departure (1000)	Total
Rasht	66,000	64,000	130,000
Ramsar	5,000	5,000	10,000
Sari	25,000	24,000	49,000
Noshahr	3,000	4,000	7,000
Total	99,000	97,000	196,000

D. Ports

Along the 700 km long Iranian Caspian coastline, there are different commercial ports used for the transportation of passengers and goods destined for domestic or regional ports.

According to the Ports and Shipping Organization of I. R. of Iran (PSO) commercial ports are classified on the basis of their capacity and strategic importance: (1) Main ports (can berth receive ocean-going and large vessels); (2) Multi purpose ports (for local and regional transportation, and (3) Ports under the direct control of PSO. On the Caspian coast there are two ports categorized as main ports and these are located in Nowshahr and Bandar-e Anzali in Gilan and Mazandaran provinces respectively.

In addition to domestic usage these ports are also the country's water access routes for transportation between Iran and the littoral countries in the Caspian Sea.

After the fall of the former Soviet Union and the resulting enhanced relations between Iran and newly formed Central Asian states, the importance of these ports are increasing and the government has planned to upgrade their capacity, as well as construct new ports.

It should be mentioned that there are also a few fishing ports referred to in the fisheries section. The significance of ports of Nowshahr and Anzali are represented in ***Table 40***.

Table 40: Port activities in Iranian Caspian commercial ports

Activity	Anzali port	Nowshahr port	Total
Arrived vessels	633	485	--
Staying duration (number /a day & night)	1,217	672	--
Unloaded cargo (1000 tons)	2,019	1,927	--
Loaded cargo (1000 tons)	70	21	91
Passengers (1000)	3	--	--

Nowshahr port in Mazandaran province has been chosen as one of the country's `Special Economic Areas' (SEA) in order to facilitate the transboundary commercial relations. Amirabad port near Nowshahr port has also been selected as a SEA.

Apart from these two commercial ports, there are other smaller ports, regarded as small-scale facilities with locally importance. Bandar-e Torkaman in Golestan Province on the east is one of them ***Table 41***.

Table 41: Specification of Iranian commercial ports along the Caspian coast

Port	Position	Distance from Tehran (km)	Area (ha)	Warehouse area (m^2)	Jetties Capacity (ton)	No. of jetties	Length of jetties (m)	Draft (m)	Harbor Areas (m^2)
Anzali	37° 28' N 49° 28' E	380	11.82	23,326	4,000	5	645	5.5	35.000
Noshahr	40° 36' N 51° 32' E	200	12.10	17,000	4,000	4	700	5.0	17.000
Total	-	-	23.92	40,326	8,000	9	1,145-	10.5	52.000

Source: National Atlas of Iran, Transportation, , Vol. 6 1998

Figure 105, ***Figure 106***, ***Figure 107***, ***Figure 108***, ***Figure 109***, ***Figure*** 110 and ***Figure 111*** reveal the extent of different transport network in the Northern Coastal Provinces of I.R. Iran.

3.3.7. Import-Export Activity

In Gilan Province, there are two ports through which the exchange of goods and passengers are carried out. These are Anzali and Astara ports, located in the western part of the Caspian Sea, while Astara is regarded as the most northern port in the region.

The important items from Anzali Port have mainly been iron plates, iron beams; steal plates, lead, glass, aluminum foils, coal, wood, paper, pulp, grease, asbestos, chemicals, swing machines, electrical appliances, motor cycles, x-ray machines, military equipments, kilka processing plants, building materials, tea, wheat, vanilla and etc. The amount of total import was 3,941.2 tones and 7,043,171 US$ in 1998.

The export items from this port were mainly fish, fruits, vegetables, potatoes, tomatoes, dates, dry fruits, biscuits, cans, rice, other food stuff, tobacco, ornamental flowers, building materials, fabrics, tissues, soaps, carpet, shoes and other leather manufactures, car hand-made manufactures, electrical appliances, plastic-made products, chemical products and etc. These items are regarded as non-oil export and totaling 104,189 tones equal to 22,816,836 US$.

For Astara Port, the main import and export items were more or less the same to Anzali Port, totaling 37,640 tones and 29,014,977 US$ for 1998 for import, and 273,699 tones and 87,764,766 US$ for export in 1998. The export and import are mainly done through marine transport and roads by tracks and the country involved are mainly Azerbaijan, Armenia, Turkmenistan, Kazakhstan and Russia.

In Mazandaran Province, there is only one major port responsible for import and export of goods and passenger. According to the data available, the main data export items were fruit, vegetables, and etc, totaling about 11,000 tones in 1998. The import for the year 1996 was 171,000 tones including wheat, chemical fertilizers and materials, iron-made products, non-metallic ores, machinery, fabrics, yarns, paper, wood and etc. ***Figure 112***, Figure 113, Figure 114, Figure 115, Figure 117 and Figure 118 show the volume of import-export activity at the Northern Ports of I.R. Iran.

3.3.8. Average household income

An analysis of the human development situation income of the I.R. Iran shows that an increase in per capita income is a prerequisite for human development. Despite ups and downs in the national economy during the last two decades, Gross Domestic Product (GDP) has in general terms grown steadily.

In the last 10 years, however economic policies were increasingly liberalized and privatized to respond to the need for reconstruction of the economy. There are no aggregate figures at the provincial level for

household expenditure and income; therefore the annual average of the country is presented.

According to the Statistical Yearbook of Iran 1998, the average net expenditure of households was 13,337,000 Rials in 1998, which is about USD 1,667 according to the free market price of the dollar in Iran (USD 1 = 8000 Rials). For urban households it was higher and equaled 16,670,000 Rials and less for rural households at 10,804,000 Rials.

The figures of 14 years ago (1986) were 1,038,500, 547,000 and 762,000 Rials respectively indicating rougly an 8% increase in net expenditure for a period of 14 years. The average expenditure on non-food commodities for both, urban and rural households constituted 64% of the total expenditure.

The distribution of urban household expenditure indicates that about 34% of the total expenditure went for housing which is approximately more than 50% of what is expended in big cities, especially in Tehran, and less in small towns and cities (*Table 42*).

Table 42: Average annual urban and rural household net expenditure (1,000 Rials)

Description	Rural	Urban	Average
Non-food	5,672	11,494	8,583
food	5,132	5,176	5,154
Total	10,804	16,670	13,737

The average annual household net income in urban and rural areas in 1998 was 15,151,894 and 9,367,760 Rials respectively for an average of 12,259,827 Rials. *Table 43* represents the income distribution by source of income.

3.3.9. Housing

In 1996, there were 784,003 houses in the three Caspian coastal provinces. Gilan province accounted for 447,088, Mazandaran 235,800 and Golestan Province had 101,151 residential units. The numbers make for a regional average of 1.2 households.

Table 43: Average annual net income by source 1998

Area	Total	Wages & salaries			Self employment		Other resources
		Public	Private	Cooperative	Agricultural	Non-agricultural	
Urban	15,151,894	3,081,538	1,882,873	65,378	560,111	3,925,142	5,636,852
Rural	9,367,760	939,464	1,653,640	4,3173	3,466,221	1,639,240	1,626,022

Population growth in the region during the past years has naturally meant the construction of new buildings, an increase in rates of land usage and growth of the housing industry.

In 1998, the average price of an old building nationwide was 453,000 Rials per sq. m. In Tehran the price stood at 1,368,000 Rials per sq. m, in Rasht 397,000 Rials per sq. m, and in Gorgan 384,000 Rials per sq. m. Rasht and Gorgan stood 9th and 10th in the national housing price indices in this respect.

The average price of each square meter of a residential unit in the country was 678,000 rials. In Tehran it was 1,558,000 Rials, Rasht 848,000 Rials (4th) and Gorgan 652,000 rials (9th).

The average combined monthly rent and deposit stood at 57,663 Rials per sq. m and 41,279 rials per sq. m in the latter two provinces respectively. In Rasht, the median rent was 3,564,000 Rials per sq.m (3rd nationwide) and the mean deposit stood at 65,198 Rials per sq. m. In Gorgan, rent was 2,682 Rials per sq. m (10th) and a deposit was 37,172 Rials per sq. m - 9th nationwide -, (*Table 44*).

3.4. Utilities

3.4.1. Energy

During the past years, the government has been spent heavily in developing the country's electricity and power networks. This has meant a variety of investments, establishment of power plants as well as development of the electricity transmission system nationwide.

Because of the distribution and decentralization of cities in the Northern provinces, the growth of the electricity network in the provinces has been more difficult. *Table 45* and *Figure 120*. give the facts on the condition of the power system and electricity network in the country and coastal provinces.

Table 44: Construction permits issued for construction of buildings in urban areas according to use, units, and materials.

	Country Total	Gilan	Mazandaran	Golestan	Area total	%
Construction permits	134,282	4,414	4,693	2,776	11,883	100
- Residential	118,422	4,049	4,170	2,475	10,694	90
- Mixed residential and establishment	5,951	97	298	178	573	5
- Commercial	6,762	92	152	73	317	3
- Industrial, educational and sanitary	1,455	16	16	12	44	<1
- Other	1,692	160	57	38	255	2
Total residential buildings	11,8422	4,049	4,170	2,475	10,694	100
- 1 unit	88,195	2,426	2,217	1,798	6,441	60
- 2 units	2,3241	1,078	1,507	441	3,026	28
- 3 units	4,169	155	197	82	434	4
- 4 units	959	135	88	60	283	3
- >5 units	1,858	255	166	94	515	5
By material types						
- Total	11,8422	4,049	4,170	2,475	10,694	100
- Brick & iron	88,107	823	903	1,942	3,668	34
- Brick & wood	1,314	729	290	367	1,386	13
- Cement block	4,564	373	505	27	905	8
- Steel skeleton	22,998	1,902	2,447	105	4,454	42
- Reinforced concrete						3
- Other	1,238	222	25	34	281	100

Table 45: Capacity of installed generators, electricity production and extensions in coastal provinces (1998)

Subject	Country	Gilan	Mazandaran	Golestan
Nominal capacity (megawatt)	24,437	3,003	2,044	
Real capacity (megawatt)	22,937	2,939	1,950	
Production (1000 mw/h)	97,862	13,498	10,274	
Hydroelectric dams				
Production (mw/h)	7,014,572	306,400	6	
Power extensions	14,127,396	588,316	966,968	
- Households	11,880,693	474,664	814,504	*
- Public	355,641	12,376	20,407	*
- Agriculture	44,159	659	1,927	*
- Industrial	74,627	2,900	5,316	*
- Commercial	1,772,276	97,717	124,814	*
Villages with electricity	39,654	1,772	3636	931
Households	3,649,562	228,093	440,713	146,629
Electricity consumption (megawatt)	77,646,091	1,964,077	3,528,661	*
- households	28,685,691	904,460	1,703,930	*
- public	7,076,572	153,216	191,506	*
- agriculture	6,781,945	9,106	66,531	*
- mining & industry	2,140,393	588,600	866,819	*
- commercial	8,483,893	233,737	456,607	*
- street lighting				

Source: Iran Statistical Yearbook, 1998

**Included in Mazandaran Province*

3.4.2. Potable Water

During past 20 years, many measures have been taken throughout the country to bring the main urban and rural residential regions within the network of the drinkable water and sewage system. To this end, about 7,396,493 cubic meter of water has been saved in the country's water reservoirs by end 1998 and about 6% of this total relates to the three Caspian coastal provinces. The length of these provinces' drinkable water network is 6,109 km or about 9 %of the county's network.

The longest length of the network is found in Mazandaran, Gilan, Golestan respectively.

The sewage system in these coastal provinces has not developed as much as the drinkable water system. Mazandaran and Golestan in particular have almost no sewage system and they are dumping sewage in wells.

In *Table 46* the situation of provision of drinkable water and development of the sewage system in the Caspian provinces is shown.

Table 46: Capacity of water reservoirs, length of network and number of water and sewage extensions in coastal provinces (1998)

Activity	Country	Gilan	Mazandaran	Golestan	Area total (km)
Reservoir capacity (m3)	7,396,493	147,107	233,740	85,750	334,207
Network length (km) with more than 80mm diameter	70,775	2,262	2,818	1,029	6,109
Number of extensions	6,997,158	190,920	288,569	119,798	599,293
Supply (lit/sec)	175,499	3,593	5,854	1,795	11,242
Production(1000m3)	3,975,534	87,000	129,970	50,231	267,207
Sale (1000m3)	2,931,802	69,007	102,946	35,923	207,876
Sewage network(km) more than 200mm diameter	12,706	1422	18	28	1,468
Sewage extensions	830,864	143,206			143,200

Source: Iran Statistical Yearbook, 1998

3.5. Environmental Risks

3.5.1. Water contamination

With an average annual rainfall of 250 mm, one third lower than the global average, most of Iran is arid or semi-arid and the only real green area is along the Caspian coast with an annual rainfall of more than 700 mm. Rapid population growth and increased urbanization

along with industrial and agricultural development are major factors affecting the quality of water resources.

Main water resources of Caspian region are fresh water from rivers and from brackish water of Caspian itself. The main source of pollution in these waters can be categorized as: (1) household sewages, (2) industrial effluents, herbicides, pesticides and chemical fertilizers; and also solid waste. As more water is supplied for household consumption and volumes of house hold sewage increases, water wastage and water pollution can both be expected to rise in the years ahead. In Northern provinces, especially in Gilan Province, where there are many factories and small-scale workshops, a major cause of water pollution is the release of effluents into rivers and absorbent wells. Because of the vast majority of factories do not have their own water treatment facilities -or if they do, their capacity is insufficient- most of their effluent is returned directly to water resources.

A. Groundwater

Because of the soil characteristics and well usage along the Caspian populated areas, groundwater is also polluted through improper disposal of solid waste and environmentally unsound use of nitrogen-based artificial fertilizers. Since groundwater moves very slowly, these foreign materials can persist in water tables for decades, not only damaging the region's water resources as a whole, but also taking years to get rid of.

Chemical pollution of groundwater -particularly by nitrates, detergents and heavy metals -has also reached serious levels in the region. Studies indicate that the level of nitrates concentration in potable water is rising in some areas, such as Sari and Babol in Mazandaran Province.

Unfortunately, exact and comprehensive figures regarding the level of contaminants in groundwater of Caspian provinces are not available and therefore there is an urgent need to quantify and document the level and extent of such problem. One of the main sources of drinking water for human consumption in this region is the well. Wells are also used for agricultural and industrial purposes, and constitute 49% of the total supply. Groundwater resources are utilized in Mazandaran and Golestan provinces but not so much in Gilan Province. The deep and semi-deep water wells are the main sources of water supply, and in fact more than half of consumed water is obtained in this way.

Almost all of the cities and villages in Gilan have piped water networks. These networks have a few water wells, which are equipped with floating engines. Water is pumped to the pipeline system in different times of the year (avoiding the peak period). Pressure of water in the pipes is not adequate and some times water is muddy and mixed with other substances. Deep wells provide water, which is pumped to the

surface, chlorine is added and after inspection, it is pumped into the pipes for distribution.

None of the cities in Mazandaran and Golestan possesses sewage system. This causes problems, particularly in the cities where water table is shallow and close to, the surface and waters of different origin are mixed.

Samples taken from the various cities in Mazandaran indicated that 98.8% of samples (n=87) were devoid of any chemical pollution. The microbial pollution of these samples did not exceed 20.7% of the total, which is far beyond the standards.

Sample taken from the waters in Gilan, (n=80) also indicated that chemical pollution did not occur at all. Biological pollution of the said samples was receded to 1.3% only, which is quite good, particularly in an area with many types of pollution sources.

B. Rivers

As it was mentioned before, there are more than 800 permanent and seasonal rivers, mainly flowing into the Caspian Sea. About 36 rivers are regarded as major rivers and the total average flow of these main rivers exceeds 16, 000 million m3 annually.

These rivers originate from high mountains of Alborz Range and then pass through populated areas or agricultural lands towards the Caspian, carrying almost al kinds of different materials and pollutants. In other words, rivers along the Caspian are in practice main place of dumping of waste and polluted materials, especially in polluted areas. This situation has caused a serious problem especially in rivers running in Gilan Province around the city of Rasht and Port of Anzali.

The main sources of riverine pollutions are therefore, household sewage, industrial effluent and agricultural wastes (e.g. herbicide).

The pesticide, herbicides and chemical fertilizers used increasingly in agricultural sector in recent decades to increase crop yields, have become a major source of pollutants in rivers. This is even worse in Golestan Province, where as the extra usage of fertilizer and chemicals, which rank first in the country (because of cotton crops which are sprayed with poison by more resistance pesticides) are mainly washed by rain after harvesting season (November) and get carried away to the sea through Gorgan Bay by Ghareh-soo and Gorgan-rood rivers. This is the same situation with rice fields, which use many durable pesticides such as lindine and Diazitone granules. The inflow of fertilizers from agricultural lands by rivers into the marine environment causes the blooms of uni-cellular or multi-cellular algae in the water resulting in oxygen depletion and pH decrement during the night. This is also the cause in Gorgan Bay and Anzali lagoon. The final effect of this situation is ecological changes especially biodiversity. The

amount of pollutions in different rivers of southern Caspian and their estimated load into the sea are discussed in the following section according to the pollutant and different environment.

C. Sea

The Caspian Sea is a closed marine ecosystem under constant environmental pressure by pollutants from the coastal regions as well as offshore oil installations. Pollution from coastal sources is due mainly to the lack of sewage systems and the consequent release of domestic and industrial effluent into the sea through coastal rivers, as it was discussed earlier.

The Caspian Sea also faces numerous environmental threats from oil extraction in the littoral states and the entrance of oil materials into the sea through rivers. Therefore, preventing oil pollution in the Caspian Sea is one of the major challenges to be addressed through national and regional cooperation. Microbial pollution caused by land sources, as well as heavy metals and other pollutants are also of great environmental importance and requires attention. The state of the Caspian environment regarding the amounts of different pollutants, their sources and the annual loads into the sea, based on available researches and studies are presented in section 5.2.

3.5.2. Exotic species

Iran is a vast country sharing boundaries with seven countries and two large water bodies; hence, the process of exchange of species across the man-made boundaries occurs regularly. The natural introduction of species is inevitable and does occur naturally throughout the world, as the species with the great powers of adaptation survive, expand and dominate new territories.

As in many other parts of the world, the introduction of exotic specie into the wild has resulted in disastrous consequences in Iran. Responsible organizations, such as the Department of Environment and the Ministry of Agriculture, are anxious to control any such actions and the Government of the Islamic Republic of Iran is determined to control any such trans-boundary transits. Customs and quarantine must be based on the "Precautionary Principle" and potential for exotic organisms to cause environmental damage.

False practices have aided this process and in the past have introduced some species of plants and animals, in many cases with disastrous results. One example is the introduction of Azolla *Azolla pinnata* from the Southeast Asia into the Anzali wetland. Although this aquatic plant was meant to be quarantined in a small pool, it escaped and found its way into natural environment where it flourished. Now this species (which is quite useful in Southeast Asia) has become a pest, competing with the other native species, for vital resources such as light and nutrients. Similarly, introduction of Grass Carp *Hypopharyngodon idell*

to the Hamoon Wetland, one of most natural and unpolluted aquatic ecosystems, yielded disastrous results, destroying the natural integrity of this ecosystem. Another important case, which has recently imposed a great danger to the marine life of the Caspian Sea, is the indirect introduction of Ctenophore and Jellyfish.

Invasion by comb jelly is one of the most important emerging environmental problems in the Caspian Sea. Mnemiopsis in its original habitat, before the 1980s, was restricted to the eastern seaboard of the Americas, with a range extending from Cape Cod, USA (41? N, 70? W) in the north, to Peninsula Valdez, Argentina (43? S, 64? W) in the south. This ctenophore is most common in bays and estuaries, and does not occur very far from shore, since it seems to do best in environments with high levels of food. In the 1980s, it was transported to the Black Sea in ballast waters. Mnemiopsis has many of the characteristics of an ideal invasive species. It is a simultaneous self-fertilizing hermaphrodite; consuming a wide spectrum of food; it tolerates a wide range of environments, with salinity ranging between 3.4 and 75 ppt and temperatures ranging between 1.3? C and 32? C; at optimal temperatures (above 20? C), it develops rapidly, reaching full sexual maturity in 12 days. It responds to elevated food concentrations with rapid growth and reproduction.

The presence of the comb jelly *Mnemiopsis leidyi* in the Caspian Sea was recorded for the first time by the Iranian Fisheries Research Organization in 1995, and warning letters were issued in this regard. Researchers from Tarbiat Modarres University also reported the occurrence of this species in large numbers. Today, after almost six years, this species has increased in number and a reduction in the catch of the fish kilka is thought to be linked with the presence of this comb jelly. However, further investigation is needed to prove the impact of *Mnemiopsis* on kilka stocks in the south Caspian Sea. It is also reported that *Mnemiopsis* has been found in funnel nets in large numbers. Two pilot studies were conducted in the southern Caspian; the results showed that in the winter of 2000, the maximum biomass of this ctenophore in the south Caspian Sea was 125 g/m^2 in the Khazarabad region; and none was observed in the surface waters of Amirabad

Chapter 4:
Institutions and Administration

4.1. Coastal Planning and Management's Legal Structure

4.1.1. Introduction

Taking into account the geopolitical position of Iran, the socioeconomic and environmental importance of Iranian shorelines becomes even more evident. A brief geographical study provides us with interesting statistics. Thirty one percent or 2,700 km of Iran's 8,755 km of borders are coastal borders. Of these, 2,043 km are situated in the south and 657 km in the north. The numbers reveal the necessity and significance of coastal preservation and management.

Considering the present regulations in regard to the legal status of the coastal lands and resources and the diversity of opinion in interpretation of these regulations by the concerned authorities, a comprehensive analysis of the legal status of these territories is indispensable. Hereunder the available regulations are reviewed along with a look at the organizations and institutions with legal or executive authority in the coastal territories of Iran.

Before engaging in our main discussion, it is essential to define certain terms and divisions. According to the **Coastal and Reclaimed Land Regulation** ratified in 1975, territories adjacent to bodies of water are divided into three categories: reclaimed, coastal and sea limits.

4.1.2. Reclaimed land

Reclaimed lands are the areas recovered because of water level decline or reduction of any other water current on the shores of seas, lakes, islands or wetlands.

Only the width of these lands is mentioned directly in the National Regulations ratified in 1963. It stipulates the horizontal line as 150 cm above the water level from the last point of seawater advancement.

However, the width of the reclaimed lands of the Persian Gulf, Sea of Oman and Lake Urumia is not mentioned in the National Regulations. The Council of Ministers is entrusted to determine the width of the reclaimed lands of the other lakes and wetlands in the country.

4.1.3. Coastal land

Coastal lands are the territories with a specified width along the shoreline of seas, lakes or gulfs that are bound at least on one side to these bodies of water.

According to law, the width of the coastal lands of the Persian Gulf and Sea of Oman is 2 km from the last advancement of water at the highest tidal point.

The width of the coastal lands of Lake Urumia is 1,000 meters from the last water advancement in 1974. The muddy areas connected to the width of these lands and salt marshes are considered as coastal lands up to their farthest limits. The width of the coastal lands of the Caspian Sea and other national lakes and wetlands has not yet been specified.

4.1.4. Sea limits

Sea limit is a part of the coastal or reclaimed land that is connected to seawater, a lake, gulf or wetland from one side. The sea limit width at Caspian Sea is 60 meters from the last point of water advancement in 1963.

The sea limit width at the Persian Gulf and Sea of Oman is 60 Meters from the last tidal point. The sea limit width at Lake Urumia is 60 meters from the last point of water advancement in 1974.

The sea limit width of other national lakes and wetlands must be determined by the approval of the Council of Ministers. *Table 47* will facilitate access to these data.

4.1.5. Regulations of Ports and Shipping Organization

The Ports and Shipping Organization (PSO) was established in 1960 according to the **Ports and Shipping Organization's Establishment Authorization Act** under the supervision of the Ministry of Customs. Its main obligations are:

"Administering harbor related affairs at the national level, completion, expansion and maintenance of port facilities, providing telecommunication equipment and security precautions as well as coordinating and implementing **Coastal Ports and Shipping Regulations** and safeguarding the development of commercial shipping. "

Article 4 of the act stipulates that:

"**The regulations incorporated in this act encompass all the ports, harbors, canals, navigable rivers and coastal waters. The limits of each port will be determined by the decree of the Council of Ministers. "**

In 1969, special senatorial and parliamentary commissions ratified the **General Regulations of the Ports and Shipping Organization.** The

organization was now defined as an affiliate of the Ministry of Finance in the first chapter of its general regulations. Nevertheless, the entire institution, including all its facilities and personnel were transferred to the Ministry of Road and Transportation on July 6 1973.

Table 47: Major water bodies (definitions & limits)

Body of water	Reclaimed lands	Coastal lands	Sea limit Width
Caspian Sea	Horizontal line at the height of 150 cm from the water level at the last advancement point of seawater in 1963 (at the points where this line intersects the public coastal road, the limits of the reclaimed land would be the aforesaid road.	It is not specified.	60 meters from the last point of water advancement in 1963.
Persian Gulf and Sea of Oman	It is not specified.	2 km from the last point of seawater advancement from the highest tidal point.	60 meters from the highest tidal point.
Lake Urumia	It is not specified.	1,000 meters from the last point of water advancement in 1974. The connected muddy lands and salt marshes up to their farthest limits are included in the coastal lands.	60 meters from the last point of water advancement in 1974.
Other National Lakes and Wetlands	It will be determined by the Ministry of Agriculture's proposal (currently, the Ministry of Jihad Construction) and the ratification of the Council of Ministers.	It is not specified.	It will be determined by the Ministry of Agriculture's proposal (currently, the Ministry of Jihad Construction) and the ratification of the Council of Ministers.

The second chapter of the General Regulations deals with the duties and the authorities of the organization. Article 22 of this section indicates that:

"The organization has the authority to issue establishment permits for wharves and other facilities as well as ratifying the concerned plan inclusive of the right of supervision in the construction and operation stages."

Although this act has not directly mentioned reclaimed and coastal lands and the limits of the sea, nevertheless, the article is basically related to construction procedures in the coastal areas. The measure does include executive power that is still in force and being invoked.

This organization is considered the custodian of ports and marine transportation. In order to implement harbor management, the legislator has made the establishment of any wharf or any related facility contingent upon the issuance of a permit from the organization. It is evident that construction of any marine facility without a permit is a flagrant contradiction of the jurisdiction and powers of the PSO.

4.1.6. Regulations of the Ministry of Construction Jihad

At present, the Forests and Pastures Organization (FPO) affiliated to the Ministry of Construction Jihad) and the Ministry of Power are the two institutions with the greatest legal responsibilities with respect to the country's coastal lands. Other public entities might have limited dealings with affairs related to these areas, but their interaction is insignificant in comparison with the above-mentioned ministries.

In order to have a better understanding of the established regulations; what follows is a brief chronology of these measures. It is important to point out that management and ownership regulations have altered according to the water level fluctuations in the domestic lakes especially the Caspian Sea and Urumia Lake.

- The first law ratified regarding reclaimed lands was approved by the Council of Ministers in 1932 and was in force until 1945. In this ordinance, the government relinquished its right to the ownership of reclaimed coastal lands.

- In 1945, the Cabinet published a new law that considered reclaimed lands as part of government property, thus abrogating the earlier law of 1932.

- In 1963, the Council of Ministers ratified another measure regarding the registration and sale of reclaimed land that was apparently valid until 1967.

- In 1967, both the Parliament and the Senate ratified the first act on the specific subject of reclaimed and coastal lands. The law was known as the `**Coastal Lands Act**' and was valid until its nullification in 1975.

- In 1968, the Council of Ministers passed a four-article decree on the subject of coastal lands. Although the decree was subsequently invalidated, the four articles are still referred to in some cases.

- In 1968, both houses of the legislature ratified the **`Water and Water Nationalization Process Regulation'**, which is no longer in force. It was overridden by another act in 1982, namely the **`The Fair Distribution of Water Act** '. (We will discuss this act in detail under the section of the Ministry of Power's regulations.)

- Currently, the outstanding law regarding coastal lands is the 1975 **`Coastal and Reclaimed Lands Regulation'**. Most of its stipulations are still enforceable. It defines reclaimed and coastal lands as well as sea limits and the appropriate widths. There are various regulations in regard to the superstructures built on the aforesaid lands, sale, rent and exchange of lands etc. The now defunct Ministry of Natural Resources and the Forests and Pastures Organization (which at the time was an affiliate of the Ministry of Agriculture) were designated to implement this act.

It is important to point out that the FPO was established according to Article 2 of **`The Law of Re-establishment and Determination of the Duties Entrusted to the Ministry of Agriculture and Natural Resources and Dissolution of the Ministry of Natural Resources'** ratified on March 1 1972. The responsibility of this organization in regard to reclaimed coastal lands is stipulated explicitly:

"**The Forests and Pastures Organization is being established in order to implement the duties and regulations on the subject of protection, restoration, development and proper exploitation of forests, pastures, forestlands, natural groves reclaimed coastal lands and water sheds."**

Meanwhile, **`The Reclaimed and Coastal Lands Regulation'** clearly defined the obligations and authorities of the FPO in regard to the disputed lands.

The Ministry of Agriculture and Natural Resources was renamed the Ministry of Agriculture and Rural Development according to the law of May 21 1977. Article 1 of this act states that:

"From the ratification date of this act, the Ministry of Agriculture and Natural Resources and the Ministry of Cooperation and Rural Affairs will consolidate and the Ministry of Agriculture and Rural Development will be established along with the entire obligations and authorities given by the law to the previous ministries. "

Article 3, Section A indicates the overall tasks of the newly established ministry:

"Implementation of the regulations concerning the ownership and incumbency of uncultivated and cultivated lands in the suburbs, forestlands, reclaimed coastal lands, forests and etc"

On November 28, 1983, Parliament ratified the **Ministry of Construction Jihad Establishment Act.** Article 4 of the said act states:

"All the tasks related to rural development through the *Ministry of Agriculture and Rural Development* indicated in the ' Renaming the *Ministry of Agriculture and Natural Resources* to the *Ministry of Agriculture and Rural Development* and re-organization of the *National Agricultural Organization Act*' ratified by the pre-revolution Parliament on March 21 1977 are being entrusted to the *Ministry of Construction Jihad.* Hereinafter the *Ministry of Agriculture and Rural Development* will be called *Ministry of Agriculture* and all the credits, facilities and organizations that were participating in rural development activities will be detached from this organization and transferred to the *Ministry of Construction Jihad"*

On February 1 1994, **'The Bill of Ratification Regarding the Comprehensive Objectives and Tasks of the Ministries of Agriculture and Construction Jihad'** was approved by the Council of Ministers.

Article 1, Section A defines the goals and tasks of Ministry of Construction Jihad as:

"Protection, support, restoration, expansion and proper exploitation of forests, pastures, forestlands, natural groves and reclaimed coastal lands as well as protection of watersheds. "

Article 3 of this bill describes the above-mentioned goals on the subject of coastal areas:

"**Preparing and organizing bills and recommendations in order to implement the goals and obligations of the ministry and eventually submitting them to the Cabinet."**

4.1.7. Regulations of Ministry of Power

The Ministry of Power as mentioned above is one of the most heavily involved organizations in the area of national coastal management. As previously stated, in 1968, both of houses of the legislature ratified the Article 66 **"Water and Water Nationalization Process Regulation"**

that was abrogated by the 1982 **"Fair Distribution of Water Act".** The previous measure said that construction of any type of superstructure on the shorelines of the seas and lakes are subject to the permission of the Ministry of Water and Electricity in accordance with the legal limits.

The **Fair Distribution of Water Act** plays an important role in matters concerned with coastal management. The 52-article regulation was ratified by Parliament on March 5 1983. The following are selected portions of this law related to our discussion:

ARTICLE 1: According to Article 45 of the I.R. Iran's Constitution, any body of water in the seas or any amount of water flowing in the rivers, natural streams and valleys or any other natural path whether it is on the ground or underground, flood-water, sewage, lakes, marshes, ponds, natural springs, mineral waters or underground water resources are public property. (They) are under the Islamic Government's jurisdiction. They will be exploited according to the public interest and the government has the authority to protect, rent and supervise their proper exploitation.

ARTICLE 2: The natural riverbeds, public canals, rivers whether they are seasonal or permanent, dry rivers and the limits of marshes and natural ponds are under the I.R. Iran's jurisdiction. In addition, coastal lands and reclaimed lands recovered from the decline of water levels in the seas and lakes or the drying up of marshes and swamps are considered public property. In case of non-restoration prior to ratification of `Revival of Waste Lands Act' in the I.R. Iran:

NOTE 3: It is forbidden to establish any kind of superstructure or excavation. (It is forbidden to) interfere with or possess riverbeds, natural streams, public canals, dry rivers, marshes and natural ponds, as well as any land within the legal coastal limits of the seas and lakes, whether they are natural or artificial, unless the Ministry of Power grants its permission.

NOTE 4: The Ministry of Power will notify the owner or the occupant of the superstructure to evacuate or demolish it during a certain period of time, if the superstructure is built on the river-bed or limits of the streams, rivers, public canals, dry rivers, marshes or natural ponds and interferes with the activities of the aforesaid ministry. If the owner or the occupant refuses to abide by the Ministry of Power's notification, this ministry would attempt to evacuate or demolish the superstructure with the permission and supervision of the public prosecutor or his/her representative. Damages will be determined and compensated according to the Articles 43 and 44 of this act.

ARTICLE 48: Issuance of operating permits or transfer of operation rights for exploitation of gravel, sand and clay from the river-beds,

streams, dry rivers or lands within the legal coastal limits of the seas and lakes is subject to prior approval by the Ministry of Power.

It is important to point out that the obligations and the range of authority of the Ministry of Power in proximity to the seas are limited to the lands within the sea limits and do not include the coastal lands.

The main reason for this limitation is enshrined in the reason for being of the ministry. In 1974, the Ministry of Power was established and superseded the Ministry of Water and Electricity. Article 1 of the **Ministry of Power Establishment Act** reads:

"In order to maximize the exploitation of national water and energy resources, as well as providing an adequate amount of water and energy for various kinds of consumption including industrial, agricultural, rural, urban and transportation means, the Ministry of Power is being established to fulfill the following main objectives":

- To determine the national energy policy
- To prepare and implement the necessary plans for establishment of electrical power plants, refining plants for extracting fresh water from salt water etc…
- To conduct studies and research in order to identify the national water resources whether they are on the ground, underground or etc…
- Monitoring the exploitation of water resources and implementation of the `Water and Water Nationalization Process Regulation'
- Performing necessary research in the field of water resources and applying new scientific and technical methods for optimum and more effective exploitation of water resources."

It is quite evident from the above legal text that the Ministry of Power has a broad range of responsibilities concerning water-energy. Hence, any kind of interference, possession or exploitation of national water resources must be under the continual supervision of this ministry. Therefore, the legislator has subjected the establishment of any facility within the limits of any body of water, to prior approval by the Ministry of Power. It is clearly quite possible that the establishment of any superstructure, excavation, alteration and possession within the limits of any body of water could interfere with optimum exploitation of water resources by the Ministry of Power.

4.1.8. Regulations of other organizations in the coastal areas

4.1.8.1. Regulations Concerning the National Trade and Industrial Free Zones

The Supreme Council of Trade and Industrial Free Zone in I.R. Iran ratified 16 articles of regulation regarding exploitation of land and national resources in the I.R. Iran's Trade and Industrial Free Zone. Articles 5 and 15 are cited for better understanding our discussion:

ARTICLE 5:

All the rights concerned with the lands located within the boundary of each region and subject to the Urban Land Regulation, State Forests and Pastures Nationalization Act, State Forests and Pastures Protection and Exploitation Act and the Coastal and Reclaimed Lands Regulation will be exercised by the previously mentioned organization according to this regulation.

ARTICLE 15:

All the authorities entrusted to the concerned ministries in dealing with trespassing, occupation and destruction of public and national lands, coastal lands and the sea limits according to the State Forests and Pastures Protection and Exploitation Act ratified in 1969 and its subsequent amendments, Coastal and Reclaimed Lands Regulation ratified in 1975, the entrusted authorities subject to Articles 11 and 15 of the Environmental Protection Act as well as the special authorities delegated to other public institutions, from the date of this regulation will be entrusted to this organization within the jurisdiction of the Free Zones.

4.1.8.2. Regulations of Fisheries Joint Stock Company

The Fisheries Joint Stock Company (FJSC) is a national institution closely associated to the question of marine affairs. It is the sole legal authority for exploitation of aquatic resources in the country. All legal articles concerned with this company have emphasized the observance of other ministries' regulations. And even though the company is not the decision-making authority in regard to national coastal management, there are certain legal articles worth mentioning that give this company freedom and authority in coastal constructions:

In Article 3 of the FJSC's Memorandum of Association, the domain of its activities is described as the entirety of the bodies of water located within the jurisdiction of I.R. Iran including Caspian Sea, internal waters (including all the lakes, rivers, marshes, dam-lakes), coastal waters etc.

The Note attached to the article states that:

"Fisheries joint Stock Company could employ any potentially suitable area for establishment of fisheries facilities in its domain of activities by observing all the legal principles concerned with coastal waters. "

Article 4 of this act describes the duties of fisheries and Clause A stipulates its major tasks:

- Establishment, development and maintenance of FJSC's ports by observing the duties of other ministries.
- Conducting all the necessary actions in order to protect the aquatic resources in the Sea of Oman, Persian Gulf, Caspian Sea, marshes, gulfs, estuaries and rivers related to the aforesaid sea by observing all the legal principles.

The FJSC has the legal responsibility of establishing structures for catching purposes in the coastal areas, but it has to acquire necessary permits from the concerned ministries. For example, the company has to obtain permission from the authorities listed below for port construction:

- National Forests and Pastures Organization according to the Coastal and Reclaimed Lands Act ratified in 1975.
- Ministry of Power according to the Fair Water Distribution Act Article 2, Note 3 ratified in 1982.
- Ports and Shipping Organization according to Ports and Shipping Organization General Regulation, Article 3, Clause 22 ratified in 1969 by the special commissions of both legislative houses.

Unfortunately, there is no well-defined procedure for acquiring these permits. This results in time-consuming bureaucratic entanglements and potentially irreversible mistakes in exploitation of national water resources.

4.1.8.3. Regulations of the Department of the Environment (DOE)

The **Protection of Seas and Rivers against Petroleum Contamination at International Borders Act** was ratified on February 2nd, 1976. Article 13 of this regulation concerning possible damages incurred to the ports or coastal structures stipulates that:

"In case of any damage incurred to the Iranian ports, beaches, coastal facilities, fishes or natural resources due to violation of

these regulations, a court will sentence the concerned authorities to compensate the damages"

Article 18 of the same act in regard to ecological studies states that:

"Any kind of marine ecological study as well as prevention of water contamination within our national territorial jurisdiction is still entrusted to the Department of the Environment."

According to the Article 19, the Ministry of Road and Transportation and the Ministry of Justice are bound to implement the above-mentioned law.

4.1.8.4. The Act of Establishment for the National Committee of Battements of Natural Disasters and their Effects

According to this law:

"This committee is being established to exchange information, studies and national research and to develop rational procedures for prevention and reduction of natural disasters' effects due to storms, floods, drought, from pests, air pollution, earthquakes and earth movement, water level fluctuation in seas, lakes, rivers and etc… The chairman of this committee is the Interior Minister. (The committee) is comprised of ministers and high authorities of the following institutions and ministries: National Meteorological Organization, Ministry of Power, Ministry of Agriculture, Ministry of Health, Ministry of Construction Jihad, Ministry of Road and Transportation, Budget and Planning Organization, Department of the Environment, Ministry of Housing and Urban Development, Geophysics Institute, Red Crescent, Forests and Pastures Organization and Ministry of Commerce (With approval of the chairman, the military forces could have a representative in this committee).

In the Second Note of the same article, the Budget and Planning Organization is ordered to allocate the necessary credits to implement this plan, if other related institutions have not foreseen a specific budget for this issue.

Following this act, the decree for its enforcement was ratified by the Council of Ministers on March 2, 1994. Article 1 of this directive stipulates that:

"In order to prevent and abate the effects of natural disasters, the aforesaid national committee is being established as a coordinating committee with nine supplementary research committees to exchange information, studies and scientific research."

"The Supplementary Committee of Flood, Sea Water Level Fluctuation and River Overflow Prevention" has been established under the authority of the Ministry of Power and has the following members:

Ministry of Interior, Ministry of Power, Ministry of Construction Jihad, Ministry of Road and Transportation, Ministry of Housing and Urban Development, Housing and Building Research Center, I.R. Iran Broadcasting, National Meteorological Organization, National Geology Organization, Ministry of Agriculture and Ministry of Telecommunications. Its permanent secretariat is located in the Office of Protection, Engineering and Control of Rivers, Shorelines and Floods.

4.1.9. The Act for Establishment for the Higher Council of Oceanography

The above-mentioned council was instituted for scientific enhancement, development of a comprehensive policy, coordination of national activities and expertise and to insure proper exploitation of the valuable resources of the Persian Gulf, Sea of Oman and the Caspian Sea. Its establishment was ratified by the I.R. Iran Parliament on August 10 1991.

The members of the aforesaid council are:

Minister of Road and Transportation, Director of National Meteorological Organization, Managing Director of the Ports and Shipping Organization, Director of the Department of the Environment, Managing Director of Fisheries and Aquatic Affairs Company, Director of the National Geology Organization, Managing Director of the Continental Shelf Oil Company, Deputy Minister of Culture and Higher Education, Commander of I.R. Iran Navy, Commander of Sepah-e-Pasdaran Navy, Director of the Armed Forces Geographical Organization, three experts in this field appointed by the chairman of the council and the Deputy Minister of Telecommunications for International Affairs.

The Minister of Road and Transportation is the chairman of the above-mentioned council and its secretariat is located in the National Meteorological Organization.

This council is comprised of seven specialized committees that include:

1. Committee of Oceanography, Dynamic Physics of Oceans and Marine Meteorology (National Meteorology Organization)

2. Committee of Marine Services, Marine Law and Transportation (Ports and Shipping Organization)

3. Committee of Ocean Engineering and Marine Topography (Oil Ministry)

4. Committee of Marine Environment and Marine Contamination Control and Monitoring (Department of the Environment)

5. Committee of Living Marine Resources (Fisheries and Aquatic Affairs Company)

6. Committee of Inorganic Marine Resources (National Geology Organization)

7. Committee of Oceanographic Education and Culture (Ministry of Culture and Higher Education)

4.1.10 Conclusion

1. Coastal and reclaimed lands belong to the government, except in the cases that the law has foreseen. (See the Articles 3 and 4 of the **Coastal and Reclaimed Lands Regulation**).

2. Issuance of construction permit within the legal sea limits, depends directly on the status of the applicant (whether it is a public institution or the private sector):

   A) In reference to Article 7 of the Coastal and Reclaimed Lands Regulation:

   "If a public institution is planning to establish a necessary facility within the legal coastal limits, it has to obtain the permission of the Council of Ministers for the desired exploitation and application. Upon completion of this stage, the permission of the following authorities for construction on the land areas within the sea limits is required:

   - National Forests and Pastures Organization (According to the Coastal and Reclaimed Lands Regulation)
   - Ministry of Power (according to the Fair Water Distribution Act, Article 2, Note 3)
   - Ports and Shipping Organization (according to the General Regulations of Ports and Shipping Organization, Article 3, Clause 22)

B) If the private sector wants to establish a facility within the legal sea limits, it has to receive permission from at least four different authorities.

I. Permission of an institution that the facility's activity falls within the jurisdiction of.

II. National Forests and Pastures Organization (for implementation of Coastal and Reclaimed Lands Regulation)

III. Ministry of Power (for implementation under the Fair Water Distribution Act)

IV. Ports and Shipping Organization (According to the General Regulations of the Ports and Shipping Organization, Article 3, Clause 22)

3. In reference to Article 9 of the Coastal and Reclaimed Lands Regulation, sale, rent and exchange of coastal and reclaimed lands fall under the jurisdiction of the Ministry of Construction Jihad.

4. According to the Article 8 of the Fair Water Distribution Act, issuance of an operating permit or the transfer of operational rights to exploit sand, gravel and clay within the national coastal limits is entrusted to the Ministry of Power.

5. In reference to the Coastal and Reclaimed Lands Regulation, Article 4, Note 1, and according to the Urban Land Organization's New Memorandum of Association, Article 5, Note 2 ratified by the Council of Ministers in 1988: The Urban Land Organization is authorized to implement the regulations related to this matter. This applies if the reclaimed lands or the lands within the coastal limits are considered inside city limits. (The Urban Land Organization was renamed the National Land and Housing Organization in 1993.)

6. According to the Coastal and Reclaimed Lands Regulation, Article 11, any trespassing into the aforesaid lands and their illegal occupation or destruction by removing sand, gravel, soil or stone is considered a public offense and is subject to legal punishment and if required to eviction and dispossession. The Ministry of Construction Jihad (FPO) is bound to immediately react and request police assistance in removal of the trespassers and to inform the court in writing about the location of the crime for the ensuing criminal prosecution.

Chapter 5:
Important Issues

5.1. Sustainable use of natural resource

Tackling the threats to the human environment – notably water, soil and air – is a complex problem. A comprehensive approach is needed to take into account a wide range of issues relating to management, legislation, education and institution-building, and would have to comprise two sets of measures. Macro-level measures would address the complete range of issues involved in I.R. Iran's human environment problem as a whole, while provisional level measures would focus on making improvements in sectors related to water, soil and air.

A. Macro-level measures

A number of measures are recommended at the macro level to strengthen environmental management in I.R. Iran so that the challenges the country is facing can be tackled effectively.

Restructure and strengthen the Department of the Environment and its affiliated institutions and committees on order to increase their ability to carry out the provisions of Articles 43 and 50 of the constitution as well as Agenda 21, regarding the well being of the environment.

Conduct comprehensive studies aimed at developing the laws, regulations, and quantitative/qualitative standards needed to achieve the environmental goals.

Assess the environmental impact of current and future development projects.

Adopt an "ecosystemic" approach to urban development, particularly in planning municipal services and infrastructure such as transportation, housing, communications, sewerage systems and commercial areas and industrial parks.

Use economic tools such as imposing taxes to reduce water, soil and air pollution; raising prices to curb excessive consumption of fossil fuels; and fining polluters.

Use educational programmes and media campaigns to enhance public awareness of environmental pollution.

Gradually phase out subsidies on fossil fuels.

B. Provisional level preventive measures

- Special measures to prevent and reduce pollution also need to be applied in sector directly related to water, soil and air.

- Expand and increase the number of air quality monitoring stations in urban areas, such as Rasht, Anzali, Sari and Gorgan.
- Require vehicles to meet exhaust emission standards.
- Implement pollution controls on old vehicles that emit heavy exhaust fumes and strictly enforce existing emission regulations.
- Use clean technologies in industrial activities.
- Expand natural gas delivery networks and convert vehicles to propane fuel.
- Develop and implement a provisional waste management program.
- Take environmental considerations into account when locating industrial units and planning land use.
- Recycle methane gas from landfills.
- Make combustion systems more efficient.
- Improve construction and insulation techniques.
- Conduct environmental impact assessments for any new activity, especially factories or activities related to environmental changes.
- Establish provincial water conservation measures.
- Require municipalities and housing and urban development offices to respect environmental concerns when preparing urban master plans.
- Require farms to construct proper drainage systems for agricultural wastewater.
- Draw up and implement a plan for reducing the consumption of pesticides and chemical fertilizers, promoting the use of organic fertilizers and monitoring the application of agricultural chemicals.
- Require industrial units, housing complexes and hospitals to construct and use water treatment systems.
- Prevent pollution from solid waste disposal by locating landfill sites appropriately.
- Draft appropriate laws and regulations and apply innovative farm management techniques to ensure the sustainable exploitation of soil resources and farmlands.
- Prevent the conversion of fertile agricultural lands and forests to construction and industrial uses.
- Prevent direct percolation of pollutants through the soil.
- Educate the users of soil resources, particularly farmers, about the causes of soil degradation.

- Adapt strict measures on proper waste disposal, especially at places near or adjacent to rivers or to the sea.

5.2. Marine pollution and water quality

5.2.1. Source of pollution

Main Sources of Pollution entering into the marine environment could be categorized as follows:

5.2.1.1. Surface Waters

Rivers carry pollutants to the sea. More than 90% of pollution is therefore related to the rivers. These rivers carry effluent and sewage, from the industrial complex to the lowlands. Along their path, the rivers also tab the agricultural wastes and transfer them down stream.

All sorts of pollutants may be found in the composition of the water e.g. hydrocarbon, artificial compounds, organic matter, metals, nutrients, etc.

Self-refinement is not reliable in these environments, and occasionally concentration of pollutants is ten times the standard level.

5.2.1.2 Effluent

Transfer of the pollutants, produced by factories, farms, and residential areas, by the rivers threatens the ecosystem of the sea. Occasionally, large amounts of pollutant are injected into a small area such as the estuary, which kills all types of marine life. Storm, waves, wind may create such a situation. Uncontrolled use of fertilizers may enrich the rivers and lakes and render it vulnerable to eutriphication. This may cause growth of seaweeds and reduce the dissolved oxygen in the water. This phenomenon is seen in Anzali complex. Pesticides are eventually carried to the rivers and marshes, concentration of harmful metals such as mercury increases and it is passed to the different levels of food chain. Fish are the eventual consumers and man is the receiver of the contamination.

Lead, is also added to the waters by the effluent of battery making factories, paint producing factories, etc. This element also finds its way into the food chain including human beings.

Mercury is used in industries such as mirror making, electronics industry, plastic manufacturing. Cadmium like wise is used in battery making factories, plastic manufacturing, etc. All these elements have detrimental impact on human health. Thermal pollution raises the temperature of water and kills off the marine organisms.

5.2.1.3 Oil pollution

Discharge of large volumes of oil into water, threatens the aquatic environment. Increase in the oil exploration and exploitation activities in the Caspian Sea is the main source of the oil pollution. Traffic of super tankers in the Caspian, increases the discharge of oil products. Different stages of oil exploration and exploitation causes heavy damages to the environment.

Marshes in the Southern Caspian region are well known as breeding and resting habitats for birds. Oil pollution adversely affects the populations of these birds. Pollution interferes with breeding biology of birds and eventually kills them. Oil damages the marine life both, in the water and ashore.

5.2.1.4 Sea transport

Large numbers of vessels travers the Caspian Sea. Each of these vessels, produce oil slick and all together, they pollute the waters. These vessels have to tab large volumes of water in their tanks, to keep their balance on the water. When this water is discharged, all types of oil products (ballasting and deballasting), are released into the sea. Sometimes vessel traffic includes transportation of animals also. Noise pollution is also associated to the oil production and movements of the ships.

5.2.1.5 Harbors and anchor sites

These are the most polluted sites in the Caspian. Harbor activities (e.g. cleaning, service, etc.) render the harbors un-hospitable to the marine life.

5.2.1.6 Urban and industrial development

Increase in the population of cities in the coastal areas, resulted in an increase in the residential units and this has resulted in over production of sewage, and urban waste. Industrial waste, hospital waste and laboratory effluent are all produced in large volumes. Mixing of this effluent with drinking water occurs because of surface waters, entering the wells. The water level, is high, close to the surface and run off, and often easily mixes with the underground water and sewage. This spreads epidemic infectious disease among the people.

5.2.1.7 Interference with Nature

Sand excavation changes the behavior of rivers. Obtaining each ton of sand yields 200 kg of small, fine particles. These materials are released into the rivers. For some river, this may exceed 4 tons/day. If the suspended particles reach threshold of 100 mg/l. 85% of benthic creatures are lost.

Harvest of the shells form the beaches, changes the slope, changes the birds habitat, destroys the top soil and causes soil erosion, changes in the course of rivers and building embattlement, stops fish migration. Altered embankment will also impact the environment and causes soil erosion. Presence of soil particles in the water decreases the light penetration and affects rate of photosynthesis in the water.

5.2.2. Nature and quantity of Pollution

5.2.2.1. Point Sources

A. Nutrients

According to the data collected throughout the Southern Caspian coastline from 19 stations, the following results have been obtained concerning the concentration of nutrients in the seawater (*Table 48*).

Phosphates (PO_4)

The range of PO_4 seawater content is between 0.03 and 0.15 ppm with an average of 0.06 ppm. The maximum standard level (WHO, 1984) of phosphate in surface seawater is 1 ppm, therefore none of the 19 stations were polluted according to this standard.

According to the results obtained, the average concentration of PO_4 on the eastern side of the sea (0.08 ppm) is more than that of the western side (0.05 ppm). The maximum amount was observed in Chapak-rood River and in Ghare-soo River and Chaloos area, and the minimum in Jaf-rood River.

Nitrates (NO_3)

The range of nitrate concentration in the surface seawater is between 0.03 and 0.41 ppm with an average of 0.21 ppm, therefore none of the stations surveyed had a level more than standard. Again, the average amount on the eastern side of the sea (0.21 ppm) is more than the western side (0.20 ppm).

The surface seawater in Sefid-rood, Chaloos, Lang-rood and Tonekabon regions possess the highest concentrations and Chapak-rood, Anzali and Kapoorchal proved to have the lowest amount of nitrate contents.

Estimation of input

To determine the river nutrients loads into the sea, sampling was carried out on samples from 7 stations situated on the river mouth, taking into account the total annual volume discharged by each river, the following results were obtained (*Table 49*).

Table 48: The concentration of PO_4 and NO_3 along the Southern Caspian

No.	Location	Amount (ppm)	
		NO_3	PO_4
1	Ghare-Soo Rm.	0.27	0.11
2	Palangan S.	0.23	0.08
3	Tajan Rm.	0.30	0.09
4	Chapak-Rood S.	0.03	0.15
5	Babol-Rood Rm.	0.23	0.06
6	Sorkh-Rood Rm.	0.26	0.08
7	Alamdeh S.	0.10	0.04
8	Hosseini S.	0.18	0.07
9	Chaloos Rm.	0.35	0.11
10	Salmanshahr S.	0.14	0.04
11	Nashta-Rood Rm.	0.24	0.09
12	Tonekabon Rm.	0.30	0.09
13	Ramsar S.	0.21	0.07
14	Langrood S.	0.33	0.04
15	Sefid-Rood Rm.	0.41	0.05
16	Gaf-Rood S.	0.10	0.03
17	Anzali Rm.	0.08	0.04
18	Kapoorchal S.	0.09	0.08
19	Astara Rm.	0.17	0.07
	Standard limit	**50.00**	**1.00**

Table 49: The input of nutrients from different rivers into the Caspian Sea

No.	River	Water Volume $10^6 m^3$	PO_4		NO_3		Total (tons)
			%	Amount	%	Amount	
1	Ghare-soo	101.0	3.63	11.11	1.37	27.27	38.380
2	Tajan	207.4	6.09	18.66	3.13	62.22	80.880
3	Babol-rood	425.0	8.33	25.50	4.93	97.75	123.250
4	Chaloos	372.0	13.37	40.92	6.56	130.20	171.120
5	Nashta-rood	30.7	0.90	2.76	0.37	7.36	10.123
6	Sefid-rood	4,000.0	65.53	200.00	82.70	1,640.0	1,840.000
7	Astara	101.0	2.31	7.07	0.86	17.17	24.240
Total	**----**	**5,237.1**	**100.16**	**306.02**	**99.92**	**1,981.97**	**2,287.993**

As a whole, the maximum river nutrient load was observed at the Sefid-rood estuary (1,840 tons per year) followed by Chaloos river estuary (171 tons per year), the lowest loads were observed at extreme west (Astara) and east (Ghare-soo) coastal estuaries. The annual total load of these rivers is estimated to be 2,288 tons.

B. Total Suspended Solids (T.S.S) and BOD

Above mentioned surveys indicate that the amount of T.S.S in seawater is more than the standard limit (WHO, 1984) in all stations of the urban and agricultural sewage are the main source of such a high T.S.S. level. Astara station demonstrates the highest contamination followed by Ghare-soo and Palangan stations. The minimum amount is observed in Babol-rood region having a level below the standard limits (*Table 50*).

Table 50: The concentrations of T.S.S along the Caspian Sea

No.	Location	T.S.S. (ppm)
1	Sorkh-rood	114.50
2	Babol-rood	37.80
3	Tajan	89.36
4	Ghare-soo	217.85
5	Gorgan	147.58
6	Gorgan-rood	97.10
7	Palangan	143.50
8	Astara	401.80
	Standard limit	**40.0**

The amount of BOD was measured only in three stations, results indicate levels below the standard level (WHO, 1984) ranging from 2.33 -13.27 ppm (*Table 51*).

Table 51: The concentrations of BOD along the Caspian Sea

No.	Location	BOD5 (ppm)
1	Babol-rood	1.4
2	Tajan	13.27
3	Chaloos	2.33
	Standard limit	**50**

Amongst the five rivers investigated, Gorgan River with 40.5% total suspended material has the maximum load, and Babol-rood River with 9.8% has the minimum load. The total TSS load of these (five rivers) into the sea is estimated to be about 163,000 tons annually (*Table* 52).

Table 52: Input of T.S.S. into Caspian Sea

River	Volume water ($10^6 m^3$)	T.S.S (tons)	Percent	Information
Babol-Rood	425.0	16,065	9.83	1 season only
Tajan	207.4	18,533	11.34	4 seasons analysis
Ghar-e- soo	101.0	22,002	13.47	12 months analysis
Gorgan	448.0	66,115	40.48	4 seasons analysis
Astara	101.0	4,058,108	24.85	10 months analysis
Total	**1282.4**	**4,180,823**	**99.97**	

C. Petroleum Hydrocarbons

In Water

Based on the results obtained from investigations made at 9 sampling stations along the Caspian Sea coastal zone, from Astara to Babolsar, (*Table 53*), the average concentration of petroleum hydrocarbons is negligible, reaching 2.2 ppb, therefore water of these areas could be considered unpolluted.

Table 53: The Concentration of petroleum hydrocarbons

No	Water (ppb)		Sediment (ppm)	
	Location	Amount	Location	Amount
1	Chamkhale	2.18	Chamkhaleh	54.85
2	Kiashahr	7.81	Kiashahr	82.01
3	Astara	1.79	Babolsar	85.12
4	Lisar	1.37	Gorgan Rm.	24.46
5	Shafa-rood	2.22	Neka S.	20.66
6	Babolsar	1.45	Amirabad S.	22.73
7	Tonekabon	1.02	Tonekabon	68.65
8	Chaboksar	0.98	Khajehnafas S	18.60
9	-	-	Tajan Rm.	25.96

In Sediments

Data obtained (*Table 54*) reveals that petroleum concentrations in the sediment of sampling stations ranges from slightly polluted (18.6 ppm) up to heavily polluted (85.12 ppm). The average Petroleum content at all these stations is 42.7 ppm, therefore the whole region could be regarded as moderately polluted.

The distribution pattern of petroleum contamination along the entire coast reveals that the maximum concentration of petroleum

hydrocarbons occur in the middle region (from Sefid-rood to Babol-rood), and the eastern coastal region is the least polluted.

Estimation of Input

The petroleum hydrocarbon input by rivers, flowing into the Caspian Sea has been measured for two rivers, Astara (west) and Shafa-rood (South of Astara). Approximately 0.61 tons of petroleum hydrocarbons annually enter the Caspian Sea through these two rivers (*Table 5.7.*).

Further studies are needed to measure input of all other rivers in order to calculate the total petroleum hydrocarbons discharge into the sea.

Table 54: Input of Petroleum Hydrocarbon into the Caspian Sea

River	Water Volume $10^6 m^3$	Petroleum Hydrocarbons	Percent
Astara	101.0	0.181	29.72
Shafa-rood	192.5	0.428	70.27
Total	293.5	0.609	99.99

Heavy Metals

Heavy metals concentrations in the marine organisms, sediments and water of the Caspian Sea have been measured (*Table 55*) and results obtained are discussed in this section.

Biota

Various degrees of heavy metals concentration have been determined in different fish muscles. Based on the degrees of heavy metal concentration the pollution could be classified as: un-polluted, slightly polluted, and heavily polluted. Among the estimated heavy metals concentration in the fish muscles only silver (Ag) concentration is less than the permissible concentration. The concentration of (Cr) is about the permitted level, while concentration of Cd, Hg and Pb is twice as much as the permissible concentration. The fishes of the Caspian Sea are polluted with certain concentration of Zn and Cu.

Fe and Mg are the most dominant toxic pollutants found in muscles of most of the fishes.

Invertebrates: concentration of heavy metals in invertebrates is much less than that of the fishes.

Table 55: Concentration of heavy metals in water, sediment and biota

		Surface Water						Surface Sediment						Aquatic Animals					
		River		Anzali Wetland				Anzali Wetland		Rivers		Caspian Sea		Caspian Fish			Mollusks		
Metal	Permitted Level	Concentration Range (ppm)	Pollution Extend	Concentration Range (ppm)	Pollution Extend	Mean Crust of Earth (ppm)	Mean World Sediment (ppm)	Concentration Range (ppm)	Pollution Extend	Concentration Range (ppm)	Pollution Extend	Concentration Range (ppm)	Pollution Extend	Permitted. Level (mg/kg)	Concentration Range (ppm)	Pollution Extend	Concentration Range (ppm)	Pollution Extend
Hg	0.001	0.534	NP	0.23-0.77	VP	0.08		1.1-4.1	VP	1.100-2.500	VP			10-2	0.03	P		
Cd	1.000	0.001-7.6	NP	0.01-0.04	NP	0.2		0.3-1	P	0.001-7.400	NP-VP			15-0	0.21	P		
Pb	1.000	0.09-32.1	NP	0.13-0.37	NP	14	19	22.5-140	VP	0.020-7110.00	NP-VP			200	0.3-2.3	NP-P	16.1	NP
As	0.010	0.028	NP	0.01-0.04	P	1.8		0.1-1.1	NP	0.3-0.7	NP			50				
Cr	1.000	0.5-1.57	NP	0.98-1.93	P	100	70	65.1-142.5	P	0.04-3403	NP-VP	14.2-109.7	NP	0.02-21	0.19	NP		
Cu	1.000			0.02-0.04	NP	50	33	34-51	NP	0.003-132	NP-VP	17.3-168.1	NP-VP	? 10	0.4-53.4	NP-P	120.6	NP
Zn	1.000			0.01-0.11	NP	75	95	81.5-200	VP	0.01-853	NP-VP	13.2-104.7	NP-P	? 15	14.6-38	P-VP	325.7	NP
Ni	1.000	0.35-5.7	NP	0.26-0.45	NP	80	52	14.3-23.9	NP	0.01-200	NP-VP			1				
V				0.35-1.33			135	21-131.8	NP	34-77.6	NP	45.3-112.7	NP					
Fe	3.000			0.07-0.03	NP	4.41	4.41	2.9-4.7	NP	0.8-5415	NP-VP	0.9-5.8	NP	26.2	0.07-0.28	VP	1492	NP
Mn	0.001-0.600			0.01-0.47	NP	850	770	208-892		251-823	NP	207.5-892.1	NP	? 0.1	0.4-30.9	P-VP	20.2	NP
Ag	0.001-0.010					0.1				0.003	NP			20-80	0.3	NP		

Compared to fishes, the average concentration of heavy metals in invertebrates is 100 times less than that of the fishes. Invertebrates play an important role in the marine food chain. Therefore, accumulated heavy metals in the invertebrates could possibly be transferred to the higher trophic level of the food chain.

Further detailed studies focusing on the determination of other pollutant concentration of invertebrates are required.

Sediments

Heavy metals concentrations were measured in rivers, Anzali wetland and the Caspian Sea sediments. Rivers of the Caspian Basin have various degrees of heavy metals concentrations, are directly proportional to the distance from the steel factories or mines situated on the bank of rivers. Sediments of the Anzali wetland are considered highly polluted due to their high concentration levels of Hg, Cr, Pb and Zn. As far as other heavy metals concentrations are concerned, they could be classified as little contaminated or un-polluted.

Water

The waters of Sefid-rood River and Anzali wetland were investigated for any heavy metals concentration. Results showed a low concentration of heavy metals compared with the standard limit (WHO, 1984). This indicated that these waters could be classified as un-polluted. Further investigations are needed in this regard.

5.2.2.2. Non-Point Sources

These types of pollution sources comprises of agricultural effluents and pollutants, divided into two groups: A) Chemical fertilizers and B) Pesticides

A. Chemical fertilizers

Nitrates and Phosphates are the main components of most chemical fertilizers used in Iran. Sixteen percent of the total fertilizers (national consumption) are used in the northern provinces of Iran, Gilan, Mazandaran and Golestan. In Gilan, 51,553 tons of fertilizers were used in 1996, out of which urea constituted 61% .The amount of fertilizers used in Mazandaran and Golestan was 190,217 tons in the same year, out of which ammonium phosphate constituted 52% (*Table* 56).

During 1996, 241,770 tons of fertilizer was used in the northern provinces of the IR-Iran, of which Urea has been the most commonly used (48%).

Table 56: The type, amount and percent of the used chemical fertilizer in the northern provinces (ton)

	Province Mazandaran & Golestan		Gilan		Total	
Fertilizer	Amount	%	Amount	%	Amount	%
Urea	85,675	45.040	31,249	60.610	116,924	48.36
Ammonium Nitrate	1,335	0.700	1,723	3.340	3,058	1.26
Ammonium Sulfate	952	0.500	2,460	4.770	3,412	1.41
Ammonium Phosphate	97,254	51.120	15,576	30.220	112,830	46.66
Super Phosphate Tripol	2,400	1.260	1	0.001	2,401	0.99
Potassium Sulfate	2,590	1.360	544	1.050	3,134	1.29
Others	11	0.005			11	0.03
Total	190,217	99.985	51,553	99.991	241,770	100.00

B. Pesticides

In recent years, the use of pesticides has increased because of agricultural intensification in Gilan, Mazandaran and Golestan provinces.

According to WHO, 3.2% of the authorized pesticides used in Iran are considered as extremely dangerous, 11.8% of these pesticides are classified as seriously poisonous and 24.7% are semi dangerous. Statistics indicate that in 1996, eight groups of pesticides have been used in solids and liquids, and only one type was used in evaporate form. In 1996, 2,935,726 litters of liquid pesticides and 2,591,062 kg of solid pesticides were used in these two provinces; herbicides (43%) and insecticides (74%) were the most commonly used chemicals.

In Gilan Province alone, 914,942 litters of liquid pesticides (insecticides 83%) and 638,426 kg of solid pesticides (insecticides 63%) were used. In other words, 62.2 litters of chemicals were used in each square km of Gilan, out of which 43.4 kg was in solid form.

In Mazandaran and Golestan province also a total of 2,020,784 litters of liquid (insecticides 38%) and 1,952,662 kg of solid pesticides (insecticides 71%) were consumed during the same period. This means that in each km^2, 45.3 litters of liquid and 43.8 kg of solid pesticides have been used (*Table 57*).

Table 57: List of pesticides used in Gilan and Mazandaran provinces

No.	Pesticides	Gilan		Mazandaran		Totals		Totals	
		(lit)	(kg)	(lit)	(kg)	(lit)	%	kg	%
1	Herbicides	577,026	14,156	683,558	39,672	1,260,584	42.9	53,828	2.07
2	Insecticides	152,433	526,325	775,541	1,369,393	927,974	31.6	1,895,718	73.1
3	Fungicides	28,642	89,755	114,468	503,313	143,110	4.8	593,068	2.8
4	Tickicides	155,842	1,990	447,147	--	602,989	20.5	1,990	0.07
5	Rodenticides	--	--	70	1,022	70	0	1,022	0.03
6	Snailicides	--	--	--	14,976	--	--	14,976	0.5
7	Miticides	999	6,200	--	24,290	999	0.03	30,490	1.1
8	Fumigates	352,638		--	500,000		852,638		

According to these data, it can be seen that in the whole coastal region, an average of 26.8 litters of liquid and 43.6 of solid pesticides have been used in each km^2. The type of pesticides used in the country is shown in ***Table 58***.

The following results were obtained from a survey carried out in Gilan and Mazandaran provinces regarding the input of pesticides due to agricultural activities along the Caspian coastal region. Seasonal variations and yearly fluctuation of pesticides used including, D.D.T, A.L.D, M.C, M.O.C and H.C.H, were detected in this survey.

Astara station indicated the highest level and the most commonly used pesticides were, Aldrine, H.C.H (Beta) as well as, H.C.H (Delta + Gama) in lower concentrations.

Summer and winter seasons showed highest and lowest level of pesticide respectively.

Astara and Ghare-soo Rivers had the highest level of pesticides concentration.

HCH was the most common pollutant and Di-Aldrine the least common pesticide used.

The average concentration of pesticides indicates that waters in Gilan are more polluted as compared to waters of Mazandaran and : HCH isomers, total HC, total Aldrine and DDT were the most commonly used pesticides.

Table 58: Concentration of organo-chloride pesticides (ppm) along the Southern Caspian Sea.

No.	Location	H.C.H	D.D.T	A.L.D	M.O.C	H.C
1	Astara R.	11.348	1.210	4.250	ND	2.251
2	Nokandeh R.	5.036	0.177	0.942	ND	1.505
3	Shafarood Ri.	4.370	0.141	0.830	ND	1.601
4	Anzali S.	7.994	0.702	2.067	0.821	1.425
5	Sefid-rood R..	1.808	0.179	0.236	0.470	1.131
6	Chamkhaleh R.	1.617	1.590	0.209	0.068	1.206
7	Ramsar R.	2.946	0.070	0.459	0.001	1.391
8	Nashta-rood R.	0.869	0.224	0.185	0.025	0.920
9	Sardabrood R.	3.809	0.130	0.057	ND	0.448
10	Chaloos R.	2.341	0.194	0.332	0.187	1.636
11	Sorkh-rood R.	1.724	0408	0.040	0.849	1.442
12	Babol-rood R.	1.604	0.432	0.289	ND	1.793
13	Talar R.	1.408	0.265	0.491	0.603	1.281
14	Larim R.	4.011	0.354	0.671	ND	0.985
15	Tajan R.	1.490	0.463	0.557	0.483	0.858
16	Ghane-soo R.	4.589	1.844	0.791	0.054	0.944
17	Khagehnafas R.	3.887	0.614	0.864	0.513	0.855
18	Anzali R.	2.323	0.0914	0.209	0.0027	1.570
19	Gafrood R.	0.927	ND	0.106	ND	1.083
20	Nashta-rood R.	2.099	0.003	0.022	ND	1.877
21	Babolsar S.	4.102	0.006	0.138	ND	1.537
22	Ashooradeh S.	2.017	0.021	0.017	0.318	1.533

According to the available data, each year more than 24 tons of chlorinated pesticides are carried into the southern Caspian basin by the inflowing rivers (*Table 59*).

These are the residue of the pesticides sprayed over the farmlands, orchards and other agricultural lands. The sprayed pesticides are broken down to less dangerous compounds and eventually are carried to the sea.

Amongst ten rivers studied, Sefid -rood was found to contain more than 50% of all different types of pesticides under study. This is mainly due to the vast surface area of the Sefid -rood basin and the discharge of farmlands and rice paddies, into the basin. Therefore, most of the insecticides used in these farms eventually find their way to the sea. Other than this river, three other major rivers; namely as Astara, Chaloos and Babol-rood, carry the highest amount of pesticides discharge into the sea.

On the other hand, the least amount of chlorinated pesticides is found in Nashta-rood and Sardab-rood basins. Concentrations of the

pesticides do not vary greatly, from west to east as pesticides are also heavily used in the western region.

The 60.7% (maximum) of the total HCH pesticides used in the region have been found in the Sefid-rood region, but only 2% (minimum) in Nashta-rood. Sefid-rood also possesses the highest concentration of D.D.T (49%), and Sardab-rood the lowest D.D.T concentration level that is only 0.4% of the total. Aldrine (ALD) concentration also happens to be the highest in Sefid-rood (46.2%) and lowest in Sardab-rood (0.1%).

The other two pesticides (MOC and HC) are also found to have their highest quantity in Sefid-rood with 92.3% and 65.8% respectively, and in the lowest quantity in Ghareh-Soo (0.2%) and Sardab-rood (0.3%).

It could be concluded that among the 5 surveyed rivers, the highest load of pesticides belong to Sefid-rood river and the lowest to Sardab-rood (while it passes through the mountains before reaching the sea).

Table 59: Input of pesticides into the Sea

No.	River	Water Vol. $10^? m^3$	HCH		DDT		ALD		MOC		HC		Total Tons
			Tons	(%)	Tons	(%)	Tons	(%)	Tons	(%)	Tons	(%)	
1	Astara	101.0	1.146	9.6	0.122	8.4	0.429	21.0	ND		0.227	3.3	1.924
2	Shafa-rood	192.5	0.843	7.1	0.027	1.9	0.160	7.8	ND	-	0.309	4.5	1.339
3	Nashta-rood	30.7	0.027	0.2	0.007	0.5	0.006	0.3	0.001	0.04	0.029	0.4	0.070
4	Sardab-rood	43.5	0.168	1.4	0.006	0.4	0.003	0.1	ND	-	0.020	0.3	0.197
5	Chaloos	372.0	0.871	7.3	0.072	5.0	0.124	6.1	0.070	3.4	0.609	8.9	1.746
6	Babol-rood	425.0	0.682	5.7	0.184	12.7	0.123	6.0	ND	-	0.735	10.7	1.724
7	Talar	118.0	0.166	1.4	0.031	2.1	0.058	2.8	0.071	0.3	0.151	2.2	0.477
8	Tajan	207.4	0.308	2.6	0.096	6.6	0.115	5.6	0.010	0.5	0.178	206	0.707
9	Ghar-e-soo	101.0	0.463	3.9	0.186	12.9	0.080	3.9	0.005	0.2	0.095	1.4	0.829
10	Sefid-rood	4000.0	7.232	60.7	0.716	49.5	0.944	46.2	1.880	92.3	4.524	65.8	15.296
Total	--	5591.1	11.91		1.447		2.042		2.037		6.877		24.309

5.3. Human Health and Well-being

From 1960 to 1995, Iran's human development index (HDI) indicators increased 0.452, moving Iran from the group of countries considered to have low human development to the ranks of those states enjoying medium human development.

The trend of growth in Iran's HDI in the past decade (from 0.642 to 0.758), has not been constant. There was a slight decline in 1995 and 1997. Advances in the national HDI are rooted both in the process of modernization and in the process of the changes wrought in the last 20 years. The transformation of the social environment has significantly affected income, education and health (the three basic components of HDI), bringing not only progress but also challenges to the country.

Before the revolution, GDP per capita expanded at a rate equal to 150% from $1,985 in 1960 to $ 4,970 in 1976. After the revolution growth slowed but in the second decade it rose from $ 3,715 to $ 5,222. There are wide disparities in human development at the provincial level (*Table 60*). In 1990, some provinces including Tehran, Gilan, Mazandaran, and Golestan enjoyed higher levels of human development than many other provinces. This gap, largely explained by the different levels of gross expenditure per capita, derives from the scope of opportunity, investment and economic resources available in the provinces.

According to *Table 60*, Gilan province is among the higher growth provinces and Mazandaran is listed in the medium range. Poverty distribution among the provinces is similarly uneven: It follows that provinces enjoying a higher level of human development have a lower level of poverty.

Table 61 delineates the gap between the richest and poorest provinces according to their ranking on the gross expenditure per capita index. The respective HDI, Human Poverty Index (HPI), Gender Development Index (GDI) and Gender Empowerment Measure (GEM) have been correlated and the positive difference shows that a particular province ranks higher on these indexes than the gross expenditure per capita index, while a negative difference indicates the reverse.

Table 60: Human Development by Province, 1996

Rank	Province	HDI	GDI	GEM	HPI
1	Tehran	0.842	0.610	0.441	11.3
2	Qom	0.795	0.555	0.229	17.6
6	Gilan	0.759	0.646	0.279	20.9
12	Mazandaran	0.724	0.566	0.245	22.1
26	Sistan & Baluchestan	0.545	0.393	0.222	39.5

HDI = Human Development Index
GDI = Gender –Related Development Index
GEM = Gender Empowerment Measure
HPI = Human Poverty Index
Source: Human Development Report of I. R. of Iran, 1999.

Table 61: Situation of Human Development and Gross Expenditure Per Capita Indices, 1996

Rank	Province	GEP	HDI	DIFF	GEP	HPI	DIFF	GEP	GDI	DIFF	GEP	GEM	DIFF
1	Tehran	1	1	0	1	1	0	1	4	-3	1	1	0
6	Gilan	9	6	3	9	7	2	9	1	8	9	6	3
12	Mazandaran & Golestan	13	12	1	13	10	3	13	7	6	13	10	3
20	Sistan & Baluchestan	23	26	-3	23	26	-3	23	25	-2	23	19	4

Source: Human Development Report I. R. Iran, 1999.

As it was mentioned above, the improvement in Iranian's health status over the last 20 years has been one of the main reasons for the progress in human development in the country. Expansion of health facilities, particularly health care has greatly contributed to longer life expectancy, which is one of the three components of the human development index (HDI).

To maintain these trends and achieve higher life expectancy, it will be necessary to sustain basic health care, conduct stronger campaigns against communicable diseases, pay more attention to the prevention

of non-communicable diseases, and take measures to prevent genetic diseases. Also promote a culture of using health and medical information; strengthen health information and health information dissemination centers, especially in rural and remote areas, to publish materials on health and medical issues, especially on local problems, productive health, immunization, prevention and control of endemic illnesses, and treatment of epidemic diseases were among the special services provided by the PHC in the recent years.

However, more progress in human development requires further development of the health network, particularly with respect to the provisions of basic health services aimed at reducing mortality.

Life expectancy in countries with high human development ranges from 75 to 80 years, indicating that there is still plenty of room for the improvement in health status. In this regard special emphasis has to be given to reducing mortality among children less than five years of age and mothers.

At the same time, qualitative improvements in health care services and universal health care coverage are also crucial to increase life expectancy. Some of the main and most urgent measures are:

- Maintaining government's role in providing health care services for all as subsidy programs in this area.
- Strengthen the PHC
- Improve the quality of health services and client satisfaction.
- Expand and strengthen the medical information dissemination system.
- Expand the role of private sector in policy making and health program design.

Another important issue in increasing health standards is food security. According to the definition given by International Conference on Nutrition held in 1992, food security is "access for all at all times to sufficient food needed for a healthy and active life".

From this perspective, food security requires not only a sufficient supply of food, but also its equitable distribution. Therefore, it points out to the need for measures supporting food production and equitable distribution. The high priority accorded to food security in the general policies of government's future plans reflects this important issue, from which, self sufficiency in agricultural products and subsidy on important main food items such as bread and dairy, are some examples of this policy. In addition to these general objectives, some other actions should be considered in the future, the most important of which are:

- Continue to provide carefully targeted subsidies on basic goods and foodstuffs.
- Reform the guaranteed purchase system for basic agricultural products such as rice, tea and citrus fruits, which are important food production in Caspian coastal provinces.
- Plan for reducing food wastage and expand food-processing industries.
- Set up a nutritional monitoring system.
- Increase the public knowledge of basic food requirements and food consumption patterns by further diversification towards the consumption of more meat, eggs and diary products.

At the countries level, among the strategies and measures aimed at achieving food security, those targeting the reduction of income poverty must take priority. As shown by surveys conducted, people who are unable to buy food are usually the worst hit by food poverty. Low consumption of nutritious foodstuffs, clearly traceable to the low purchasing power of some social groups, as well as a lack of nutrition awareness, also undermines food security.

5.4. Legal Framework for Protection and Management of Coastal Areas

By the national law of the Islamic Republic of Iran Department of the Environment has been appointed as the responsible authority for the environmental protection and development. Except in few cases related to the fisheries, the national laws and regulations are referred to the entire environment of the I.R.-Iran in general and they do not specify the Caspian Sea in particular.

National laws and regulations related to the protection of the environment in general could be enumerated as:

- Law of " Environmental protection and Development" (1991)
- Law of " Protection and Exploitation of the Fisheries Resources ", (1974)
- Law "Applicable to Any Economical, Cultural, societal Development", (1989).
- Law of " prohibition of Any Establishments which is Against the Health and protection of the Urban and Sub-urban areas " , (1949)
- Law of " Protection of the Sea and internal water- bodies Against the Oil and Oil-products Pollution,"(1975).

- Law Related to " Punishments Applicable to the Over-exploitation of the Fishery Resources in the Persian Gulf and the Caspian Sea", (1979).
- Law of " Proper use of water Resources", (1982)
- Law of " Protection against the Natural Environmental Damages", (1991)
- Law of " Endangered Species of Wild Fauna and Flora," (1974)
- Law of "Environmental Protection against the Water Pollution", (1984).
- Law of "Environmental Protection against the Air Pollution",(1975).
- Environmental Protection and Enhancement Act, (1974).
- Law of "Protection of the Natural Parks, Protected Areas and Sensitive Areas", (1975).
- Law of "Environmental Health", (1992).
- Law of "Establishment of the National High Commission on Oceanography", 1991.

On account of the needs to have a well coordinated oceanographic activities and better management of the living and non-living resources of the Persian Gulf, Sea of Oman and the Caspian Sea a National High Commission on Oceanography was established in the year 1991, which include seven committee involving different relevant ministries, organizations and departments.

1. Committee of the physical oceanography, ocean dynamic and oceanic meteorology (National Meteorological Organization)
2. Committee of the Marine services, shipping, trade, and law of the sea (National Ports and Shipping Organization)
3. Committee of marine engineering and mapping (Ministry of Petroleum)
4. Committee of the environmental protection and marine pollution control (Department of the Environment)
5. Committee of the marine living resources (Fisheries Department)
6. Committee of the marine non-living resources (Department of Geological Survey)
7. Committee of the Oceanographic education and knowledge (Ministry of the Higher Education)

The main environmental acts in the country could be summarized as follows:

I. The Environmental Protection and Enhancement Act (1974)

Section 1
The Department of the Environment shall be responsible for the protection and enhancement of the environment , for the prevention and control of any form of pollution or degradation leading to the disturbance in the balance and proportion of the environment , and for the conduct of all matters related to wildlife and the aquatic biota of the territorial waters.

The Department of the Environment, here in after referred to, as the 'Department' shall be attached to the president of I.R.I Office. It is a corporate body with financial independence functioning under the supervision of the Environmental High Council.

Note 1: The Iran Fisheries Company and the southern Fisheries Company shall (continue to) function and act in accordance with the law and regulations governing them.

Section 2
The Chairman of the Environmental High Council is the President of I.R.I. The Council shall be composed of the Minister of Jihad , the Minister of Health , Director of the plan and Budget Organization , the Director of the Department of the Environment and four other qualified persons recommended by the Chairman of the Environmental High Council and appointed for a term of three years by the chairman.

Section 3
In addition to the jurisdiction and powers vested in the Game and Fish protection High council under the Game and Fish Law, The Environmental High Council shall have jurisdiction and powers to:

a. Set aside certain areas as national nature monuments, wildlife refuges and protected areas, and to define precisely the Limits and boundaries there of subject to:

   1. The provisions of the Game and Fish Law as well as the provisions of the Laws and regulations the Forest and Range Organization;
   2. The approval of the Minister of Agriculture and natural resources in respect of regions where forestation or rangeland projects have been, or are being implemented by or with the consent of the Forest and range Organization;
   3. The approval of the Minister of Economy in respect of regions where exploration and exploitation of minerals are under way in accordance with applicable Laws.

Issuance of any permits for exploration and exploitation of minerals in areas designated as national parks, national nature monuments, wildlife refuges and protected area shall be subject to approval of the Environmental High Council.

Note: Designation of the area described in the preceding paragraph and establishment of criteria and regulations applicable there to shall be governed by the implementation regulations of the present Act.

b. Determine the types, validity and price of the licenses provided in section 8 hereof.

c. Approve the grant of rewards to persons under the implementation regulations of the present Act.

Section 4
None of the restrictions and regulations to be established in respect of the area and regions mentioned in section 3 (a) hereof shall conflict with the ownership right and usufruct exercised legally by individuals within such area and regions.

Section 5
The Director of the 'Department' shall be appointed by president of I.R.I. The Director shall also function as secretary of the Environment High Council.

Section 6
In addition to the jurisdiction and powers vested in the Game and Fish Department under the Game and Fish Law, the 'Department' has jurisdiction and power to:

a. Conduct economic and scientific researches and studies concerning environmental protection and enhancement, control of pollution and prevention of any disturbance in environmental balance, inter ail, by:

   1. (Development of) methods for the maintenance of the ecological Balance of nature;
   2. (control of) any such alterations in the biological , chemical condition of land , water and air caused by various physical developments as may cause changes in the natural condition , including alteration and degradation of riverbeds , degradation of forests and rangelands , marine ecological changes disturbance in the natural drainage of waters , and change in and destruction of wetlands;
   3. (Control of) agricultural pesticides or use of any substance harmful to the environment;

4. (Development of) methods for the control and prevention of noises harmful to the environment;
5. Protection of the environment, from the standpoint of the phenomena of nature, and beautification thereof;

b. Recommend standards and criteria for purposes of control and prevention of the pollution of water, air and land , of the discharge of refuse , including garbage and industrial waste matters , and control of factors and influences affecting the environment.

c. (Adopt) measures appropriate for the enhancement of the environment within national Laws and compatible with the rights of individuals.

d. Develop and implement training and educational programs for purposes of public enlightenment in connection with the protection and enhancement of the environment.

e. Establish Zoological gardens and museums of natural history.

f. Impose provisional prohibition and with respect to the time, place, type, manner and quantity of hunting and fishing , and promulgation thereof in accordance with the provision of Article 4 of the Game and fish Law.

g. Cooperate with similar foreign and international agencies and establishments for purposes of environmental protection within the bounds of reciprocal commitments.

Section 7
Should implementation of development project or operation thereof be, in the judgment of the 'Department', inconsistent with the Laws and regulation governing protection of the environment, the 'Department' shall notify the ministry or the agency concerned according so that the project may be reviewed and the difficulty smoothed in cooperation with the organizations involved. In the event That disagreement arises (in this respect), the matter shall be dealt with in accordance with any decision adopted thereon by the president of I.R. Iran.

Section 8
To attempt any sort of hunting and fishing, breeding and of, and dealing in, wild animals or parts thereof, and any use of, or touring in, the areas mentioned in Section 3 (a) hereof shall be subject to license or permission to be issued by the 'Department'. Should the necessity arise for the 'Department' to issue any exgratia license or permission it may do so with the approval of the Environmental High Council.

Note: In cases where the issue of licenses provided in the present Section as well as of permits - for importation and exportation of wide

animals and parts thereof are the responsibility of other Ministries or agencies under governing Laws the issue authority shall act with the approval of the 'Department'.

Section 9

Any practice that may lead to the pollution of the environment shall be prohibited. The term 'pollution' applies to the scattering of foreign matter about or addition thereof to water, air, soil or Land to such an extent that biological, chemical or physical composition or quality thereof is so changed as be harmful to man, other living animals, plants, and monuments and / or structures.

Note: The use of biocides to control animal and plant pests and noxious insects in accordance with the Laws and regulation of the Ministry of Agriculture and Natural Resources shall not be governed by the provisions of the present Section.

However, should the use of such biocides be inconsistent with the enhancement of the environment, the 'Department' shall make recommendations for revision or modification of applicable rules and regulations, for substitution of substances uses as biocides, and for adoption of other methods of pest control.

Section 10

Requirements for the control of pollution or degradation of the environment and prevention of the emission of noises harmful to the environment, and the establishment of pollution standards required under Section 9 hereof as well as the prohibition and restriction concerned with the protection and enhancement of the environment shall be governed by such rules and regulations as may be approved by the parliamentary Committees of Agriculture and Natural Resources, Health, and justice.

Section 11

Considering the requirements and criteria established under the regulations referred to in section 10 here of, the 'Department' shall distinguish such factories and workshops that contribute to the pollution of the environment , and it shall the owners or managers thereof notice either to do away the causes of pollution within a definite period of time or to discontinue operation. In giving such notice the 'Department' shall indicate its reasons for doing so. If the factories and workshops fail to act on the notice within the given time, their operation shall be stopped on orders issued by the 'Department'.

In the event that any person concerned should object to such notice he may Lodge a complaint with the Local court of first instance. The court shall hear the case at once and out of turn , and over-rule the notice or stoppage of the operation (of the factory or workshop concerned) if it

sustains the objection. Any decision adopted by the court shall be binding and irrevocable.

Note: with regard to any sources and factors constituting an immediate threat (to the environment), the Director at the 'Department' may dispense with giving the notice , and issue orders for the operation and activity thereof to discontinue.

Section 12
Owners and managers of the factories and workshops referred to in Section 11 shall discontinue their operations as soon as the "Department's" order to that effect is notified to them. Continuation (resumption) of such operation shall depend upon the consent of the 'Department' or to the judgment passed by a competent court to this effect. If they fail to comply (with the "Department's" order) they shall be liable to imprisonment ranging from sixty one days to one calendar year or to a penalty of five thousand and one Rials to fifty thousand Rials or to both the imprisonment and the penalty.

Section 13
Any person offending against the requirement and the criteria established under the regulations provided in section 10 hereof shall be liable to a penalty ranging from five hundred Rials to five thousand Rials depending on the case as stipulated in such regulations.

Section 14
As regards the offenses stated herein the 'Department' shall be considered as the complainant or the plaintiff , as the case may be.

Section 15
For purposes of the present Act as well as of the Game and Fish Law , any functionary designated by the 'Department' to detect such offenses and sue persons therefor shall be on a par with a Law officer of the Ministry of Justice if he has already received (proper) training , in connection with (the fulfillment of) the function of Law officers , at a special course under the supervision of the public prosecutor.

Note- In cases where other agencies or organizations are required under the overrunning Laws to sue persons for the offenses stated herein the 'Department' shall intimate its views (in this connection) to such agencies or organizations.

Section 16
The Land and building in government-owned estates situated within the confines of the areas specified in Section 5 (a) and the government-owned wetlands shall be (placed) entirely at the disposal of the 'Department' which shall exploit the wetland (to the exclusion of the Bandar Anzali Lagoon) in the capacity of Legal successors of the

organization concerned. However , the 'Department' is not entitled to transfer them.

Note: In the event utilization of these resources should entail the felling of tress , the Range and forest Organization shall act directly in accordance with the 'Department'.

Section 17
If the land and building of the estates situate within the boundaries of the areas mentioned in Section 3(a) hereof are required by the 'Department ' , it may purchase them and take possession thereof in accordance with the provisions the Law concerning purchase of Land , Structures and physical Developments for purposes of preservation of Historical and Archaeological Monuments as ratified in Azar , 1347 (Nov./Dec. 1968).

Section 18
The 'Department' shall have a uniformed body of guards with necessary equipment.

Section 19
Areas of the country wherein the provision or Section 11,12 and 13 hereof are to become operative shall be designated by the 'Department' in accordance with the requirement and criteria established under the implementation regulation hereof , and they shall be proclaimed subject to the sanction thereof by the (Environmental) High Council.

Section 20
Subject to the approval of the Environment High Council the 'Department' may develop part of its responsibilities and power with regard to implementation of the provisions of Section 11,12 and 13 hereof upon the municipalities or government agencies and/or organizations concerned , as the case may be , whereupon such municipalities, agencies or organizations shall assume responsibility for the implementation thereof.

Section 21
With the exception of the regulations referred to in Section 10, the implementation regulations governing the present Act shall be approved by the Council of ministers subject to endorsement thereof by the Environment High Council.

II. Text of protection and exploitation of the fisheries resources

Article 1
The fisheries resources of the waters under the sovereignty and jurisdiction of the Islamic Republic of Iran (I.R. of Iran) are the national wealth of the country. Protection and exploitation of these

resources are among the responsibilities of the government of the I.R. of Iran. Management, conservation and exploitation of these resources in line with the national interest of the country are carried out under the provisions of the present law and its executive regulations.

Article 2
Executive domains of the present law and its excessive regulations, except to the cases specified in the present law , cover all the waters under the sovereignty and jurisdiction of the I.R of Iran including inland and marine territorial waters.

Article 3
In order to enhance the quality and quantity of fish products, support the juridical and natural entities involved in fisheries and aquatics sectors, and manage, utilize, and develop the existing resources, Iranian Fisheries Company (Shilat) carries out the following activities :

a. Conducting scientific and applied research on the areas related to fisheries resources including: their life, exploitable resources, their living habitants, amount of stocks, protection and management of the resources in the waters subject of article 2 of the present law.

b. Conducting necessary research and activities on the fishing ground, methods of exploitation, aquaculture, and processing of fish products.

c. Carrying out activities on fishing management and putting into force the related regulations, resource protection, rehabilitation of existing stock, improvement of the waters subject of article 2 of the present law.

d. Establishment, development, monitors, and management of fishing ports while observing the domain of the authorities of other organizations.

e. Encouragement and support fishing, fish farming, fish production and storage industries through making studies, offering training and promoting technico-advisory services.

Proviso: Duties and power of Iranian Fisheries Company subject of the present law will not contradict those of the Environment Protection Organization.

Article 4
Catch as well as the processed product on board of fishing vessel in the waters under sovereignty and jurisdiction of the I.R. of Iran are subject to the country's import - export rules.

Article 5
Registry of any fishing vessel by the ports and shipping Organization is subject to the formal approval of Iranian Fisheries Company.

Article 6
No natural or juridical entity is authorized to exploit fisheries resources of the waters subject to article 2 of the present law unless the valid license had already been obtained. Terms of issuance, suspension, cancellation, validity period, extension, full or partial transfer of license and tariff rate of fishing vessel are subject to the executive code of conduct of the present law.

Article 7
Tariff rate of foreign fishing vessels operating fishing activities, in accordance with the rules of the present law, in the waters under the sovereignty and jurisdiction of the I.R. of Iran shall be determined subject to the proposal and approval of the Cabinet.

Article 8
Establishment of the cooperatives, associations and companies involved in fishing and fish farming business would be possible subject to the observation of the rules and regulations of ministry of cooperation and the approval and supervision of Shilat.

Article 9
Fishing ports will be managed under the authority and supervision of Shilat.
Proviso 1: Offering services or managing port facilities in some cases may be given over to cooperative or private companies.
Proviso 2: Shilat is authorized to receive some charges as tariff for offering the right of entrance, berth for the vessels in fishing ports in accordance with the tariffs approved by the members of the cabinet.

Article 10
In order to support coastal fishermen, industrial fishing vessels are prohibited to fish in the coastal water of the I.R. of Iran.

Article 11
In order to support fishery activities:

a. Shilat may oblige the owners of foreign or Iranian industrial fishing vessels to insure their own vessels to the Iranian insurers or to those who have representatives in Iran, to compensate or any probable losses imposed by these vessels on coastal fishing vessels within the territory of coastal waters.

b. Agriculture products Insurance fund is required to insure the catch and other insurance companies have to do so with regard to the fishing gears.

c. Iranian Fisheries Company is obliged to determine the insurance policy of the vessel and fishing gears before issuing the fishing license for all vessels.

Article 12
Carrying and applying illegal fishing gears and also explosive , toxic and or electric materials which may cause to weakness , illness and or mortality of fish are prohibited.

Article 13
Foreign fishing vessels not forbidden to fish in the waters subject of article 2 of the present law unless there is a mutual agreement between the government of the I.R. of Iran and the flag state.

Those foreign fishing vessels operating on behalf of the Iranian companies that have signed an agreement, based on the approval of Shilat and the provisions of present law and other statutes of the I.R. of Iran, with the owners of these vessels, are authorized to catch fish.

Article 14
Resource management plan for the waters subject of article 2 of the present law will be developed on the basis of scientific research and studies by Shilat (experts) which aim at identifying and introducing exploitable resources. Such a plan should cover time, area, quantity, method, species and gear principles of fishing in a way that it could guarantee sustainable utilization of fisheries resources.

Proviso: Shilat is required to issue fishing license in accordance with the principles of the above - mentioned plan.

Article 15
Those fishing vessels permitted to fish in the waters subject of article 2 of the present law are obliged on the basis of the provisions of executive regulations of the present law to expose the signs, names , letters and numbers to vision that make their identity know.

Article 16
Those fishing vessels which are permitted to fish in the waters subject of article 2 and those Iranian fishing vessels fishing out of the territory of the waters subject of the same article of the present law have to on the basis of the executive regulations transfer the statistic and information on catch in printed papers and within the determined time schedule to Iranian Fisheries Company.

Article 17
Carrying out any kinds of aquaculture activities after obtaining the pertinent license from Iranian Fisheries Company by those natural and juridical persons who meet the determined provisions in the present law and its executive regulations is allowed.

Article 18
It will be prohibited to issue license for the establishment of aquaculture farm and facilities if they impose damages on fisheries resources. When these facilities are exposed to pollution or contagious diseases, Shilat shall be responsible to order the necessary preventive measures.

Article 19
Measures subject of article 3 of the present law due to be taken by Iranian Fisheries Company with respect to the inland waters (behind dams or rivers) should be taken through early coordination with Ministry of Energy in accordance with water utilization plan. Stocking the drinking or agriculture waters which should be done and used in accordance with water supply plan in the specified time - schedule would be possible only after making coordination with and obtaining license from Ministry of Energy.

Article 20
Rules on establishing the processing facilities and conducting any types of processing activity , controlling and monitoring the of these facilities shall be determined by Shilat.

Article 21
The discipline forces would be the sole bailiff of judicature to inspect and with any detecting operations in the way of putting into force the present law and its executive regulations.

Proviso: Domain of authority and term of reference of the bailiffs of the Discipline Forces in implementing the present law shall be specified with due regard to disciplinary force rules.

Article 22
a. Any foreign fishing vessel which operates on fishing activities in the waters subject of article 2 of the present law without obtaining the required license shall be convict to the payment of from two to one hundred million Rials cash penalty and confiscate of the catch. In addition the court may confiscate the fishing vessel , fishing gears , and any other equipments on board of the vessel.

b. Criminals of the following crimes:

1. Fishing operations by the Iranians without obtaining the required license determined in the present law.
2. Illegal transfer of catch from the vessel to an unauthorized vessel.
3. Supply and transfer of fish in order to run aquaculture without having obtained the health.
4. Sale of illegal fishing gears.

5. Change the route, create physical barriers and establish any illegal facilities in the rivers which have been identified as the immigration route or natural hatching of fish.
6. Causing any kinds of pollution or spreading contagious diseases and evacuating industrial wastage or any other pollutants which impose damages on fisheries resources.

Shall be convicted based on the judgment of the judicial courts to pay cash penalty three times of the value of the catch (in accordance with the type of crime , capacity of the vessel , volume and species of the catch) for the cases 1,2 and 3 or from one to five million Rials for other cases. In addition , the court may confiscate the fishing and farming products or the income received in return of their sales and fishing or other applied gears in committing the crimes and also prevent the operation of pollutant unit until recovery of its deficiency.

In case, the above- mentioned crimes are repeated, the court, in addition to the prescribed penalties, may confiscate the fishing and other gears used in committing the crimes.

c. Iranian Fisheries Company is the authorized body to identify those fishermen who have committed one or all of the following crimes. The court may convict the criminals on the basis of their crimes to the payment of from one to ten million Rials cash penalties and confiscation of their catch and fishing gears:

   1. Fishing in the forbidden areas or closed season.
   2. Catch of the species which have been forbidden to be caught.
   3. Catch of the species for which the required permission has not been obtained.
   4. Fishing activities of industrial fishing vessels in coastal fishing grounds.
   5. Fishing with illegal gears and materials or the maintenance of such of gears or materials on board of the vessel without having obtained permission from Shilat.
   6. Carry and store illegal catch on board of the vessel.
   7. Avoid transferring the information related to article 2 of the present law or transfer forged information on catch and fish farming activities and under provisions of the present law and its executive rules.
   8. Non-Compliance with the rules with respect to expose the signs , name , letters , and numbers to vision which make the identity of the vessel known.

d. Catch , processing supply , sale , transportation , maintenance , import and export of various species of sturgeon and caviar without the permission of Shilat are forbidden and the criminal/s will be

convicted to pay cash penalty up to three times of the value of the product (in accordance with the type and quantity of catch) and to a sentence of from 30 days to three months punishment prison and in the case of repeat at the same act will be convicted to pay cash penalty and to sentence from go days, to six months.

Article 23

The necessary executive rules for the present law will be prepared within three months following the proposal made by ministry of Jehad-e-Sazandegi in coordination with the Environment Protection Organization , and will be adopted by the members of the Cabinet.

The present law includes twenty three articles and five provisos which were adapted in the public session of the Islamic Consultative Assembly on 25.9.1995 and confirmed by the Guardian Council on 3.10.1995.

III. Framework of the environmental impact assessment undertaken by the DOE

The framework of the DOE regarding the environmental assessment could be enumerated as :

a. Survey and assessment of all the Urban/Sub-urban projects and plans which are related to industrial, developmental, services and production programs, So that any harm or destruction to the environment is prevented or at least reduced as far as possible.

b. Implementation of an effective, long term, environmental protection management at the national level through a close co-operation with other relevant departments/organization.

c. Environmental studies and investigations related to:

   1. Human activities impact on environment and providing alternative remedies to solve the problem of urban migration as well as the problems inherent to urbanization.
   2. Proper management of the non-renewable resources by the means of cooperation with other relevant departments/ organizations and providing the required guideline in this regards.
   3. Assess the environmental impact of economical activities and also provide an effective means to prevent those activities which are contradictory to the environmental protection.
   4. Identifying the harmful environmental impact of developmental, industrial agricultural, services and production plans/projects, and subsequently preparing a suitable substitutions for such projects/plans which may harm the environment.

5. Providing guideline for the environmental impact assessment of large-scale industrial, developmental activities.

IV. High Council for the Environment (HCE)

In April 1994, the high council for the Environmental High Commission (HCE), presided by the president of the Republic. approved that major development projects(power plants, petrochemical plants, refineries, dams and water structures airports, ports, industrial estates, steels mills, etc.) must prepare EIA prior to their construction.

According to the clause 82 of the Law of the Second Five-Year Economic, social, and Cultural Development Plan(1994-1998), all major development projects, either productive or services, are obliged to prepare EIA as well as Feasibility Study.

The standard procedures was prepared and submitted to the HCE by the Iranian National Committee on Sustainable Development (INCISED), in the late 1997.

V. Environmental Impact Assessment (EIA)

In January 1998 standard procedures for implementation of EIA was approved by the (HCE). In July 1997, collaborative project of about us $300/000 was signed with the United Nations Development Programme (UNDP), to support activities institutional strengthening of EIA in the I.R.Iran implemented with cooperation of the plan & budget Organization(PBO) of I.R.Iran.

According to the guideline of the Environmental High Council for the Environment (HCE) dated (23.Dec.1997), the proponents of the following national projects / programmes are obliged to prepare and submit Environmental Evaluation and Feasibility studies as well as Environmental Impact Assessment:

a. Petro-chemical factories /companies of any scale,

b. Refineries of any scale,

c. Power plants with regeneration potential of more than 100 MW,

d. Steal industries with production capacity more than 300,000 tons / year,

e. Dams, and any other structures such as :

   1. Dams with height more than 15 m. and/or with axially structures more than 40 hectares and /or with lake surface area of more than 400 hectares.

   2. Artificial man-made lakes with surface area more than 400 hectares.

3. Irrigation and drainage projects / programmes extending more than 5,000 hectares.

f. Industrial town (of any type) with area of more than 100 hectares.

g. Air-port with run-way facilities more than 2000 meter

Article 3 - The EIA applies to the above-mentioned seven project categories (without consideration of dimensions), if they are set up within a distance in which they could be effected or impact on projects and plans mentioned in Article 2.

Article 4 - The EIA applies the above-mentioned seven project and plan categories (without consideration of dimensions), as they are at a distance in which they could be effected or could have an impact on special habitats.

Note 1: The list of special habitats, their location, and their impact distance as approved by the authorities will be regularly published by the DOE.

Note 2: The list, location, and impact distance of the country's seven project categories (according to Article 2) shall be provided and issued by the DOE.

Article 5 - The executives of the projects and plans, subject to the EIA, will present a brief report to the DOE and the department, after studying the report, will clarify the sensitive points that should be considered by the executives within a month period.

Note: All of the environmental rules and regulations approved by the authorities and that must be observed during the EIA process, shall be prepared by the DOE and presented to the projects' executives.

Article 6 - Executives of the plans and projects, subject to the EIA, are required to prepare an EIA report according to the specifications announced by the DOE and other related regulations. The experts, scientific centers and professional companies whose credentials are approved by the concerned authorities shall prepare the EIA reports.

Note: Until the establishing of such professional companies and scientific centers, the Planning and Management Organization in coordination with the DOE shall issue the primary list.

Article 7 - The EIA report shall be divided and prepared in two separate sections: an input period and output period based on their primary activities. The main activities shall be presented in order to reduce negative environmental impacts.

Article 8 - Conclusion of the EIA report must incorporate the author/s advice based on one of these three recommendations:

a) Considering the broad dimensions of the environmental impact, the implementation of the project or plan shall not be approved.

b) The project or plan by taking necessary measures to reduce the negative environmental impact can be implemented. (cost should be mentioned)

c) The project or plan without taking large-scale measures for reduction of environmental impact can be implemented.

Article 9 - The DOE, according to the published regulations, shall make known its final viewpoints within a maximum of three-months.

Note 1: Coordinating the activities related to the environmental assessment of plans and projects, the Scientific Committee of the EIA, attended by experts and university authorities, has been established under the supervision of the head of DOE. The committee's members include:

- The head of DOE as the committee's chairperson
- Five scholars and university professors selected by the head of DOE
- Representative of the and Planning and Management Organization
- Representative of the Forests and Pastures Organization
- Representative of the Iranian Standard and Industrial Research Institute
- Representative of the ministry or organization which presents the assessed plan

Note 2: If the implementation and exploitation of each project, based on the result of an EIA report, is contradictory to environmental rules and regulations, the DOE will make the situation known to the said ministry or organization to revise the project in order to bring it into compliance. If there is any disagreement, the President will decide the matter.

Article 10 - Considering the existing status of the environment, the aspects, which should be studied during the EIA process for all seven plans and project categories, shall be divided into four sections:

A) Impact on physical environment

1. Impact on soil: morphology

2. Impact on water: quality and quantity of water
3. Impact on land, air, and sound changes in weather and rains, quality of weather
4. Secondary impact on soil water and weather

B) Impact on natural environment

1) Impact on flora
2) Impact on fauna
3) Impact on habitats, and bird migration routes

C) Impact on social and cultural Environment

1) Impact on people's health and their mise-en-scene
2) Impact on social setting: employment, housing, and education
3) Impact on cultural environment: cultural and religious beliefs of people, cultural heritage

D) Impact on development plans

1) Impact on other agricultural, industrial, and service development plans
2) Impact on region's monitoring plan
3) Impact on region's land use

This standard, containing 10 articles and 8 notes, was approved by the High Council for the Environment on Dec. 23, 1997.

Executive strategies and Guidelines

According to the EIA standard's regulations, the executives of the plan and project categories mentioned in Article 2 of these regulations, are required to provide an EIA report.

In order to realize the regulation's objectives and systematic implementation of its articles, as well as acceleration of the revision process of the EIA reports, The DOE's Environmental Impact Assessment Office has provided an integrated baseline for preparing a brief assessment report (Article 5), EIA report (Article 6). This includes determining procedures of the review and assessment process of the reports, as follows:

The first step for achieving the goal is clarification and determination of the legal stages for sending the EIA report and related work plan to the DOE. To this end, the attached chart based on the mentioned articles in the EIA Regulations has been prepared.

The second step for providing an executive plan of action regarding the said Regulations is, presenting of a framework and directory for

preparation of a 'plan abstract' and 'a brief EIA report. The report's list of contents has been mentioned in fameworks 1and 2. In addition, recommendations have been proposed for improving the reports and avoiding wastage of time and energy.

In the next step this office is to provide and propose a guideline for preparation of the EIA report. After primary revision of its brief version and completing its related data, the report shall be provided considering the revision group's proposals.

By establishing professional committees within the Environmental Impact Assessment Office, special strategies and guideline for any of the seven projects and plan categories mentioned in Article 2 of EIA Regulations shall be provided. These committees will also undertake the primary and final revision of the EIA report. Questionnaires and checklists are to be provided in certifyin g observation of the articles mentioned in the Regulations and assessment of the reports.

The next measure for the EIA Office is to determine and publish the method of the revision process, its related regulations and norms and the executive stages. This procedure is intended to inform the provisional directorate generals of the DOE of the work plan of action.

Before beginning the brief assessment, it is highly recommended that the corpus of environmental rules, regulations, norms and standards related to the proposed plan or project are collected and studied.

The non-technical abstract should be able to answer the following questions:

- What kind of plan has been proposed? What are the plan's objectives?
- What needs and necessities are there for the plan's implementation.
- What is the process and activities of the proposed plan?
- Where will the plan be implemented?
- What stages are there in the plan? When will every stage be started and how long it will be continued?
- What is the general status of the region's environment?
- Which factors will be affected by implementation of the plan?
- Which measures will be taken to reduce the negative impact of the plan?

Format 1: Guidlines for preparing abstract of plan or project

1- Name of the company

2- Name of employer

3- Name of the project

4- Name and address of the project's executive

5- Objective of the project's execution and what it needs to be implemented

6- Type and general characteristics of the project

7- Executive phases of the project and its timetable (preparation, construction

8- The project's activities

9- Type and scale of the resources, sources and consumption of raw materials, method of provision, production capacity, and type and scale of primary and subsidiary production

10- Proposed site for implementation of project, alternative sites and reasons of choosing the proposed location

11- Infrastructural needs (roads, general services, housing) and other existing facilities

12- Estimate of the needed human resources

13- List of positive and negative consequences of implementing the project

14- List of important pollutants and wastes (air pollutants, industrial and health hazardous emissions, garbage, noise and sound, rays produced in processes and activities)

15- List of measures relating to prevention, control, and reduction of any negative environmental impact

Format 2: Guidelines for preparing the plan's brief version of the EIA report

1- Non-technical abstract: including the project's type and characteristics, existing choices, a short report of the environment's present status, and important impacts of the plan on environment and prevention programs, reduction and control of the negative impacts and presenting results of the EIA.

2- Explanation of the proposed plan or project

2-1- Plan's title

2-2- Objectives and needs of the plan

2-3- Status of the plan in the general national policies and programs

2-4- Environment rules, regulations, and standards related to the project

2-5- Determining position of the proposed location on the map and describing existing different land uses of the region

2-6- Location and technical choices of the plan

2-7- Identification of different phases of the project (preparing, constructing, implementing, and exploiting,) and future development programs

2-8- Proposed processes and activities of the project (production, services,…) and chart of production process

2-9- Lateral activities and future projects (construction of roads, related facilities and general services)

2-10- Outstanding characteristics of the project in terms of choices made, possible alternatives and phases of the project include:

2-10-1- Production capacities

2-10-2- Estimating of investment (in rials, and dollars)

2-10-3- Estimating type, scale, provision and transformation of raw materials

2-10-4- Estimating type and quantity of resources (water, energy, fuel) method of consumption, provision and transformation

2-10-5- Estimating human resources

2-10-6- Estimating type, and scale of primary and subsidiary production

3- Phase of preparation and infrastructure measures that lead to

somechanges in and causes destruction of the environment. This phase of activities include excavation, destruction of flora, construction of a storage pool, changes in drainage, drilling, use of explosives, changes in the flow of surface water, providing credit lines for loans, constructing of roads and other general infrastructure facilities

4- Important pollutants and wastes produced during different processes and in every phase of the plan, such as: air pollutants, health hazardous and industrial effluvium, garbage, noise and sound, rays and vibrations

5- Dangers, possible accidents and potential safety hazards related to the plan in every proposed phase. This includes explosions, leakage, consequences of natural disasters and other unexpected events.

6- Explaining the present status of the region's environment according to the following parameters before implementation of the project (the use of maps, tables and charts is recommended):

6-1- Defining the location under study and pinpointing it on the map

6-2- Physical environment

6-2-1- Pedology (potentials, gradient, erosion), soil pollution and its main sources.

6-2-2- Geology (topography, proneness to earthquakes, landslides, general tectonic overview...)

6-2-3- Water resources (location, quality and quantity of surface and underground water, drainage conditions in the region, cyclical periods of flooding water shortages), water pollution and its sources, present rate of consumption, availability, volume and accessibility of water resources

6-2-4- Weather and climate (compass card, rains, temperature and rate of evaporation during a period of 5-10 years), air pollution and its sources

6-2-5- Sound and vibration, sound pollution and its sources

6-3- Natural environment (water and land habitats including a detailed list of flora and fauna and any rare and valuable species, four regions of environment)

6-4- Social, economic and cultural milieu (population characteristics, employment, housing, education, health services [or the lack thereof], religious and cultural tenets, cultural heritage)

6-5- Development plans and land uses (agricultural, industrial, and servicing development plans, land use of region and land monitoring plan)

7- Forecasting positive and negative impacts of the plan for all proposed choices and in all phases

7-1- Impact on physical environment (soil, geological features, water, weather and climate)

7-2- Impact on natural environment (flora and fauna both in water and on land)

7-3- Impact on cultural, economic, and social milieu (population, employment, housing, education, health, religious and cultural tenets, cultural heritage...)

7-4- Impact on other development plans and land uses in the region

8- Prevention methods, reduction and control of negative environmental impacts related to the plan's activities

8-1- Proposing specific methods for reducing negative impacts on the cultural, economic, social, natural, and physical environments

8-2- Presenting a general program of environmental management for measuring and control of environmental impacts and monitoring the accuracy of the proposed activities

9- Sources and references used for preparing the brief version of the EIA report, departments, organizations, real and legal persons.

10- Name, area of responsibility and experiences of any advisors and authors of the brief version of the EIA report

5.5. Public Participation in Planning and Management

The public participation in environmental affairs and the help it can give the government are tremendously important in environmental management today. In I.R. Iran, youth, women, the owners of production and industrial units and non-governmental associations are all involved in efforts to protect the environment.

Youth participation embraces the "Young Cooperators" scheme, school meetings in environmental issues and the work of environmental

activists in schools. Women's participation in environmental affairs has been less significant, however. There are many opportunities to enlist women's involvement by raising their awareness of environmental issues such as the hazards caused by detergents and other domestic products and by improper use of agricultural chemicals in rural areas.

The role of industrial and production units in reducing environmental pollution has not been institutionalized, but managers of these units could, by rigorously applying environmental standards, play an important part in decreasing the inappropriate discharge of industrial effluent as well as limiting harmful factory emissions.

Although non-governmental organizations (NGOs) concerned with environmental issues are not yet sufficiently developed, there are signs that they are on the increase. Existing environmental NGOs include the Green Front, which was established in 1991, the Association of Environmental Specialists, and the Women's Society for the Campaign against Environmental Pollution, founded in 1994. These groups have been engaged primarily in educational and publicity activities.

Given the enormity and nature if the environmental challenges facing Caspian region, it is essential for ordinary people to get involved in preventing pollution and managing environmental issues. Indeed, it will simply be impossible to solve many of the current environmental problems without the enthusiastic public input, especially in coastal region of Caspian, where the whole area is populated and all lands are used for agricultural or other purposes adjustment to the sea.

The active participation and cooperation of the industrial and manufacturing sectors is also vital, given the role of industrial pollutants in pollution as a whole. The commitment of producers and manufacturers to observing environmental standards strictly is a basic requirement of enforcing laws aimed at preventing air, water and soil pollution and protecting Caspian's natural environment. The establishment and expansion of environmental consultancy firms to advice producers and manufacturers on their compliance with these standards is of special importance here.

Since public awareness of environmental issues plays a crucial role in preventing pollution, NGOs involved in awareness-raising need to be supported by the government and particularly by the Department of the Environment. Another way to secure NGO participation in environmental affairs is to have NGOs include environmental objectives in their national terms of reference. The mass media also have a key part to play in heightening public awareness of environmental issues and promoting public participation in environmental protection.

5.6. Islamic City Councils

Article 100

In order to enhance social, economic, development, health, cultural and educational programs and other welfare affairs, public participation in accordance with local circumstances is desirable. The supervision council of every village, district, city, township or province will administer the affairs of every village, district, city, township or province. People will elect the members of these councils.

Law determines the conditions of the elected and the elector, the limits of duties and authorities, the election procedure, the manner of supervision of the previously mentioned councils and their hierarchy in accordance with national unity, territorial integrity, subordination to central government and the basic principles of the Islamic Republic system.

Regulations for Establishment, Election and the Duties of the National Islamic Councils and the Election of Mayors

Establishment

Article 1 – The Village, District, City, and Residential Complex Islamic Councils will be established according to the regulations specified in this law. In order to enhance the social, economic, development, health, cultural and educational programs as well as other welfare affairs through popular participation and supervision of the affairs of every village, district, city and big residential complex

Article 2 – The word `Council' in this law is intended to describe Village, District, City and Residential Complex Islamic Councils.

Article 3 – The term of activity of each council is four years from the date of its establishment and their re-election is not prohibited.

Article 4 – The Islamic Council in a village with a population of less than 1,500 has three members and in a village or district with a population of over 1,500 has five members.

Article 5 – In each district, the members of the Islamic District Council are elected by a relative majority from among the elected members of the villages within the district jurisdiction. If the person elected as an original or an alternate member of the District Council is a candidate from the Village Council, that person is permitted to stay in the Village Council as well.

Article 6 – A District Council will be established when at least three quarters of the Village Councils in the district's jurisdiction have been established.

Note – Only one person is permitted to sit in the District Council from any given village. If the number of villages in a district is less than five, then the members of the District Council will be elected from among all the members of the Village Councils and eventually at least one person is to be elected from each village.

Article 7 – The number of members of an Islamic City or Residential Complex Council is determined as following:

I. For the residential complexes of 200 households to 1,000 households, three members; and for the residential complexes with over 1,000 households, five members.

II. For cities with a population of up to 50,000; five members

III. For cities with a population of 50,000 to 200,000, seven members

IV. For cities with a population of 200,000 to 1 million, nine members

V. For the cities with a population of over 1 million, 11 members

VI. For the city of Tehran, 15 members

Note – The criterion for determination of population in any city or village is the latest population census.

Article 8 – The number of alternate members of the councils are two to six persons in proportion to the number of original members of each council, with priority given to those with the higher number of votes.

If the number of nominees is less than the total number of original and alternate members, the original members are elected and the remainder of elected individuals will be selected as alternate members.

If the number of nominees is less than the required number of original members, the election will not take place.

Article 9 – If a member or members of the council for any reason decides to leave the council, the alternate members, according to the number of votes they polled, will be invited to the council.

Article 10 – The members of the Islamic Parliament, Governor-generals, Governors, District Governors, Rural District Governors, Director Generals and managers of public bureaus are permitted to

attend the sessions of the Islamic Council in their jurisdiction but have no voting rights.

Note – Councils are bound to hold an emergency session, if the concerned Rural District Governor, District Governor or the Governor requests it. This request has to be in writing with prior notification of the session's time and agenda.

Article 11- If a Rural District Governor is invited to the Village Council, a District Governor is invited to the District Council or a Governor is invited to the City Council, he is bound to participate in the sessions of the concerned council. This invitation must be in writing with prior notification of the session's time and agenda. In case of refusal to participate in the council's sessions without any acceptable justification, the aforesaid person will be notified in writing by the higher authorities and if this conduct continues that person will be reprimanded.

Article 12 – The Village Council and the District Council will be established in the regions that are defined as village or district in the National Divisions according to Articles 2 and 3.

Article 13 – In the residential complexes that are located outside the legal jurisdiction and limits of the cities and the villages and whose units are privately owned, according to law, they are called Residential Complexes and a council by the name of Residential Complex Islamic Council will be established.

Note – Residential areas located outside the legal jurisdiction and limits of the city with at least 200 households are customarily referred to as Residential Complexes. Based on the discernment of the Ministry of Interior and solely for establishing an Islamic Council, they will be subject to the election process for residential complexes. The duties and authorities indicated in this law concerning the Residential Complex Council will be implemented and they will have their own regulations in other matters.

Article 14- A person could only become the member of one council.

Note – The members of Village Islamic Councils who become an original or alternate member of the District Islamic Council are not subject to the above-mentioned article.

Article 15 – The council sessions are official when two-thirds of its original members are present and the decisions made by the absolute majority of the members in attendance are enforceable.

Article 16 – The first session of the councils will be held within a week after the announcement of the election results. The supervisor of the

National Divisions in the electoral constituency will invite the members to attend the first session and the oldest member will become the chairman of the council for the first session. In the same session, the members will elect one chairman, one deputy and at least one secretary.

The Duties of the Councils

Article 68 – The duties and authorities of the Village Islamic Council:

a. Supervising the proper execution of the decisions made by the Village Islamic Council.

b. Study and discernment of the present deficiencies, requirements and shortcomings in the village and preparing practical improvement plans and suggestions in these matters and submitting the same to the concerned authorities.

c. Attracting public participation and donations and cooperation with the executive authorities of the ministries and organizations that are active in regard to rural affairs and providing necessary accommodations for enhancement of these affairs.

d. Clarifying and justifying governmental policies and persuading the villagers to implement the aforesaid policies.

e. Supervise and follow up the implementation of the development projects and plans designated for the villages.

f. Collaboration with the concerned authorities for establishment, management, maintenance and operation of public, economic and social facilities required by the village.

g. Provide aid in emergency situations like war and natural disasters, helping the needy and unattended families with local donations.

h. Try to resolve and arbitrate local disputes.

i. Provide necessary bases for implementation of health regulations and preservation of environmental sanitation.

j. Cooperate with the local Law Enforcement Forces to uphold the law and public security.

k. Provide suitable grounds for public participation in implementation of production activities initiated by ministries and public organizations.

l. Attract public cooperation and participation in religious and cultural activities.

m. Elect an appropriate person as the Rural District Governor for four years according to the concerned regulations and presenting him/her to the District Governor for issuance of the mandated order.

Note - The Rural District Governor could be removed from office by the vote of the majority in the Rural Islamic Council according to the related regulations and the District Governor would be notified for issuance of a dismissal order.

Article 69 - The duties of the Rural District Governor

1. Implement all decisions of the Rural Islamic Council
2. Cooperate with the Law Enforcement Forces, submit reports on the violation of the Public Compulsory Military Service Law, securing public order and resolving local disputes.
3. Announce governmental regulations and decrees
4. Protect and maintain public and development facilities and the properties of the village.
5. Collaborate with governmental agencies and organizations and create accommodations for enhancement of their activities.
6. Protect environmental health by implementing health regulations.
7. Cooperate effectively with the Registration of Personal Status Organization in regard to registration of new births and the number of deaths.
8. Cooperate effectively with the concerned authorities in order to protect and preserve natural resources within the village jurisdiction and limits.

Article 70 – The duties and authorities of the District Islamic Council

1. Study and identify the social, cultural, educational, economic, development, health problems and deficiencies and to provide improvement plans and suggestions to the executive authorities of the region.
2. Cooperate with the executive authorities to enhance the development plans in the region. (This) includes construction and maintenance of public roads, electrical facilities, drinking water pipelines, canals for irrigation, repair of mosques and other activities for protection and development of farms,

gardens, pastures and forests through coordination of the concerned authorities in the region and public organizations.

3. Cooperate with the national and regional executive authorities and the Rural Islamic Councils in order to provide public service, hold national and local elections and conduct population, agricultural, animal husbandry and industrial census and surveys
4. Cooperate with the concerned authorities in order to prepare and delineate the district's overall profile by collecting information and necessary statistics based on the economic, social and cultural specifications and regional natural resources.
5. Establish the necessary coordination between the Rural Islamic Councils within a given district.
6. Supervise regional development plans and protect, maintain and exploit public and development installations and facilities, and the farms, pastures and the forests outside the limits of the villages within a given district.
7. Oversee the Rural Councils in order to guarantee the proper observation of legal duties.
8. Arbitrate disputes between several villages or Rural Councils located in the same district in cases for which no legal remedy exists.
9. Follow up cases of public violation wherein the complainant is a concerned authority.
10. Investigate public affairs within the district or the affairs outside the jurisdiction of the Rural Islamic Council's duties and authorities.
11. Investigate and follow up the problems of the people in the independent farms and villages with less than 20 households that do not have a Village Islamic Council.
12. Raise public funds in the village in order to cover the expenses for administration of the council
13. Cooperate with the Law Enforcement Forces to maintain order and preserve security and public order.

Article 71 – The Duties of the City Islamic Council:

To elect a mayor for a four year period.

Note 1 - The City Islamic Council is bound to elect a suitable mayor immediately after the council's official inauguration.

Note 2 – The mayor can not be a member of the City Council simultaneously.

Note 3 – Appointment of the mayor in cities with more than 200 thousand inhabitants and provincial capitals will take place by a proposal from the City Council and the decree of the Interior Minister. In other cities, the City Council's proposal and the decree of the Governor-general will appoint the mayor.

Note 4 – A mayor's term in office terminates under the following conditions:

a.) Written resignation with the City Council's approval.

b.) Removal of the mayor by the City Council according to the legal regulations.

c.) Suspension according to law.

d.) Lack of any of the conditions specified for the mayoral position through discernment of the City Council.

1. To study and identify the social, cultural, educational, health, economic and welfare deficiencies, requirements and shortcomings in the electoral constituency. Also, to provide improvement plans and practical suggestions in these fields for better planing and eventually submitting them to the concerned authorities.

2. To supervise proper implementation of the Council's decisions approved plans for the Municipality and other service providing organizations, unless the supervision interferes in the natural process of these organizations.

3. Cooperate with the executive authorities, national agencies and organizations in various fields including social, cultural, educational, economic and development affairs upon their request.

4. Planning for public participation in implementation of social, economic, development, cultural, educational and other welfare services with the approval of the concerned authorities.

5. Encourage people in development of athletic, cultural and recreational centers with the coordination of concerned authorities.

6. Establish social associations for aid and guidance establish production, distribution and consumption cooperatives, conduct statistical surveys, local investigations and maintain proper distribution of the public's staple food items with the approval of the concerned authorities.

7. Supervise proper management of the capital and cash assets, moveable and non-movable properties of the Municipality as well as supervision of its income and expenses without interfering in the natural process of Municipality affairs.

8. Ratify proposed regulations by the Municipality, after verifying them according to the Ministry of Interior's guidelines.

9. Approve the Comprehensive List of Municipality Income and Expenses, which the Municipality prepares every six months, and eventually publish it for public acknowledgement, a copy will be sent to the Ministry of Interior.

10. Collaborate with the Municipality in ratification of the City Limits Plan by considering the Guiding Plans and the Comprehensive Urban Development Plan, when it is prepared by the Municipality and approved by the Ministry of Interior and Ministry of Housing and Urban Development.

11. Ratify the Annual Municipality Budget and its supplementary budget and amendments, to settle the annual budgets of the organizations and companies affiliated with the Municipality according to the financial regulations of the municipalities, as well as ratifying the City Council's Budget.

Note – All the Municipality's income will be deposited with the approval of the City Council into bank accounts and will cover the expenditures according to the concerned regulations.

12. To ratify the proposed loans by the Municipality, after examining them accurately in regard to their amount, duration and commission.

13. To ratify and supervise the transactions including purchase, sale, contract or rent in the name of the Municipality, considering the Financial and Transaction Regulations of the Municipality and cost effectiveness of the transaction.

Note – In order to facilitate Municipality affairs, the Council could approve and authorize the Municipality to conduct transactions up to a certain limit in accordance with the Transaction Regulations of the Municipality.

14. Ratify the Memorandum of Association of the institutions and companies affiliated with the Municipality with the consent of the Ministry of Interior.

15. Ratify bills concerning municipal taxes and altering the amount or type, considering the general policy of the government announced by the Ministry of Interior.

16. Supervise the proper proceedings of the claims against the Municipality.

17. Supervise health-related issues within the city limits.

18. Supervise the activities of the theaters, cinemas and other public facilities that are managed by the private, cooperative or public sector. Prepare regulations in regard to the sanitation of these institutions based on the Municipality's proposal and implement contingency plans to prevent and control fire and similar accidents.

19. Ratify the necessary regulations in regard to unbounded urban lands, from an urban development, health and aesthetic perspective.

20. Supervise the establishment of morgues and cemeteries and their related equipment and transportation facilities in accordance with urban development and health.

21. Provide regulations to supervise the excavation of urban installation's, canals and other routes.

22. Supervise the execution of the plans for construction and development of cross walks, streets, squares, parks and public facilities according to the regulations.

23. Approve the names as well as renaming of avenues, streets, alleys and squares within the city limits.

24. Ratify the necessary regulations prepared by the Municipality for utilization of billboards as well as the proper usage of street walls for commercial advertisement, and publishing these regulations for public information.

25. Ratify the service rates provided by the Municipality and its affiliated organizations, observing the financial and transaction regulations of the Municipality.

26. Approve the rate of taxi fares and other transportation vehicles' fares within city limits.

27. Prepare regulations for the establishment and management of public fruit and meat markets owned by the Municipality.

28. Pass a law for better cooperation between the Municipality and the concerned agencies concerning staging agricultural, artistic, trade and other fairs.

Note 1 – The City Council is bound to execute all the regulations the City Association was liable to implement, and the City Council will replace the City Association in all matters after one year.

Note 2 – All the ministries, public institutions or organizations affiliated with government are bound to find all the terms "City Association" in their regulations and send a bill to the parliament in order to amend them with the term "City Council" within a year.

Article 72 – The specifications and conditions for appointment to the mayoral position are according to the regulations proposed by the Ministry of Interior and ratified by the Council of Ministers.

Article 73- If one or several members of the City Council have objection to the mayor's performance, first the chairperson of the City Council would notify the mayor. In case of failure to observe the notification, the matter will be sent by the chairman of the City Council in written questionnaire form to the mayor. The mayor has a maximum of 10 days after the written notification to participate in the regular or special session of the City Council and answer questions.

If the mayor refuses to participate or his answers are not satisfactory, then in another session the matter will be pursued in the form of an interpellation with the signature of one third of the Council members. There will be a maximum of 10 days between the date of notification and the session date that will be determined by the chairperson of the City Council. The Council will vote after presenting its question or questions to the mayor and the mayor's subsequent reply. If two-thirds of the Council votes against the mayor, he will be removed from office and another person appointed as mayor by the Council.

Note – Within three months after the vote of non-confidence and removal of the mayor or termination of the mayor's term, one of the Municipality's personnel will be appointed by the City Council to supervise and manage the affairs of the Municipality.

Article 74- The City Council or its members should not interfere in the appointment or removal of Municipality personnel or give them any orders.

Article 75- The entire moveable and non-moveable properties in possession of the Islamic City Council belongs to the concerned Municipality and all the financial needs and accommodations of the City Council will be allocated from the Municipality Budget of that city.

Article 76- Except for matters related to the Municipality, the duties of the Residential Complex Council are the same as the City Council.

The City and District Councils could impose taxes in proportion to the production and income of the residents according to the regulations ratified by the Council of Ministers, in order to raise money for the necessary service and development plans in the village or the city.

Note – Any taxation a month after its remittance to the Ministry of Interior is collectable. The Ministry of Interior has the right to nullify or alter any new taxes that it determines contrary to regulations.

The Village, District and City Councils are bound to send a copy of their entire ratification to the Governor, District Governor of their electoral constituency or the concerned organizations for their acknowledgement.

In order to reduce the pollution in the cities near the Caspian Sea all new buildings must have private sewage systems from the year 2000, otherwise they will not receive a Work Completion Permit.

By the coming year, the City Council will establish a compost factory in Tonekabon. The City Council has started the clean up of the rivers inside the city limits and there are training programs to raise public awareness concerning environmental issues in the mosques.

5.7. Administrative, Planning, Management and Research Capability

The followings are the main areas of research and capacity building enhancement for improvement of the health of the marine and related environment.

- Establishment of a National Marine, Reverine and Groundwater Sampling Network within already existing research institutes, routinely sampling water column, sediments, invertebrates, fishes and seabirds.

- Improvement of existing national laboratories to carry out sophisticated analysis and to provide data with accuracy at nationl/regionl level (equipment, instrument, training, intercalibration exercises)

- Establishment of a National Pollution Monitoring and Control laboratory which would carry out investigation and monitoring programme in collaboration with existing institutions in the country as well as the Regional Monitoring Activity Centre.

- Establish a centre of excellence in one of the existing research institutes for identification and monitoring of the various types of pollutants caused by reverine and non-reverine pollution including the monitoring and inventory measures for point and non-point sources of industrial and agricultural pollution. The centre shall be equipped with analytical laboratory equipment. This centre could be part of institution networks with trained manpower. The centre would be able to set-up new permissible emission and quality standards, and more over be would able to identify hot spots of pollution.

- The proposed surveys and investigation to be carried out based on internationally accepted standards such as QUASIMEME system (Quality Assurance Information in Marine Environment Monitoring) would be as :

- Surveys on marine based pollution ,existing situation ,potential future changes with emphasizing on oil exploration, exploitation and transportation (tankers and pipeline) and their impacts

- Surveys on land based pollution , existing sources ,potential future changes and its impacts.

- Investigation on petroleum hydrocarbons contents in the sea waters, sediment and biota and their sources

- Studies of the important atmospheric inputs in the southern Caspian basin.

- Investigation on sedimentation processes in the southern Caspian basin.

- More comprehensive investigation and survey on Ground waters.

- Investigation of POPs dynamic in the southern Caspian basin

- Studies on primary production cycles in southern Caspian basin.

- Survey on contaminants bioaccumulations and their transfer to different trophic levels.

- Quantification of different source of treats to the environment, which could include land-based and marine pollution, sea-level rise, eutrophication, biodiversity.

- Investigations on the biology, catch composition, population dynamic, Stock assessment of the commercially important fishes.

- Studies on the genetic taxonomy of the Southern Caspian fishes.

- Extensive research to determine the maximum sustainable yield (MSY), total allowable catch (TAC) and population dynamics of the sturgeon species in particular and other commercial fishes of regional interest.

- Identification of critical habitats and also documentation of species (endemic and exotic).

- Quantification of existing coastal habitats and related watersheds.

- Investigation on shoreline alteration and coastal erosion with emphasis on land reclamation activities and coastal development and also habitats alteration caused by sea level fluctuation and human activities.

- Investigation on the mechanism and cause of sea level fluctuations using prediction models by means of historical climatological data and new technology such as isotopes method.

- Studies on impact of sea level fluctuations on the Caspian Sea water dynamics and on biodiversity, and developing measurements to differentiate climatological effects from other local influences, which leads to the sea-level fluctuation. Production of more watershed and ocean models to estimate the range of changes in the sea level. Quantification of positive and negative impacts of the sea-level rise must be done along with regular meteorological observations.

The data obtained through the above mentioned institutions will eventually lead to pollution control measures and also provides necessary data and information enabling the competent authorities to undertake certain environment management steps as follows :

- Oil pollution and hazardous waste contingency plan for the transboundary movement of oil and hazardous substances

- Development of guidelines, standards and criteria for the management of land based pollution

- Land based pollution contingency plan

- Preparation a guideline and standards as well as regulations for oil and sea bed activities like exploitation, exploration and transmission line

- Investment in the fisheries other than sturgeon, which can promote sustainable use of other bio-resources, improves local income, and reduces the pressure to poach. New types of fisheries are to be identified and introduced to the coastal area.

- Establishment of new hatcheries in the Gilan and Mazandaran provinces as well as enhancement of existing hatcheries for the artificial propagation and releasing of commercially important fishes as pike perch, Caspian trout, roach and bream.

- Enhancement of existing sturgeon hatcheries to increase the realizing capacity and to provide extension services as follow-up of growth process of the cultured sturgeon, surveying fish health, and assistance in maturation process Sturgeon aquaculture technology could be introduced to the area using fast growing and fast maturing species.

- Establishment of a Training Centre for Advanced Fisheries Science, specially in the field of Sturgeon fishery and Sturgeon culture.

- Investment to revive sturgeon and caviar production units in the Mazandaran and Gilan and construction of few artificial spawning grounds.

- Introduction of small-scale sturgeon farming to the coastal provinces of I.R. Iran i.e. Gilan and Mazandaran. This project can provide sustainable local employment, can attract attention and support of regional and international community, it can also create co-funding with private sector involved in the caviar and sturgeon meat production, live-food production for sturgeons, mechanical diggers, water pumping/ filtration systems, storage and transport of sturgeon products and processing equipment and facilities. The sturgeon-farming industry could as well include a sturgeon-breeding centre.

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Annexes

Annex 1: List of phytoplankton in the Caspian Sea

CHRYSOPHYTA

1. *Actinocyclus ehrenbergi*
2. *Amphora avails*
3. *Bacillaria paradona*
4. *Campylodiscus clypeus*
5. *Campylodiscus echenenis*
6. *Conscindiscus gigas*
7. *Conscindiscus granii*
8. *Conscindiscus perforatus*
9. *Cyclotella caspica*
10. *Cyclotella meneghiniana*
11. *Cymbella parva*
12. *Cymbella prostrata*
13. *Cymbella sp.*
14. *Cymbella stuxbergi*
15. *Dinobryon sp.*
16. *Diplonois interupta*
17. *Gomphonema sp.*
18. *Gyrosigma acuminatum*
19. *Gyrosigma attennuatu*
20. *Gyrosigma fasciola*
21. *Gyrosigma gaci*
22. *Gyrosigma kuetzingii*
23. *Gyrosigma scalproide*
24. *Gyrosigma spenceri*
25. *Gyrosigma strigile*
26. *Gyrosigma wansbackii*
27. *Melosira granulata*
28. *Melosira guergensii*
29. *Melosira moniliform*
30. *Navicula anagulata*
31. *Navicula cryptoeophala*
32. *Navicula gracilis*
33. *Navicula menisculus*
34. *Nitzschia acicularis*

35. *Nitzschia acuta*
36. *Nitzschia closterium*
37. *Nitzschia constricta*
38. *Nitzschia distans*
39. *Nitzschia fonjcola*
40. *Nitzschia holsatica*
41. *Nitzschia intermedia*
42. *Nitzschia lanceolata*
43. *Nitzschia palea*
44. *Nitzschia regula*
45. *Nitzschia reversa*
46. *Nitzschia seriata*
47. *Nitzschia sigma*
48. *Nitzschia sigmoidea*
49. *Nitzschia sublinearis*
50. *Nitzschia tenirustris*
51. *Nitzschia tryblionella*
52. *Nitzschia vermicularis*
53. *Pinularia interrupta*
54. *Pleurosigma angulatum*

Cyanophyta

1. *Anabaena bergii*
2. *Anabaena kisselris*
3. *Anabaenopsis arnoldii*
4. *Merismopedia elegans*
5. *Merismopedia minama*
6. *Microcystis sp .*
7. *Oscillatoria geminata*
8. *Oscillatoria limosa*
9. *Oscillatoria tenuis*

CHRYSOPHYTA

1. *Pleurosigma delicatulu*
2. *Pleurosigma elongatum*
3. *Pleurosigma interrupta*
4. *Pleurosigma salinarum*
5. *Pleurosigma sp.*
6. *Rhicosphenia calcar avis*
7. *Rhicosphenia fragilissima*
8. *Rhicosphenia sp.*
9. *Scletonema costatum*
10. *Scletonema subsalsum*
11. *Stephanodiscus binderana*
12. *Stephanodiscus dubius*
13. *Stephanodiscus hontzschii*
14. *Synedra acus*
15. *Synedra pulchella*

16. *Synedra sp.*
17. *Synedra ulna*
18. *Tabellaria fanestrata*
19. *Tabellaria intermedia*
20. *Thalassionema nitzschoides*

PYRROPHYTA

1. *Ceratium fusus*
2. *Glenodinium variabile*
3. *Exuviaella cordata*
4. *Goniaulax digitale*
5. *Exuviaella marina*
6. *Goniaulax minima*
7. *Glenodinium behningii*
8. *Goniaulax polyedra*
9. *Glenodinium caspicum*
10. *Goniaulax spinifera*
11. *Glenodinium danicum*
12. *Gonyostomum sp.*
13. *Glenodinium lacustera*
14. *Gymnodinium lacustera*
15. *Glenodinium lenticula*
16. *Gymnodinium rhomboides*
17. *Glenodinium penardii*
18. *Gymnodinium sp.*
19. *Gynodinium variabile*
20. *Peridinium achromaticum*
21. *Peridinium granii*
22. *Peridinium latum*
23. *Peridinium leonis*
24. *Peridinium orbicullare*
25. *Prorocentrum micans*
26. *Prorocentrum obtusum*
27. *Prorocentrum praximum*
28. *Prorocentrum sculellum*

Annex 2: List of important tress in the Caspian coastal region

A. Caspian low land forest species:

1. *Parrotia persica*
2. *Pterocarya fraxinifola*
3. *Zelkova crenata = carpinifolia*
4. *Gleditschia caspica*
5. *Albizzia Julibrissin*
6. *Diospyrus lotus*
7. *Ulmus "campestris"*
8. *Quercus castaneaefolia*
9. *Sintenisiana*
10. *Carpinus orientalis = duinensis*
11. *Betulus*
12. *Celtis caucasica*
13. *Australis*
14. *Acer insigne = A. velutinum*
15. *Laetum*
16. *Tilia rubra = caucasica*
17. *Pyrus boissieriana*
18. *Juglans regia*
19. *Fraxinus excelsior*
20. *Alnus subcordata*
21. *Glutinosa*
22. *Orientalis*
23. *Populus alba*
24. *Buxus sempervirens*
25. *Ilex aquifolium*
26. *Crataegus melanocarpa*
27. *Microphylla = Lagenaria*
28. *Oxyacantha*
29. *Cotoneaster vulgaris*
30. *Multiflora*
31. *Corylus sp.*
32. *Paliurus aculeatus*
33. *Punica granatum*
34. *Lonicera iberica*
35. *Floribunda*
36. *Berberis vulgaris*
37. *Prunus lanurocerasus*
38. *Divaricata*
39. *Caspica*
40. *Cornus austraslis*
41. *Sanguinea*
42. *Jasminum officinale*
43. *Mespilus germanica*
44. *Ligustrum vulgare*
45. *Vitis vinifera*
46. *Smilax excelsa*
47. *Periploca graeca*
48. *Hedera helix*
49. *Pastuchowii*
50. *Rubus caesius*

B. Caspian mountain forest species

1. *Fagus orientalis*
2. *Quercus castaneaefolia*
3. *-sintenisiana*
4. *-iberica*
5. *-macranthera*
6. *Carpinus orientalis = duiensis*
7. *–betulus*
8. *Ulmus "campestris"*
9. *Celtis caucasica*
10. *–Tournefortii*
11. *Acer campestre*
12. *A. tataricum*
13. *Pseudoplatanus*
14. *–platanoides*
15. *Fraxinus excelsior*
16. *–oxyphylla = oxycarpa*
17. *Alnus glutinosa*
18. *Juglans regia*
19. *Taxus baccata*
20. *Ilex aquifolium*
21. *Evonymus latifolius*
22. *–velutinus*
23. *Juniperus communis*
24. *–oxycedrus*
25. *–sabina*
26. *Carataegus Azarolus*
27. *–pectinata*
28. *–monogyna*
29. *Cotoneaster vulgaris*
30. *Sorbus graeca*
31. *–Boissieri*
32. *–torminalis*
33. *Viburnum lantana*
34. *Colutea persica = gracilis*
35. *Lonicera iberica*
36. *–floribunda*
37. *–caucasica = orientalis*
38. *Berberis vulgaris*
39. *Cerasus microcarpa*
40. *Prunus divaricata*
41. *–Boissieriana*
42. *Rubus sp.*
43. *Rosa sp.*

Source: Forests & Rangelands Research Institute

Annex 3: List of zooplankton in the Caspian Sea

Phylum: Arthropoda

Order: Cladocera

1. *Halicyclops sarsi Naupli*
2. *Limnocalanus grimaldii Naupli*
3. *Calanipeda aquae dulsis Naupli*
4. *Eurytemora grimmi Naupli*
5. *Acartia clausi Naupli*
6. *Harpacticoid*
7. *Podon polyphemoides*
8. *Polyphemus exigus*
9. *Podonevadne camptonyx similes*
10. *Podonevadne c amptonyx hamolus*
11. *Podonevadne camptonyxpodonoides*
12. *Podonevadne camptonyx macronix*
13. *Podonevadne angusta*
14. *Evadne anonyx typical*
15. *Ccercopagis prolongata*
16. *Ccercopagis micronix*
17. *Cercopagis longiventris*
18. *Cercopagis robusta*
19. *Cercopagis pengoi*
20. *Cornigerius maetoicus ssp hircus*

Order: Cypripedium

21. *Naupli balanus*
22. *Ctpris balanus*

Phylum: Rotatoria

Order: Ostracoda

23. *Synchaeta kr. kr. (krogne)*
24. *Synchaeta vorax*
25. *Synchaeta stylata*
26. *Brachionus calyciflorus*
27. *Keratella cochlearis*

Phylum: Protozoa

28. *Tintinnopsis tolubolosa*
29. *Tintinnidium sp.*
30. *Codonella relicta*
31. *Zoothamonium plagicum*
32. *Infosuria sp.(eiliota)*
33. *Foraminifera*

Phylum: Colenterata

34. *Medosa*

Annex 4: List of Benthos in the Caspian Sea

1. *Amathilina sp*
2. *Axelboekia sp*
3. *Cardiophilus sp*
4. *Caspicola sp.*
5. *Chaetogammarus sp*
6. *Corophyum sp.*
7. *Derzhavinella sp*
8. *Gmelinopsis sp*
9. *Hypaniola kawalewskii*
10. *Hyponia invalida*
11. *Nematoda*
12. *Nereis diversicolor*
13. *Niphargogammarus sp*
14. *Niphargoids sp.*
15. *Obesogammarus sp.*
16. *Pandorites sp*
17. *Paraniphargoids sp*
18. *Pontogammarus sp*
19. *Pterocuma grandis*
20. *Pterocuma pectinata*
21. *Pterocuma rostrata*
22. *Pterocuma sowinsky*
23. *Schizorhyncus bilamellatus*
24. *Schizorhyncus eudorellaides*
25. *Stenocuma diastyloides*
26. *Stenocuma graciloides*
27. *Stenogammarus sp.*

Crustaceans

28. *Abra ovata*
29. *Balanus*
30. *Cerastoderma lamarek*
31. *Chironomidae*
32. *Corophium nobile*
33. *Corophium sp*
34. *Corophium spinulosum*
35. *Corophium spinulosum*
36. *Mytilaster lineatus*
37. *Niphargoides aequimanus*
38. *Niphargoides caspius*

39. *Niphargoides compressus*
40. *Niphargoides macrurus*
41. *Niphargoides sp*
42. *Volgacuma telmatophora*

Bivalvia

43. *Abra ovata*
44. *Crastoderma lamarcki*
45. *Dezhavinella macro**
46. *Didacna proctata*
47. *Mytilaster lineatus*
48. *Niphargoides aequmanus*
49. *Niphargoides borodini*
50. *Niphargoides carasus*
51. *Niphargoides carausui*
52. *Niphargoides caspius*
53. *Niphargoides compactus*
54. *Niphargoides compresus*
55. *Niphargoides derzhavini*
56. *Niphargoides grimmi*
57. *Niphargoides macrurus*
58. *Niphargoides motasi*
59. *Niphargoides similes*
60. *Pandorites podoceroides*

Amphipoda

61. *Amathlinia cristata*
62. *Axebaeskia spinosa*
63. *Behningiella brachypus*
64. *Cardiophilus baeri*
65. *Caspicola knipovitch*
66. *Corophium chelicorne*
67. *Corophium curvispinum*
68. *Corophium monodon*
69. *Corophium mucronatum*
70. *Corophium nobile*
71. *Corophium nobile*
72. *Corophium robustom*
73. *Corophium spinulosum*
74. *Corophium volutator*
75. *Dikerogammarus aralensis*
76. *Gammarus ischnus*
77. *Gammarus pauxil*
78. *Gmlinia tuberculata*
79. *Gmliniopsis aurita*

* Macrochelata

80. *Pontoporeia affinis mic* **
81. *Pseudatibrotus caspius*
82. *Stenocuma diastylodies*
83. *Stenocuma gracilis*
84. *Stenocuma grasiloides*
85. *Stenocuma tenuicauda*
86. *Zernovia volgensis*

Cumacea

87. *Carinacuma bierchtin*
88. *Caspicuma campylaspoides*
89. *Pseudocuma cercaroides*
90. *Pterocuma pectinata*
91. *Pterocuma rostrata*
92. *Pterocuma sowinskyi*
93. *Schyzhrhyncus bilamellatus*
94. *Schyzhrhyncus eudorelloides*
95. *Volgacuma telmatophora*

Mysidacea
Cirripedia

96. *Balanus spp.*

Decapoda

97. *Rhithropanapeus harrassii*
98. *Nereis diversicolar*

Polychaeta

99. *Hypania invalida*
100. *Hypaniola kawalewski*
101. *Manayankia caspia*

Oligocheata
Enoplata
Rhynchobdellea

102. *Archaobla*

Diptera

103. *Chironomidae*

** Microphthalma

Annex 5: List of marine organisms along the Southern Caspian Coast

Bivalvia

1. *Abra ovata*
2. *Adacna hypanis vitrea*
3. *Adacna laeviuscula laeviuscula*
4. *Adacna vitrea (3 varieties)*
5. *Cerastoderma lamarcki lamarcki*
6. *Cerastoderma umbonatum*
7. *Dezhavinella macrochelata*
8. *Didacna baeri*
9. *Didacna barbotdemarnyi*
10. *Didacna langipes*
11. *Didacna parallella*
12. *Didacna proctata*
13. *Didacna pyramidata*
14. *Didacna trigonoides*
15. *Didacna trigonoides praetrigonoides*
16. *Didacna trigonoides trigonoides*
17. *Dreissena caspia*
18. *Dreissena elata*
19. *Dreissena elata (7 varieties.)*
20. *Dreissena poly morpha*
21. *Dreissena poly morpha andrusovi*
22. *Dreissena poly morpha poly morpha*
23. *Hypanis plicata*
24. *Hypanis plicata golbargae*
25. *Hypanis plicata plicata*
26. *Monodacna albida*
27. *Monodacna angusticostata*
28. *Monodacna caspia*
29. *Monodacna colorata*
30. *Monodacna semipellucida*
31. *Mytilaster lineatus cabanisi*
32. *Mytilaster lineatus starobogatovi*
33. *Niphargoides aequmanus*
34. *Niphargoides borodini*
35. *Niphargoides carausui*
36. *Niphargoides carsus*
37. *Niphargoides caspius*
38. *Niphargoides compactus*
39. *Niphargoides compresus*

40. *Niphargoides derzhavini*
41. *Niphargoides motasi*
42. *Niphargoides similis*
43. *Pandorites podoceroides*
44. *Pontodreissena rostriformis*
45. *Pontodreissena rostriformis compressa*
46. *Pontodreissena rostriformis distincta*
47. *Pontodreissena rostriformis grimmi*
48. *Pontodreissena rostriformis pontocaspica*
49. *Protodidacna protracta*
50. *Protodidacna protracta profundicola*
51. *Protodidacna protracta protracta*
52. *Protodidacna protracta protracta submedia*

Gastropoda

1. *Theodoxus pallasi (11 varietiesieties)*
2. *Theodoxus schultzi*
3. *Theodoxus zhukovi payvandi*
4. *Pyrgohybrobia convexa*
5. *Pyrgohybrobia eichwaldiana*
6. *Pyrgohybrobia conica*
7. *Pyrgohybrobia parva*
8. *Pyrgohybrobia turrita*
9. *Pyrgohybrobia dubia*
10. *Pyrgohybrobia curta*
11. *Pyrgohybrobia gemmata*
12. *Pyrgohybrobia oviformis*
13. *Pyrgohybrobia subconvexa*
14. *Pyrgohybrobia grimmi*
15. *Pyrgohybrobia chrysopsis*
16. *Pyrgohybrobia cylindrica*
17. *Eurycaspia lencoranica*
18. *Eurycaspia pseudodimidiata*
19. *Eurycaspia pseudobacuana*
20. *Trachycaspia dimidiata*
21. *Trachycaspia bacuana*
22. *Trachycaspia laticarinata*
23. *Turricaspia uralensis*
24. *Turricaspia sajenkovae*
25. *Turricaspia dagestanica*
26. *Turricaspia spica*
27. *Turricaspia spasskii*
28. *Turricaspia pulla*
29. *Turricaspia rudis*
30. *Turricaspia fedorovi*
31. *Turricaspia turricula*
32. *Turricaspia eulimellula*

33. *Turricaspia grimmi*
34. *Turricaspia elegantula*
35. *Turricaspia lirata*
36. *Turricaspia concinna*
37. *Turricaspia andrusovi*
38. *Caspiopyrgula nossovi*
39. *Oxypyrgula pseudospica*
40. *Oxypyrgula pullula*
41. *Oxypyrgula bagatscheviana*
42. *Oxypyrgula simplex*
43. *Oxypyrgula dubia*
44. *Oxypyrgula turkmenica*
45. *Oxypyrgula ebersini*
46. *Oxypyrgula columna*
47. *Oxypyrgula vinogradovi*
48. *Laevicaspia caspia*
49. *Laevicaspia curta*
50. *Laevicaspia meneghiniana*
51. *Laevicaspia eburnea*
52. *Caspiella kolesnikoviana*
53. *Caspiella abichi*
54. *Caspiella kowalewskii*
55. *Caspiella cincta*
56. *Caspiella conus*
57. *Caspiella marginata*
58. *Caspiella derbentina*
59. *Caspiella ovum*
60. *Caspiella trivialis*
61. *Caspiella similis*
62. *Celekenia aenigma*
63. *Clessiniolla varietiesiabilis*
64. *Clessiniolla triton*
65. *Caspia baerii*
66. *Caspia sowinskyi*
67. *Caspia pallasii*
68. *Caspia isseli*
69. *Caspia gmelinii*
70. *Caspia knipowitchi*
71. *Caspiagaillardi*
72. *Ulskia derzhavini*
73. *Ulskia ulskii*
74. *Ulskia schorygini*
75. *Ulskia nana*
76. *Ulskia behningi*
77. *Abeskunus depressispira*
78. *Abeskunus brusiniana*

79. *Abeskunus brusiniana michelae*
80. *Abeskunus exigua*
81. *Abeskunus sphaerion*
82. *Horatia marina*
83. *Anisus eichwaldi*
84. *Anisus kolensikovi*
85. *Anisus sulcatus*
86. *Anisus djalalus*

Amphipoda

1. *Pontoporeia affinis*
2. *microphthalma*
3. *Amathlinia cristata*
4. *Gmlinia tuberculata*
5. *Gmliniopsis aurita*
6. *Gammarus pauxil*
7. *Gammarus ischnus*
8. *Caspicola knipovitch*
9. *Dikerogammarus aralensis*
10. *Cardiophilus baeri*
11. *Zernovia volgensis*
12. *Pseudatibrotus caspius*
13. *Axebaeskia spinosa*
14. *Behningiella brachypus*
15. *Corophium nobile*
16. *Corophium spinulosum*
17. *Corophium volutator*
18. *Corophium curvispinum*
19. *Corophium chelicorne*
20. *Corophium monodon*
21. *Corophium robustom*
22. *Corophium mucronatum*
23. *Stenocuma grasiloides*
24. *Stenocuma gracilis*
25. *Stenocuma diastyloides*
26. *Stenocuma tenuicauda*
27. *Pterocuma pectinata*
28. *Pterocuma sowinskyi*
29. *Pterocuma rostrata*
30. *Schyzhrhyncus eudorelloides*
31. *Schyzhrhyncus bilamellatus*
32. *Caspicuma campylaspoides*
33. *Volgacuma telmatophora*
34. *Pseudocuma cercaroides*
35. *Carinacuma bierchtin*

Decapoda

1. *Rhithropanapeus harrassii*
2. *Nereis diversicolar*

Polychaeta

1. *Hypania invalida*
2. *Hypaniaola kawalewski*
3. *Manayankia caspia*

Annex 6: List of fish species inhabiting the Southern Caspian Sea (divided by the family

Acipenseridae

1. *Acipenser gueldenstaedti*
2. *Acipenser nudiventris*
3. *Acipenser persicus*
4. *Acipenser stellatus*
5. *Huso hoso*

Anguillidae

6. *Anguilla anguilla*

Atherinidae

7. *Atherina boyeri*

Balitoridae

8. *Nemacheilus angorae*
9. *Nemacheilus bergianus*
10. *Nemacheilus brandti*
11. *Nemacheilus malapterurus*
12. *Nemacheilus rhadinaeus*

Clupeidae

13. *Alosa braschnikovi*
14. *Alosa caspia*
15. *Alosa curensis*
16. *Alosa pontica*
17. *Alosa saposchnikowi*
18. *Alosa sphaerocephala*
19. *Clupeonella cultriventris*
20. *Clupeonella engrauliformis*
21. *Clupeonella grimmi*

Cobitidae

22. *Abramis brama*
23. *Abramis sapa*
24. *Cobits aurata*
25. *Cobits caspia*
26. *Cobits taenia*

Cyprinidae

27. *Acanthalburnus microlepis*
28. *Alburnoides bipunctatus*
29. *Alburnus alburnus*
30. *Alburnus filippi*
31. *Aspius aspius*
32. *Barbus brachycephalus*
33. *Barbus capito*
34. *Barbus lacerta*
35. *Barbus mursa*
36. *Blicca bjoerkna*
37. *Capoeta capoeta*
38. *Carassius auratus*
39. *Chalcalburnus chalcoides*
40. *Chondrostoma oxyrhynchum*
41. *Ctenopharyngodon idella*
42. *Cyprinus carpio*
43. *Gobio persus*
44. *Hemiculter leucisculus*
45. *Hypophthalmichthys molitrix*
46. *Hypophthalmichthys nobilis*
47. *Leucaspius delineatus*
48. *Leuciscus cephalus*
49. *Pelecus cultratus*
50. *Pseudorasbora parva*
51. *Rhodeus sericeus*
52. *Rutilus frisii*
53. *Rutilus rutilus*
54. *Scardinius erythrophthalmus*
55. *Tinca tinca*
56. *Vimba vimba*

Esocidae

57. *Esox lucius*

Gadidae

58. *Lota lota*

Gasterosteidae

59. *Gasterosteus aculeatus*
60. *Pungitius platygaster*

Gobiidae

61. *Benthophilus ctenolepidus*
62. *Benthophilus macrocephalus*
63. *Benthophilus magistri*
64. *Benthophilus stellatus*
65. *Knipowitschia caucasica*

66. *Neogobius caspius*
67. *Neogobius fluviatilis*
68. *Neogobius kessleri*
69. *Neogobius melanostomus*
70. *Neogobius ratan*
71. *Proterorhinus marmoratus*
72. *Proterorhinus semipellucidus*

Mugilidae

73. *Liza aurata*
74. *Liza saliens*

Percidae

75. *Perca fluviatilis*
76. *Stizostedion lucioperca*
77. *Stizostedion marinum*

Petromyzontidae

78. *Caspiomyzon wagneri*

Poeciliidae

79. *Gambusia affinis*
80. *Gambusia holbrooki*

Salmonidae

81. *Oncorhynchus mykiss*
82. *Salmo trutta*
83. *Stenodus leucichthys*

Siluridae

84. *Silurus glanis*
85. Syngnathidae
86. Syngnathus abaster

Annex 7: List of birds in Southern Caspian region according to their place of finding

(M= migratory N=native)

GLN = Golestan National Park
LV = Lavandovil (Protected Area)
AK = Amir-Kelayeh (Wetland)
DN = Dashte -Naz (Plain)
M = Miankaleh (Peninsula)
CA = Central Alborz (Mountain)
SK = Siah-Keshim (Wetland)
SMK = Sameskandeh
FK: = Fereydonkenar

Species	GLN	LV	AK	D N	M	CA	SK	SMK	FK
1. *Acanthis cannabina*		M			M				
2. *Acanthis flavirostris*	N						M		
3. *Acrocephalus agricola*					M				
4. *Acrocephalus arundiaaceus*					M		M		
5. *Acrocephalus dumetorum*					M				
6. *Acrocephalus schoenobaenus*					N				
7. *Acrocephalus scirpaceus*		M			M		M		
8. *Aegithalos caudatus*		M	M	M	N			N	
9. *Alauda arvensis*	N		M	M	M				
10. *Alauda cervinus*		M			M				
11. *Alauda gulgula*		M							
12. *Alauda pratensis*		M	M	M				M	M
13. *Alauda similis*			M		M				
14. *Alauda spinoletta*	M	M		M	M				
15. *Alauda trivialis*			M	M	M			M	
16. *Alcedo atthis*		N	N	N	N		N		M
17. *Alectoris chukar*	N								
18. *Ammoperdix griseagularis*	N								
19. *Anthopoides virgo*									
20. *Anthus compestris*	M								
21. *Anthus novaeseelandiae*	M								
22. *Apus apus*	M	M			M			M	
23. *Apus melba*					M			M	
24. *Arenaria interpres*		M			M				
25. *Asio flammeus*		M							
26. *Athene noctua*		M							
27. *Bambxcilla garrulus*	N								
28. *Burhinus oedicnemus*		M			M				
29. *Calidris alba*		M			M		M		
30. *Calidris ferruginea*		M			M		M		
31. *Calidris minuta*		M			M				
32. *Calidris olpina*		M			M				M
33. *Calidris temmenckii*		M			M				
34. *Callandrella cinerae*	M	M			M				
35. *Callandrella rufescens*					N		M		

Species	GLN	LV	AK	DN	M	CA	SK	SMK	FK
36. *Callandrella ucutirostris*	M								
37. *Caprimulgus aegyptius*					M				
38. *Caprimulgus europaeus*	N	M		M	M			M	
39. *Carcuelis carduelis*		M		M	M		M	N	M
40. *Carcuelis chloris*		M		M	M		M	M	
41. *Carcuelis spinus*		M		M			M		
42. *Carpodacus erythrinus*	M				M			M	
43. *Cercotrichas galactotes*					M				
44. *Certhia familiaris*	N	M	M						
45. *Cettia cetti*			N		M		M		M
46. *Chalidorias eucopterus*		M			M		M		
47. *Chalidorias hybrida*		M	M		M				
48. *Chalidorias nigra*		M			M		M		
49. *Charadrius alexandrinus*	M		M	M	M				
50. *Charadrius asiaticus*		M			M				
51. *Charadrius dubius*	M		M		M		N		
52. *Charadrius hiaticula*	M				N				
53. *Charadrius leschenaulti*					M		M		
54. *Charadrius mongolus*							M		
55. *Chlamydotis undulata*	M				M				
56. *Cinclus cinclus*	N	M			M				
57. *Lamator glandarius*									
58. *Clamator jacobinus*									
59. *Cocothraustes cocothraustes*					M				
60. *Columba eversmanni*									
61. *Columba livia*	N			N			M		
62. *Columba oenas*	N	M			M			N	
63. *Columba palumbus*	N	M	M	M		M			
64. *Coracias garrulus*	M	M	M	M	M		M	M	
65. *Coruus corax*									
66. *Coruus corone*	N	N	N	N			N	N	N
67. *Coruus frugilegus*	N	M	M			M	M	M	
68. *Coruus macrorhynchos*				N					
69. *Coruus monedula*							M		
70. *Coruus splendens*					M				
71. *Coturnix coturnix*	M				N			M	
72. *Crex crex*					M				
73. *Cuculus canorus*	M	M	M	M			M		
74. *Cursorius cursor*							M		
75. *Delichon urbica*		M							
76. *Denanthe oenanthe*	N	M			M	M	M		
77. *Dendrocopus major*	N			N				M	
78. *Dendrocopus minor*	N								

Species	GLN	LV	AK	D N	M	CA	SK	SMK	FK
79. *Dryocopus maritus*	N								
80. *Emberiza bruniceps*	M								
81. *Emberiza buchanani*	M								
82. *Emberiza cia*	N				M			M	
83. *Emberiza citrinella*	M	M		M	M		M	M	
84. *Emberiza culandra*	N			M	N				M
85. *Emberiza hortulana*					M				
86. *Emberiza leucocephala*		M		M	N		M		
87. *Emberiza melanocephala*					M				
88. *Emberiza schoeniclus*	M	M			N		M		
89. *Eremophila alpestris*	M				N				
90. *Erithacus rubecula*	M	N	M		N		N	M	M
91. *Eudromias morindus*					M				
92. *Falco columbarius*		M		M	M				M
93. *Falco naumanni*	M	M			N			M	
94. *Falco subbuteo*	M	M	M		M			M	
95. *Falco tinnunculus*	N	N		M	N		N	N	N
96. *Ficedula albicollis*	M				M				
97. *Ficedula parva*	M	M	M	M	M			M	
98. *Francolinus francolinus*					N				
99. *Fringilla coelebs*	N	M		M	M		M	N	M
100. *Fringilla montifringilla*	M	M			M		M		M
101. *Fulica atra*	M		M				M		M
102. *Galerida cristata*	N			N	M			M	M
103. *Gallinago gallinago*		M		M	M		M		M
104. *Gallinago media*		M			M		M		
105. *Gallinula chloropus*					M		N		M
106. *Garrulus glandarius*	N	N		N	N			N	
107. *Gelochelidon nilotica*		M							
108. *Glareola pratincola*		M			M				
109. *Grus grus*		M			M				
110. *Haematopus ostralegus*					N				
111. *Himantopus himantopus*		M			N		N		
112. *Hipolais cligata*					M				
113. *Hipolais icterina*	M								
114. *Hipolais languida*					M				
115. *Hipolais pollida*					M				
116. *Hirundo dourica*					M				
117. *Hirundo rustica*	M	M	M	M	M		M	M	
118. *Hydroprogne tschegrava*		M			M				
119. *Jxnx torguilla*				M	M				
120. *Lanius collurio*		M	M	M	M			M	
121. *Lanius excubitor*	M	M			M		M		

Species		GLN	LV	AK	DN	M	CA	SK	SMK	FK
122.	*Lanius isabellinus*	M				M				
123.	*Larus argentatus*		M			M		M		
124.	*Larus canus*		M			M				
125.	*Larus fuscus*					M		M		
126.	*Larus genei*		M			M				
127.	*Larus ichtyyaetus*		M	M		M		M		M
128.	*Larus marinus*					M				
129.	*Larus minutus*		M	M		M		M		M
130.	*Larus ridibundus*	M	M	M		M				
131.	*Limocola falcinellus*					M		M		
132.	*Limosa laponica*			M		M		M		
133.	*Limosa limosa*			M		M				
134.	*Locustella fouviatilis*					M				
135.	*Lonius minor*	M	M			M		M		
136.	*Lonius senator*									
137.	*Lullula arborea*	N		M	M	M		M		
138.	*Luscinia luscinia*		M			M				
139.	*Luscinia megarhunchos*	M		M	M	M		M	M	
140.	*Luscinia svecica*					M				
141.	*Lusciniola melanopogon*							M		M
142.	*Lymnocryptes minimus*					M				M
143.	*Melanocorypha bimaculaala*	N	M							
144.	*Melanocorypha calandra*	N				M				
145.	*Melanocorypha lucoptera*					M				
146.	*Melanocorypha xeltoniensis*		M			M				
147.	*Merops apiaster*	M	M	M	M	M		M	M	
148.	*Merops superciliosus*		M	M	M	M		M	M	
149.	*Monticola saxatilis*	M				M				
150.	*Monticola solitarius*									
151.	*Motacilla alba*	N	N	N	N	M		M	M	M
152.	*Motacilla cinerea*	N	M	M	M	M		M	M	M
153.	*Motacilla citreola*		M			M		M		
154.	*Motacilla flara*		M	M		M			M	
155.	*Muscicapa striata*	M	M	M	M	M		M	M	
156.	*Nectarinia asiatica*							N		
157.	*Numenius arquata*			M		M		M		
158.	*Numenius phaeopus*		M					M		
159.	*Numenius tenvirostris*		M			M		M		
160.	*Oenanthe deserti*	M				M				
161.	*Oenanthe Finschii*	M				M				
162.	*Oenanthe Hispanica*					M			M	
163.	*Oenanthe Isabellina*	M	M			M			M	
164.	*Oenanthe picata*	M								

Species		GLN	LV	AK	D N	M	CA	SK	SMK	FK
165.	*Oenanthe Pleschanka*	M				M				
166.	*Oriolus oriolus*	M	M			M		M	M	
167.	*Otis tarda*					M				
168.	*Otis tetrax*					M				
169.	*Otus brucei*	N	M							
170.	*Otus scops*	M								
171.	*Panurus biarmicus*		M	M						
172.	*Parus ater*	N			M	M			N	
173.	*Parus Caeruleus*	N	M	M	N	M			N	
174.	*Parus logubris*	N						N		
175.	*Parus Major*	N	M	N	N	N			N	M
176.	*Passer ammodendri*	N						M		
177.	*Passer domesticus*	N	N	N	N	N				N
178.	*Passer hispaniolensis*	M			M	N		N		
179.	*Passer moabiticus*							N		
180.	*Passer montanus*	N	N	N	N	N				
181.	*Pentronia brachydactyla*	M								
182.	*Pentronia petronia*	N								
183.	*Ph. Lobatus*		M			M				
184.	*Phasianus colchicus*	N				M		M	N	
185.	*Philomachus pugnax*		M			M		M		
186.	*Phoenicurus erythrontus*	M				M	M			
187.	*Phoenicurus ochruros*	M								
188.	*Phoenicurus phoenicurus*	M	M		M	M		M		
189.	*Phulloscopus collybita*	M	M			M		M	M	M
190.	*Phulloscopus eglecutus*	M								
191.	*Phulloscopus ntidus*		M		M	M			M	
192.	*Phulloscopus trochilus*	M	M			M				
193.	*Pica pica*	N	N	N		M		N	N	N
194.	*Picus viridis*	N	M		M				M	
195.	*Pluvialis apricaria*		M			M				
196.	*Pluvialis squatarola*		M			M		M		
197.	*Porphyrio porphyrio*	M			M	M		N		M
198.	*Porzana porzana*	M		M	M					
199.	*Porzuna pusilla*			M						
200.	*Prunella modularis*	N	M			M				
201.	*Prunella oculans*	M	M			M				
202.	*Pterocles orientalis*	N				N				
203.	*Pyrrhocorax graculus*	N								
204.	*Pyrrhocorax pyrrhocorax*	N								
205.	*Pyrrhula pyrrhula*	M								
206.	*Rallus aruaticus*					M		N		
207.	*Recurvirostra avosetta*		M			M				

Species		GLN	LV	AK	DN	M	CA	SK	SMK	FK
208.	*Remiz pendulinus*	M	M	M	M	N				
209.	*Rhodopechys sanguinea*	N								
210.	*Riparia riparia*		M	M			M	M	M	
211.	*Saxicola torguata*	M	M	M		M		M		
212.	*Saxicola yuberta*	M		M	M	M				
213.	*Scolopax rusticola*	M	M		M	M		M	M	M
214.	*Serinus pusillus*	N			M				M	
215.	*Sitla europaea*	N			N				N	
216.	*Sitla tephronata*	N								
217.	*Sterna albifrons*		M			M				
218.	*Sterna hirundo*		M			M				
219.	*Sterna sandvicensis*		M			M				
220.	*Streptopelia decaocto*									
221.	*Streptopelia orentalis*	M								
222.	*Streptopelia senegalensis*				M					
223.	*Streptopelia turtur*	M	M	M	M			M	M	
224.	*Strix aluco*	N			N					
225.	*Sturnus roseus*	M	M			M				
226.	*Sturnus vulgaris*	N	N	N	N	N		N	M	M
227.	*Sylvia althaea*	M								
228.	*Sylvia atricapilla*	M			M				M	
229.	*Sylvia borin*		M		M	M		M		
230.	*Sylvia communis*	M	M		M	M		M	M	
231.	*Sylvia curruca*		M			M			M	
232.	*Sylvia hortensis*	N				M				
233.	*Sylvia minula*	M				M				
234.	*Sylvia mystacea*	M	M			M		M		
235.	*Sylvia nisria*	M				M				
236.	*Tringa erythropus*		M			M				
237.	*Tringa glareola*		M			M		M		
238.	*Tringa hypoleucos*		M			M		M		
239.	*Tringa nebularia*		M			M		M		
240.	*Tringa ochropus*		M			M		M		
241.	*Tringa stagnatilis*		M			M		M		M
242.	*Tringa totanus*		M	M		M		M		
243.	*Troglodytes troglodytes*	N	N	M	N			M	N	M
244.	*Turdus liiacus*		M	M	M	M		M	M	M
245.	*Turdus meula*	N	M	M	M	M		M	N	M
246.	*Turdus philomelus*	N	M	M	M	M		M	M	
247.	*Turdus pilaris*	M	M		M	M		M		
248.	*Turdus ruficollis*	M			M	M				
249.	*Turdus turquatus*	M			M					
250.	*Turdus viscivorus*	N				M		M		

Species		GLN	LV	AK	D N	M	CA	SK	SMK	FK
251.	*Turnix sulvatica*	M		M	M	M		M		
252.	*Upopa epops*	N	M	M	M	M		M	M	
253.	*Vanelus gregarious*							M		
254.	*Vanelus indicus*							N		
255.	*Vanelus leucurus*					M				
256.	*Vanelus vanelus*	M	M	M		M				M
257.	*Xenus cinerreus*			M		M		M		

Source: Behrozirad , 1969

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