In the name of God

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Status of Aquaculture in Islamic Republic of Iran

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Iranian Fisheries Organization (SHILAT)

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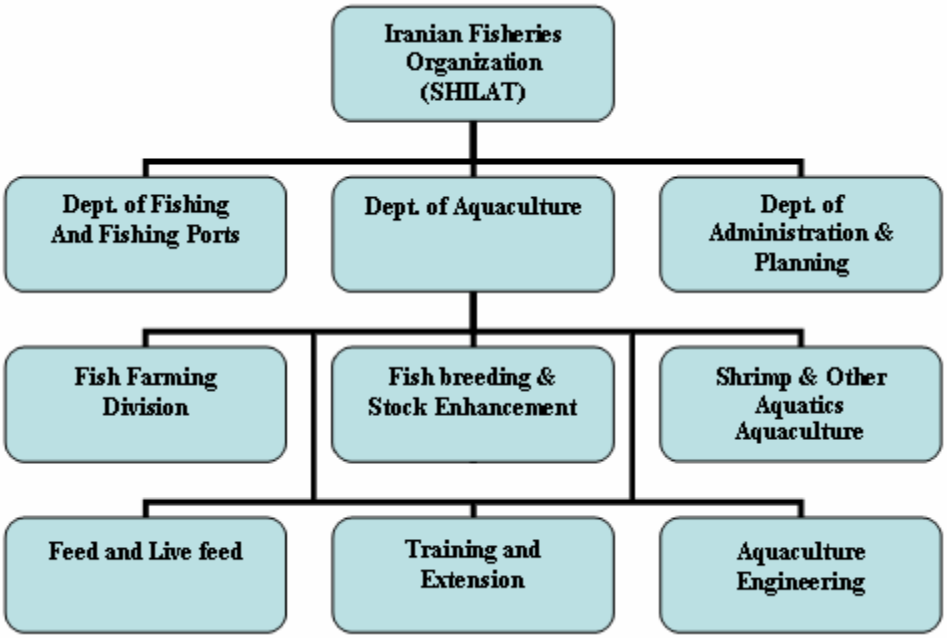
Ministry of Jihad-e Agriculture



Background

Iran is famous for her long history, 2600 year's civilization, her pistachio, nice carpets and also for her delicious Caviar. The Islamic Republic of Iran comprises a land area of 1.64 million km2. It lies in the northern part of the temperate zone, between latitudes 25o00' and 39o47' north and longitudes 44o02' and 63o02' east. The average altitude is over 1200 m. Iran is bordered by Turkmenistan, Caspian Sea (over 900 km of coastline), Azerbaijan, and Armenia in the north, Afghanistan and Pakistan in the east, the Sea of Oman and Persian

Gulf in the south (1850 km of coastline), Iraq and Turkey in the west. The country features three main climatic zones and can growth several different fish and shrimp species:

- Arid and semi-arid regions of the interior and far south, which are characterized by long, warm and dry periods, lasting sometimes over seven months, and covering nearly 90% of the country.
- Mediterranean climate (mainly in the western Zagros Mountains, the high plateau of Azerbaijan, and the Alborz mountains), characterized by warm, dry summers and cool, damp winters and covering about 5% of the land surface.
- Humid and semi-humid regions (mainly in the Caspian, but also in west Azerbaijan and the southwest Zagros), also covering about 5% of the land surface.

Although the record of aquaculture in Asia gets back to thousands of years ago, and specially the people of south-eastern Asia are the pioneers of fish culture in the world, but there had been no attention to this important matter until last five decades in Iran. The first experiment was done about culture of rainbow trout near Tehran in Mahisara (Karaj) in 1959. The first farm established for warm water in Guilan province and Abzi Company in Khuzestan province (Shooshtar) in 1971. Shrimp culture in Iran has a short history, effectively backs to 1991.The industry have developed very rapidly over the past 10 years and great progress has been made.

Status of Iranian aquaculture

Iran has a great capability for fisheries activities. Some 2700 km of coastal area in the southern and northern Iran and hundreds of lake, rivers and springs provide huge potential for fishing, aquaculture and culture based fisheries activities.

The government of Iran has considered fisheries sector as an important approach for job creation, food safety and poverty alleviation in the 4^{th} National Five-Year Development Plan (NFDP). In 2003 some 17095 employee were directly involved in the aquaculture sector. Fisheries products provide 2.7 gr. per capita of animal protein supply in the country. While the production has exceeded from 124000 tons in 2004, the government has targeted production of 280000 tons of aquaculture products in 2009. Fish is an expensive, high status food item in Iran. The consumption in Iran is 6.7 kg per capita (year book of Iranian fisheries statistic 2004), the main goal of the government is to increase the fish consumption to 7 kg (for comparison, the fish consumption per capita in the world are 13.5 kg). Faced with the population development static and even declining levels in some of the capture and fisheries, the government is looking at aquaculture more and more as an alternative source of fish and shellfish products, and contributor of animal protein to food security by raising fish consumption to 13.5 kg per capita.

Table 1 : National aquaculture production

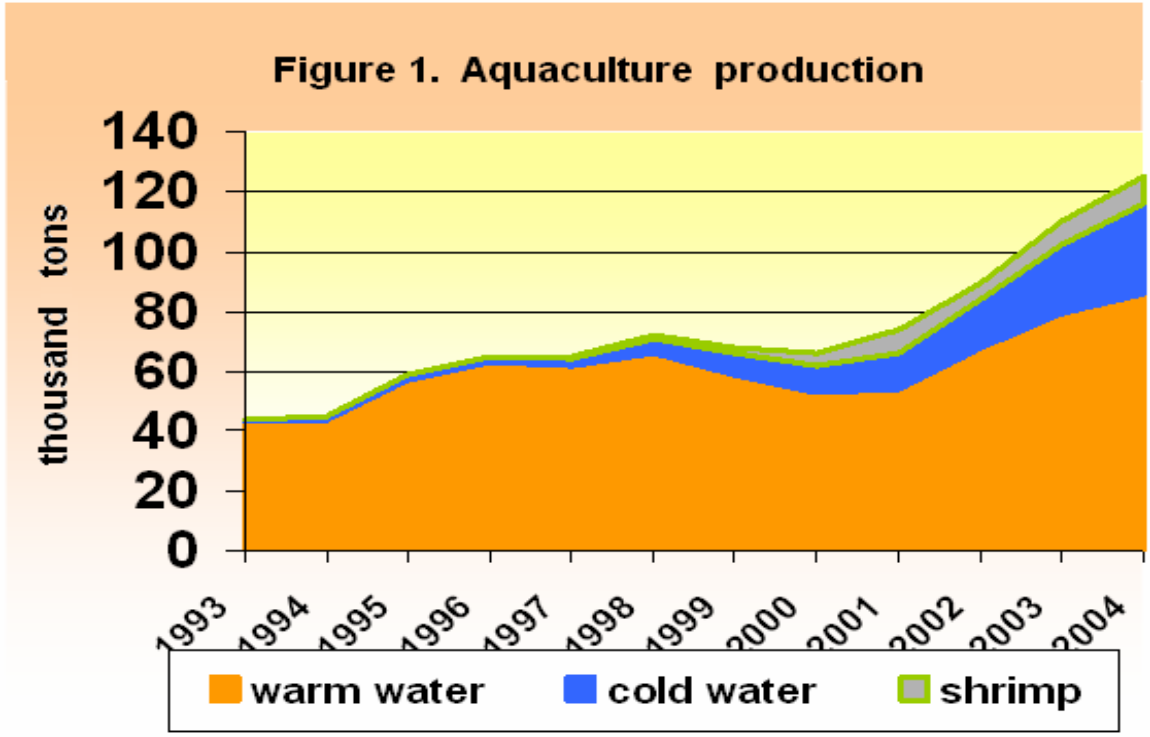
q= mt.

	1998	1999	2000	2001	2002	2003	2004
Warm water fish	27183	27374	23000	27500	28060	61084	65400
Coldwater fish	2514	4994	7000	9000	12170	23138	30000
Shrimp	523	869	1800	4010	7630	7492	8930
Natural & resources	34780	38763	36000	25940	25785	18461	20230
Total	65000	72000	67800	66000	73645	110175	124560

Source: Year book of Iranian Fisheries Statistics

Development of aquaculture started in the early 1980s in Iran, and northern provinces and some of coastal southern provinces, passed the development route of this industry very rapidly, so that the rate of cultured fish production has increased about 125 thousand tones during the recent years (table 1). The total fisheries and aquaculture in 2004 was 475,000 tons (year book of Iranian fisheries statistics 2004). One of the goals for the government is to achieve an aquaculture production of 100,000 tons of marine fish in the Persian Gulf, Oman Sea, and the Caspian Sea. Iran has since 1990 build up shrimp farms with a yearly production of 4,000 ton shrimp, the plans for increasing to 47,000 tons in 2009. 22,000 ha. have been screened and found suitable, in addition and area of 110,000 ha that may have potential for shrimp farming.

The production of fingerlings of several species are produced and set out in the Caspian Sea and Persian Gulf for restocking purposes. In 2004, a total of 235 million was released into the sea (Abdolhay 2005). There are no selections or breeding program on any of the species in use for restocking purposes. There is however plans for such a program for both shrimps and the Caspian trout (*Salmo trutta caspius*, Kesler 1877).total aquaculture production are shown in figure 1.



Culture species

Warm water fish culture includes extensive rearing of four Chinese carp, namely Common carp(*Cyprinuscarpio*),Grasscarp(*Ctenopharyngodonidella*), Silver carp (*Hypophthalmichthys molitrix*) and Bigheadcarp (*Aristichthys nobilis*). They are introduced from Romania, Hungary and China. Coldwater fish farming includes rearing rainbow trout (*Oncorhynchus mykiss*) in tanks, reservoir dams and raceway farms. Rainbow trout is introduced from several countries such as United Kingdom, Italy and Norway.

Shrimp farming system is semi-intensive aiming production of 3 MT/ha in rectangular, earth ponds. *Penaeus indicus* is the main culture species because of availability of wild spawners, easily maturation in captivity and its tolerance to various environmental conditions (salinity in particular). Several experiments shown *P.semisulcatus* and *Fenneropenaeus merguiensis* can't be trustable species for pond culture. Slow growth of *P.semisulcatus* and high mortality of Banana shrimp are main disadvantage of those species.
Farming of fresh water prawn (*Macrobrachium rosenbergii*), sturgeon (*Huso huso*), *Abramis brama*, *Chanos chanos*, *Barbus sharpeiy*, *Stizostedion luciperca* are introduce to farmers for diversification of production and provides more flexibility in marketing.

Shrimp Culture

In 2004 Iran has produced 8930 Mt of shrimp in 310 farms. Comparing year productions and number of farms, show 20% and 12% decrease in 2002. That was because of low price of shrimp in world market and out break of disease in one farm complex (Choebdeh farm complex, Khuzestan) were major factors (Table 2). In spite of the control of disease in the Khuzestan province (white spot) some of farms production has been damaged completely in year 2005.

Table 2 and 3 shows number of farms in used for shrimp culture and number of Post Larvae which have produced in the shrimp hatcheries in years of 1994 – 2004.

Table 2: Number of farms, pond area and annual production of shrimp

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
No. of farm	12	37	39	62	80	137	201	278	207	250	310
Pond Area(ha)	47	182	183	442	612	1337	2465	3635	2647	3589	4272
Production(Mt)	53	136	163	523	869	1800	4010	7630	5990	7492	8930

Table 3: production of Shrimp post larvae (millions), (1994–2004)

Species	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
P.indicus	282.0	18.0	24.7	57.0	114.0	306.0	532.0	828.0	683.0	764.3	1142.6

Source: Year book of Iranian Fisheries Statistics

Stock enhancement:

Fish Stock enhancement

One of the main goals for Shilat is to preserve and maintain the diversity of species in the Caspian Sea & Persian Gulf. In the last 10-20 years a severe stock depletion for several of the species have been the subject for discussions and effort have been made to launch programs for the preservation of these. One of these programs is the re-stocking program, which annually releases about 280 million fry and fingerlings into the Caspian Sea & Persian Gulf (Table 4) . It is an important event for the whole community when the releases are done (Abdolhay 2005).

Table 4: Releasing of fingerlings (millions) to the Caspian Sea & Persian Gulf for fish stock enhancement, (1995–2005)

	Species	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Caspian sea	Sturgeon	9.12	12.45	21.62	24.55	18.85	18.27	20.00	19.60	20.00	21.12	9.95
	Kutum	117.9	142	154	143	148	147	232	225	155	179.37	229.12
	Caspian salmon	0.80	0.42	0.34	0.51	0.41	0.45	0.36	0.34	0.32	0.35	0.30
	Bream	11.20	8.48	12.99	13.80	14.20	14.30	15.50	16.50	17.00	16.33	27.14
	Perch	2.27	2.41	3.8	3.61	4.2	3.9	7.40	5.50	11.00	7.54	10.22
	Sea carp	0	0	6.50	24.00	9.00	32.00	17.90	7.60	2.00	0.0	0.34
	Caspian roach	0	0	15.80	13.90	10.70	16.20	19.10	12.23	12.00	10.41	3.82
Persian Gulf	Yellow seabream	-	-	-	-	-	-	-	-	-	0.05	0.65
	Gray grouper	-	-	-	-	-	-	-	-	-	-	0.05

Total rounded	**141**	**166**	**214**	**221**	**206**	**233**	**312**	**287**	**217**	**235**	**282**

Decreasing of some species in 2005 comparing with year 2004 is because of lack of the wild brood stock in the natural resources.

Shrimp Stock enhancement

Table 5 shows number of shrimp larvae released in northern part of Persian Gulf & Oman Sea in years of 1997-2005.

Table 5 : Releasing of Shrimp larvae (1-3 gr.) in Persian Gulf & Oman Sea (thousands)

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	total
Number	7000	2080	4200	1900	4600	5700	13500	62703	9095.7	**110778.7**

Marine Cage Culture

With the assistance of a Sea Cage Company from Norway, Shilat had feasibility studied potential for marine fish farming in northern coast of Persian Gulf, Oman Sea and southern coast of Caspian Sea. The result shows a good potential for cage culture in various areas.

Major nominated candidates for cage culture are Silver Pomfret (*Pampus argenteus),* Milk fish (*Chanos chanos),* Cobia *(Coryaephaena hippurus),* Asian sea bass (*Lates calcarifer*), Rabbit fish (*Siganus sp.*) and Gilthead Sea bream (Sparidae) in Persian Gulf and Oman Sea. Major candidates are sturgeon (*Huso huso*), Rainbow trout *and Salmo trutta caspius* for Caspian Sea.

They estimated for cage culture 200000 tons for central, 10000 for West and 40000tons for east of Caspian Sea respectively (Konradsen 2001). Also the potential for Persian Gulf Cage culture estimated 150000 tons as well (except Khouzestan province).

There is significant potential for the development of a viable marine fish culture industry based on sea cage production systems in Iran. Immediate application of available technical and financial resources into the establishment of pilot and commercial cage farm facilities is required to meet the ambitious goal of developing the sea cage industry in future. In the long term, the production of large volumes of high and medium value marine fish for world markets is likely to represent the greatest potential for Sea cage culture in Iran. This will be attained through investments by large companies, or vertical integration by companies contracting smaller producers, as is happening within the salmon industry today. Sea Cage Culture in Iran can develop to become a major industry in Iran, second only to the oil and gas industry.

The government has decided to establish 4 pilot farms during 4^{th} national five years development plan. At present the first sea cage farm with 180 metric tons capacity is installed between Queshm and Hengam Islands in Persian Gulf. This project will carry out for three years period production in pilot scale with the candidate species.

Human resource

The total Job from fisheries was 97381 and aquaculture and related activities provide 10921 job in 1994 (11.2% total fisheries). Jobs from fisheries reached to 156470 and from aquaculture and related activities reached to 17095 Jobs in 2003 (year book of Iranian Fisheries 2003) (Table 6).

Table 6: Jobs from aquaculture and related activities

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Aquaculture	10921	11004	11630	10250	16661	19872	23581	20150	20240	17095
Total	97381	111848	108398	112181	122170	122961	143148	144398	144584	156470

Shrimp culture has a great roll in poverty alleviation and creating of job opportunities along the southern coasts of Iran. It has created more than 4000 direct, full time employment in the farm and hatcheries, and equal number of indirect full time job opportunities in feed mill plants, processing units, etc. Moreover part time employees in related sectors (construction, transport, equipment services, etc.) could not be neglected.

Market

Iran is today exporting several fish products. The most important one is of course Iranian Caviar products, recognized as the best in the World. The cultured shrimps are EC approved and exported. In addition canned tuna, Kilka (Thai/Japanese market) and some by-products from the sturgeon caviar production (fish meat, swim bladder, gel-products from skin).

Iran is one of the main food producers in the region, and export to all Arabic countries is possible. With ISO 14000 standard, the potential for export also to the rest of the world is very high. The export of species that would not fit the Iranian customs to eat, like eel, shellfish etc. have also a huge potential for development in aquaculture. If the right feed is found, the relatively low production costs could prove to be an important competitive factor.

Expected fish consumption per capita in Iran is estimated based on the total fish supply which has increased from 4.5 kg in 1998 to the 6.7 kg in 2004 . Increase of fish supply to the community has a great importance for the government as a key issue in development of Fisheries sector.

Based on the 4th NFDP fisheries products will exceeds 760000 tons including 280000 freshwater fishes which can not penetrate in to international market. So the producers have to relay on domestic market.As Iranian eats some 23.1 kg of beef, lamb and 11.8 kg poultry meats, The government has made a lot of efforts to change the Iranian food consumption behavior toward the fisheries products among them fish cooking training course for the housewives, fisheries products shows and direct sell round the country, release of booklets and books for the kids and entertainment, documentary programs could be mentioned.

Marine fish and shrimp have a good demand in international markets. In 2004 Iran has exported some 20329 tons of fisheries products, including Caviar, marine shrimp and fishes and value added products such tuna cans and smoked fish with the value of 85.3 million

USD. Caviar has the highest value while shrimp has the highest contribution to the volume. Considering the huge potential for shrimp culture in southern Iran, it is estimated that shrimp production will increase to 46000 tons in 2009 which have to seek international markets (year book of Iranian Fisheries 2004).
Fisheries import is mainly including tuna fish and fishmeal. Fishery import in 2003 is estimated 69000 tons with a value of 60000 million USD (Shakouri & safiyari 2004).

Applied research, education and training :

Applied Research

Several Institute have responsibility for applied research. Iranian Fisheries Research and training Organization www.ifro.ir affiliated to ministry of Jehad-Agriculture is the major source of applied research and training on fisheries and aquaculture. It has 10 research centers country :
Four centers are located by the Persian Gulf and Oman Sea: (Khuzestan, Bushehr, Hormozgan and Sistan –Baluchestan provinces)
Five fisheries research centers are located by the Caspian Sea (Guilan, Mazandaran and Golestan provinces, International Institute of cold water in Mazandaran and International Institute of Sturgeon in Guilan).
Artemia Research Center located by the Urmia Lake(works on Artemia and live feed)
The supreme Committee of Research is the highest reference and responsible for approving fisheries research project in the country. University professors, representatives of executive departments of Shilat and some experienced researchers and experts are members of the committee.
Results of the research will submit to Shilat for running pilot projects and modification. The result will then transmit to the farmers trough short training courses and manuals. In this process, Shilat's training and demonstration centers have a great roll. It should be mentioned that since last year, all research departments affiliated to the Ministry has organized in a united department, Deputy of Research, Training and Extension.
Universities have a huge capacity for research activities. However there is not a proper and systematic link between the industry and university. According to the law 1% of total income of certain industrial activity should be invested for research and development. Agriculture is not included in this category. When there is a support from IFRO and / or Aquaculture Dept., interesting and valuable applied researches has been made by university students and lecturers.
Free researchers whom like to do a research project would submit their proposal to the organization. Accepted proposal would benefits financial support from annual to improve the growth potential of the stocks used in aquaculture and active selection and breeding program for each of the species in use should be launched. For this purpose the use of institutions with wide experience in practical implementation of methods in different types of species are necessary. For this purpose, international organizations which have a long, worldwide experience in implementation of breeding programs for different fish and shrimp species with great success can cooperate as partner.
For mariculture the need for skilled people will be achieved through a training program for selected people to run the pilot plants. They can then train people for the private farms. The technology of this business is however developing rapidly, and there must therefore be a

continuous process of learning new techniques. For Iran to be able to develop further and make their own self- sustainable aquaculture business, the resources should be put into an R&D centre, which provides the scientists to work and develop their full potential.

Education and Training

Since 1970' Ministry of Science, Research and Technology has put Fisheries Science Course in Iran's universities program. At present, some universities offer B.Sc. , M.Sc. and PhD courses in various field of fisheries and aquaculture sciences .Tehran and Chamran (In Khuzestan) and Gorgan (In Golestan province) universities are the oldest ones.
In addition, University of Applied Sciences, offers fisheries training courses in two faculties located by the Caspian Sea (Guilan) and Persian Gulf (Bushehr). The university gives its priority to practical topics aiming to meet what that is needed in aquaculture /fisheries industries units.

TRENDS, ISSUES AND DEVELOPMENT

The 4th National Five Years Development Plan has elicited the horizon of fisheries sector in 2009. According to the NFDP total production of fisheries sector would be 763000 tons at the end of the plan (Figure 2). This is based upon the reasoning that Iran has a good potential in fisheries production, mainly through aquaculture.

Table 7. Aquaculture production projection in the 4th five-year plan for aquaculture, 2005-2009 (tons).

	2005	2006	2007	2008	2009
Shrimp farming	14132	23824	32248	40485	47318
Cold-water fish farming	32312	38617	46436	53536	60361
Warm-water fish farming	94961	105309	121503	138011	163158
Sea cage culture	180	1000	2000	2900	4500
Sturgeon culture	167	407	694	1081	1510
Total	268752	169157	202881	236013	276847

It’s obvious that some solutions needs more investment and international and regional collaboration will bring about the sustainability of the industry.

Establishment of fish farm complex is one of the Government's major plans for increasing fish production in the country. Azadegan (12040 ha. Khuzestan province), Ghasr-e-shirin (3000 ha, Kermanshah province.) are some examples in which part of the projects are ready for operation.

There are more than 40000 of rivers, springs and wells in Iran. Some 379 of them have a capacity more than 500 lit/sec are located in mountainous and cold area providing good potential for trout farming.Primarily studies has indicated a huge potential for shrimp culture in south and northern part of the country .Since 1992 some 45000 ha of land in 4 provinces neighboring Persian Gulf and Oman sea and Golestan (in north)are allocated to investors. Out of this some 20000 ha is under construction and 6000 ha is ready for operation.

Weak domestic market for the fish and hard international market for the shrimp are the major weakness points that may influence the NFDP.

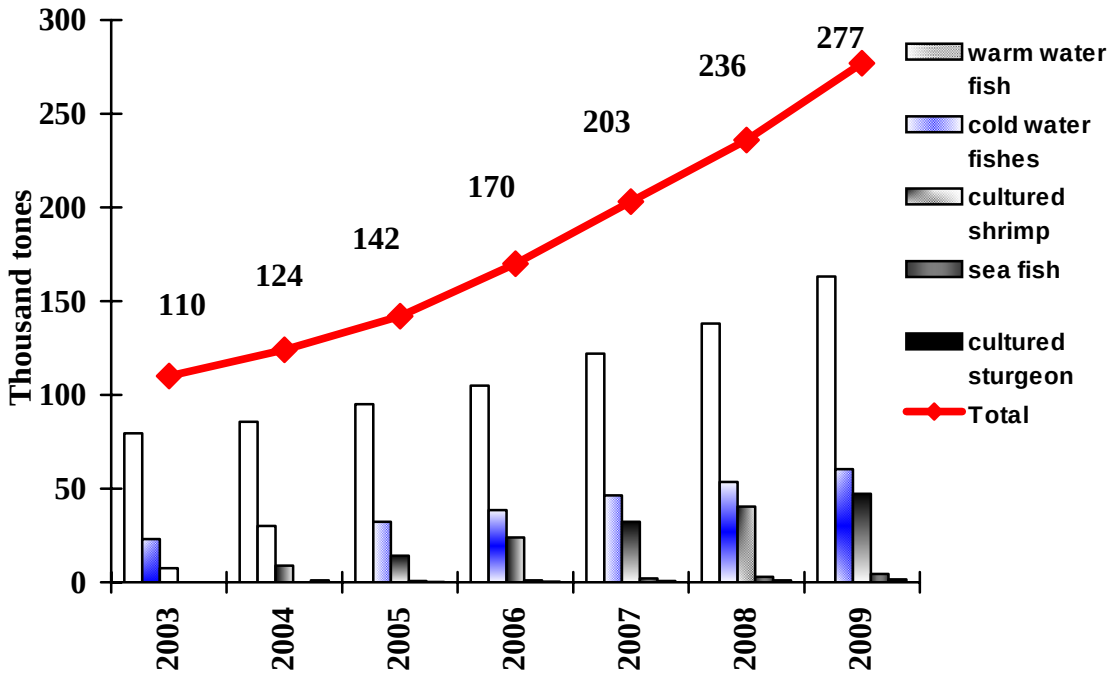


Figure2: Prospect of national aquaculture production in 4th national five years development

SHILAT, in line with local governments countrywide, developed its 4th Five-Year Plan for Fisheries(Table 7 & Fig.2), for 2004–2009. This plan expects to follow up on:

- Food security through increasing of domestic fish production.
- Quality improvement and waste reduction in fisheries.

- Training on sea cage culture
- Market improvement.
- Fish conservation and enhancement.
- Propagation of marine fishes
- Improved aquaculture productivity.
- Sea cage culture development
- Expansion of applied research.
- Increased fish consumption.

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