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FISHERIES AND AQUACULTURE IN TAJIKISTAN: REVIEW AND POLICY FRAMEWORK

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Cover photograph: *River valley with a trout farm in the background, Wahdat district, Tajikistan* (courtesy of FAO/Raymon van Anrooy).

FISHERIES AND AQUACULTURE IN TAJIKISTAN: REVIEW AND POLICY FRAMEWORK

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PREPARATION OF THIS DOCUMENT

This document contains: (i) the Review study on capture fisheries and aquaculture in Tajikistan; and (ii) a Diagnosis of the sector, structured as a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis. Both documents were prepared by national fisheries and aquaculture experts in Tajikistan with technical and financial assistance from the FAO Sub-regional Office for Central Asia, the Aquaculture Service (FIRA) and the Fisheries and Aquaculture Department, FAO, Rome.

The Review study on capture fisheries and aquaculture in Tajikistan was prepared by Mr Abduvali H. Khaitov (Tajik Agrarian University), Mr Ahmadjon Gafurov (Mohii Tajikistan of the Ministry of Agriculture of Tajikistan), Mr Raymon van Anrooy (presently Fisheries and Aquaculture Officer, FAO Subregional Office for the Caribbean), Mr Mohammad R. Hasan (FAO Fisheries and Aquaculture Department), Mr Pedro B. Bueno (FAO Consultant) and Mr Sedat Yerli (Hacettepe University).

Logistical and operational support in the collection of information was received from Ms Svetlana Balkhova (previous FAO National Correspondent to Tajikistan) and staff members of the Ministry of Agriculture of Tajikistan.

The Diagnosis part of this document reflects the outcome of a Fisheries Sector Stakeholder meeting held on Friday 7 March 2008 at the Ministry of Agriculture in Dushanbe. The draft version of this document was used in the National Workshop on the Policy and Strategy for Fisheries and Aquaculture Development for Poverty Alleviation in Tajikistan, held in Dushanbe on 10–11 May 2010. The document accounts with the approval of Mr Sijoviddin Isroilov, Deputy Minister for Agriculture of Tajikistan.

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ABSTRACT

The fishery sector currently plays a minor role in development of the rural economy of Tajikistan. Its contribution to the country's Gross National Product was in recent years less than 0.1 percent. Despite the availability of extensive water resources (ponds, reservoirs, lakes, rivers and channels), fish production has fallen from 4 000 tonnes in 1991 to 214 tonnes in 2006. As a consequence, fish consumption per capita has decreased to a level less than 0.5 kg, compared to 3 kg at the end of the 1980s.

Fishery in Tajikistan started with the construction of Farkhadskiy and Kayrakkum reservoirs in the north of the Republic. Aquaculture development received the most attention. In the early 1960s the government carried out a large-scale program of fish farming development. Under this programme aquaculture farms with a total area of about 2 500 hectares (ha) were established. Production technologies included semi-intensive culture and extensive polyculture of carp in earthen ponds. Species cultured were common carp *Cyprinus carpio carpio,* silver carp *Hypophthalmichthys molitrix,* bighead carp *Hypophthalmichthys nobilis,* and grass carp *Ctenopharyngodon idella*.

Aquaculture provided 70–80 percent of the marketed fish before independence. After independence the reform process of the economy led to a partly privatized fishery sector. The poorly managed privatization process negatively affected the fishery and aquaculture sector. Combined with a general economic crisis, breaking of communications and dramatic decrease in trade with the former Soviet Union states, limited availability of commercial fish feeds and hatchery equipment, limited investment in research, training and education, the privatization process can be considered disastrous for the sector. At present the sector is slowly recovering but the severe winter in 2007/2008 (the coldest in over 25 years) set back the sector's growth. The principal fishery sector governing body is the Ministry of Agriculture (MOA). Scientific research is mainly carried out by the Department of Ichthyology and Hydrobiology of the Institute of Zoology and Parasitology under the Academy of Science, of Tajikistan and the Faculty of Ichthyology and Physiology of farm livestock of the Tajik Agrarian University.

The MOA, recognizing the potential contribution of the capture fisheries and aquaculture sectors to rural poverty alleviation, achievement of food security and generation of alternative employment, has started to support actively the rehabilitation of the sector. Acknowledging that the country cannot develop the sector on its own, the MOA took a leading role in the initiation of regional collaboration, by organizing the first Regional Intergovernmental meeting to initiate the establishment of a Central Asian Fisheries Organization in November 2008.

This FAO Fisheries and Aquaculture Circular has three main aims. First, it is intended to inform those interested in fisheries and aquaculture in Tajikistan about the current situation with regard to fishery resources and their utilization in the country. Second, it attempts to provide background information in support of the national sectoral policy and strategy formulation process. Thirdly, it may serve as guidance for future interventions by the government and donors in support of the sustainable development and management of the sector.

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ACKNOWLEDGEMENTS

The authors hereby would like to acknowledge the important contribution of Mr Sijoviddin Isroilov, Deputy Minister for Agriculture of Tajikistan, Ms Svetlana Balkhova (previous FAO National Correspondent to Tajikistan), Mr Firuz Akhronov (Institute of Zoology and Parasitology, Tajik Academy of Science), Mr Farukh Fatkhuloevich Azizov (Department of Ichthyology and Physiology of Livestock of the Tajik Agrarian University), Mr Rustam Ibrahimov (Mohii Tajikistan), Mr Tsukasa Kimoto (former FAO Emergency Coordinator for Tajikistan) for their support provided to the collection of the data, field missions and consultations. We further express our gratitude to Ms Elif Erkal, Ms Cana Salur, Mr Haydar Fersoy, Mr. Ozgur Altan and Mr Mustapha Sinaceur (FAO Subregional Office for Central Asia), Mr Jiansan Jia, Ms Marianne Guyonnet and Ms Tina Farmer (FAO Fisheries and Aquaculture Department) for their technical, administrative, editorial, operational and supervisory support in the production of this circular. Ms Danielle Rizcallah is acknowledged for final formatting of the document. Last but not least, the authors would also like to thank the fisheries sector stakeholders who participated in the SWOT meeting on 7 March 2008 and all the experts who have contributed to the review with information and advice.

ABBREVIATIONS AND ACRONYMS

IUU	illegal, unreported and unregulated
GNP	gross national product
LIFDCs	low-income food-deficit countries
MOA	Ministry of Agriculture of Tajikistan
SWOT	strengths, weaknesses, opportunities, threats
TCP	Technical Cooperation Programme

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EXECUTIVE SUMMARY

The fishery sector can play an important role in the rural development of Tajikistan. It currently contributes less than 0.1 percent to the GNP (gross national product) but a vast inland water resource comprising storage basins, glaciers, lakes, rivers, ponds and irrigation channels presents a large production potential that can be realized with good management and technology and the appropriate policy and incentives to encourage private sector investments.

Fishery in Tajikistan began with the construction of two major water storage basins. Aquaculture development began in 1960 when the government undertook a large-scale fish culture development programme by establishing several fish farms and research and educational centres. The farming technology was based on semi-intensive polyculture in earthen ponds of various carp species. Aquaculture provided 70–80 percent of the fish production. The diversity of indigenous species of commercial value however was poor. The ecological niche for herbivorous fishes was filled only when Chinese carps were introduced.

With independence and the subsequent economic reform, fishery was partially privatized but the initial stages of privatization lacked the appropriate technological and policy support. Fish production fell from 4 000 tonnes in 1990 to just a little over 200 tonnes in 2006 but it was not just because of a poorly managed privatization process. The reasons for the severe contraction of output included an economic crisis and a civil strife, disruption of technical exchanges and trade among former Soviet Union republics, the ensuing scarcity of supply and high costs of inputs, deteriorating facilities, and little support for research and extension. Privatization thus suffered from the understandable indifference of investors because of low productivity and profitability of fish culture and fishing. The lack of private investment exacerbated the neglect of the sector.

At present the sector is however slowly recovering, although the harsh winter in 2007/2008, the coldest in over 25 years, has set back the little growth it had managed to achieve. Some entrepreneurs have taken cautious steps to rehabilitate old facilities and adopt improved culture technologies. A few farms have started to show encouraging results. But the ancillary industries remain poorly developed. Most inputs have to be imported and the post-harvest and processing facilities are inadequate but then there is not enough volume to process. There is very low investment in the post-harvest sector although over the past five years some enterprises have ventured into this segment of the industry.

The principal fishery sector governing body in Tajikistan is the Ministry of Agriculture (MOA). Mohii Tajikistan, the fishery department under the Ministry, is responsible for the sectoral management and development on behalf of the Ministry. Scientific research is mainly carried out by the Department of Ichthyology and Hydrobiology of the Institute of Zoology and Parasitology under the Academy of Sciences of Tajikistan and the Faculty of Ichthyology and Physiology of farm livestock of the Tajik Agrarian University. To support the development of the sector the Government and Majlisi Oli (parliament) of the Republic Tajikistan have adopted the Law of the Republic of Tajikistan on Fisheries in December 2006, which regulates the development and management of the sector and is the basis for development policy and strategy for capture fishery and aquaculture. Tajikistan is a signatory to several international protocols and agreements that relate to fishery and the environment. The country started to implement the FAO Code of Conduct for Responsible Fisheries since 2008.

A diagnosis of the fishery sector, mainly through an analysis of its strengths, weaknesses, opportunities and threats (SWOT), indicates a few strengths, which include the abundance of suitable fishery resources, a legacy from the Soviet Union of good science and technology, the presence of a number of private fishery, fish farming, processing and trading enterprises that have shown receptivity to innovation, and a legal framework already established for fishery management and development. On the other hand, the industry has a weak technology and manpower base owing to the neglect that it had suffered after independence and during the civil strife. The transition to a market economy has not been accompanied by adequate technological and policy support to encourage private sector investment.

Sector management, as yet, lacks the private sector mechanism: the country has no union, cooperative society or association of fishers and fish farmers at the national level.

The opportunities for growth are presented by a tradition of fish consumption, a potential local demand of 70 000 tonnes of fish yearly based on a per capita consumption level of 10 kg, increasing the productivity of waterbodies through stocking and stock enhancement; and the presence of indigenous as well as established introduced species for culture, many of which can command a good price if quality and safety of the products are ensured. The fishery industry can exploit the opportunities through improved management and production technology, guided by strong research and extension. Showing that the industry can be profitable through improvements in productivity and viability would encourage private investment and create demand for more and better services.

Threats to the productivity of the water resources in terms of suitability for fisheries and aquaculture development come from the use of water for crop (mainly cotton) irrigation and the deterioration of the water resources from various sources of pollution. Water resources suitable for fishery development are mostly managed by the irrigation service and the network of irrigation users, not by fishery organizations. This problem of being a secondary user of water can be addressed by a better integrated management of the agriculture and fishery sector, in which also the hydropower sector should be involved. A poorly managed privatization process and the wrong policies could lead to the concentration of ownership of resources in a very few establishments or individuals and to the exclusion of the poorer and weaker segments of the population in fisheries development activities and access to fisheries resources. The other extreme is that ownership becomes extremely diffused and fragmented that production units lack the economy of scale.

The MOA, recognizing the potential contribution of the capture fisheries and aquaculture sectors to rural poverty alleviation, achievement of food security and generation of alternative employment, supports actively the rehabilitation of the sector. Acknowledging that the country needs collaborative assistance to accelerate the development of the fishery industry, the MOA took a leading role in the initiation of regional collaboration, by organizing the first Regional Intergovernmental meeting to initiate the establishment of a Central Asian Fisheries Organization in November 2008. In early 2010 Tajikistan was the first country to accept the Central Asian and Caucasus Fisheries and Aquaculture Commission (CACFish). This FAO-affiliated commission (a so called Article XIV body under the FAO Constitution) is a regional fishery body is expected to work on both capture fisheries and aquaculture issues in the wider Central Asian region. The government has also entered into multilateral and bilateral agreements on economic and technical cooperation to complement national efforts and resources for capacity building. At this juncture, fishery management and development sorely needs scientific and technology guidance and the strengthening of fishery research, training and extension capacities will require a significant amount of investment. The sector has considerable natural assets and what it needs are effective tools, guidelines and support to improve its economic viability and social and environmental responsibility, which it needs to prove that it is worthy of investing public funds and private capital. A progressive and modernized fishery industry would contribute better to improving national wealth and the social and economic status of rural communities.

PLATE 1

Participants in the Intergovernmental meeting to initiate the establishment of a Central Asian regional fisheries organization, Dushanbe, November 2008

Courtesy of: FAO/Raymon Van Anrooy.

1. INTRODUCTION

The capture fishery and aquaculture sector is important world-wide in terms of its contribution to food production, employment and income generation. Box 1 provides a global overview of the contributions of capture fisheries and aquaculture to these economic objectives.

BOX 1
Global overview, contribution of capture fisheries and aquaculture to national economic goals

Capture fisheries and aquaculture supplied the world with about 110 million tonnes of food fish in 2006, providing an apparent per capita supply of 16.7 kg live weight equivalent. In 2006, per capita food fish supply was estimated at 13.6 kg (excluding China). Overall, fish provided more than 2.9 billion people with at least 15.0 percent of their average per capita animal protein intake. The share of fish proteins in total world animal protein supplies grew from 14.9 percent in 1992 to a peak of 16.0 percent in 1996, declining to about 15.3 percent in 2005. Notwithstanding the relatively low fish consumption by weight in low-income food-deficit countries (LIFDCs) of 13.8 kg per capita in 2005, the contribution of fish to total animal protein intake was significant – at 18.5 percent – and is probably higher if the contribution of small-scale and subsistence fisheries are fully recorded. As to inland fisheries, in 2006, reported global inland water catches exceeded 10 million tonnes. This was a 12.8 percent increase over 2004 data. Asia accounts for two-thirds of total global inland capture production. Aquaculture contribution has been increasing from 3.9 percent of total production by weight in 1970 to 36.0 percent in 2006. In the same period, production from aquaculture outpaced population growth, with per caput supply from aquaculture increasing from 0.7 kg in 1970 to 7.8 kg in 2006, an average annual growth rate of 7.0 percent. Aquaculture accounted for 47.0 percent of the world's fish food supply in 2006.

In 2006, more than 110 million tonnes (77.0 percent) of world fish production was used for direct human consumption. Trade in fish and fishery products plays an important role in improving food security and contributes to meeting nutritional needs. Fish and fishery products are highly traded with more than 37.0 percent (live weight equivalent) of total production entering international trade. World exports of fish and fishery products reached US$86 billion in 2006. Export value expanded at an average annual rate of 5.0 percent in the period 1996–2006. In real terms (adjusted for inflation), exports of fish and fishery products increased by almost 104.0 percent between 1986 and 2006. Available data for 2007 indicate further strong growth to about US$92 billion. Although some weakening in demand was seen in 2007–2008 with the turmoil in the financial sector, the long-term trend for trade in fish is positive.

Fishery net exports continue to be of vital importance to the economies of many developing countries. They have increased significantly in recent decades, growing from US$1.8 billion in 1976 to US$24.6 billion in 2006. The low-income food-deficit countries (LIFDCs) play a growing role in the trade in fish and fishery products. In 1976, their exports accounted for a mere 10 percent of the total value of fishery exports. This share has reached 20.0 percent in 2006, when their fishery exports were US$17.2 billion and their fishery net export revenues were an estimated US$10.7 billion.

Aquaculture provides worldwide employment to millions of people. Total employment in the aquaculture sector is highest in China where in 2006 almost 13.06 million people worked in this sector. Between 2002–2003 in the European Union, approximately 65 000 people were employed in aquaculture i.e. 15.5 percent of the total employment in the fishery sector. In Europe, some 123, 000 people are employed by the aquaculture industry, with three countries – the Russian Federation, France and Spain – accounting for half of those employed. On gender based occupation, the majority of the workers are men, with the exception of the Russian Federation where fish culture is dominated by women.

Source: FAO (2009).

The fishery sector can potentially play an important role in the development of Tajikistan's rural sector and to the country's economy. In recent years however the share of the sector to the GNP has been less than 0.1 percent. Tajikistan has vast natural water resources that include ponds, reservoirs, lakes, rivers and irrigational channels. Despite these abundant water resources catches have significantly decreased from 3 700 tonnes in 1990 to 214 tonnes in 2006 and 285 tonnes in 2007 (Khaitov, 2006; Ahmadjon Gafurov, Mohii Tajikistan, personal communication, 2008). As a consequence, fish consumption per caput has decreased to a level below 0.5 kg (compared to 3 kg at the end of the 1980s). This, while recommended fish consumption levels by various nutritional institutions vary between 12 and 23 kg per caput per year.

The Ministry of Agriculture of Tajikistan and the Food and Agriculture Organization of the United Nations (FAO) recognized that very limited information was available on fisheries and aquaculture in Tajikistan and that the historical development, particularly the era since independence in 1991, has not been documented. In order to support the development and management of the sector in a structured and coherent manner it would be necessary to understand the current situation in the sector. To fill the existing gap in information, a review study was conducted in 2008–2009[1]. This study has three aims: inform those interested in fisheries and aquaculture in Tajikistan about the current situation with regard to fishery resources and their utilization in the country; provide background information in support of the national sectoral policy and strategy formulation process[2]; and serve as guidance for future interventions by the government and donors in support of the sustainable development and management of the sector.

This Circular comprises two parts, namely, (i) the Review study on capture fisheries and aquaculture in Tajikistan; and (ii) a Diagnosis of the sector conducted through a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis.

This review comprises eight chapters. Chapter 1 is Introduction and Chapter 2 is a historical review describing the situation in the fishery sector before independence in 1991, and thereafter until 2006. Chapter 3 describes the current status of natural resources and the potential of the sector in Tajikistan and the status of fishery and aquaculture in inland waterbodies. Chapter 4 gives an overview of the current development in fish storage, processing, distribution and marketing and an analysis of the consumption pattern of fish in Tajikistan. Chapter 5 is devoted to the institutions and their roles and activities in management, research, technology, statistics and information, manpower development and infrastructure and facility improvement. Chapter 6 reviews the sectoral policy and legal aspects of management. Chapter 7 considers the social and economic aspects of fishery and aquaculture including employment and welfare, cost and return structures of fish farming, credit and insurance services. Chapter 8 provides the outcomes of the sectoral diagnosis, prepared by a fishery sector stakeholder meeting in March 2008 to analyse strengths, weaknesses, opportunities and threats (SWOT) of the sector.

[1] Relevant information after 2009 have been added to update the review.

[2] The draft of this review was one of the major references to the formulation during May-July 2010 of the Policy and Strategy for Fisheries and Aquaculture Development for Poverty Alleviation in Tajikistan (2010-2025), which has been adopted by the Government.

2. HISTORICAL BACKGROUND

The milestones and highlights of the development of the fishery sector are described in this chapter; a large part is devoted to the period before independence until 1991, while information from the period 1992–2006 is added wherever available. There is a marked difference between these two periods; the first period until independence saw a gradual build-up of the fishery industry including aquaculture in terms of resource development and management, scientific manpower, technology, and administration. The second period (after independence) saw a decline in all these owing to various reasons. Recent efforts however have been initiated to revive the industry and recover its previous importance, this time in the context of a market economy.

2.1 Fisheries and aquaculture before independence (1991)

The fishery sector as a branch of the national economy was formed in Soviet times. Development of fishery in the Republic is connected with the creation of the first fish farm in 1936 under Dushanbe on an area of 36 ha on the river Luchobka, and establishment of the Vakhsh hatchery in Khatlon in 1951 on an area of 72 ha. These were established to provide seed to collective and state farms engaged in the commercial production of fish.

In the world of ichthyofauna there are about 22 thousand species of fish. In Tajikistan waterbodies there are about 64 species belonging to 13 families. The list of the 3 species indicating the type of waterbodies that are their habitats in Tajikistan appears as Annex 5.

The most valuable in terms of commercial potential are the following species: fringebarbel sturgeon (*Acipenser nudiventris*), Amu Darya trout (*Salmo trutta oxianus*) and rainbow trout (*Oncorynchus mykiss*), Aral asp/asp (*Aspius aspius*), grass carp (*Ctenopharyngodon idella*), silver carp (*Hypophthalmichthys molitrix*), European catfish/common catfish/wels catfish (*Silurus glanis*), sazan/common carp (*Cyprinus carpio carpio*) and its hybrids, pike perch (*Sander lucioperca*), common bream/freshwater bream (*Abramis brama*), marinka (common marinka *Schizothorax intermedius intermedius*), scaleless osman/naked osman (*Gymnodiptychus dybowskii*), chramulya/seven khramulya (*Capoeta capoeta capoeta/ Varicorhinus capoeta capoeta*), American buffalo, channel catfish (*Ictalurus punctatus*), sabre fish (*Polecus culfratus*), white-eye bream (*Ballerus sapa*) and others.

Fish in Tajikistan is originated basically from two ichthyofauna complexes: Ponto-Caspian and East Asian. The features of the country determine the variety and quantitative structure of its fish fauna. In valleys and flat lowlands there are from ten to more than fifty species of fishes, in the highlands there are only two to three species and some waterbodies have none. The type of water body plays an important role in qualitative and quantitative development of fishes. The fish species in the rivers are the most diverse i.e. 54 species and forms, followed by the water storage basins (reservoirs) with 34 species, ponds 29 species, lakes 26 species, and springs 12 species (Annex 5 indicates the distribution of the fish species in Tajikistan by water body/environment).

Fishery in Tajikistan traces its beginning to the construction in 1956 of Farkhadskiy and Kayrakkum water storage basins in the north. In the basin of River Syr Darya and the Kayrakkum reservoir, there live 36 fish species. Of this, 21 are commercial and include northern pike/pike (*Esox lucius*), common catfish (*Silurus glanis*), pike perch, snakehead (*Channa argus argus*), small fry/roach/Aral roach (*Rutilus rutilus*), sharpray/ostroluchka (*Capoetobrama kuschakewitschi kuschakewitschi*), rudd (*Scardinius erythrophthalmus*), Aral asp, pike asp (*Aspiolucius esocinus*), common bream/freshwater bream, ziege/sabre fish, white-eye bream, Turkestan barbel (*Luciobarbus capito conocephalus*), Aral barbel (*Luciobarbus brachycephalus*), seven khramulya, marinka, silver carp, sazan, grass carp, and Syr Darya sturgeon/shovelnose (*Pseudoscaphirhynchus fedtschenkoi*).

Kayrakkum Rybpromkhoz (State fish farm), formed in 1962 on the Kayrakkum reservoir, has 13 major species: sazan, pike perch, common catfish, asp (*Aspius aspius*), common bream, barbel, sabre fish, white-eye bream, silver carp, cupid, crucian carp (*Carassius carassius*), small fry, and pike (Table 1).

Before the formation of Kayrakkum reservoir, Tajikpotrebsouz was responsible for capture fishery which produced up to 4 tonnes in the lakes of Pamir, and up to 10.1 tonnes in lakes of the reserve Tigrovaya balka (Maksunov, 1968). The creation of the 52 000 ha Kayrakkum reservoir promoted the organization of a specialized fish farm that increased catch.

By 1989 the total capacity of fish capture in Kayrakkum reservoir has reached 473 tonnes (Akhronov, 2006). The capture fishery statistics during 1981–1990 is given in Table 1. The volume of fish capture during these years varied from 304.6 to 481.3 tonnes. Sazan made up 11 to 42 percent of the catch, pike perch from 12 to 43 percent and white-eye bream up to 11 percent. During the years of unrest from 1991 to 2000, fish capture was unstable, poaching was rampant and no reliable records were kept.

Recent efforts assisted by FAO have enabled recovery and slowly pushed production levels from 214 tonnes in 2006 , 226 tonnes in 2007, 504 tonnes in 2009 (despite the severe winter in 2008 that destroyed standing crops and broodstock), and close to 700 tonnes in 2010. The medium term target is 2 500 tonnes by 2015. The long term strategy is to increase the area of pond fish farms to 15 000 hectares (mostly in high aquaculture potential areas), use higher quality seed, and apply better farming and capture fishing technology and management practices. The target output from this strategy is 14 000 tonnes of fish and other aquatic products. This would be more than three times the highest yield Tajikistan had recorded before independence, which was 4 000 tonnes (Isroilov *et al*., 2012).

TABLE 1
Share of each species of the catch in Kayrakkum reservoir, 1981–1990

Year	Total catch	Sazan	Common catfish	Pike perch	Aral asp	Common bream	Turkestan barbel	Sabre fish	White-eye bream	Silver carp	Grass carp	Snakehead	Others	Total
		(tonnes)							(%)					
1981	311.3	42.3	8.8	15.5	0.7	26.9	3.7	0.3	0.9	0.3	0.1	0.03	0.16	99.69
1982	351.0	32.5	7.8	14.2	1.1	34.5	1.0	2.0	5.6	0.3	0.1	0.04	0.7	99.84
1983	402.3	32.4	6.3	11.6	2.2	34.0	0.2	2.0	9.3	0.6	0.05	–	0.05	98.7
1984	417.8	21.7	7.1	17.3	6.0	32.2	0.2	4.4	10.7	0.2	0.01	0.002	0.48	100.292
1985	422.9	16.9	9.2	25.9	3.1	31.7	0.11	6.2	3.5	0.15	0.005	0.07	0.57	97.405
1986	481.3	15.0	7.4	22.9	6.8	30.7	0.21	3.3	3.2	0.4	0.004	0.05	2.4	92.364
1987	359.8	28.8	3.8	33.4	6.5	14.0	0.8	2.5	9.0	0.08	0.08	0.02	0.05	99.03
1988	360.7	37.9	6.0	34.0	7.8	14.0	0.6	1.9	0.6	1.3	0.05	0.02	7.6	111.77
1989	473.2	16.7	7.2	43.4	5.3	14.1	0.2	1.6	6.0	0.6	0.02	0.3	2.4	97.82
1990	304.6	11.1	4.5	28.3	6.8	38.0	0.003	0.4	3.8	0.5	0.02	0.2	6.3	93.623

Note: Other species include pike, crucian carp, barbel, seven khramulya, rudd, sharpray/ostroluchka and some others, which rarely appeared in catches.

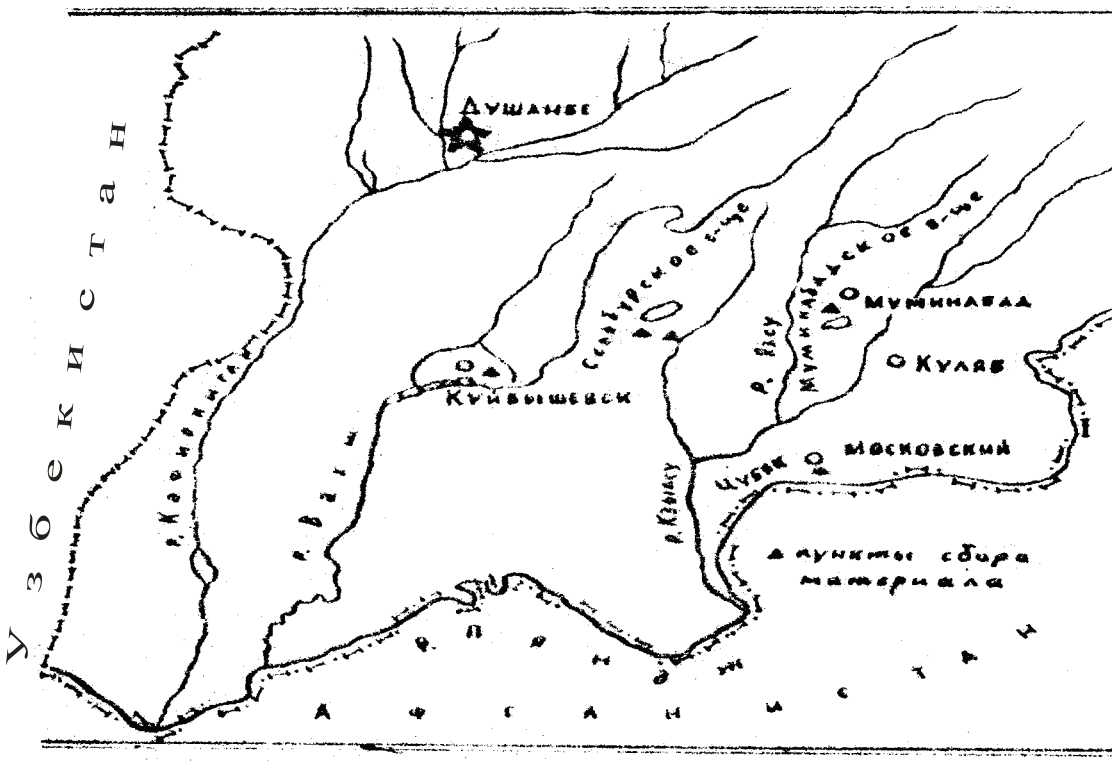
2.2. Water resources

The vast natural water resources of the country comprise the largest rivers of Central Asia – Amu Darya and Syr Darya, some 500 glaciers with a total volume of 120 km^3 and a reserve of freshwater in the dammed lakes whose overall capacity exceeds 30 km^3. There are 300 large and small rivers, about 1 300 lakes with a total area of 705 km^2, and eight water storage basins. Their combined discharge makes up to 12 percent of the volume of river flows in Central Asia. The water of these important rivers are used for hydropower and irrigation. Many inland waterbodies are located in the mountains in difficult-to-access zones.

2.2.1. Central and Southwest Tajikistan

The total surface area of the lakes of the reserve Tigrovaya balka is 4.5 thousand ha, Muminabad reservoir 260 ha, Selbursk 240 ha, Golovnoye 750 ha, Baypazinsk 160 ha, and Nurek 10 thousand ha. Among the species found in the lakes are common carp, common catfish, Turkestan barbel, pike, asp, riffle minnow (*Alburnoides bipunctatus*), topminnow (*Belonesox belizanus*), sawbelly (*Hoplostethus intermedius*), and Amur stunned fish. The fish species of the lakes consisted of anadromous and semi-anadromous species migrating upstream of the Rivers Pyanj and Vakhsh.

FIGURE 1
Hydrographic map of Tajikistan



Source: Khaitov (2005).

Fishery development of the lakes began in the 1930s. Fishing was carried out on less than half of the areas comprising some two thousand hectares. The organization of capture fishery was poor. There was neither inspection nor control over the quantity of captured fish. No aquaculture, ameliorative or introduction activities were carried out in the lakes. Nevertheless, the registered catch was 40-50 tonnes a year, and 85 tonnes of fish were reportedly caught in 1955, mostly common carp, common catfish and barbel. Estimated yield of the lakes was 20 kg per ha.

The Nurek reservoir, built in 1973, is one of the largest waterbodies in Central Tajikistan. Its ichthyofauna of the reservoir was formed by the indigenous species living in river Vakhsh. These included marinka, Samarkand khramulya (*Capoeta capoeta heratensis*), Amu Darya trout, Tibetan char, char (*Salvelinus fontinalis*), Tadjik char, Turkestan catfish (*Glyptosternon reticulatum*), Amur bullhead, topminnow, and Amur stunned fish.

The hydrofauna of the flooded zone was studied by Akhronov (1983) followed by a study of its hydrological and chemical characteristics during the first year of flooding (Khaitov, 2005; Amirkulov, 2006). The data on phyto and zooplankton during flooding collected by Akhronov, Karimov and Grishchenko (1985) provided the basis for introducing planktivorous fishes, peled (*Coregonus peled*) and silver carp in the Nurek reservoir. In the spring of 1978 the first one million pieces of peled in larva stage was stocked; 3.5 million more were seeded in the next years. In the autumn of 1978, some 300 000 fingerlings of silver carp from the Kuybishev fishery association were stocked.

In May 1979 experimental and commercial fish capture was organized. Some 0.4 tonne of fish was caught. The most frequently caught species was seven khramulya, 51 percent, followed by marinka 6 percent, peled 1.8 percent and Amu Darya trout 1 percent. Some common carp was also caught.

By the autumn of 1979 the peled had grown to average sizes of 500–600 g. However, in 1980–1981 a deterioration of the peled population was observed in the reservoir. The surviving peled population had low fat content, which indicated poor nutrition. A scientific mission in 1982 found that after the desired water level in the catchment was reached, the flow of organic matter into the basin stopped. This resulted in the poor development of phyto- and zooplankton. Zooplankton structure was reduced 10 times and its biomass decreased 13 times. The biomass of infusorians and others microscopic organisms that served as food for zooplankton decreased by three times. The number of indigenous and introduced species decreased as well. Thus, one of the principal causes of peled stock deterioration and the weak development of ichthyofauna in Nurek in general was a rapid decline in primary productivity. The absence of conditions for reproduction added to the weakening of the stocks. The condition of the introduced common carp stocks was satisfactory as it found suitable spawning environments.

In the Nurek reservoir, Amu Darya trout is generally small when it reaches maturity, but can reach 30–39 cm and 2–5 kg. It matures in 3–4 years attaining a body length of 25–30 cm and weight of 250-600 g. It spawns in November at the water temperature of 6–7 C in water of 3–4 m deep. In the reservoir conditions the absolute fecundity of trout reaches up to 3 500 eggs, which is much more than in river populations.

Considering the status of the reservoir and its future prospects, it would be more expedient to use it for sports and amateur fishery. For this purpose, Issyk-Kul trout (*Salmo ischchan*) or rainbow trout could be introduced to feed on the riffle minnow, bullhead, seven khramulya, marinka and smaller fishes. Aquaculture can provide another option for fishery sector development in Nurek reservoir. In 1982 in Nurek reservoir some first experiences with cage cultivation of rainbow trout were obtained. The rainbow trout in cultured in the cages reached a commercial weight of 220 g in the period from December till the end of May. The experiences showed that cage culture could be developed effectively in the reservoir. In early 2009, with support from FAO Technical Cooperation Programme (TCP) Project “Emergency assistance to Tajikistan in the aquaculture sector, livestock sector and comprehensive assessment and programme development” some new fish culture cages were constructed near the Nurek dam in the reservoir. At the time of writing this circular, no information on the fish production in these cages was available.

PLATE 2
Lower dam of the Nurek reservoir

Courtesy of: FAO/F.F. Azizov.

Muminabad and Selbursk reservoirs. The zooplankton (Khaitov, 2005), and phytoplankton (Andrievskaya, 1985) of these waterbodies have been extensively studied. Muminabad reservoir was found to have the following species: Samarkand khramulya, common carp, carp, riffle minnow, topminnow, several kinds of char and Turkestan catfish. In Selbursk, the Turkestan barbel, marinka, common carp, crucian carp, riffle minnow and topminnow were found.

Benthic fauna however was poor, the consequence of using the water in the dam to a point where the water level is almost at the zero mark. No fishing was carried out on the reservoir. Nevertheless, in 1966 the Fishery Department under the SSR Tajikistan's president's office caught 3.5 tonnes of seven khramulya and carp. In Selbursk the usual catch was 2.3 tonnes. In the long term it might be possible to use these waterbodies for pond fishery and commercial fish culture. The status of primary productivity of the other waterbodies in the southern and western regions Tajikistan, including the Baypazinsk reservoirs and the river deltas, has not been studied. Nevertheless these waterbodies do have some fishery potential.

2.2.2. Pamir

The waterbodies in this region are the freshwater lakes Yaschilkul 4 800 ha, Bulunkul 340 ha, Zorkul 10 000 ha, Sarez 8 700 ha, Turumtaykul 890 ha, Chakankul 920 ha, Rangkul 780 ha, Karakul 38 000ha; the brackish lakes of Sassykkul 890 ha, Tuzkul 130ha, Shorkul 1 500 ha; and the rivers Gunt, Pyanj, Alichur, Murghab, Bartang, Shahdara, Yazgul, and others. These contain a variety of fish species and population. The large and accessible freshwater lakes located close to major roads present the greatest interest in terms of fishery.

Lake Yaschilkul. Fishery research on the Pamir lakes began in the 1930s with expedition by Tashkent University. It was found that the prevailing species of Lake Yaschilkul are adult groups of false osman (*Schizopygopsis stoliczkai*),. It was possible to catch up to 40–45 tonnes of false osman. In the 1940s F. Gurvich of the Tashkent University started studying Lake Karakul (Gurvich, 1958). He found that because of the absence of planktivorous fish, the natural stock of zooplankton in the lake was not being used. The core and unique

representative of the lake's ichthyofauna is the Karakul char that has no commercial value. Gurvich (1958) suggested that the species with the highest prospects for introduction in Lake Karakul would be Issyk-Kul osman (the winter form), Sevan/Issyk-Kul trout and peled. To enhance the ichthyofauna of Pamir, it was suggested to introduce false osman and marinka.

In 1963 the staff of the ichthyology and hydrobiology department of the Institute of Zoology and Parasitology of Soviet Republic Tajikistan surveyed the food base of the fish and the ichthyofauna of the lakes Yaschilkul, Bulunkul, Zorkul, Big Khargush and others.

According to Maksunov (1968), 22 000 ha of the Pamir lakes were populated with commercial fish. Taking into account the geographical features and the food base of the lakes, their fish productivity was estimated at 10 kg per hectare and a total possible yield of 220 tonnes. In 1967 some 34 000 uneven-age crucian carps were released into Lake Yaschilkul. Crucian carp became acclimatized to the conditions of the Pamir lakes and now make up one percent of the catch.

All the Pamir lakes have suitable environmental and water conditions for fish except Sassykkul, Tuzkul and Chukurkul. The ones with the greatest fishery potential are Yaschilkul, Bulunkul, Zorkul, Turumtaykul and Karakkul. The other lakes have no fishery value because of their small area or remoteness. Fishery development of the Pamir lakes began in 1940s by the local cattle-breeding state farm, Bulunkul. According to the regional administration, the catches of commercial fish in 1940–1960 varied from 62.3 tonnes in 1945 to 1.4 tonnes in 1957. In 1962–1964 and in 1973 the fishermen of Kayrakkum Rybpromkhoz were engaged in fish capture on the lakes Bulunkul and Yaschilkul. In those years the catches ranged from 16 to 60 tonnes. In 1960 a fishing brigade of local residents was organized on the lakes Jashilkul and Bulunkul. Fishing was undertaken from May to September. As a whole the brigade was badly equipped; after the catch is sorted out the fish were kept for 2–3 days in a spring and then delivered to Khorog or Murghab. Such capture fishing did not meet the requirements of the standard for fish capture. Therefore, no more than 20–25 mt of fish was caught in a season. Refrigeration and a good transport facility could have increased the number of brigades to three; they could have fished in lakes Turumtajkul, Zorkul and Uchkul, which would have increased the annual commercial fish harvest in Pamir to 100 tonnes.

The lakes of Pamir are suitable for stocking with trout and whitefish (*Coregonus luttoka*). Proceeding from this scheme of reconstruction and stage-by-stage introduction of food organisms and fishes was proposed by Mohii Tajikistan in 2008. In the lakes Jashilkul and Turumtaykul it is proposed by the Institute of Zoology and Parasitology of the Academy of Science to introduce such food organisms as *Mysis oculata* var. Relicta Pall and *Neomysis intermedia*, which thrive in a narrow temperature range. As for fish, Issyk-Kul trout, Siberian peled and broad whitefish can be stocked in the deeper lakes of Pamir. The following species are recommended: in the lake Karakkul, peled; in the lakes Bulunkul and Zorkul, whitefish, broad whitefish (*Coregonus nasus*) and peled. The first stage of introduction had been implemented in the 1960s.

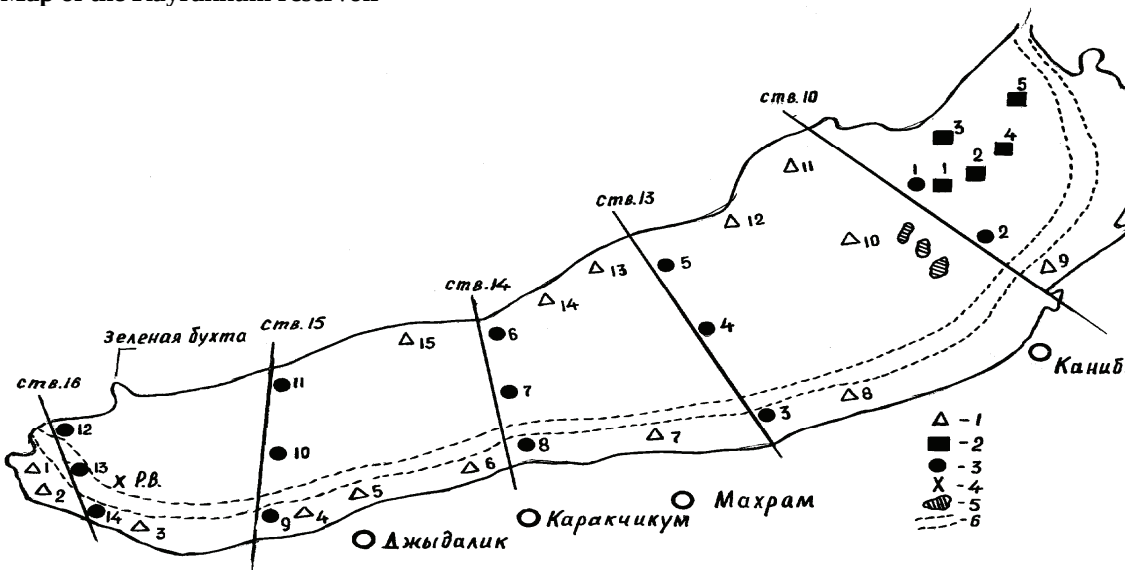
Biological studies in the Lake Yaschilkul were the basis for introducing one million larvae of peled in 1980–1981 and 268 000 fingerlings of Issyk-Kul trout. Peled fingerlings of 20 g each introduced in 1979 – 1982 reached 600 g within 1 year and has become a target for capture fisheries. In the long term, when the reconstruction of ichthyofauna of Pamir lakes is completed and the introduced species shall have become objects of fish capture, fish production of the lakes could increase to 20–22 kg per ha. With a total area of 16 000 ha, lakes Yaschilkul, Bulunkul, Turumtaykul and Zorkul have a potential yield of 400 tonnes a year.

2.2.3. Northern Tajikistan

The main waterbodies of Northern Tajikistan other than the drainage networks and rice fields are the Farkhadskiy reservoir with 4 600 ha, Kayrakkum with 52 000 ha, Katasay 260 ha and a 190 km stretch of the river Syr Darya.

Because of the structural reorganization of Kayrakkum reservoir, the strengthening of the resources base, the increase in number of fishermen, and other development, the catch began to increase: in 1966 it was 248 tonnes, almost doubling in 1968 to 442 tonnes and increasing to about 455 tonnes in 1970.

FIGURE 2
Map of the Kayrakkum reservoir



Source: Khaitov (2005).

The trend in fish capture (Table 2) shows an increase in fish capture capacity that followed the unplanned stocking of common carp. In 1968 and 1969 when 442 and 468 tonnes were caught, respectively, the share of common carp was 60–61 percent, although this went down to 19 percent in 1973 and to an insignificant volume (i.e. 4.6 tonnes) in 1976 when common carp practically disappeared in the reservoir. The stock of common carp, then the main commercial species, was depleted by overfishing and the lack of water. Therefore in the spring 1976 the capture of common carp was banned for five years. At the same time, the decision to restock the reservoirs with fingerlings of common carp grown in the Kayrakkum hatchery facility was implemented. Over the period 1977–1980, some 2.8 million fingerlings of common carp from the hatchery were released into the reservoir.

Protection and conservation of the juvenile fish in the cut off lakes of the upper reservoirs were intensified in the 1980s. In 1981 the regional fishery inspection and the society of hunters and fishers rescued 122 thousand fish and in 1982, 282 thousand more juveniles in the cut-off waterbodies of the upper reservoirs. Meanwhile, the level of the reservoir gradually began to stabilize. It enabled the limnophilous fishes to spawn completely. The catch volumes of common carp and other species were restored gradually. In 1980 the ban on common carp fishery was lifted and the catches have increased from 273 tonnes in 1980 to 350 tonnes in 1982 and 402 tonnes in 1983. The regulatory measure to reduce variation in the water level increased the fish production by more than twice with an annual gain of 40 tonnes. Catch increased because of the large common carp and common bream which comprised 65 and 10 percent, respectively, of the fish capture. The capture of 3–5-year old fish removed the

most reproductive members of the population. If the fish capture continues at such rate, the stock of common carp will be drastically reduced. At the same time, there were numerous coarse species such as sabre fish, small fry, ostroluchka, rudd, etc. In 1975 these species were quite numerous and made up 32 percent of the annual catch of more than 500mt but in 1977 – 1982 their share in the catch went down to 2–10 percent.

TABLE 2
Catch of commercial species of Kayrakkum reservoir, 1967–1976 (tonnes)

Species	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Common carp	192.8	264.3	284.1	217.1	140.1	124.9	98.5	117.9	115.4	4.6
Common catfish	12.4	19.5	19.3	25.8	22.9	24.8	23.3	30.3	30.0	5.4
Pike perch	10.5	24.4	22.2	20.1	28.0	33.7	52.0	70.4	69.5	22.9
Asp	12.8	9.5	13.4	3.3	1.6	3.5	6.6	27.4	27.6	5.8
Common bream	83.9	58.5	49.2	38.2	135.8	129.2	158.2	160.8	157.3	53.8
Turkestan barbel	23.3	36.9	33.5	15.3	9.0	8.8	6.7	12.3	5.9	2.3
Crucian carp	1.6	1.1	5.8	5.3	2.0	2.6	1.7	0.3	–	–
Pike	0.1	0.5	1.3	3.2	7.1	5.0	3.3	4.5	–	–
Sabre fish	4.9	2.4	1.9	4.6	1.0	23.5	47.9	28.1	–	–
White-eye bream	–	–	–	3.1	7.8	42.0	60.3	15.8	–	–
Snakehead	–	–	–	–	–	–	0.7	0.8	–	–
Other species	38.4	24.4	37.0	118.5	140.7	76.4	57.4	54.0	88.5	6.0
TOTAL	**380.7**	**441.5**	**467.7**	**454.5**	**496**	**474.4**	**516.6**	**522.6**	**494.2**	**100.8**

A 3- to 4-year old sazan grows up to 2 kg in the conditions of Kayrakkum water basin with a nutritive ratio of 1:5, while the coarse species with this feed factor and of same age reach 30 to 250 g depending on the species. Therefore, a large biomass of these small species in the same water body can undermine the primary food base. An analysis of the composition of fish capture in the past few years shows that pike perch and common catfish catches comprised a 22 percent share. Taking into account such predators as snakehead and asp, which are caught in smaller numbers and are not considered in fish capture, the share of predator species can make up to 30 percent. In the biological balance the ratio of non-predatory and predatory fishes should be 95:5; the share of predators should not exceed 5 percent of the total fish biomass. In such a water body as Kayrakkum reservoir with a rich biological structure, predators are necessary to keep the mass of coarse species in balance, but not as one of the main objects of fish capture. In this regard, in the spring of 1983 the decision was made to limit sazan capture to 100 tonnes and to raise to 50 tonnes the catch limit of coarse and stunted fishes like sabre fish, Aral roach, ostroluchka, rudd, common bream and the predators common catfish, pike perch, snakehead and Aral asp.

PLATE 3

Fish harvest from Kayrakkum Lake consisting of both wild fish (above) and stocked fish (below)

Courtesy of: FAO/M.R. Hasan.

PLATE 4
A fingerling production pond of Sugd Mahi Farm (left) and a view of Kayrakkum Lake (right)


Courtesy of: FAO/M.R. Hasan.

In order to increase the fish production in the reservoirs, starting in 1982 a yearly sum of 80-100 thousand roubles (approx. US$2 500 – 3 200[3]) was spent on aquacultural and ameliorative works in the upper reservoirs, on 20 km of the channel and 7 lakes with a total area of 173 ha. The lakes that form at the upper parts of the basins tend to be cut off when the water level recedes. The development aimed to connect these small lakes to avoid the mortality of an estimated stock of 30 million juveniles, which are a significant stock of commercial species. There are opportunities to increase the fish production of the reservoirs by regulating the water regime and reducing the influence of drainage, setting up fish protection screens at the pump stations, improving the food reserve, improving and rehabilitation of spawning grounds and breeding of sazan and herbivorous fishes.

To enhance the ecological niches and increase the productive efficiency of the waterbodies in the Farkhadskiy and Kayrakkum reservoirs, reduction of weed and coarse species and enrichment of commercial ichthyofauna were carried out until the early years of this millennium. The managers introduced fish feed organisms including mysids and shrimps, and some fishes such as pike perch, crucian carp and herbivorous species.

Katasay reservoir was built in 1965 in the vicinities of Ura-Tube. It is a small reservoir solely for irrigation. Its water level would fall to near zero mark when water is released for irrigation. The hydrochemical regime and phytoplankton of these reservoirs was studied by Andrievskaya (1985), and benthos by Akhronov (1983). Only marinka is found here. The reservoir can be useful for sports fishing. A group of lakes in the upper Zaravshan include the lake Iskanderkul, a group of Marguzor and Fan lakes. But these are at high altitudes, oligotrophic and have poor primary productivity. Marinka and char inhabit some of them.

2.3. Fisheries and aquaculture

In the early 1960s the USSR and Tajikistan launched a large-scale programme of aquaculture development. It included the creation of enterprises in the Republic, development of new technologies, establishment of research centers, training programs and other activities. During the decade 1960–1970 a number of aquaculture facilities was built with a total pond culture area of 2 600 ha. Aquaculture was focused on one system, the polyculture of carp species in ponds using semi-intensive technologies. In the succeeding decade pond culture was producing 2.0–2.5 tonnes of fish per hectare per year, the highest productivity level in the USSR. Eventually average yield rose to 3–3.5 tonnes per ha per year in the 1970s; in Khatlon region it was more than 4mt per ha. In 1989 the brigade of a famous fish farmer S. Nozimov harvested a record-breaking 9.4 tonnes/ha from a 30 ha pond area.

[3] 1 US$ = 31 Russian Rouble as of September 2012.

As indigenous ichthyofauna is poor in terms of commercial species and the ecological niche for the herbivorous species was vacant. Therefore, artificially reproduced fry of carp were stocked in the lakes, reservoirs with relatively stable water levels and drainage channels. These were fished after 3-5 years. The stocking of Chinese carps raised the productivity of the waterbodies 2–3 fold.

2.3.1. Production systems

In Tajikistan there were two basic systems of fish production: fishery in natural waterbodies and aquaculture in ponds. Cage culture of trout on a pilot scale in the Nurek reservoir was introduced recently, under the emergency assistance project of FAO after the severe winter of 2007–2008.

2.3.1.1. Capture fisheries

Capture fishery was carried out by the fishing brigades of the state fishery enterprises. The territory for capture was allocated to each brigade. Usually 10–15 fishermen worked in one brigade. The brigades were equipped with 2–5 motor boats, 10–20 stationary net with various mesh sizes and/or 1-2 seines. Some brigades had 1 cutter. Every year the enterprises applied for a specific allocation of the total catch quotum by species for the current year. The quota applications were submitted to the Uprybhoz at Central Asian Acclimatization Station (CAAC) which presented the applications of all fishery enterprises to "Vostokrybvod" and to the Scientific and Industrial Council. The Council allocated annual quotas for each facility on the basis of the scientific institute's assessment of the fish stocks in a certain water body. The quotas protected fish stocks from being overfished. In the quotas the quantity of tackles (nets, seines) of certain mesh sizes and lengths, the number of vessels, and number of fishers in a brigade were also specified.

Commercial fish capture was regulated by the Rules on Commercial Fishery in the waterbodies of the Republic, which was based on an All-Union standards: capture seasons were closed during spawning, minimal mesh size was usually 27–36 mm, closed zones (spawning sites of commercial species), protected species, penalties for illegal fishing, etc. The penalty was high for illegal fishing, regardless of the size of fish. In some cases "Glavrybvod", the central coordination body for fisheries in the former Soviet Union, had the right to stop the activity of fishing brigades and to withdraw the quota if gross violations of the fishery legislation was proved.

2.3.1.2. Aquaculture

Only carp culture was well developed although one small trout facility produced up to 20 tonnes annually. One of the more important fish production technologies used in Tajikistan since 1960s has been carp polyculture in large earthen ponds. The species included common carp *Cyprinus carpio carpio*, silver carp *Hypophthalmichthys molitrix*, bighead carp *H. nobilis* and grass carp *Ctenopharyngodon idella* (Table 3). The period of vegetation lasted from the end of March or the beginning of April up to the end of October-November; wintering is November to March. Commercial species were cultivated in two-year cycles: during the first year yearlings were grown in the fry ponds (5 – 10 ha) until they reached 25 g. After wintering they were grown in feeding ponds (10 – 75 ha) to 500 – 1000 g. In 1970 – 1980 the average efficiency of the ponds in Tajikistan was 3.0 tonnes per ha and in Khatlon area it was 4 – 4.5 tonnes per ha, in comparison with 1.5 – 1.7 tonnes average across the USSR (Khaitov, 2006).

Lime and fertilizers were constantly applied in ponds until the season of vegetation. They promoted active development of plankton for grass and silver carps, and also the growth of vegetation for grass carp. Additional feeds were given to sazan and partially to grass carp.

Feeds for sazan include agricultural byproduct such as wheat bran and/or imported compound pellet feed, while grass carp are mostly fed with fresh grass (Table 4). High-grade combined fish feed with some protein content was prepared in the specialized factories which produced feed of high quality that usually contained 28–32 percent crude protein for fry and 24–28 percent for juveniles. All facilities had well equipped laboratories for feed quality testing, water quality assessment and fish health control. Heads of laboratories and senior experts were highly qualified staff, who often had studied elsewhere in the Soviet Union.

A special programme on brood stock development was carried out under the All-Union programme. Special reproduction centers were created and artificial reproduction with the use of hormonal stimulation, fertilization and egg incubation was applied. Fish fingerlings from A. Dzhami's hatchery were distributed to the Surkhan-Darya area of Uzbekistan and other Union republics in Central Asia and to the Russian Federation. Experienced experts worked in the aquaculture facilities. Aquaculture production was defined basically by 5 year state plans through the state budget; funds were allocated based on pond area and technological norms.

TABLE 3
Major aquaculture species of commercial importance in Tajikistan

Most common aquaculture species in ponds	
Common English name	**Scientific name**
Bighead carp	*Hypophthalmichthys nobilis*
Common carp/sazan	*Cyprinus carpio carpio*
Grass carp	*Ctenopharyngodon idella*
Rainbow trout	*Oncorynchus mykiss*
Silver carp	*Hypophthalmichthys molitrix*
Other aquaculture species of potential importance	
Common English name	**Scientific name**
Black carp	*Mylopharyngodon piceus*
Crucian carp	*Carassius carassius*
Golden carp/goldfish	*Carassius auratus auratus*
Snakehead	*Channa argus argus*

Source: Hasan (2008).

2.4. Management structure and development activities

This section briefly describes the structure and activities in fisheries management, trading and research and development.

2.4.1 Fishery management and trading

In the former USSR the Tajikistan fishery sector was a part of Ministry of Fisheries of the USSR. In Tajikistan two divisions were functioning: local producers supervised by the Department of Fishery Management and the trading organization, Rybsbyt. Officially, they were independent from each other at the republican level.

Department of Fishery Management. The Department of Fishery Management was responsible for fish production and processing in the republic. It was founded in 1965 and basically controlled by the former All-Union Ministry of Fisheries which means that all financing for the establishment of new enterprises came from the common budget of the former all-Union Ministry of Fisheries of the USSR. All waterbodies and fish stocks belonged to the state, as well as all the fishing enterprises, aquaculture, processing, production of equipment and feed, research facilities, engineering units, and construction companies which formed the fishery management structure of Tajikistan. The director and the assistants supervised the management process. The divisions of the departments were directed by deputy directors and their decision areas were on pond culture, commercial fishing, feed and equipment supply, and fish processing.

TABLE 4
Common aquaculture species and the related information in Tajikistan

Species	Farming system*	Feeding/fertilizer regime**	Rearing period	Harvest size (kg)	Average sale price (Somoni/kg)	Stocking density (no./ha)
Bighead carp	Modified extensive to semi-intensive	Organic and/ or inorganic (NH_3 and PO_4) fertilizers	2–3 years	1.5–3.0	8.0	2–3 000
Common carp	Modified extensive to semi-intensive	Wheat bran and/or pellet feed[1]	2–3 years	1.0–2.5	10.0	4 000
Grass carp	Modified extensive to semi-intensive	Fresh grass	2–3 years	2.0–6.0	10.0	1 000
Silver carp	Modified extensive to semi-intensive	Organic and/ or inorganic (NH_3 and PO_4) fertilizers	2–3 years	1.5–3.0		
Rainbow trout	Semi-intensive to intensive	Pellet feed[2]	2–3 years	0.2–1.0	60–80	

*Three species polyculture of common carp, bighead carp and grass carp in earthen ponds is the usual aquaculture practice; **Feeding and fertilization are irregular and often feeding/fertilization is not done.
US$1.00 = 3.45 Tajak Somoni (at exchange rate of 2008); [1]Imported from Kazakhstan; [2]Imported from Iran (Islamic Republic of), the Russian Federation and Turkey
Source: Hasan (2008).

Rybsbyt. The agency was responsible for import and domestic sale of fish from other republics of the former USSR. To provide normal consumption of fish, which was 12 kg per caput per year. The All-Union Ministry of Fisheries imported fish from the regions of the coastal zone of Soviet Union. Every year 20–30 thousand tonnes of frozen, salted and smoked sea fish and canned food was imported. Capacious industrial cold storehouses could be found in all main cities and some landing sites. Also at Rybsbyt there were facilities for sea fish processing (basically the salted and smoked herring) that were imported in semi-processed form. Moreover, Rybsbyt was responsible for the supply of the state structures with fish, including the army, militia, corrective establishments, prisons and schools. Rybsbyt had branches in all regions of the Republic. After independence in 1991 all the regional branches were gradually transformed into (private) trading companies, which mostly were detached from the fishery sector. Seasonal problems started to occur with the processing and sale of live and fresh fish. The remaining capacity for fish processing and storage did not exceed 100 tonnes a year and the enterprises involved were generally small.

In Kayrakkum and Nau Sogdian areas there were large factories producing compound feed of various nutritive values and sizes. Their production capacity corresponded before independence to the aquaculture sector needs in the republic. These factories no longer function.

Gydrorybproject (under the Central Asian project to establish the fishery sector) was responsible for the development of engineering projects in Uzbekistan, Kyrgyzstan, Tajikistan and Turkmenistan. Projects included construction of ponds, production and supply of equipment for fishing and aquaculture, storage, processing, transport and marketing of fish. After the break-up of USSR, it does not exist anymore.

The Central Asian ichtyo-pathological laboratory was responsible for the control of fish diseases and their treatment. Its scope was Tajikistan and the neighboring countries. There

were close communications between Uprybhoz at the Council of Ministries (SM) of Tajikistan and the State Fishery Committee, Uzbekistan, Rybsbyt, *"Gydrorybproject"*, *The Central Asian ichtyo-pathological laboratory* on the national level and through the USSR Ministry of Fisheries.

2.4.2. Education and science

During Soviet times, education and scientific activities in fishery were carried out by the Department of Ichthyology and Hydrobiology of the Institute of Zoology and Parasitology of the recreated Faculty of Ichthyology and Physiology of Livestock of the Tajik Agrarian University. Fish-breeding facilities were provided with experts directed by the Ministry of Fisheries of the USSR. The dissolution of the Union and ethnic conflicts contributed to the reduction in the personnel of the department from 27 to 3 employees. At present the department has only 5 staff providing the management and technical assistance to the fishery sector.

2.4.3. Research, management and development activities

The Ministry of Energy and the State Unitary Enterprise in 2001–2002 recommended the multiple use of Nurek and Baypazinsk reservoirs and the organization of an industrial fishery. A fish farm in the Baypazinsk reservoir was established during this period. Research on the lakes Yaschilkul and Bulunkul in 2002–2003 in Khutumatu, Gorno-Badakhshan Autonomous Region recommended the multiple use of the Pamir lakes for fishery and production of raw materials for feed. It envisaged the organization of a constantly operating fishing brigade, preparation of forage for cattle and construction of a hatchery by the Lake Yaschilkul for the reproduction of Issyk-Kul trout and restocking of other lakes.

In 2004–2005, the Department of Ichthyology and Hydrobiology of the Institute of Zoology and Parasitology of the Academy of Science studied the status of fish resources in the waterbodies of the flooded zone of Rogun and Sangtudin reservoirs. It recommended ecological assessments and compensatory means for the damage to fishery by the construction of the hydro facility. A succession of processes that affected the structure of fish stocks in the Kayrakkum reservoir in recent years also affected the fishermen. Under the initiative of the State Unitary Enterprise – Mohiparvar, Academy of Science of Republic of Tajikistan and the Kayrakkum fishery enterprise, a study was launched to find out the reasons for the increase in abundance of species such as common bream and sabre fish, the sharp reduction in the population of sazan and pike perch, and the mass occurrence of small fry in the reservoir.

The study of the status of the Kayrakkum ichthyofauna revealed that the principal reason of the changes in the species structure of the reservoir was the sharp reduction of the spawning areas in the upper reservoirs on the west coast. Numerous waterbodies formed in this area. During high water periods (in April when it was peak spawning period), fish gathered there to spawn but in June and July these waterbodies would be cut off from the channel of Syr Darya so that the young fish perish.

With the start of the construction of the cascade on reservoirs on the rivers Vakhsh, Zaravshan and Pyanj, the staff of the Department launched studies on the biological regime formation of Sangtudin I and II and Rogun reservoirs, which are functional (Sangtudin I) after being rehabilitated. The Department continued studies and in 2010 these studies were still ongoing.

The long-term comparative data of the catches show significant fluctuations between periods but a huge drop after 1990, which is indicative of various problems (Table 5). The share of the leading species like sazan, pike perch, common bream and common catfish has been decreasing. The share of silver carp compared to the previous years increased from 0.1 to 0.6 percent.

Poor management of the resources and the of fish stocks wastes plenty of fish; when water is released for irrigation, isolated bodies of water form and masses of fish of different sizes and age perish. Water-collecting stations have no fish screens, which destroys thousands of fish fry. Poaching is also widespread. In the light of this situation, the Government in March 2001 promulgated. Decision #123, which recommended measures to restore fish production in the Republic. Among other provisions is the allocation of irrigated areas to fish-breeding facilities for the production of materials that serve as feed ingredients. Certain areas would be set aside to grow herbage for grass carp and grains for the feed of other species. But this has been set back by lack of financing.

In 2001 the political and economic situation was stabilized and fish capture also became stables. Sazan appeared to be the best species in Kayrakkum reservoir; it reaches 32 cm and 1 100 g in two to four years. Pike and pike perch are predators and their rate owes to a good food base. Weed and coarse species are abound in the reservoir, serving as the food base for the predators; pike perch can utilize 50 percent of the mysids.

TABLE 5
Catches in Kayrakkum reservoir over a 45-year period (tonnes)

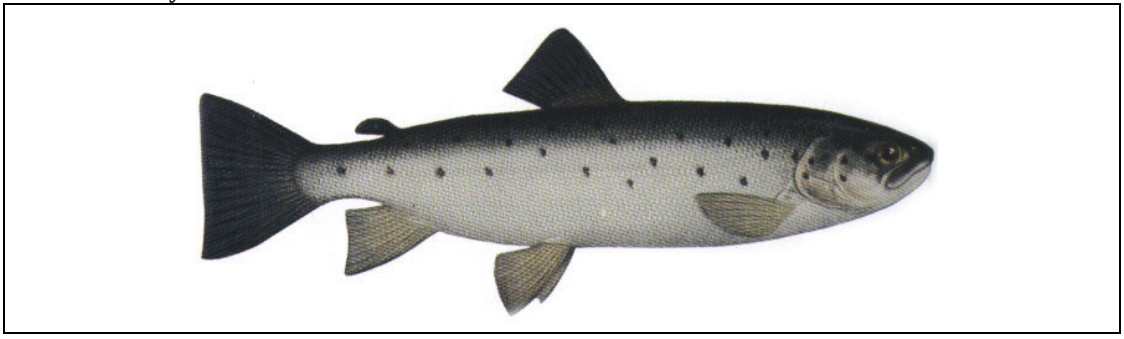
Years	*Catches*	*Years*	*Catches*
1960	76.3	**1985**	422.9
1965	272.2	**1990**	304.7
1970	454.5	**1995**	89.5
1975	494.2	**2000**	122.4
1980	273.4	**2005**	120.2

Fishery development in any water body depends on the organization of fish capture and reproduction activities. On the eastern shore of Kayrakkum reservoir there are hatchery facilities that have been functioning for many years. Broodstock of sazan and herbivorous fishes are caught from the reservoir and delivered to these hatcheries to spawn. The fry are grown to fingerling size and released in the reservoir.

The introduction of peled and Issyk-Kul trout in the lake Jashchilkul in 1980s showed positive results. The rate of the growth of peled was high; in two years they reached 670 g (Akhronov, 1983); however they did not go on spawning. The studies of Akhronov (2006) showed that Issyk-Kul trout congregates to spawn in the same place on the river Small Marjanay. Spawning takes place in October-November.

No control or surveillance measure is undertaken on the lakes of Pamir. The recommendations of the Department of Ichthyology and Hydrobiology to the local authorities (Hokimat) made in 2000 to establish a hatchery on the coast of Yaschilkul in order to restore and improve the population of trout has not been carried out.

FIGURE 3
Introduced Issyk-Kul/sevan trout



Courtesy of: FAO/F.F. Azimov.

Ojegova (1959) and Maksunov (1968) studied the primary productivity and fish population dynamics of Farkhadskiy reservoir on the river Syr Darya. Its ichthyofauna has been based on rheophilic (61.6 percent) and limnophilic (38.4 percent) species. Eleven rheophilic species lived in the reservoir. These include Fringebarbel sturgeon, Syr Darya sturgeon/shovelnose, pike asp, ostroluchka, sabre fish, common catfish, roach, rudd, Turkestan barbel, common bream, and sazan.

In 1947–1954 Tajikpotrebsouz and Raypotrebsoyuz were engaged in fish capture in the Farkhadskiy reservoir. But these organizations had no qualified fishery experts so that the capture potential of the reservoir, number and mesh size of fishing gear and other factors were not taken into account. There was no control over the quantity of landed fish. According to Maksunov (1968), more than half of the catches were sold in the markets of Leninabad and Nausk region. Commercial catches were minimal and added up to only 1.3 to 6.9 tonnes during early sixties.

In 1954, Rybpromkhoz was created to develop commercial fishery in all waterbodies of the Republic, conserve fish stocks (including restocking), and conduct restocking of fish on these waterbodies. The catches began to increase and by 1958 had reached 42tonnes in one year. But catches were not stable. The fish was caught basically by seines and stationary nets during spring and summer time. Large species like sazan, common catfish, common bream were caught but stocks of these species were managed poorly. Catch statistics had wide margins of fluctuation. Fish production did not exceed 8–10 kg per ha but the potentials of the reservoirs were much higher, as indicated in Table 6.

TABLE 6
Commercial fish catches in Farkhadskiy and Kayrakkum reservoirs during 1964–1981 (tonnes)

Farkhadskiy reservoir				Kayrakkum reservoir					
Year	Catch	Year	Catch	Year	Catch	Year	Catch	Year	Catch
1964	175.7	1971	19.5	1964	204.0	1970	456.5	1976	105.7
1965	54.6	1972	23.6	1965	272.9	1971	495.9	1977	151.4
1966	67.0	1973	22.6	1966	248.0	1972	479.6	1978	227.8
1967	28.8	1974	22.8	1967	336.9	1973	516.6	1979	236.3
1968	15.1	1975	40.7	1968	439.1	1974	522.4	1980	273.4
1969	23.5	1976	46.2	1969	467.7	1975	524.7	1981	311.6

The spawning area of important species in Farkhadskiy reservoir was an area called “blue gulf” with a depth of 2.0–2.5m and thick with reeds and pondweeds. Waste water disposal from the river Isfanasay penetrated the area, the relentless exploitation of the reservoir, siltation and overgrowth of the vegetation have made the area unfavourable for fish reproduction. By 1981 fishing stopped in Farkhadskiy reservoir. Subsequently the Farkhadskiy reservoir together with the site of Syr Darya, from the downstream basin of Kayrakkum reservoir down to its confluence in Farkhadskiy, was transferred to the society of hunters and fishers of the Leninabad region. It was not a good decision. The Leninabad Regional Committee on Environment Protection decided to divert the channel of the river Isfanasay from the blue gulf. It may have been more appropriate to dredge the silt and carry out biological remediation of the spawning area in order to restore the fisheries resources. Table 7 shows the composition of commercial fishes caught in Farkhadskiy reservoir during the period 1971–1976.

In 1956, the Institute of Zoology and Parasitology set up a control station for year round monitoring of the ichthyology and hydrobiology of the Kayrakkum reservoir. The process of the biological regime formation of Kayrakkum reservoir was similar to that of Farkhadskiy. A considerable role in the formation of hydrofauna in the reservoir, especially zooplankton and zoobenthos and fishes was played by the waterbodies on the upper streams of Syr Darya.

Fishing in the Kayrakkum reservoir started in 1957. Good management and qualified fishermen equipped with fishing gear and transport increased the catches. From 29 tonnes in1957, by 1965 catch had increased to 273 tonnes although it dipped to 225 tonnes in 1966 (Maksunov, 1968).

Rampant poaching in recent years has depleted the trout population in many places. Therefore, trout has been a subject to protection and the capture of Amu Darya trout is now forbidden.

TABLE 7

Species composition of commercial fish catches in Farkhadskiy reservoir (total catch in tonnes and share of each species in percent), 1971–1976

Species	**1971**		**1972**		**1973**		**1974**		**1975**		**1976**	
	Tonnes	%	Tonnes	%	Tonnes	%	Tonnes	%	Tonnes	%	Tonnes	%
Sazan	40	20.5	43	18.2	37	16.0	39	17.1	35	8.6	16	3.4
Common catfish	2	1.0	3	1.3	3	1.4	3	1.4	11	2.7	8	1.7
Pike perch	4	2.0	13	5.5	2	0.9	4	1.8	11	2.7	31	6.7
Asp	1	0.5	1	0.4	--	--	1	0.4	4	1.0	3	0.6
Turkestan barbel	6	3.1	7	3.0	4	1.8	6.2	27.2	8.4	20.6	15	3.2
Common bream	15	7.7	45	19.0	60	26.4	34	14.9	59	14.5	49	10.6
Crucian carp	11	5.7	13	5.5	12	5.4	1	0.4	3	0.7	3	0.6
Pike	9	2.0	2	0.9	4	1.7	1	0.4	4	1.0	5	1.0
Sabre fish	-	0	-	-	-	-	-	-	-	-	27	5.8
White-eye bream	-	0	-	-	-	-	-	-	1	0.2	-	-
Snakehead	-	0	-	-	7	3.1	8	3.5	9	2.2	-	-
Small fishes	107	56.5	109	46.2	97	42.5	75	32.9	186	45.7	305	66.0
Total	**195**	**100**	**236**	**100**	**226**	**100**	**228**	**100**	**407**	**100**	**462**	**100**

3. THE CURRENT STATUS OF FISHERIES AND AQUACULTURE

NATURAL RESOURCES AND POTENTIAL OF THE FISHERIES SECTOR

The vast waterbodies of the country, distributed throughout its territory, are a significant natural asset for fishery development. Culture-based fishery, stock enhancement and aquaculture have been carried out on and around these waterbodies with varying levels of intensity and results. While the variety of species with commercial value is limited, there are both indigenous and introduced species that have been fished, cultured and traded. Improving the management of and technology for capture fishery and aquaculture and strengthening the support services to increase economic efficiency would encourage more private investment in the sector.

3.1 Geography and climate

Tajikistan is located geographically between $36^{o}41^{1}$ and $41^{o}05^{1}$ of middle latitude and $67^{o}\ 37^{1}$ and $75^{0}14^{1}$ east longitude. The longest distance from north to south is 440 km while from west to the east the maximum distance is 825 km. In the north Tajikistan borders with Uzbekistan and Kyrgyzstan, in the south with Afghanistan and in the east with China.

The total surface area of Tajikistan is 143.1 thousand km^2. The country is divided into 3 administrative regions which are further subdivided. The population is about 7.6 million people. The landscape of the country varies from 300 m to 7 495 m above sea level. The climate is diverse with generally hot summers and mild winters. It is considered semi-arid to polar in the Pamir Mountains. Tajikistan is rich with deposits of commercial minerals.

A wide range of climatic conditions has given rise to varied landscape and agro-climatic conditions. Much of the country is endowed with dense vegetation and a wide distribution of numerous species of flora and fauna: 4513 species of plants, 10 000 species of invertebrates, 62 species and forms of fishes, 44 species of reptiles and 85 species of mammals.

3.2 Water resources

The country has abundant water resources within its territory which drain the basin of Amu Darya, one of the largest rivers in Central Asia with a water volume of over $50km^3$ a year. In the mountain areas of Tajikistan the volume of water of the largest glaciers is 1 200 km^3.

3.2.1. Rivers

The five major river systems that course through the country have a combined length of nearly 5 000 km. These are listed below.

Rivers	Length of water course (km)
Amu Darya	2 400
Syr Darya	2 212
Panj	1 125
Zarafshan	877
Bartang/Murghab/Aksu	528
Vakhsh	524
Kafirnigan	387
Total length	**4 752**

Pyanj and Vakhsh merge to form the river *Amu Darya*. *Zerafshan*, which is 640 km long and 800 m at its widest stretch, is formed by the rivers Match and Fandarya. There are an

additional 80 large and small rivers such as the *Match* (200 km), *Yagnob* (118 km), *Magian* (67 km), *Kiptut* (50 km), *Fandarya* (26 km) and others.

Vakhsh with a length of 643 km and width at its widest stretch of 1.5 km is formed by the merging of the rivers *Surhob* (151 km) and *Obihingou* (198 km). Some 229 streams drain into Vakhsh and forms about 700 lakes. Vakhsh drains into Amu Darya. Average annual drainage is more than 20 million m^3.

Kafarnigan is formed by the merging of the rivers *Sardaimiona and Sorbo*. It is 382 km long and 300 m wide at its widest stretch. This river feeds into Amu Darya.

Kzylsu has a length of 220 km and a width up to 250 m. One of its larger tributaries is the river *Jahsu* with a length of 142 km and a width up to 200 m. It feeds into the river Pyanj whose average annual drain is 1.3 million m^3. The basin of Pyanj includes several lakes, nine of which are fairly large.

PLATE 5
Mountain landscape of the River Pyanj

Courtesy of: FAO/A.F. Fatkhuloevich.

Two major negative impacts on the fisheries productivity of the waters are the poor maintenance and management of irrigation systems and pollution from various sources. Poorly maintained irrigation systems, particularly the channels, causes an 18 percent water loss. The level of the underground waters in the area of the reserve Tigrovaya Balka has gone down to 2–3 meters in the period 1972 – 2010. Agriculture has had an important impact on the water regime of some important rivers. For instance, the re-charge of River Javansu from June to February averages 0.6 m per second and 2 m per second during the high water period. The water's pH value is around 3 to 4 while it should be around 7. In 1997 nearly 40 million m^3 of effluent water was dumped into the major rivers. The most polluted rivers are Kafirnigan, Syr Darya and Vakhsh. Pyanj also receives 4 percent of the effluent discharged into the river systems.

3.2.2 Lakes

Tajikistan has some 1 300 lakes with a total area of 705 km^2. Most of the lakes (78 percent) are located in the mountainous areas of Pamir-Alay and are distributed over an area of 3 500

to 5 000 km^2. In lower mountain areas and foothill zones there are about 30 lakes with a total area 2.5 km^2. The major lakes and their water surface areas are listed below.

Major Lakes	Surface area km^2
Karakul	380
Sarez	80
Zorkul	100
Yaschilkul	48

3.2.3. Reservoirs

The country has eight major reservoirs. The volume of water they contain provides 12 percent of the drain of the rivers in Central Asia.

1. *Kayrakkum* reservoir, built in 1956 on the river Syr Darya in Leninabad area, has a reservoir 56 km long and 6–15 km wide. Its average depth is 8 m. Its total area is 520 km^2. It is used for the seasonal regulation, hydroelectricity generation, irrigation, aquaculture and fishery. Fifteen commercially important fish species are found in this water body.
2. *Kattasaysk* was built in 1956; it is 3 km^2 with an average depth of 19 m. It uses the water of the river Kattasaj. The reservoir is located upstream of the city of Istaravshan.
3. *Daganasaysk* built in 1985 catching the inflow of Syr Darya in the Leninabad area. It uses the water of the river Daganasaj which has a volume of 0.028 km^3 and a total area of 2.81 km^2. It is used for irrigation and domestic supply. Three commercial species are found in the basin.
4. *Muminabad* was built in 1958; it has an area of 2.6 km^2 and a volume 30 million m^3. It is located in the river Obisurh. Four commercial species live in the reservoir.
5. *Selbursk* built in 1964 in the Vosejskom area is 2.5 km long, 2.4 km^2 in area and 25 million m^3 in volume. Its water comes from the river Kzylsu. Three commercial species live here.
6. *Sarband*, 100 km below the Nurek reservoir, was built in 1962. During a year the level varies between 2 and 3 m. The area of the reservoir is 7.5 km^2 and its depth is 2 m. There are 6 or 7 commercial species in this storage basin.
7. *Baynazin* was created in 1988. Its length is 30 km, width is 4 km and its volume is 101 million m^3. Shoals with depths up to 2.0–2.5 m occupies half of the reservoir. Four commercial species are found here.
8. *Nurek* is the largest reservoir, with a volume of 10.5 billion m^3. It was created on the river Vakhsh in 1980. It is 70 km long and from 0.5 to 5 km wide. Its maximum depth is 300 m but the average is 120 m. In summer the water surface temperature reaches 24–26 ^{0}C but at a depth of more than 35 m it is 4 C throughout the year. The fluctuation of the water level within a year is between 30 and 50 m. There are five commercial species in the basin.

3.2.4. Irrigation network

The system of irrigation channels, water storage and drainage networks is well developed. Their total length is more than 9 400 km. There are 5 852 km of channels with a water flow of 100–300 m^3 per sec that have fishery value.

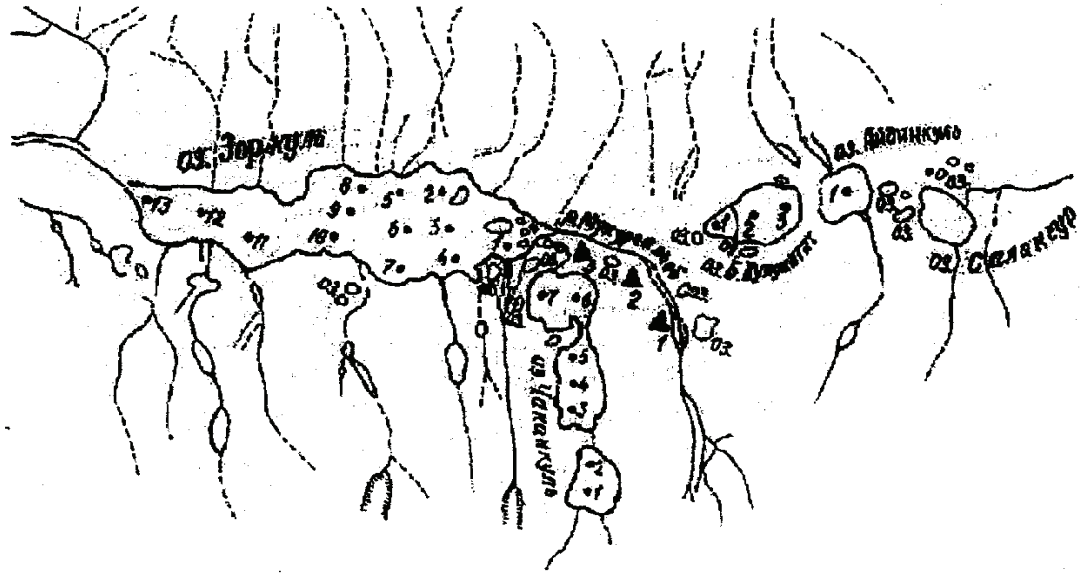
3.2.5. Geothermal waters

In the Pamir area there are more than 70 sources of thermal and cold mineral waters. Apart of these sources – Garmchashma. Avdj. Yamchun. Kyzyl-Rabat and Djelandy – are considered to have therapeutic effects. Geothermal waters are used also for the cultivation of cucumbers. tomatoes and ornamental plants. Aquaculture is planned in some cases.

3.3. Fishery development prospects of the waterbodies

All reservoirs and lakes in Tajikistan can be used in a better way for the production of fish than they currently are. Fish productivity in all reservoirs and lakes can be increased with the restocking of selected species and better management of the existing resources. This will need better equipment and training of staff, fishers and fish farmers. Restocking for culture-based fishery and cage culture activities have shown to improve productivity of waterbodies in Tajikistan and profitability of the fisheries sector enterprises.

FIGURE 4
Schematic map of Lake Zorkul, indicating locations of hydrobiological (limnological) stations



Source: Khaitov (2005).

Available information suggests that the best profitability can be achieved with semi-intensive pond culture, restocking of reservoirs and cage culture. Suitable waterbodies are located in all regions of the Republic: the large lakes of Pamir – Zorkul, Bulunkul, Yaschilkul; Iskandarkul located in the central part, the Nurek and Baypazin reservoirs, and Rogun reservoir that has been rehabilitated.

The lakes and reservoirs located in the downstream stretches of rivers are suitable for capture and culture-based fishery. Reservoirs and lakes located on the middle reaches of the rivers Syr Darya, (Kayrakkum, Farkhad), Kysylsu (Selbursk), Yahsu (Muminabad) and others, are used also for fisheries. Reservoirs with large volumes are suitable for fishery development but similar activities are difficult to carry out on the waterbodies in the flatlands because of their small dead-water volume (the water is used completely for crop irrigation at some time in the year).

In a number of warm-water reservoirs, such as Kayrakkum, restocking of sazan and herbivorous fishes or breeding them in cages could produce more than 1 000 tonnes of marketable fish. These waterbodies include the reservoirs in Kattasaysk and Daganasaysk in the north of Tajikistan, Muminabad, Selbursk, Sangtudin and Shartuz, and the lakes in the lower reaches of Vakhsh and Pyanj in the south.

3.4. Fish fauna, native and introduced

Before the large-scale construction and irrigation works in Central Asia, indigenous fish species in the waterbodies of the Aral sea basin had not experienced human influence.

Professor Kamilov and Professor Urchinov in 1973 mentioned in a survey report 84 kinds of fishes including rare and introduced species in the rivers and lakes of the Aral basin. As a result of the water regime regulation and introduction of new species, essential changes in species composition occurred. Some species have become rare such as three endemic shovelnose (the big and small Amu Darya and Syr Darya), ostroluchk, gelyan, Zarafshan dace (*Leuciscus lehmanni*), Aral barbel, Aral salmon and Aral asp. They were unable to adapt to the changes in the ecosystem and the aquatic environment in particular. The newly created hydropower dams, reservoirs for irrigation and other irrigation system components (e.g. sluices, pumps) became a barrier to their migration to the spawning grounds. Moreover, the water level regimes, as controlled by the hydropower and irrigation authorities often became detrimental for the indigenous fish populations in many reservoirs and rivers.
In order to increase the fishery potential of the waterbodies a number of introduction activities were carried out from 1960 to 1990. Pike perch and common bream were brought from the lower reaches of the river Ural to Kayrakkum reservoir. In 1970s a mix of Chinese (called “Far East herbivorous species”) carps were introduced for pond culture in Kuybishev; these included the bighead carp, silver carp, grass and black carp (*Mylopharyngodon piceus*). In addition, three species of the “American buffalo” bigmouth buffalo (*Ictiobus cyprinellus*), smallmouth buffalo (*Ictiobus bubalus*) and black buffalo (*Ictiobus niger*), as well as channel catfish and sturgeon bester were introduced in 1976–78.

Trout production began when rainbow trout and steelhead trout were introduced by LLC "Forel" in the Vahdatskogo region. In later years, amber trout was added.

In 1979–1983 Siberian peled was released into Nurek reservoir. The introduction activities in the lakes of Pamir in the 1980s appeared also successful. Siberian peled, grass carp and Issyk-Kul trout released into the lakes in Jashilkul adapted well to the environment. The fish were able to spawn in the river Mardjanoy and some specimens reached 15 kg. The average weight of the fish caught during some scientific expeditions was 5–7 kg in the 1980s.

3.4.1 Commercial species

The waterbodies of Tajikistan are habitat to more than 64 species and breeds of fish from 13 families but only 20 species are considered of commercial value (31 percent). At present 13 out of the 20 species with commercial value are target species of capture fisheries. . Some of the other, less prevalent species, have small populations or are listed in the Red Book. Mollusks are numerous in the reservoirs but have no commercial value in Tajikistan. Crayfish and the river shrimps Palamonida are found in the waterbodies of Vakhsh basin. These were introduced during Soviet times but are not considered of commercial value. The target capture fisheries species (species with commercial value) are listed in Table 8.

The majority of species are Cyprinids which, owing to intra-muscular bones and poor meat quality, are sometimes not much in demand in the local markets. But there are species such as the less prevalent pike perch and snakehead with good market prospects as well as trout, pike and whitefish (*Coregonus luttoka*). The European catfish/wels catfish is popular in the local market and also in neighbouring countries. But investors in the reproduction and culture of these species are few in Tajikistan.

PLATE 6
River valley with a trout farm in the background

Courtesy of: FAO/Raymon Van Anrooy.

TABLE 8
Main commercial fish species from capture fisheries in Tajikistan

Common/local name	Scientific name
1. Common carp/sazan	*Cyprinus carpio carpio*
2. Carp	*Stizostedion lucioperca*
3. White-eye bream	*Ballerus sapa*
4. Common bream/freshwater bream/ eastern bream	*Abramis brama*
5. Common catfish/wels catfish	*Silurus glanis*
6. Crucian carp	*Carassius carassius*
7. Grass carp	*Ctenopharyngodon idella*
8. Silver carp	*Hypophthalmichtys molitrix*
9. Snakehead	*Channa argus argus*
10. Sabre fish	*Polecus culfratus*
11. Small fry/roach/Aral roach	*Rutilus rutilis*
12. Northern pike/pike	*Esox lucins*
13. Aral asp	*Aspius aspius*

The indigenous ichthyofauna is rather poor in terms of biodiversity and most of the species have little commercial value or prospects. Nevertheless, these indigenous fish species and the beauty of the landscape make recreational fishery and ecotourism promising. This part of the fishery sector remains under-developed so far.

3.5. Capture fisheries

Inland fisheries production in 2000–2007 was estimated at 167–298 tonnes annually (Table 9).

This output has been mainly from capture fisheries because aquaculture was nearly insignificant during this period. The productivity of most waterbodies is low. Restocking is not being done or poorly organized and the irrigation and hydropower sectors are in control of the water levels in most canals and rivers, causing restocking efforts to fail in many cases. This makes fisheries development efforts in many areas a risky investment. Water levels in reservoirs and rivers highly depend on the irrigation needs which often conflict with the fishery sector objectives.

TABLE 9
Annual production of fish in Tajikistan during 2000–2007 (tonnes)

Year	2000	2001	2002	2003	2004	2005	2006	2007
Total	167	235	298	226	167	167	215	225

The installation of devices, such as screens, that provide protection of fishes in water intake and pumping constructions of irrigation schemes would prevent fish being carried by the irrigation water to the irrigated lands. The absence of fish-passes in hydropower constructions prevents the migration of certain fish species to and from their traditional spawning grounds. The Regional Scoping Workshop on the Use of Irrigation Systems for Fish Production in Central Asia, held in Tashkent, Uzbekistan, 17–20 July 2007 recognized that fisheries is often neglected by other water user sectors in Central Asia[4].

There are many technological shortcomings as well. Fishing enterprises use only stationary nets, which have low efficiency. Moreover the few motorized boats and other equipment the enterprises possess are generally poorly maintained or non-functional as spare parts are not available in the local markets. To illustrate the decline in overall fishing capacity, Tables 10 and 11 compare the availability and capacity of motorized fishing boats in the fishery enterprises between the years 1991 and 2005.

TABLE 10
Number of motor boats in the fishing enterprises of the Republic of Tajikistan

Motor power (Horsepower)	1991			2005		
	Total	State	Private	Total	State.	Private
<12	23	23	0	12	0	12
Up to 20	23	23	0	0	0	0
Up to 25	12	12	0	15	0	15
Up to 30	7	7	0	5	0	5
Up to 60	2	2	0	1	0	1
Up to 90 and more	1	1	0	1	0	1
Total	**68**	**68**	**0**	**34**	**0**	**34**

3.5.1 Constraints to capture fishery

Inland capture fisheries in Tajikistan continuous to suffer from the poor state of equipment and gears. Cold storage facilities are inadequate (particularly in the country side where fishing

[4] More information can be found on this subject in the Report of the Regional Scoping Workshop on the Use of Irrigation Systems for Fish Production in Central Asia. Tashkent, Uzbekistan, 17–20 July 2007; FAO Fisheries Report No. 843, Rome, Italy, 2008. Available in English language at: ftp://ftp.fao.org/docrep/fao/010/i0075e/i0075e00.pdf and in Russian language at: ftp://ftp.fao.org/docrep/fao/010/i0075r/i0075r00.pdf

is conducted) and modern processing facilities for the production are completely lacking. Economic obstacles to the development of capture fisheries include the absence of state subsidies and favourable financial and taxation regimes for starting entrepreneurs in the fisheries sector. Moreover, fishers who would like to invest in better, more environmentally friendly gears and technologies have no access to formal credit or investment sources and arrangements to do so.

TABLE 11
Capacities and number of small vessels in the fishery enterprises of the Republic of Tajikistan

Names of small vessels	Displacement (kg)	1991			2005		
		Total	State	Private	Total	State	Private
Carp	900	2	2	0	1	0	1
ПМК-130	4 700	3	3	0	2	0	2
МРБ	18 000	1	1	0	-	0	-
Motor boats of	600	4	4	0	4	0	4
different types	800	3	3	0	0	0	-
and	1 000	2	2	0	0	0	-
modifications	3 000	1	1	0	0	0	-
Total		**16**	**16**	**0**	**7**	**0**	**7**
Boats of different modifications	100 to 500	60	60	0	27	-	27
Total		**76**	**76**	**0**	**34**	**0**	**34**

Poaching is widespread. Most catch by inland fisheries (legal and illegally caught fish) can be considered illegal, unreported and unregulated (IUU), as catches are rarely recorded officially. Carp, asp, common catfish and pike perch comprise most of the illegal catches. Poaching continues to deplete the fish resources of many natural waterbodies in the Republic.

Absence of modern laws and regulations that guarantee private sector fishers and fish farmers rights to water supply are constraining investments as well. Restocking practices as part of the management strategy of various reservoirs are generally ill- organized. The costs of restocking that were in the past covered by the state budget are not covered any more. As a consequence restocking has ceased.

Pollution is rendering the aquatic environment for many fish stocks in Tajikistan unsuitable for fish. Drainage and irrigation systems are often too polluted by mineralization and high concentrations of toxic substances used in agriculture and industry. The volume of mineral salts brought into the hydro-ecosystems reaches 70–80 million tonnes a year in Tajikistan (Ahmadjon Gafurav, Mohii Tajikistan, personal communication, 2008).

People are not aware of the possibility that parts of the irrigation networks can be used for fish production. The small number of ichthyologists and other fishery experts, together with the lack of fisheries development programmes in the country, contribute to the low level of public awareness of the potential of capture fisheries.

3.6. Recreational fisheries

Recreational fisheries today has the same structure as it used to have. Most recreational fisheries is done in an unorganized way by individuals. However, there are also fishing clubs and the Association of Hunters and Fishers of Republic of Tajikistan. The Association of Hunters and Fishers of Republic of Tajikistan was established 15 May 1956 by a Resolution of the Tajik SSR Cabinet Ministers. It aims to bring together recreational fishers to jointly protect and improve fish resources (Van Anrooy *et al.*, 2010). Unorganized recreational fishers fish in the waterbodies of all the regions except for the protected territories, private

aquaculture farms, other enterprises and the territories allocated for the fishers' clubs. The lakes and rivers of foothill and plain areas are very popular locations for recreational fisheries. There are no catch statistics or estimations of catches made by unorganized fishers. The popular target species for recreational fishers are carp, common catfish, pike perch, asp, snakehead, common bream and pike in the plain areas, trout in the foothill areas and marinka in all zones.

Recreational fisheries is generally not of the subsistence type. Although many recreational fishers bring home their catch, the activity is not primarily aimed to support the family livelihoods. Caught fish is not sold but traditionally eaten by fishers, their relatives or friends in various preparations. A recent regional expert workshop on recreational fisheries in four central Asian countries, including Tajikistan (Van Anrooy *et al*., 2010) concluded, amongst others, that recreational fisheries harvests provide a significant contribution to food security (qualitative and quantitative) in remote rural areas; besides, it is estimated that at least 10 percent is sold at local markets. As such, recreational fisheries brings additional income to many rural households. The socio-economic situation in some rural areas in Central Asia (particularly in Tajikistan and Kyrgyzstan) causes that many there people are forced to fish in support of their livelihoods. Nevertheless, the fisheries should generally be regarded as recreational fisheries instead of commercial or subsistence fisheries

Private fishers can be members of clubs and societies of hunters and fishers. Association of Hunters and Fishers of Republic of Tajikistanhas branches in all regions of the country and in the main cities and settlements. The members pay a small annual membership fee. They obtain membership cards and can visit the allocated territories to carry out recreational fishing. Commonly they buy a ticket for each visit; the price of the ticket is low and varies between settlements. The settlements have their own support personnel. The association sometimes organizes sports fishing contests. The association estimates that annually between 50 and 60 tonnes of fish species of commercial value are caught by recreational and sports fishers in Tajikistan.

There are no restocking programs that aim to support recreational fisheries activities although the carp restocking activities by the Government carried out until 2002 have had positive effects on the stocks exploited by recreational fishery. There is neither a code of conduct for recreational fishery in Tajikistan, nor specific guidelines for recreational fishers. The recreational fishers have to abide by the Law of the Republic of Tajikistan on Fisheries and the regulations under it.

3.7. Aquaculture

Aquaculture is probably the most promising branch of the fishery sector. At this time however only one aquaculture system is reasonably developed in the Republic, that is pond culture of carp. Pond fish farms exist in all the regions. Today only a small part of the fish farming facilities belongs to the state; most aquaculture enterprises are private-owned. In 2009 the number of Dekhan farms involved in pond aquaculture was estimated at 63 by Mohii Tajikistan.

The total area of fish culture ponds in Tajikistan is around 3 800 hectares, which includes feeding ponds of 3 453 hectares (see Table 12, column 2) and hatchery ponds of 345 hectares. Potentially these ponds can yield more than 10 300 tonnes of fish a year at the average yield of 3 tonnes per hectare. The hatcheries and nurseries have the potential to produce 30 million yearlings (fingerlings of 1 season old) per year but inadequate investment has prevented them from using their potential to the fullest extent.

TABLE 12
Area of fish farms and production targets for aquaculture fish under the fishery development programme of Tajikistan, 2009–2015

Names of farms	Area (ha)	Production target (tonnes)						
		2009	2010	2011	2012	2013	2014	2015
PLLC A. Djomi	894	100	150	210	300	450	600	650
PLLC Guli Surkh	760	45	60	90	120	200	300	400
State fish farm Chubek	761	60	90	120	200	300	350	374
Ltd. Firuz-1	377	20	30	60	90	120	150	200
PLLC Sukufonh	87	180	190	200	220	240	260	270
PLLC Mohiparvari Panchikent	156	35	45	60	90	110	130	150
State fish farm Boypazi in Nurek	unspecified	10	15	20	25	30	35	40
Forel Ltd.	18	4	6	8	10	12	14	16
Dekhkan farm and fish facilities	400	50	100	150	200	250	300	400
Total	**3 454**	**504**	**686**	**918**	**1 255**	**1 712**	**2 139**	**2 500**

3.7.1. Culture technology

Fish farmers continue to use the carp polyculture method adopted during the Soviet times, which did not require much investment. Fish are generally not fed but liming and fertilization is conducted to stimulate plankton growth (Table 13). Therefore, silver carp became the basic cultured fish contributing 70–85 percent to total production. Common carp, grass carp and bighead are additional species cultured. Carp culture is primarily extended extensive or semi-intensive and with irregular use of fertilizer (organic manures with occasional use of chemical fertilizers, ammonia and phosphate) ((Table 13). On-growing carps are fed with grass (for grass carp) and wheat bran (for common carp) and occasionally with feed imported from Kazakhstan (Table 14). Maize, barley, cotton seed cake and sunflower cake are available and mostly used for livestock and hence these agricultural by-products have potentiality for use as feed in aquaculture (Tables 14 and 15). Inorganic/chemical fertilizers are generally more accessible than organic manures. Other feed ingredients occasionally used in aquaculture are wheat flour, corn flour, dry grass and alfalfa (lucerne). Some other ingredients reportedly available in the markets are various oilseed cakes, whole wheat grain, rice bran, rai flour, blood meal, silkworm pupae (Table 15). However, information about the quality and quantity of these feed ingredients is poorly documented.

TABLE 13
Commonly used organic manures and inorganic fertilizers for aquaculture in Tajikistan and their indicative price, 2007–08

	Organic manures/inorganic fertilizers	Source	Price (US$/tonne)
1	Organic manure	Farms	25
2	Ammonium nitrate	Open market	150
3	Ammonium phosphate	Open market	251
4	Common lime	Open market	63

Source: Mohii Tajikistan (2008).

PLATE 7
Carp ponds in Sugd Area

Courtesy of: FAO/Ozgur Altan.

TABLE 14
Feed and feed ingredients used in aquaculture in Tajikistan and their indicative price, 2007–08

	Ingredients	Source	% CP	Target species	FCR	Price (US$/tonne)
1	Wheat flour	Local/imported		Trout		600–700
2	Wheat bran	Local/imported		Carps		230–300
3	Corn flour	Local/imported		Trout		460–520
4	Dry grass (hay)	Local		Carps		
5	Alfalfa (Lucerne)	local		Carps		
6	Egg shell			Carps/trout		
7	Chalk powder			Carps		
8	Trout feed	Imported (Turkey)	60	Trout	1.5	1,500
9	Trout feed	Imported (Iran)	39–48	Trout		2–5,000
10	Trout feed	Imported (Russia)		Trout		
11	Carp feed	Imported (Kazakhstan)	18–36	Carps	4–4.5	435

CP = Crude protein; FCR = Food conversion ratio
Source: Hasan (2008).

In recent years, pond culture of rainbow trout has been taken up by some private farmers and feedings are based mostly on complete feed. Trout feeds are imported on *adhoc* basis either from the Russian Federation, Turkey and/or Iran (Islamic Republic of) with crude protein content varying between 40-50 percent (Table 14). Cost of these imported feeds is approximately US$2.0–5.0 per kg depending upon the pellet size and protein content. Occasional use of farm-made feed has also been reported without much success and common feed ingredients used for the preparation of farm-made feed are maize flour, wheat flour, wheat bran, whole egg and dried animal liver.

TABLE 15
Availability of feed ingredients for aquaculture in Tajikistan and their indicative price, 2007–08

	Ingredients	Source	Target species	Price (US$/tonnes)
1	Cotton seed cake	Local	Carps	520–580
2	Other oil cakes	Local/imported	Carps	
3	Whole wheat grain	Local/imported	Carps	385
6	Rice bran	Local/imported	Carps	
8	Rai	Local/imported	Carps/trout	
9	Rai flour	Local/imported	Carps/trout	
10	Yeast flour			
11	Hydrolysed yeast			
14	Fishmeal	Imported	Trout	
15	Meat meal	Imported	Trout	
16	Bone meal	Imported	Trout	
17	Meat and bone meal	Imported	Trout	
18	Blood meal	Imported	Trout	
19	Silkworm pupae		Trout	580

Source: Hasan (2008).

Unavailability of quality feed has been identified as one of the critical factors for expansion of aquaculture (both for carps and trout). Although availability of complete feed may not be the major constraint for the expansion of semi-intensive carp polyculture, it is however, one of the most important constraints for trout aquaculture. The country holds a viable option of expansion trout aquaculture (semi-intensive and intensive) in ponds and cages; however, the large-scale expansion of trout aquaculture has not taken place as the availability of quality feed is continuing to be the major constraint as the scale of economies may not allow the manufacture/production of trout feed nor its importation under the existing import regulation (28 percent import tariff is imposed on aquaculture feed).

PLATE 8
Imported trout feed from Iran (Islamic Republic of) in a trout farm in Tajikistan

Courtesy of: FAO/Ozgur Altan.

The Soviet-era methodologies of artificial reproduction by hypophisation (hormonal injection) to induce spawning, growing larvae or fry to fingerlings and wintering are used at

smaller scale than before. Large ponds (50–100 hectares and more) are filled with fresh water every year in spring, although the water supply in recent years (e.g. 2007 and 2008) has not been reliable. The large ponds require significant investments in terms of stocking of fry and fingerlings and in making the ponds productive (through fertilization and feeding). If the proper investments can be made the fingerlings would grow in two growing seasons to market size fish. In the autumn of the second growing season the fish would be ready for harvest.

PLATE 9

Manuring and feeding of carp farm in Tajikistan. A farm labourer with organic manure (composted cow dung) at pond side (right) and grass as feed for grass carp in Abdur Rahman Jame Fish Farm, Khalton (left)

Courtesy of: FAO/M.R. Hasan.

Whereas in the planned economy period the farmers only had to grow the fish, they now have to sell it as well. This requires skills other than they now have. Farmers have complained that at current prices of fertilizer and fingerlings a two-year crop cycle is not profitable. This suggests the need for adaptation of effective and cost-saving technologies.

Some large-scale enterprises stock at higher densities (3 000 – 4 000 fry per ha). At this density fish would be smaller so that they are grown three years until they attain 1.5 to 3.0 kg. The market price of large silver carp is higher per kg than of smaller specimens. This practice is applied only because there is no real market competition and land and water taxes are very low. From 1991 to 2006 various attempts were made to develop more profitable production systems but the economic crisis made the efforts remain at experimental or pilot scale. However, a preliminary economic simulation of fertilizer/feed based aquaculture in Tajikistan prepared by Hasan (2008) showed that both feed and fertilizer-based aquaculture can be profitable although poor quality feed (FCR = 5:1) presently used for common carp appears to be a major constraint for better productivity (Table 16).

PLATE 10

Use of dry and soaked wheat bran as feed in semi-intensive fingerling rearing pond, Khalton, Tajikistan

Courtesy of: FAO/M.R. Hasan.

TABLE 16

A simple economic simulation of fertilizer/feed based aquaculture in Tajikistan, per ha basis

Fertilizer/feed	Ammonia	Phosphate	Fresh grass	Complete feed**	**Total**
Amount of feed/fertilizers used (tonnes)	4.0	2.0	30.0	20.0	
Unit cost (TS*/tonne)	1 380	690	100	1 500	
Total cost (TS)	5 520	1 380	3 000	30 000	**39 900**
Fish species	Bighead		Grass carp	Common carp	
Amount of fish produced (tonnes)	2.0		1.0	4.0	**7.0**
Unit sale price of fish (TS/kg)	8		10	10	
Total price of fish (TS)	16 000		10 000	40 000	**66 000**
Conversion efficiency	3:1		30:1	5:1	
BCR	1:2.3		1:3.3	1:1.3	**1:1.7**
Net profit (TS)	9 100		7 000	10 000	**26 100**

*TS = Tajak Somoni, US$1.00 = 3.45 Tajak Somoni; **Imported from Kazakhstan; BCR = Benefit cost ratio.

Note: The above data are mostly based on empirical observation and not necessarily experimentally validated. Data on the amount of feed/fertilizer and fish production were obtained from Jilkul Gulisurk Fish Farm while the conservative estimate of unit cost of feed, fertilizer and fish were provided by Mohii Tajikistan (Ahmadjon Gafurov, Mohii Tajikistan, personal communication, 2008).

Source: Hasan (2008).

The fish farm PLLC A. Djomi has established over the years a broodstock base, through natural and artificial methods. This has contributed to an increased productivity per hectare. Unfortunately, the severe winter in 2007/2008 had caused the condition of the broodstock to deteriorate. The fish farm has a capacity to produce 250 million fry of carp and other herbivorous species, the only facility of this capacity in the former USSR. Currently the production capacity is less than 10–15 million fry.

Trout production in concrete (race-way like) tanks is conducted by Forel Ltd. in Wahdat. This trout farm has a total area of 18 hectares and water area of 2.5 ha. The farm has 25 rectangular cement cistern of varying size ranging from 20 to 40 square metres. All ponds are flow through with water coming from River Vakhsh. Trout produced in this farm are mostly imported from the Russian Federation. Trout eggs imported from Iran (Islamic Republic of) were received under an emergency project from FAO in 2009, in support of aquaculture sector rehabilitation after the disastrous winter season in 2007/2008. In 2010 trout eggs were imported by the Forel Ltd. from Denmark. The trout eggs received from FAO were, at fingerling stage, also distributed to Baypaz state farm at Nurek Reservoir for cage culture and Shujufon Ltd at Kayrakkum in 2009/2010. In both locations trout growth rates under cage culture conditions were better than expected, particularly as only limited feeds were supplied.

PLATE 11
Forel Fish Farm (Forel Ltd.) in Yos village, Wahdat district

Courtesy of: FAO/M.R. Hasan.

PLATE 12
Feed used for feeding of trout in Forel Farm

Courtesy of: FAO/M.R. Hasan.

PLATE 13
Larval rearing tank at Gulmohi Forel Farm (left) and an empty pot used for mixing of feed ingredients to prepare farm-made feed (right)

Courtesy of: FAO/M.R. Hasan.

The very low and stagnant level of production over the past decade – the entire production of commercial fish was only a little over 200 tonnes and stocking material produced was a mere 2 million pieces in 2006. This reflects the sorry state of fish farming facilities in the country. Table 17 highlights the urgent need to improve and modernize the physical assets of the sector.

TABLE 17
Number and operational status of fishery equipment

Items	Transport for live fish	Refrig-erator	Feed distributor	Cane cutte r	Net	Special clothing	Boats
Total number	15	5	10	10	10	50	8
Functioning	6	5	6	8	6	30	4
Being repaired	9	-	2	-	2	5	1
Non-working	-	-	2	2	2	15	3
% functioning	40	50	60	80	60	60	50

Since 1993 as a result of the economic crisis production declined further. This was aggravated by a civil strife, the cessation of economic relations between the States, and the sharp increase in the prices of formulated feeds and inorganic fertilizers, equipment and machinery. Table 17, above, is a snapshot of the status of equipment but it does reflect a general and gradual deterioration of fishery equipment and facilities after independence.

The preceding discussion suggests that the reasons for the sharp decrease in fish production had been the (i) severance of the economic links with other former Soviet Republics, especially Uzbekistan, Kazakhstan and the Russian Federation, (ii) increase in the prices of feed, mineral fertilizers and organic manures, (iii) deterioration of equipment and infrastructure, (iv) low living standard of and thus low purchasing power of the population, (v) low market prices of fish in the local markets, and (vi) the civil strife. The reasons for the limited use and production of fish farming areas (from 25–35 percent) are the shortage of natural feed resources, high cost of formulated feeds, and lack of fertilizers.

In this regard, the government in March 2006 passed Act No.106, which provides for a state investment programme, which guaranteed some technical support for fisheries over the period 2006–2008. It envisaged investments from external sources and donor assistance. The bilateral and joint venture programmes that have been planned included the following:

1. Technical assistance in fish culture from the Turkish International Cooperation and Development Agency (TIKA) (not materialized yet; limited to participation in international seminars only);
2. Agreement between the Ministry of Agriculture of the Republic of Tajikistan and the Corporation Korovar of Iran (Islamic Republic of) to develop trout pond culture facilities in Nurek (not materialized yet)
3. Protocol signed between the Ministry of Agriculture of the Republic of Tajikistan, and the Fund "Sodiroti Obziyon" of Iran (Islamic Republic of) to cooperate in the rehabilitation of the fishery sector of Tajikistan. Additional activities under the protocol include establishment of trout culture facilities in Nurek in the area of Shahrinavsk (not materialized)

The Mohii Tajikistan staff and some key aquaculture scientists have formulated the Aquaculture Sector Development Programme of the Republic of Tajikistan 2009–2015. The aim is to increase aquaculture production to 2 500 tonnes annually 2015, enhance the stock of the commercial species up to 3.5 thousand pieces, and produce some 65 million seed of different species but mostly carps and other herbivorous fishes. Annex 4 lists the plans under fishery sector development programme in the country designed to achieve production targets.

3.7.1.1. Rice-fish culture

This system has a good potential owing to the extensive rice area of the country. Rice-fish cultivation is common in many parts of Asia but this method is hardly applied in Tajikistan.

Some farming enterprises in Tajikistan are experimenting, with some success, fish culture in rice fields. They claimed an increase the profitability of the land cultivated but the lack of reliable information makes it difficult to present the practice as a success story here. It has become apparent however for the piloting farmers that the rice-fish cultivation has prospects in Tajikistan's rice-growing areas. A key problem for expansion of this activity is the fact that many paddy rice fields dry up during the growing season, as a result of rice-culture practices and insufficient irrigation water availability.

3.7.1.2. Ornamental fish

There is no ornamental fish culture carried out in aquaculture farms in Tajikistan. Aquarists raise ornamental fish in aquaria as a hobby, but not as a business. Ornamental fishes are sold in a network of pet-shops in the cities and two small wholesale markets (Shokhmahsur and Yakkachinar) in Dushanbe and other major cities. Aquarists import some of their ornamental fish from China, the Russian Federation, Malaysia and some other countries in Southeast and South Asia. The retail prices in Dushanbe, surveyed in May 2008, indicate a good potential for ornamental fish culture to augment household incomes, or as an additional enterprise of a fish farm. As there is no commercial-scale production, aquarists are not adhering to codes of good practice and conduct the import of the aquaculture species as they like). No limitations to import of aquarium species exist. .

3.7.1.3. Culture-based fisheries

Culture-based fishery was a widespread form of fish production in the past in Central Asia, including Tajikistan, but nowadays there is no state support for the restocking of waterbodies. Some fishing companies, such as Shukufon Ltd which is active in Kayrakkum Reservoir (Sugd Oblast), carry out restocking practices in the reservoirs under their management. They generally follow the regulatory requirements to produce and release each year hundreds of thousands of fingerlings. However, the lack of monitoring of the actual release makes that sometimes the fingerlings are not properly released. Moreover, the success of restocking practices is negatively influenced by the disappearance of good spawning areas (e.g. in Farkhadskiy and Kayrakkum reservoirs) as a consequence of irrigation regimes and the lack of screens that protect fish from being shredded in pumps of irrigation systems and hydropower plants. Some other the shortcomings of culture based fishery in Tajikistan are the poor variety of species, basically consisting of the carp species; extensive technology used; lack of access to working capital for fish reproduction; shortage of quality feed for larvae, fry and fingerlings; inadequate government support; lack of technical and industry support services including training in restocking and extension services; and poaching and other forms of illegal, unreported and unregulated fishing.

3.8. Support industries

There is no organized support industry for the fisheries sector. Fisheries enterprises and private fish farmers have to search and order the equipment and materials by themselves. The status of the support services is described as follows:

Feeds and feed manufacturing equipment. Sugd Mahi Fish Farm in Kayrakkum, Sugd and Naus plants produce pellet/granulated feed. Ingredients used in these feed plants are dried fish offal (fish processing waste from canning), wheat bran, egg shell, bone meal and chalk powder. These feeds are used for poultry, horse and pet animals. There are several reasons for which these feed plants do not/are not capable to produce fish feed: (a) outdated machineries are not suitable for manufacture of quality aquafeed, (b) apparently there is no large-scale demand of complete feed for carp culture, (c) cost of complete feed may be too high to be used as supplementary feed in existing semi-intensive carp culture, and/or (d) these feed plants did not establish any contact with fish farmers neither they do have any assessment of

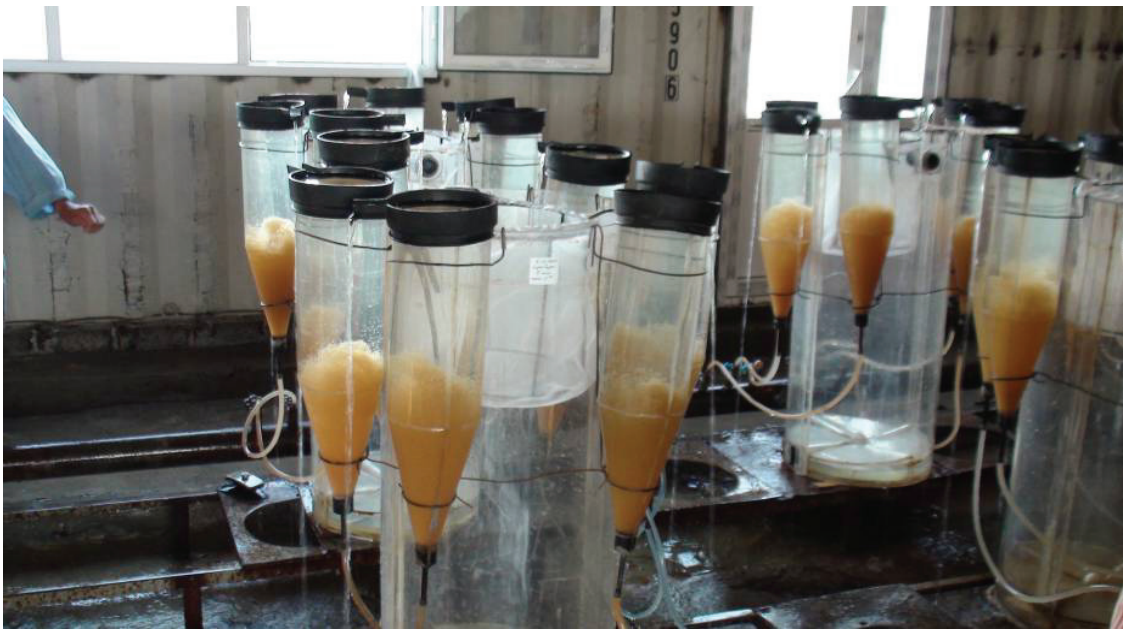
the requirement of cost-effective carp feed necessary to support carp farming in the country. On contrary, small-scale production of high quality trout feed may be economically feasible but the availability of some of the essential feed ingredients (e.g. fishmeal, fish oil, soybean meal and some of the feed additives) would be one of the major constraints. On the other hand, fish farmers engaged in carp farming can obtain many of the available feed ingredients (e.g., whole wheat grain, wheat bran, corn flour, cotton seed cake) from millers who have distributors all over the country and use them as supplementary feed and/or produce farm-made feed to be used in addition to fertilization.

Hatchery services and equipment

The country has adequate physical facilities for carp seed production for further expansion of aquaculture, but the carp breeding facilities were established during the early sixties and no replenishment of broodstock was done since then. Shukufon joint stock Company at Kayrakkum Reservoir and Plemrybkhoz Ltd. in the Jami region are the only two companies that produced carp seeds in 2009 and 2010. Various Dekhan fish farms are establishing their own small hatchery facilities for carp seed production. Systems being established are low-cost, proven technologies that make use of the standard reproduction protocols as defined before independence.

PLATE 14

A simple carp hatchery in Khudjand



Courtesy of: FAO/Ozgur Altan.

Generally incubators are available and the water sources are sufficient in terms of volume and quality in the locations of the carp hatcheries. As a consequence of limited knowledge on fish breeding and sub-optimal technologies, mistakes are commonly made by technical staff and mortality rates are high at eggs, larvae and fry stage. The hatcheries do not possess heating systems, water filtering equipment, UV-filters, automatic feeders or aeration equipment. This limits the length of the season in which they can reproduce fish. Most fry-tanks and broodstock tanks are located outdoors. In 2010 Forel Ltd in Vakhdat started producing trout eggs in a small-scale hatchery facility.

All hatcheries also encounter problems at fingerling stage with predation by birds (mainly cormorants) and snakes, and the non-availability of formulated high-quality fry and fingerling feeds. Consequently mortality rates further increase.

Dekhan fish farmers in Tajikistan generally prefer to purchase larvae of grass carp, common carp, bighead carp and silver carp. They prefer larvae over fry or fingerlings as the relative survival during transport is higher and the costs of purchase are much lower. Although some hatcheries possess functional old trucks with water tanks that were used in earlier times to transport live fish (broodstock and fingerlings) these trucks are now hardly used anymore.

Modern fish hatchery equipment is not available in the Tajik market and needs to be imported.

Veterinary services. The country has no network of veterinary stations in aquaculture and there is no special laboratory for water quality tests and fish disease diagnosis. When farms were using extensive culture methods the need for veterinary services for fish was low because of low stocking density. Nevertheless, the lack of fish health monitoring activities and limited human capacities in this field may also have caused that fish health problems go unnoticed. Fisheries managers and technologists who have finished higher education before 1994 have some basic knowledge of fish diseases and treatment protocols. The private aquaculture farms generally buy a basic set of medical preparations through private trading companies. The latter however do neither have a reliable stock of drugs and chemicals for water quality improvement nor for specific fish disease treatment. In the period January – December 2008, water quality parameters of 6 key fisheries reservoirs and pond farms used for aquaculture and culture based fisheries were monitored. The cooperation between the Tajik Agrarian University and FAO resulted in valuable information for the farms. The information collected and recommendations to improve water quality were shared with the farmers.

Fisheries and fish culture equipment. The fishing and fish farmer enterprises place orders for equipment from private trading organizations. This is how they acquire boats and nets, but there are no specialized trading companies selling fisheries and aquaculture equipment in Tajikistan. As a consequence most equipments (e.g. cages for fish culture, pellet making machinery, nets) are imported. Farmers encounter problems with finding suppliers in the international market, due to language problems (many cannot communicate in English or Chinese). At the same time foreign companies are often hesitant to export equipment to Tajikistan and request advance payment in full, asking the importer to assume all risks involved in transport and custom clearance procedures. Moreover, the complicated and costly money transfer system, custom clearance delays, as well as high transport costs make that procurement of equipment from abroad is a costly process. In recent years (2007–2009) a number of fish eggs (trout), fingerlings (carp species) and fish feed imports have encountered large delays and failures due to the above, causing high mortality among eggs and fingerlings and deterioration in quality of imported fish feeds.

Freezing and storage facilities were established before independence in all large scale aquaculture and fishing companies for their own use. The fishing brigades usually received or purchase block ice at the ice plants. Cold storage and ice-making services are still available and functioning in some of the fishing companies (e.g. Shukufon Ltd. at Kayrakkum Reservoir), but in general these services have been lost after independence. Ice-making machinery is available in the local market, but the latest low-energy technology needs importing. Most aquaculture and fishing enterprises do not have the funds to purchase such equipment at present.

Other materials, including fuel. Aquaculture enterprises can buy organic and inorganic fertilizers in the local market at competitive (market) prices (indication of average prices can be found in Table 18 below). Knowledge about the application of fertilizers to the ponds is insufficient among most farmers, which causes that fertilization takes place in the wrong way and is less effective. Fuel costs per litre are low compared to western standards, but as

purchasing power of the farmers is not high fuel costs (e.g. if pumping of water is required) can be substantial to the farmers.

Most other materials have to be imported by the private companies. The process of placing an import order goes through several intermediaries, which increases prices by 2 to 4 times.

Support industries are thus few and limited for the fisheries sector; only two facilities are selling seeds and farmers use rice, wheat or grain bran and cotton seed oil cake for supplementary feed of the pond fishes.

TABLE 18
Prices of the basic materials used in aquaculture in Tajikistan, September 2007

Fertilizers/feed ingredients/ other materials	Price per tonne (US$)
Organic manure	25
Ammonia nitrate	150
Ammonium phosphate	251
Cotton seed cake	520–580
Wheat flour	600–700
Wheat bran	230–300
Corn flour	460–520
Other oil cakes	158
Whole wheat grain	385
Silkworm pupae	580
Common lime	63
Gasoline, diesel oil	710

Source: Hasan (2008); Ahmadjon Gafurav (Mohii Tajikistan, personal communication, 2008).

4. PROCESSING, MARKETING AND TRADE OF FISH AND FISHERY PRODUCTS

All companies in Tajikistan involved in fish processing, fish wholesale and fish trade companies are private-owned. A fish trading license is required for import and export of fish and fisheries products. Rules and regulations set the standards for quality and safety; there are as yet no voluntary certification schemes and codes of conduct. The trading volume however is small, which is understandable as there is very little production of fish in the country. A fairly sizable volume of imports of processed products fills the current gap between demand and supply in the domestic market. The imported products generally have a high price, which reduces demand. Fresh fish from local production would be more affordable to the people. A higher volume of domestic production of affordable fish and fisheries products would generate a larger domestic market and reduce reliance on imports and foreign exchange needs.

4.1. Processing, storage and quality certification

The capacity for processing and storage of fish and fish products in the country are largely insignificant. Because of very small supplies, fish is distributed mostly live or in fresh form. Processing lines require significant investments, which would only be justified if supplies are available. In the last 2–5 years some enterprises have (re-) started trading in fresh and processed products which increased the availability of canned and frozen imported fish. Processing enterprises are required to pass their products through a quality and safety procedure, after which they receive (if all is fine) a national certificate of quality for each lot of each kind of product. For this purpose the enterprises can send samples to Dushanbe for certification. The certificate can be also obtained in the regional divisions of Tajikgosstandart.

At present the largest fish processing plant and fish cold-storage facility is in hands of Shukufon Ltd. at Kayrakkum. This is an integrated company as it also possesses a hatchery, aquaculture ponds, cage culture facilities and a permission to fish the Kayrakkum reservoir. It processes fish caught in salted form, dried and smoked form. The species processed are often low value fish for which no fresh-fish market exists. Sometimes the company also imports fish products and pasteurizes and cans these products. Various forms of canned products have been produced in the past, but the last few years the canning facility was not used.

Live fish and processed fish products sold in shops are certified according to the standard called GOST C 2 TU 9240 PT 00401064.002 – 99 developed by experts the Ministry of Agriculture and Tajikgosstandart with the Ministry of Health in April 2007. The fish should conform with the standards of weight, length, organoleptic parameters, external appearance, color, meat density and smell. Each lot of fish or processed fisheries products must have the veterinary and quality certificates.

4.2. Distribution and marketing

Marketing of fish and fisheries products can be performed only in those places allocated by the local administrations. Selling is allowed in these places if the wholesalers or retailers possess documents certifying the origin of the catch and its quality. Special places are designated for fish sale in the markets. These are equipped with water taps, electricity, special counters and a roof. Sometimes there is refrigeration available. Each retailer has a separate counter. The market authorities provide containers for waste which are emptied and cleaned regularly. Larger markets have a waste water drain.

In all supermarkets and almost every grocery store in Dushanbe and Khudzhand imported fish and fisheries products can be purchased in frozen and canned forms. Also in the bazaars, one or two shops would be selling imported fish and fish products from the Russian Federation and other post-Soviet countries. The products include frozen, salted, smoked fish canned food and

pastes, and tinned caviar. The price of these product forms is high, ranging from US$20 to 32 per kg.

PLATE 15
Fish market survey in Dushanbe Bazaar, May 2010

Courtesy of: FAO/Ozgur Altan.

The fishing enterprises sell fish directly on the banks of waterbodies at prices that are nearly 50 percent below the retail price. Small enterprises transport fish by car from landing site to wholesale market, larger ones such as Shukufon Company use refrigerated trucks. A small part of the harvest is processed, some are salted, and other portions are sold fresh and frozen in the company store.

Most fish farms are located 70 to 100 km from urban centres. They harvest in autumn. Part of the harvest is sold under small contracts (up to 200 kg) at farm gate, the other part is sold by the farm itself in shops and markets or delivered to special costumers that include the Ministry of Defence and correctional institutions. A major portion of the fish (up to 70 percent) is sold in public markets, about 15 percent in shops and supermarkets, and the rest to wholesalers and special costumers. Local production provides 90 percent of the smoked fish products, the rest is imported.

The fish market chain has not been well analysed. Many fish sellers are intermediaries (middlemen) who handle much of the fish that get into the market. They place a 10-20 percent mark-up on the price of fish. Retailers in turn have their own margin; Table 19 shows seasonal fluctuation of fish price within a year and Table 20 shows the prices of fresh fish during the month of Ramadan in 2007 to illustrate the peak price of fish during the year.

Technical problems in marketing invariably pose product quality problems. In the Tajikistan situation, these include shortage or simply lack of water for cleaning fish, very low refrigeration capacity and lack of ice. Returns to retailers can be low because of quality problems. A visit to the Shohmansur market by the authors of this review showed from 10-15 women selling fresh fish other than one specialized shop. The group estimated that some 300 kg of fish are sold daily. The fee for a fish display counter is 2 somonis (about US$0.61) per day. One dealer can sell about 3 000 somonis (US$923) worth of fish. After deducting all other fees and charges, a sellers' daily profit would be around US$5.75 on the average.

TABLE 19
Seasonal fluctuation of fish price, 2007

Species	Price per kg of fish (US$)		
	Jan–May	Aug –Dec	Ramadan
Sazan (up to 1 kg)	0.5–0.6	0.8	1.5
Sazan (1–3 kg)	2.0	1.8–2.0	5.0
Sazan (>3 kg)	4.0	3.5–4.0	7.0–8.0
Common carp (up to 1 kg)	1.4	1.6–2.0	3.0–4.0
Common carp (1–3 kg)	2.8	2.0–2.5	4.0–5.0
Common carp (>3 kg)	3.0	2.5–3.0	5.0–6.0
Common catfish (up to 1 kg)	1.8	1.0–1.6	2.0–3.5
Common catfish (1–3 kg)	4.0	2.4–2.8	4.0–5.0
Common catfish (>3 kg)	4.0–4.2	4.0	7.0
Grass carp (up to 1.3 kg)	1.1	1.0–1.2	2.0
Grass carp (1.5–3.0 kg)	1.6	1.6–1.7	3.0
Grass carp (>3 kg)	2.0–2.2	2.4–3.0	6.0
Bighead (up to 1.2 kg)	0.6	1.2	2.0–2.5
Bighead (1.5–3 kg)	0.8–1.0	1.1	3.0
Bighead (>3 kg)	1.1	2.0–2.3	4.0–5.0
Common bream (up to 0.3 kg)	0.3	0.4	0.4
Common bream (>0.3 kg)	0.5	0.6–0.7	0.9
Aral roach (up to 0.3 kg)	0.3	0.3	0.4
Aral roach (>0.3 kg)	0.5	0.6	0.9

TABLE 20
Prices of fresh fish during Ramadan, 2007

Species	Somoni/kg (US$/kg)
Common carp	12.0–14.0 (4.3)
Bighead carp	5.5–7.5 (2.3)
Snakehead	12.0 (3.6)
Grass carp	12.0 (3.6)
Pond carp	13.0 (4.0)
Common catfish	13.0–14.0 (4.3)
Asp	7.5 (2.3)
Aral roach	4.0 (1.2)

1 US$ = 3.25 Somoni as of 2007.

4.3. Fish trade

Fish trading enterprises must obtain a trading license. The supplier is obliged to show the buyer a copy of the certificate of product origin. Whether the fish has been imported or produced on a fish farm it is necessary also to show the veterinary certificate; this can be obtained from the Veterinary Control Service Department under the Ministry of Agriculture. The copies of the certificates of origin and the veterinary control should be presented to the local authorities as well as to the buyers, as requested. Transport of fish (or other aquatic products) should be accompanied by the copy of the certificates of origin and veterinary control.

The more common species in the market are common carp, silver carp, grass carp, pike perch, small fry, common catfish, snakehead, pike, asp, and common bream. Frozen, smoked and naturally dried fish are imported from Turkey, the Russian Federation, Norway, the United Arab Emirates, the United Kingdom, People's Democratic Republic of Korea, Latvia and Turkmenistan. Canned fish products are imported from Belgium, Canada, Germany, Italy, Latvia, United States of America, Turkey, the Russian Federation, New Zealand and the United Arab Emirates. According to State Statistic Agency (previously known as Goskomstat) the

fish imports in 2006 were (a) frozen fish, including fillet, 778.4 tonnes valued at US$767 600 (51 percent from Lithuania, 30 percent from the Russian Federation, the rest from Latvia and Turkey); and (b) dried and salted fish including fish flour, 9.6 tonnes worth US$78 000 (99 percent from the Russian Federation, 1 percent from Norway).

Almost all canned fish products are imported, mostly from the Baltic countries. The total value of imported canned food is US$1.35 million but value for each product form is not segregated. Available information is reflected in Table 21. There are established standards for various products in particular fish products. Standards include the type of production, basic characteristics, product structure, label and packaging.

TABLE 21
Import of fish and fishery products, 2004–2006 (volume in tonnes and value in US$)

Fish and fish Products	2004		2005		2006	
	Tonnes	Value	Tonnes	Value	Tonnes	Value
Fresh fish	-	-	5.0	4 300	30.0	21 400
Frozen fish	29.8	11 000	624.4	282 600	744.0	712 100
Fillet	-	-	-	-	34.4	55 500
Naturally dried, dried, salted. smoked, flour	17.5	11 000	8.6	8 300	9.6	7 800
Canned	-		0.1	300	-	-

Source: Ahmadjon Gafurov, Mohii Tajikistan, personal communication, 2008.

4.4. Supply, demand, consumption and consumption patterns

Tajikistan is among the countries with the lowest per capita consumption of fish at less than 0.5 kg per year, compared to the recommended norm of 10 kg by the Ministry of Health of Tajikistan. During the former USSR per capita annual consumption was 5–6 kg. The principal reasons for the low consumption are the decrease in imports of fish and fisheries products and the very low domestic fish production. The prices of pond-cultured silver carp (average price 24 Somoni/kg) and other carp species (10–16 Somoni/kg) are low enough to be affordable for a large part of the population; they are generally lower than the price of meat (beef 30 Somoni and mutton 31 Somoni/kg) and poultry (20 Somoni/kg).

Economic development, and the expansion of tourism, would stimulate demand for fish. The country's 7.6 million people (September 2010 census) (Svetlana Balkhova, FAO, personal communication, 2011) means a potential local demand of more than 76 000 tonnes of fish a year at the recommended annual consumption norm of 10 kg per capita. Even if the target was lowered to 5–6 kg, as in the 1970s and 1980s, there would still be a need to produce or import 35 000 tonnes. It is necessary for the government to create enabling conditions to encourage farmers to produce more fish. The conditions should be favourable for the development of the existing fish farms, development of new technologies and the appropriate introduction of species in aquaculture that are demanded by the market (while taking into account ecological and social objectives). Local people, especially the younger generations, are familiar mostly with freshwater fish. The large availability of marine fish, as was the case until independence, has gradually reduced. The population now prefers catfish, sazan, snakehead, pike perch, and asp. In general, a larger fish (>1.5 kg) is preferred. The larger fishes (1.5 kg or more) caught from natural waterbodies are in highest demand, and their price is only a little lower than that of meat. Large silver carps and bighead, grass carp from culture are also popular. Such fish as sturgeons and trout can be found in some markets as well.

There is a difference in fish consumption patterns between urban and rural areas. Fish is mainly distributed to the urbanized areas, and as such their populations have better access to fish and fisheries products. If fish appeared regularly in the markets in rural areas, it may

become also part of the diet of the rural population. The development of a network of small fish farms around the country would make fresh fish more available to the rural population.

Fish is purchased mainly in fresh form and consumed at home, in cafeterias and in restaurants. Home consumption of fish is prevalent. In Tajikistan there is no tradition of molluscs, shrimps, river crayfish and water plants consumption. Some of these aquatic species (including marine fish species, and crustaceans) are believed to have a good chance of acceptance, by market retailers, but this is not supported by any evidence.

5. GOVERNANCE AND INSTITUTIONAL FRAMEWORKS

This section describes the fishery administrative, research, training and information structures, their functions as well as capacities. The legal framework is reviewed in the next chapter.

5.1 Fisheries administration

The management of the fisheries sector (including capture fisheries and aquaculture) is under the responsibility of the Ministry of Agriculture of the Republic of Tajikistan. The Ministry has assigned the State Unitary Enterprise – Mohii Tajikistan with the basic monitoring, control and executive functions in the capture fishery and aquaculture sector. The main duties and responsibilities of the State Unitary Enterprise – Mohii Tajikistan include:

- the provision of legal protection to the fisheries sector and the production of highly productive fishes and development of new breeds;
- promulgation of a policy on the rational use of natural and artificial waterbodies for fish production and the protection of fish which is considered a national property;
- improving the competitiveness of fish culture under a market economy;
- large-scale implementation of scientific and technical development in fishery sector;
- organization, retraining and improvement of the professional skills of personnel for the aquaculture sector;
- promoting international cooperation in fish culture as well as supporting the improvement of regulations for export and import of supplies, special equipment and fish culture materials.

Mohii Tajikistan makes use of the policy and legal documents that appear as Annex 1 and Annex 2 to carry out the above duties. Aquaculture farms and their economic activities are covered by the Law of the Republic of Tajikistan on Fisheries. Fish production is further regulated by sectoral normative documents, which include guidance on the use of raw materials and safety precautions (Annex 3 includes food safety and quality specifications). To protect private investments and assure access to resources especially land and water, the fishery law of 2007 is being modernized with the assistance of FAO's legal department. Mohii legal experts have been working with those of FAO to update the law on fishery so that it is a progressive instrument to ensure that the sector is governed properly, particularly that allocation of resources is equitable and fair, and responsible investors and producers are assured of a fair return. The higher objective of updating the fishery law is to make regulations more sensitive and better address the social needs for food security and poverty alleviation and the environmental imperative of sustainable use of resources.

5.2. Research, training and extension

5.2.1 Research

Priority research areas in fishery and aquaculture development are defined by the Academy of Science. The sector development policy is developed by Mohiparvar and the development strategy is formulated by the Department of Ichthyology and Hydrobiology of the Institute of Zoology and Parasitology of the Academy of Science. The protection and reproduction of fish stocks are carried out by the Committee on Nature and Environment Protection of Tajikistan.

The limited scientific research in the aquaculture sector is often supplemented by practical research carried out directly by the fish farms on their facilities. Instructions to support the research and the findings (when appropriate) are disseminated to the fish farms by the State Unitary Enterprise – Mohii Tajikistan. The quality and scope of the research carried out is

constrained by the limited budget available for research and development at universities, Mohii Tajikistan and other state research institutions.

5.2.2. Professional education, skills development and extension services

The fishery sector of Tajikistan is badly in need of qualified fisheries and aquaculture experts. The absence of an academic institution that educates people in fish farming is constraining the development of the sector. The available experts generally have graduated from the former Faculty of Zoology and Biology of the Tajik National University where a course in "Ichthyology" was held in the past.

The current Zoology Engineering Faculty of the Tajik Agrarian University established in 2007 a curriculum on fish culture. This study at Bachelor of Science level is titled "Technology of fish culture". In December 2007 in accordance with the Order # 82 (of the Rector of the university) the Division of Ichthyology and Physiology was created within Department of Physiology of Agricultural Livestock. In 2008 and 2009 some 20 students entered the three-year Bachelor course, thus in 2010 some 40 students are studying fish culture; a promising sign.

Education at Masters level or PhD level in fisheries or fish culture is not available in Tajikistan. Currently, most students who like to study further in fisheries and aquaculture continue their study in the Russian Federation.

Education in capture fisheries is supported by Mohiparvar of the Ministry of Agriculture and the Ministry of Education, but no formal programme is being conducted by either. Vocational training and re-training of agriculture personnel are assigned to the “Republican centre of qualifications upgrade” located at the Tajik Agrarian University where practical fish-breeding courses are organized. For capture fisheries there are no vocational schools or training programmes in Tajikistan. The human resources problem of the sector deserves urgent attention; it is the human capital after all that is the most important asset for sectoral development. Vocational training and retraining of people active in fisheries and aquaculture is very important for the survival and sustainable development and management of the sector. The limited training and education opportunities at present will cause a continuing shortage in qualified and skilled workers and managers.

Government extension services in fisheries and aquaculture exist on paper but in practice the advisory functions assigned to Mohii Tajikistan cannot be performed by the State Unitary Enterprise. Apart from the lack of trained extension workers, the limited budget of Mohii Tajikistan is a major constraint. There is no private sector extension service available, as all aquaculture specialists are either working in or owning a farm or are employed by Mohii Tajikistan or the university.

5.3. Fisheries statistics

Collecting basic statistical data is the responsibility of the State Committee for Statistics (Goskomstat). All the fishery and aquaculture enterprises are obliged to present statistics in the place of registration of the enterprise. This means that all the fishing enterprises that are leasing or renting waterbodies or parts of water body for capture fisheries purposes are obliged to provide annually their production statistics to Goskomstat. The level of data collecting is currently very low. The forms of reporting need improvement to increase the information value. There is a need to develop the system of data collection and processing in the fishery sector According to the Law of the Republic of Tajikistan on state statistics, all the fishery and aquaculture enterprises are obliged to present statistics at the place of registration of the enterprise.

Specific forms to collect the statistical data and information are provided to the fishing enterprises by the regional and local hokimiyats (local council, members are elected or nominated by the Government), which also collect the forms. The data and information in these forms are transferred to Goskomstat where the processing and analysis is done. Goskomstat has offices in the regions and cities. The structure of its central office includes a department of statistics on agriculture and ecology. The same department functions in the local offices of Goskomstat as well; the offices that collaborate with the regional and local hokimiyats.

The type of data and information collected is very limited. The statistical forms used for fishery sector data collection do not allow Goskomstat to analyze the information for management purposes or provide to international agencies, like FAO, the data and information requested on an annual basis. Goskomstat and Mohii Tajikistan recognize the data and information gap. They see the need to develop a better system of data collecting and processing in support of fishery development.

5.4. Fisheries related organizations (unions, cooperative societies, associations and other establishments of fishery and aquaculture)

In Tajikistan there is no formal union, cooperative or association of enterprises in the capture fisheries or aquaculture sector which is active at national level. In some rural localities there are however fishers or fish farmers that work together in some informal organization that may be called a self-help groups. Mohiparvar started in 2008 to support aquaculture farmers to establish some cooperation, but progress is slow.

5.5. International cooperation in fishery sector development and management

The low contribution of fishery to the Gross National Product (GNP), which is less than 1.0 percent, is precluding the sector from being considered a national priority by the government. Because of its limited output and contribution to rural employment neither the national government nor foreign donors were interested in supporting the sector in recent years. The severe winter in 2007–2008 made it worse for fishery; it was disastrous to the country's economy as a whole and especially the agricultural sector including fisheries. Enormous fish mortality figures prompted the Ministry of Agriculture to initiate action to prevent the fisheries sector from disappearing. The extremely low temperatures froze rivers, reservoirs, lakes and ponds; 37 cm of ice killed a large part of the fish stock used for aquaculture production. Low water levels in the reservoirs used for hydropower production added to the high mortality rate (60 percent) particularly of young fish. A damage assessment, carried out by Mohiparvar showed that immediate action was urgently needed. FAO was requested to support the rehabilitation of the aquaculture sector under its Technical Cooperation Programme. A project was formulated and implemented, called "Emergency assistance to Tajikistan in the aquaculture sector, livestock sector and comprehensive assessment and programme development" (TCP/TAJ/3104) with a funding of US$393 000. The project started in April 2008 with the aim of supplying trout eggs, fish fry (carp species), fish feeds, fish cages, laboratory equipment and technical advice and training to the cold-affected aquaculturists.

Other bilateral and international donor agencies are showing increasing interest in the fishery sector in Tajikistan, and the opportunities the sector provides for rural employment and income generation. This may eventually lead to more projects. (At the time of this review however no other project has materialized).

Since 2007 the fishery sector of Tajikistan and particularly Mohiparvar/Mohii Tajikistan has been actively seeking to establish regional collaboration in fisheries and aquaculture. A sign of this is the participation of Tajik fishery sector stakeholders in regional meetings, such as the following:

- Regional Scoping Workshop on the Use of Irrigation Systems for Fish Production in Central Asia. Tashkent, Uzbekistan, 17–20 July 2007.
- Regional Workshop on Inland Fisheries and Aquaculture in Central Asia: Status and Development Prospects. Beymelek, Turkey, 11–14 December 2007.
- Regional Workshop on the 1995 FAO Code of Conduct for Responsible Fisheries in the Central Asian Region: a Call to Action, Tashkent, Uzbekistan, 8–10 April 2008.
- Regional Expert Workshop on fish- and livestock feed assessment methodologies, Tashkent, Uzbekistan, 24–26 June 2009;
- Regional workshop on feasibility of fish and livestock feed production in Central Asia, Khujand, Tajikistan, 5–6 May 2010;
- Regional training on fish and livestock nutrition and feed technology, Khujand, Tajikistan, 7–8 May 2010;
- Two national workshops on Policy and strategy for fisheries and aquaculture development for poverty alleviation in Tajikistan, Dushanbe, Tajikistan, 10–11 May and 15–16 June 2010;
- Regional training on Small-scale fish feed production, Dushanbe, Tajikistan, 26–28 October 2011.

In 2008, the Minister for Agriculture of Tajikistan, Mr K.R. Kasymov, hosted the Regional Intergovernmental meeting to initiate the establishment of a Central Asian Fisheries Organization, held in Dushanbe on 10–12 November. The meeting brought together delegations of Armenia, Azerbaijan, China, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey and Uzbekistan. The meeting can be considered as the starting point of a formal regional intergovernmental collaboration in fisheries and aquaculture. As such, the Government of Tajikistan took a leading role in bringing together the countries with the aim to pool and share information, expertise and knowledge for the management and sustainable growth of the sector in Central Asia and the Caucasus.

6. POLICY, REGULATORY AND MANAGEMENT FRAMEWORKS

The legal and policy framework for the fishery industry is described in this section. The law on fishery and the law on fish culture have been enacted. The major implementing instrument of the law has been adopted, namely, the Policy and Strategy for Fisheries and Aquaculture Development for Poverty Alleviation in Tajikistan; it embodies a development programme for the period 2010–2025. A number of international conventions, agreements that have relevance to fisheries management have been acceded to by the State, foremost among these is the Code of Conduct for Responsible Fisheries. The legislations and implementing guidelines are intended to support the privatization process.

6.1. Policy, programme, and strategic planning in fishery and aquaculture

The Law of the Republic of Tajikistan on Fisheries was approved on January 4th, 2007. It provides the legal framework for the development and management of the sector. It appears as Annex 1. The "Fishery Rules in the waterbodies of the Republic of Tajikistan" as appear in Annex 2 were designed based on the 2006 law, which was approved by the Ministry of Justice of the Republic of Tajikistan on October 10, 2007 via resolution # 313.

The Aquaculture Sector Development Programme in the Republic of Tajikistan for 2009 – 2015 was approved by the Government of Tajikistan by resolution #306 on 2 June 2008. This State Programme, which appears in Annex 4, was developed with aims of conservation, extension, improvement of the genetic and productive characteristics of fish, to ensure food security of the population and create employment. It is aimed at the restoration of the sector's capacities to the level that existed in 1994. This first plan shall be complemented in line with the objectives as determined in the Strategy. The Development Programmes shall be "rolling" programmes rather than discrete programmes that have a definite life-span. The programme is backed-up with financial support from the Government in the amount of 300 000 Somoni (approximately 63 000 US$) annually. The main outputs foreseen from the programme are the establishment and upgrade of various state fish hatcheries. The state programme shows that, within the limitations of the state budget, the Government of Tajikistan considers the sustainable development of the sector essential.

The Policy and Strategy for Fisheries and Aquaculture Development for Poverty Alleviation has been adopted by the Government in November 2010. Its development was initiated in early 2010 when the Ministry of Agriculture, seeing the need for a fisheries and aquaculture policy and planning framework to systematically implement the Law on Fisheries, requested FAO's technical assistance for its formulation. A stakeholder consultation process was carried out that involved fish farmers, fishers, civil servants, fisheries specialists, researchers, retailers and others. The result was the Policy and Strategy[5]. The Strategy has four interlinked overall goals for the fisheries and aquaculture sector, in line with the three pillars of sustainable development and the need for governance. These are as follows: (1) *Social*: Alleviate poverty and ensure food security; increase employment while improving gender equity and generate higher incomes and better livelihoods in rural and mountain areas; improve the health and nutrition of the population. (2) *Economic*: Increase the production under market economy conditions; increase economic viability in the capture fisheries and aquaculture sector, including profitability of fish farming, fishing, fish processing, fish marketing and trade and support the generation of export earnings. (3) *Ecological*: Improve protection, conservation and rehabilitation of aquatic biodiversity and the aquatic environment in general; maintenance and enhancement of the productivity of land, water and available genetic resources. (4) *Institutional*: improve the research, educational and management capacity of the national

[5] The formulation process of the Policy and Strategy included two national stakeholder workshops held on 10-11 May and 15-16 June 2010. The workshops were technically supported by FAO under the Central Asia Regional Programme for Fisheries and Aquaculture Development (FishDev Central Asia).

institutions and stakeholders involved in capture fisheries and aquaculture; strengthen linkages, cooperation and coherence of approaches with other sectors.

The salient features of the Policy and Strategy are excerpted and appear as Annex 5.

6.2. International protocols and agreements related to fisheries governance

The country is signatory to a number of international conventions and protocols that have relevance to fishery. Apart from the Code of Conduct for Responsible Fisheries, which implementation is supported by the Republic, the country has ratified nine international conventions on the environment and signed the protocols of acceptance, as well as 12 international agreements on cooperation in environmental protection. These are described or listed below:

6.2.1. FAO Code of Conduct for Responsible Fishery

The country uses the FAO Code of Conduct for Responsible Fisheries as a major tool to guide the development and management of its capture fisheries and aquaculture industry. The Regional Workshop on the 1995 FAO Code of Conduct for Responsible Fisheries in the Central Asian Region: a Call to Action, held in Tashkent, Uzbekistan, on 8–10 April 2008 can be considered as the start of the implementation of the Code of Conduct in Tajikistan (FAO, 2008).

6.2.2. The UN Convention to Combat Desertification

Tajikistan signed this convention in 1995. Tajgidromet (State Committee on Hydro-Meteorology of Tajikistan) was appointed the national executive agency. The basic obligations of the country in this convention consist in use of integrated approach to decision-making to increase the efficiency of land resources, restoration, protection and sustainable management of land and water resources to improve living conditions and livelihoods. To solve these problems the State should implement a number of measures, including the following: (i) study the opportunities for financing the activities on soil protection, especially erosion and salinization control; (ii) create an infrastructure to improve the water management system in agriculture; and (iii) develop scientific basis for organic agriculture and improve opportunities for exploiting its potential.

6.2.3. The UN Framework Convention on Climate Change

Adopted by the United Nations in 1992, the UNFCCC was signed by Tajikistan in 1993. The basic objective of the Convention is to reach the stabilization of the greenhouse gases concentration in the atmosphere at the level which does not cause changes in climate. In 1998 Kyoto protocol (ratified by Tajikistan in 1999) defined the ways of implementing the convention by the international community. Tajgidromet was appointed the national executive agency.

6.2.4. Other conventions

The other conventions and agreements that the State has acceded to are:

- Ramsar Convention on the Wetlands of International Importance. 30.08.2001.
- Convention on the Prohibition for Military or Any Other Hostile Use of Environmental Modification Techniques. 26.05.1993.
- World Heritage Convention. 22.12.1995.

- Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES). 01 to 07, 1997.
- Convention on Conservation of Migratory Species of Wild Animals. 0.05 1998.
- Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and Their Disposal. 22.12.1995.
- Vienna Convention for the Protection of the Ozone Layer. 1.05.1993.
- Montreal Protocol on Substances that Deplete the Ozone Layer. 18.05.1993.
- London addition to Montreal Protocol on Substances that Deplete the Ozone Layer. 01.05.1998.
- Copenhagen addition to Montreal Protocol on Substances that Deplete the Ozone Layer. 01.05.1998.
- The Convention on Biological Diversity, 06.05.1995. It has been ratified and has taken effect in Tajikistan in 1996, and the Committee on preservation of the environment at the Government of Republic Tajikistan has been appointed responsible for its observance.

6.3. Legal and regulatory structure of fisheries

Tajikistan is a land locked country and the rivers are mainly managed in such a way that the water supports the needs of crop irrigation and energy (hydropower). This is reflected in the current laws and regulations. Indigenous (endemic) ichthyofauna has limited commercial fisheries value and aquaculture is therefore considered to become the main driver of fish production. At present aquaculture is regulated by the general laws of the agricultural sector. The State pays significant attention to the conservation of aquatic biodiversity and to environmental protection.

Fisheries management is regulated by Codes, Laws and Presidential Decrees and by Government resolutions. As to access rights and property ownership, there are laws on joint-stock companies and protection of the rights of shareholders, on companies with limited liability, and on farms.

The Government has been focusing on regaining the importance of the fishery sector with a number of initial steps to help the private sector. For instance, in March 2001 under Decision # 123 of the Republic, the Government provided for the allocation of 1 000 hectares in irrigated areas for seeding of forage and other crops to supply fishery facilities with raw materials for feed. The Government Resolution # 106 of 2006 on the State Investment Program provides for grants and technical support for the period 2006–2008. These government investments were made to show commitment from the Government towards fisheries and aquaculture development. However, these investments have yet to attract similar investments by the private sector.

The Cabinet of Ministers decision # 289 dated 06.07.2001 on the improvement of the fishery sector management system, states that the taxation terms for aquaculture enterprises are equal to that of the agricultural enterprises. This means that pond culture farms pay the uniform land tax instead of paying a range of taxes that apply nation-wide. The local taxes and duties established for agricultural manufacturers are: income tax (profit); value added tax (except for import of goods, works and services); tax on the use of water resources; property tax; and land tax.

A legal tax unit of the single land tax is the area “passed into possession, used or rented for conducting agriculture activities”. The level of the single land tax is established in the form of the fixed payment per unit area of the land, quality and water-security of the land area. The single land tax does not depend on the results of economic activities of agricultural

commercial producers; the single land tax is collected to the benefit of the local government budget.

The Tax Code envisages privileges for the fishing enterprises under the property tax of legal persons. Tax assessment of a property of a fishery enterprise involved can be lowered by the cost of the property used for the production and storage of fish products. The privileges under the land tax include:

- land areas which are not legal tax units such as land areas occupied by the rivers, lakes, water basins, channels, glaciers, bogs, and hydraulic engineering and other constructions,
- strips of banks of the waterbodies given to the enterprises, establishments and the organizations for water management needs,
- land for agricultural purpose and wood fund of the scientific organizations,
- land for experimental, training and pilot farms allocated to research organizations and educational institutions for scientific and educational purposes.

6.4. Fisheries management

The fishery sector of the Republic is going through a lengthy transition period; the privatization process is still going on along with improvement in regulations covering ownership rights and access to properties as well as the legitimate use of resources by the fishery and aquaculture sectors. Ownership transfer process is causing uncertainties in terms of fisheries management. Management issues include:

- Fishery production is low in terms of volumes and value generated and it can be argued that the sector only has some significance at the local level in some regions.
- The fish stocks and species diversity depend much more on irrigation activities than on fisheries activities. If the irrigation sector would coordinate water use with the fisheries sector, ensuring that there would be sufficient water passed to the important lakes, reservoirs and rivers that function as fish habitats, then there will be growth in stocks of fish and fisheries production could increase. However, irrigation of agriculture lands (particularly cotton) is considered much more important for the national economy than fish production.
- Many former fishing management methodologies, that were successfully used under Soviet regime, have been forgotten and are not applied anymore. Proper fish stock assessments and general fisheries research have not been done for almost two decades because of insufficient financing. Methods used to regulate the fisheries, such as the minimum mesh sizes, quota allocations for total catch or for specific species, seasonal closures and area closures are ineffective now.
- Currently used methods of capture regulation do not stimulate the sectoral development. The current regulations were made by the State committee on wildlife management, whose objective is to conserve aquatic biodiversity and fish stocks. The rational use is not of their interest. Under the current laws capture fisheries is not considered as an economic sector, but as a hobby equal to recreational/amateur hunting.
- The theoretical basis for fisheries management has become obscure.

Mohiparvar, on the basis of the Law on Fish Culture, has formulated the Rules of fish culture in the waterbodies of the Republic and registered it in the Ministry of Justice. Regulation applies to all the rivers, their inflows, channels, lakes, water basins and other fishery waterbodies except fish ponds.

The capture of water invertebrates, sports and amateur fishing, fishery for research purposes and other activities connected with fish capture are regulated under the provisions on

commercial capture fishery. The regulations aim to conserve fish stocks, and cover type of fishing gear, mesh size, protection of fish migration routes and pathways, and other concerns.

Fishery is regulated by the provisions on fish stocks protection in the fishery waterbodies and the measures of demonopolization and privatization of the fishery sector. They regulate the lease arrangements of natural fishery waterbodies.

The right to commercially catch fish in the natural waterbodies is granted to enterprises, organizations, joint-stock companies, and legal persons on the fishery sites allocated by the fish protection authorities with the purpose of implementation of the state plan.

The fishery regulations specify the minimum mesh sizes and closure periods on the natural waterbodies. Monitoring and enforcement are carried out by the inspection division of the State Committee on Environmental Protection and Forestry. The inspection division is responsible for the registration of fishing gears and fishing techniques.

6.4.1. Lease of natural waterbodies

Renting or leasing of waterbodies of fishery or fish farming purposes require these information:

1) the volume of the water body area is defined;
2) the amount of caught water animals from the water body for last three years;
3) on the basis of the three-year catch statistics the average catch per year is defined;
4) average annual catch is divided by the area the water body to determine the average productivity of 1 hectare of the water body;
5) the average productivity of 1 hectare is multiplied in the first year of rent by 1.5 percent, in the 2nd year by 2.0 percent and the subsequent years by 3.0 percent from the minimal wages. The sum is the rent for 1.0 hectare of the water body;
6) the rent is established once, in the beginning of the year.

6.4.2. Rights and obligations of enterprises

The fishing enterprise-tenant has the right: (i) to use the allocated natural fishery water body or its site according to the contract of rent; (ii) to perform fish capture in any quantity on the non-quota basis and to sell the products at their own discretion; (iii) to create part-time farms outside the water-security zone for feed production, fish production and other production activities connected with the primary activity; (iv) to create their own hunting-fishing facilities; and (v) to exercise other rights according to the legislation.

The fishing enterprise-tenant is obliged (i) to perform fish capture according to the established legislation and not to violate the nature protection legislation; (ii) not to sub-let the allocated water body; (iii) to carry out annual stocking activities, fish-breeding amelioration, rescue of the juveniles of commercial fishes and other measures to provide the safety and reproduction of fish resources; (iii) to report the condition of fish stocks in natural waterbodies and necessary measures for their reproduction annually in December to Mohiparvar; (iv) to register all fish catches in a routine fishing log; (v) to transport fish with consignment notes; (vi) to register floating craft and observe safety precautions when conducting fish capture; (vii) to provide the statistical reports in the prescribed forms; and (viii) to pay the rent on time.

7. SOCIAL AND ECONOMIC ASPECTS OF FISHERIES AND AQUACULTURE

The social and economic issues of the industry are discussed. The social issues include welfare of workers in the sector, labour and employment conditions and regulations. The economic issues include profitability prospects, financial services, and investment status. The contribution of fishery to employment, food security and the general social and economic welfare of families and communities is broadly described.

7.1. Employment in fishery and aquaculture

The law on privatization of the state property was adopted in May 1997 and the resolution of the Government of the Republic of Tajikistan on state property sale in auctions and tenders was passed in March 2004. With these laws, the government started privatization of the fishery industry, which resulted in an increase in the number of fishery enterprises in the country; some existing enterprises were divided into new smaller ones, and new small farms or dekhkans were established. As a result, the number of people working in the sector increased in comparison with the period 1994 –2003. At present about 1 700 people work in the sector. The number of administrators and managers is 16, which is about hardly one percent of all the employees of the sector.

The most number of experts with diploma in higher education in fishery, fish culture techniques, mechanics and engineering are with the Open Company of A. Djami and the Open Company Shukufon in Kayrakkum. The highest relative density belongs to the enterprises of the Hatlon region including farms and dekhkan facilities. But there is a lack of technical staff in the Kulyab region in the state facilities of Chubek and in the HF of the Open Company Shukufon.

The kind of workers mentioned above do not include the service workers such as those in transport, trade, feed and equipment supply, etc. At the time of the review there was an estimated 2 000 people involved in the fishery sector.

7.2. Social security of fishermen, aquaculturists and other workers

The social security of the workers in the fishing industry does not differ from those in other sectors. The role of the labour unions involved in social protection of fishermen in private enterprises is nil. The salaries of fishermen are low, on the average 100 US$ a month.

Under the current legislation, the employer has to pay the obligatory payment of 24 percent of the whole sum of the worker’s salary to the retirement fund (the worker receives the full salary). In addition, one percent of a worker’s income tax goes to his retirement fund, which the enterprise is obliged to pay to the pension fund.

7.3. Economics of capture fisheries and aquaculture

The technology of fishery in Tajikistan uses only stationary nets. The general economic characteristics of this current low level of technology are low initial investments, low operational costs, low production and thus low gross revenue and low (but stable in the past year) profitability.

Low technology level also characterizes fish farming, which is mainly pond culture of carp species in extensive and semi-intensive system. The economic parameters are low capital investments, low operational costs, low gross revenue, and low profitability but there has been some increase in 2007 with higher yield levels. This indicative cost and return structure (below) of a commercial fish farm producing its own seed reflects a reasonable but still low profitability.

Cost structure
1. Salary – 12 percent
2. Feed, nursing of fry to juveniles, other materials – 74 percent
3. Fuel (electricity) – 9 percent
4. Services – 5 percent

Returns
1. Operating costs – 75 percent
2. Taxes (for the land, water, etc.) – 2 percent
3. Profit – 23 percent

7.4. Credit and investment in fisheries and aquaculture

Tajikistan started the reforms with the old Soviet bank system. New financial institutions began to appear after the creation of the law on banks in 1991. The National Bank of Tajikistan regulated joint-stock banks, including agriculture and industry. The National Bank of foreign trade activities created in 1991 carries out the international currency transactions on the behalf of the Government. The national bank keeps currency reserves of the state.

Loans of 14–26 percent annual interest are allocated to commercial banks depending on terms and the use of the loan i.e. service, trade, production, rural facilities improvement or construction, and other purposes. To receive a loan a business plan and a collateral or guarantee are necessary. The bank receives the mortgage of the basic assets of the enterprise such as vehicles, as loan guarantee. The encumbered means are estimated by an independent appraiser. If the amount of loan is 1.0 million, say, somonis, the encumbered property must be not less than 1.2 million somonis. This is the basic requirement of banks.

The provisions of Resolution No. 21 dated 20 January 1997, provides that pond-based fish farms located mainly in the rural areas are equal to the agricultural enterprises in terms of credit financing, purchase of the POL, formulated feed, agricultural machinery, spare parts and other supplies. Pond aquaculture enterprises can submit a request to the Ministry of Agriculture for a soft loan. The Agroinvest Bank of Tajikistan lends to agriculture and livestock industries, including fishery.

A loan for initial capital is impossible to access by the majority of entrepreneurs in the fishery sector who have no assets to serve as collateral. As an alternative they borrow from relatives, money lenders and other informal sources of credit. In general, the amount of loan from these sources is limited and in most cases only covers the working capital.

The inflexibility in the banking system and the high rates of interest make fishery businessmen reluctant to borrow from banks. There are no financial institutions dedicated to the promotion and development of small-scale and medium-scale fishing, aquaculture and fish processing enterprises.

7.4.1. Microfinance

The fishery sector is not served by microcredit.

7.4.2. Insurance

There are several insurance agencies and companies operating in the country. The largest is a state-joint-stock venture which has 100 offices and a staff of 1 000. Its turnover is 1.0–5.0 million insurance payments a year. The insurance premium is 3–8 percent of the cost of the insured harvest or stock. At present, there is no crop insurance for aquaculture but the insurance agency has confirmed its interest in the sector.

7.5. Fishery and aquaculture in food security and alleviation of poverty

Traditionally, both during Soviet times and immediately after independence, the workers in the fishery sector had a higher status and living standard than the other social layers of the rural areas. Tajikistan is located in the south, with a relatively warmer climate, which means the productivity of the fisheries is higher.

In the 1990s more than six thousand people were employed in the fishery sector. Some large-scale enterprises built fishers settlements with schools and kindergartens for their employees. The residents were provided with food and free medical services. Fishermen were entitled to free medical treatment and their children were given tours to summer camps. Every settlement had a concert club, library and other social facilities. Each enterprise had a strong labour union which promoted the welfare of employees.

Fishing families are usually large and extended, with more than one generation living in one house but only one or two of the members are fishers. The others are in other activities such as cotton culture, cattle breeding, and the social sector and services. With the beginning of the privatization of the fishery sector, the number of workplaces decreased, especially in pond-based fish farms. Many fishermen and experts abandoned their fishing facilities and settlements. Because of neglect and lack of management and care, many houses and buildings had been destroyed and the property squandered. Working conditions of fishermen have become difficult. Companies do little to improve the well-being and health of fishermen and their families as they, too, are going through a crisis.

Fishing is done mostly on lakes and water basins. Along their banks are fishing settlements. Members of the fishing brigades usually work in shifts; while working in a brigade fishermen do not spend money on food because part of the catch is used for food. Besides, the owner of the enterprise provides fishermen with food, clothes, and other necessary means to live along the banks of waterbodies, including winter clothing and special clothes for fishing. Nowadays, inhabitants of coastal villages no longer fish only for consumption; fish is captured for sale mainly.

The majority of fishermen reside in the cities and settlements where there is electricity, potable water and other standard community services. The size of a house depends on a worker’s preference. Some of them have their own houses, some live in apartments. Foremen attract fishermen into working with fishing brigades with high wages; the payment usually is a share of proceeds from the catch. Different enterprises have different conditions. As the brigades are small (5–15 people) and fishing demands certain skills, skilled fishers are well-known and appreciated in the sector. If a fisher is separated from one enterprise, he would soon receive offers from the others.

Statistics on the real incomes of fishermen do not exist. A fair estimate is that fishers in different regions earn not less than 350–400 somonis per month. This is much higher than the wages of workers in other spheres of activity.

There is no system of training for skilled fishers. Some brigades are managed by specialists who have a higher education degree which they acquired before 1991. Some brigades do not have any expert at all with a high educational degree.

Pond-based aquaculture farms have been established close to the cities and large settlements, on lands unsuitable for agriculture. There are no settlements whose inhabitants would raise fish for their own household use; fish farming is a business. There are practically no families whose members would all be in fishing or fish farming. All fish farming settlements have electricity, gas, potable water, and services. The living standard in the settlements of aquaculture enterprises is rather good. Salaries in fish farms are a minimum of 100–

150 somonis per month. Employees work year round. The owners create additional incentives for the staff. Most farms allocate areas of land that the employees could rent to plant kitchen gardens. In recent years many fish farm owners have been selling the fish to their employees at wholesale price, which they would sell on retail and earn additional income.

PLATE 16
Destroyed trout farm near Dushanbe due to flash flood in 2010

Courtesy of: FAO/Raymon Van Anrooy.

Aquaculture has also started to experience the lack of highly trained qualified staff. In many fish farms the managers of the enterprises and leading experts have higher education, also acquired before 1991. But there is no special training programmes to prepare young people for aquaculture.

8. SECTORAL DIAGNOSIS: ANALYSIS OF THE STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS (SWOT) TO FISHERIES IN TAJIKISTAN

The review of the status of the fishery sector in Tajikistan in Chapter 3 describes numerous constraints to the sector's development as well as outlines ways to improve the social, economic and environmental status of the sector to attain sustainable development. A SWOT (strengths, weaknesses, opportunities and threats) analysis was applied to the sector to understand its prospects for development and inform policy decisions on development planning, capacity building and resource allocation. The analysis identified the following:

8.1. Strengths

- The country has the natural conditions that make it possible to create sustainable aquaculture development, such as rivers, lakes, irrigational and drainage network.
- It has abundant and as yet underutilized water resources for fishery and aquaculture.
- There is useful experience in large-scale fish culture and capture fishery from the Soviet times.
- There is a technological foundation for fish culture which can be the platform for developing, without starting from nil, the aquaculture industry.
- The administrative board responsible for the fishery sector in the Ministry of Agriculture has a small membership and does not require a big budgetary allocation for effective work.
- The government supports the privatization of the sector.

8.2. Weaknesses

- The national fishery policy, development strategy and long-term programme to stimulate growth of the sector is still being developed..
- Fishery is not among the Government's priority economic sectors.
- Funding of the department responsible for fishery within the Ministry of Agriculture is very limited, which limits its manpower complement and its management and operational capabilities.
- Low and weak levels of support services in the sector at the national and local levels.
- Scientific research institutes receive very limited funding for research in fishery and aquaculture.
- The majority of hatchery facilities are not being used or have fallen into disuse, which does not allow effective restocking of the ponds and natural waterbodies.
- In the country there is no production of formulated balanced feeds with high nutritional value.
- There is a limited effort at restocking the waterbodies.
- The productive efficiency of fish ponds and waterbodies is low.
- The system of collecting and processing of statistics on the activity of the enterprises of the sector is poor.
- There is a very low level of financing for the sector by private banks, other financial institutions, and the Government; access to credit is poor because of high interest rates.
- Insurance for the fishery sector is not developed in comparison with the insurance of agricultural business.

8.3. Opportunities

- With assistance of FAO in developing the fishery policy and development strategy, the Government can initiate the discussion with primary stakeholders of the sector and create

conditions for greater involvement of private business in the decision-making process and programme implementation.

- The recommended policy and development strategy of the fishery sector in the country (should it be approved and supported by the Government) will be a good foundation for the responsible and sustainable sector development; it would catalyze external assistance for the development of the sector.
- Create the conditions for fisheries development with programmes to attract investments in research, fishery resource management, credit, and building the overall capacity of the sector from private sector.
- Adaptation of modern technologies, experiences of the developed countries, and information acquired through technical exchange with other countries.
- Restocking of water ecosystems and the development of pond and water basin aquaculture to increase the production of fish as a major source of protein in the diet of the population.
- Banks now show interest in granting credits to fishery enterprises.
- Strengthening of cooperation with the international organizations in the development of the sector, education, research, marketing and trade.
- Development of an insurance scheme in the sector.
- Increasing employment in the rural areas.

8.4. Threats

- The waterbodies of the country are not productive during the winter period; during the cold period of the year, fish stop growing.
- The management of irrigation, which is the first user of water, poses risk to fish habitats and their reproduction.
- The increasing level of effluent draining into the river systems pose ecological threats and thus a direct threat to the fish life in rivers, lakes and reservoirs.
- Development of the sector is highly linked to the development of the national economy.
- The level of sector development will be low until financial institutions develop a credit programme for fishery and aquaculture enterprises.
- Fisheries resources management in many respects depends on irrigation, crop cultivation and requires the recognition of the fishery sector as a legitimate user of water and land resources.
- The quantity and quality of courses as well as the higher institutions of learning require substantial upgrading for them to produce trained staff for the sector.

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ANNEX 1

The Fishery Law of the Republic of Tajikistan [6]

The present law adjusts the legal, economic and organizational frameworks with a view of all-round development, preservation and increase in fish stocks, increases in fish production waterbodies and satisfaction of the needs of the population in fish production.

1. GENERAL PROVISIONS

Clause 1. The basic concepts

In the present law the following basic concepts are used:

- fishery is a sector of the national economy covering the system of activities on production, reproduction, protection and trade of fish and fish production;
- fish ponds – special constructions where the whole process of production from reproduction of fish before getting the commercial output is carried out;
- fish products – fish – live, dead, Salty, sun-dried, smoked, canned, caviar;
- brood stock – female and male fish of all kinds, their posterity, the embryos, impregnated eggs having the certificate or the breeding certificate for cultivation;
- commercial fish – a two-year-old fish suitable for trade; and
- Fishing gear – devices permitted by the law for fish capture in natural and artificial waterbodies.

Clause 2. The fishery legislation of the Republic of Tajikistan

Fishery legislation of the Republic of Tajikistan is based on the Constitution of the Republic of Tajikistan and consists of the present law and other normative legal acts of the Republic of Tajikistan. and also the international legal acts recognized by the Republic of Tajikistan.

Clause 3. The Government Authorities of the Republic of Tajikistan in fishery sector

The Government Authorities of the Republic of Tajikistan in fishery sector consist of:

- realization of the uniform state policy in fishery;
- acceptance of normative legal acts in fishery and use of fish stocks;
- definition of the authorized body;
- developing international cooperation in fishery sector, research, development, use and protection of fish stocks; and
- other authorities defined by normative legal acts.

Clause 4. The competence of the authorized body

The competence of the authorized body covers:

- the organization of special icthyological system in industrial waterbodies, development and the approval of normative and methodical frameworks, standards, acts, registration of licences, definition of the ways of development, use and protection of fish stocks and fishery development on the scientific basis:
- carrying out of state expert appraisal of civil-engineering designs, reorganizations of the enterprises, providing technical equipment and other objects affecting the condition of fish stocks;
- regulation of the relationship between the enterprises and the organizations of the fishery sector and the order of implicit observance of the obligations of the parties in cultivation, use of brood species. improvement of the quality and efficiency of the sector and consumers protection;
- obtaining of the necessary information from aquaculture facilities;
- prohibition of the fish product trade at the non-observance of the technology norms of cultivation and production; and
- other responsibilities defined by normative legal acts.

[6] Unofficial translation.

Clause 5. Objectives of the subjects of fishery sector

Persons and entities irrespective of the ownership patterns are subjects of the fishery sector and carry out the following tasks:

- cultivation and protection of fish stocks;
- preservation of the productivity of waterbodies;
- protection of habitats, reproduction conditions and fish migration routes;
- protection of species in the Red book of the Republic of Tajikistan;
- prevention of undesirable changes in water ecosystems in fish cultivation;
- effective and rational use of the pond areas for the cultivation of commercial fish from fry and eggs;
- improvement of fish stocks of the waterbodies; and
- providing of quarterly reports on fish stocks and quantity of capture to the authorized body.

2. MANGEMENT OF THE FISH STOCKS OF THE WATERBODIES

Clause 6. Objects of fishery sector

The objects of the fishery sector are:

- ponds, waterbodies, lakes, rivers, fish, fry, eggs; and
- capture, protection, processing, cultivation of commercial fish and brood stocks and fishing gear.

The natural fish stock of any waterbody in the territory of the Republic of Tajikistan is the property of the republic.

Clause 7. Management of the use and protection of fish stocks of the waterbodies

The subjects of the management of the regulation of relationship on the use and protection of fish stocks:

- allocation of fish stocks in fishery waterbodies of the state value and in the waterbodies of the general use, establishing the order of their use and protection; and
- defining the main user of the fishery waterbodies of the state value.

3. CAPTURE AND FISHERY ARRANGEMENT

Article 8. Allocation of waterbodies and their sites

The waterbodies or their sites can be allocated to legal and physical persons with the purpose of fishery and aquaculture. The order, rules and conditions of management of the fish stock capture and aquaculture, allocation of fishery waterbodies or their sites, protection of fish stocks and their habitats is established by the authorized body. Physical and legal persons on the allocated waterbodies or their sites are obliged to carry out fish protection and melioration activities to improvement the condition of waterbodies and conditions of fish reproduction and other water organisms. to undertake activities in the reproduction of food fish and to maintain the appropriate sanitary condition of the coastal fishery sites.

Clause 9. Amateur and sports fishery

The order of the organization and conduct of amateur and sports fishery is established by the authorized body.

Clause 10. The priority right of using waterbodies

The priority right to use the waterbodies and their sites for fishery activities belongs to the specially authorized organs involved in fish capture and aquaculture.

Clause 11. Scientific purposes of fishery

The main user of a waterbody is obliged not to interfere with the use of the waterbody for the organization and carrying out scientific researches.

Clause 12. Fishery in waterbodies of protective zone and reserves

The commercial entities who are involved in commercial fishery can perform fish capture in the waterbodies of protective zone and reserves in coordination with the authorized body.

Clause 13. State environmental appraisal
The construction of industrial and other objects negatively influencing the condition and reproduction of fish stocks can be performed only after receiving the positive conclusion of the state environmental appraisal from the authorized body.

4. LIMITATIONS OF WATER RESOURCES UTILIZATION

Article 14. Establishing the limitations
In case of threat to the condition of fish stocks (mass destruction of fish, disease, poisoning and pollution of the water habitats, etc.) the state body responsible for the environmental protection has the right to establish the terms of the closure of fishing in coordination with authorized body of the sector.

Article 15. Introduction and stocking of certain species in waterbodies
Introduction and fish stocking in waterbodies of the Republic of Tajikistan of certain fishes and other water organisms is allowed at the presence of the special sanction from the corresponding state body.

5. AQUACULTURE DEVELOPMENT FUND

Article 16. Formation of the aquaculture development fund
Aquaculture development fund is formed from the following sources:
- financing from the central government and local budgets for the implementation of the target aquaculture programmes;
- donations of physical and legal persons for fishery development;
- service payment resources;
- resources of ecological fund;
- other funds allowed by the current legislation of the Republic of Tajikistan.

Article 17. The support of the aquaculture development fund
State or non-state funds of the aquaculture development can be created with the purpose of the reproduction, protection of fish stocks, fish production of the Republic of Tajikistan, and also for the additional financing.

6. PROTECTION OF FISH STOCKS AND THEIR HABITATS.

Article 18. Measures on the support of fish stock protection and their habitats
Protection of fish stocks and their habitats is provided by:
- establishment of rules, Norms, terms and other requirements on protection, use and reproduction of fish stocks;
- implementation of the measures of fish stocks protection stipulated in the construction projects. influencing the condition and reproduction of fish stocks and their habitats;
- registration of fish stocks;
- restriction of fish capture in the waterbodies where introduction of new kinds of fish is carried out;
- carrying out scientific researches on the rational use and reproduction of fish stocks;
- preventive maintenance of infectious diseases of fish; and
- compensation of the damage caused to fish stocks and their habitats.

7. FINAL PROVISIONS

Article 19. Responsibility for the violation of the present law
Physical and legal persons bear the responsibility for the violation of the present Law according to the legislation of the Republic of Tajikistan.

Article 20. Enforcement of the present law
The present law is to be enacted after its official publication.

The President of the Republic of Tajikistan, E. Rakhmonov. Dushanbe, 22 December, 2006. #220.

ANNEX 2

General Fishery Provisions [7]

The present Rules are developed in conformity with clause 8 of the Law of the Republic of Tajikistan "On fishery" and adjust the order of the protection of fish stocks, other water animals and plants and their capture.

1. Basic concepts

Fishing enterprise is an organization and facilities which is engaged in fish capture;
Floats – one capture act;
Fishing ground – a place for capture with nets;
Fish kill – an occurrence of fish destruction by oxygen deficiency;
Cutting – destruction or cutting of water vegetation;
Fishing log – the book of the account of fish capture;
Stationary fishing gear – stationary nets, weights, etc.

2. Fish capture is performed by legal and physical persons (fishing organizations) on the fishery sites designated by the fish protection authorities. Legal entities involved in aquaculture, capture and reproduction of fish are free from payment for the used fish stocks. Outside fishery sites and on the sites for general use, fish capture is performed with the tickets given out by the fish protection authorities to each vessel, brigade or the commercial fishing gear.

3. Fishing enterprises and other organizations engaged in fish capture are obliged:

- by their own means in coordination with fish protection authorities to make clearing of the allocated fishing grounds, floats and other places of fish capture, fishery and ameliorative work;
- to maintain in an appropriate sanitary condition the allocated coastal sites and waterbodies;
- to allow no violation of the current legislation in the protection of fish stocks and on the regulation of fishery in the waterbodies of the Republic of Tajikistan, on the fishery sites allocated to them;
- to undertake no work that changes the natural conditions in the waterbody on the fishery sites without the permission of the fish protection authorities;
- to designate the coastal borders of fishery sites with signs according to the sample established by the fish protection authorities;
- keep the register on each fishery site or a vessel according to the established form, and present it to the fish protection authorities if required;
- to present to the fish protection authorities the registration materials on the fish capture;
- let fish protection inspectors to the fishing grounds, vessels and other floating means, warehouses, places of fish receiving and fish processing factories for the check of gear and capture means and the survey of the captured fish; and
- not to exceed the limits (as much as possible admissible norms) established for fish capture and the fishing gear.

4. Fish protection inspectors of the Ministries of Agriculture and Nature Protection have the right:

- in coordination with the scientific and fishery organizations to change the terms of fishing closure and capture of other water organisms up to 15 days for earlier or later period, depending on hydro-meteorological conditions without changing its general duration;
- in coordination with the scientific and fishery organizations to define the borders of spawning sites and wintering fish holes;
- if necessary, to give permission to perform fishing in fish kill waterbodies all with any fishing gear and at any time to enterprise, organizations and sports societies at occurrence of fish kills;

[7] Unofficial translation.

- to permit fish capture for scientific and research purposes, aquaculture, introduction, restocking and control capture with any fishing gear in all waterbodies and at any time of the year;
- to permit capture of coarse, stunted and predatory kinds of fish, except for the forbidden places and in closure terms, with the gear not stipulated for the fish capture by the fishery rules;
- to permit fish capture with nets by means of hanging pen in certain weedy sites of waterbodies;
- to give permission to the fishing enterprises, voluntary and sports societies in accordance with the centralized order to perform bait fish capture with the limited fishing gear in the places and under the terms specified by fish protection authorities with or without payment; and
- to permit free visiting of the hydraulic engineering constructions and reserves with fishery waterbodies, and also the enterprises and organizations dumping sewage and production wastes into the fishery waterbodies.

5. It is forbidden:

- to locate fishing, transport and other vessels within the borders of the places prohibited for fishery, except in emergency cases (i.e. storm, fog, failure, etc.);
- to construct dykes and restore destroyed rises along the routes to the spawning grounds of fish without coordination with the fish protection authorities;
- to arrange blockages and complete artificial obstacles of the rivers, channels and canals, to drain estuaries and lakes, except for the cases when these hydraulic engineering or ameliorative activities are undertaken in coordination with the fish protection and sanitary authorities;
- to take gravel and sand from the places of natural spawning of food fish and the coastal sites important for fishery;
- to harvest cane, reed and other water plants in the zones prohibited for fishery without coordinating with the fish protection authorities;
- to dump the ground taken up for the dredging and cleaning in spawning places, wintering fish holes and in fishing grounds;
- to dump into fishery waterbodies, on their coastal areas and onto the ice of these waterbodies not cleared and not neutralized sewage of the industrial and municipal enterprises. bark, sawdust, and also other production wastes harmful to fish;
- to perform logging of wood in the coastal areas of the rivers, their inflows and lakes that are the places of spawning of valuable kinds of fish, at the distance less than one kilometre from the coast; and
- to undertake explosive works in fishery waterbodies without the permission of the fish protection authorities, except for urgent works on compulsory descent of water from the water basins which have formed as the result of natural calamities. Fish protection authorities should be immediately informed about explosive works performed in the specified cases.

5.1. In using waterbodies for fishery, it is prohibited:

- to perform introduction and cultivation of new kinds of fish without a corresponding biological substantiation and the sanction of the fish protection authorities;
- to use any sort of the fishing gear from waterbodies infected with parasitic and infectious diseases of fish to other waterbodies without preliminary disinfection of these gear;
- to be located on a waterbody or in the surrounding areas with the fishing gear which is prohibited for the application in the given area and at present time by the operating rules of fishery, and also with the explosive and poison gases;
- any fishery activity in newly created waterbodies and water basins until further notice, and the fish capture in wintering holes;
- any fishery within all year at dams, sluices and bridges at the distance closer than 500 meters;

- to occupy more than 2/3 of the width of the river channel, streams or channels with the fishing gear and other constructions for fish capture, and also simultaneous or serial setting of seines in the lock from the opposite coast;
- to establish stationary fishing gear in chessboard order;
- to capture fish with the application of explosives, an electric current, pricking gear, and also the fire and pneumatic weapon;
- to capture fish with rutting, way gaffing, by means of rattling and hanging; and
- to use new fishing gear and capture methods without the permission of the fish protection authorities.

5.2. Reception, sale, processing and storage of the fish with size less than the size established by the fishery rules of trade measure, without necessary documents is forbidden.

5.3. It is forbidden to apply the fishing gear with the mesh below the sizes stipulated by the fishery rules. The mesh size of the fishing gear will be defined by measurement of distance between 11 units on a plait and division of the received number on 10.

5.4. Any fishery within all year is forbidden:

- before the of outfalls the rivers and channels, at the distance of 200 m in both parties from the outfalls and to the depth of a waterbody, and also in the upstream of the river or the channel at the distance of 150 m.;
- in the upper part of Kayrakkum water basin above the 5th section line and upwards the river Syr-Darya during 5 km from the place of its confluence into Kayrakkum water basin.

5.5. Any capture is forbidden in the following terms:

- in all rivers, lakes, and water basins of the Republic of Tajikistan from April 1st to June 15th;
- capture of trout in all rivers and water basins of the southwest Tajikistan from October. 15th to December 15th.

5.6. Capture of the following species is forbidden:

Fringe barbel sturgeon, pike asp, Aral asp, the Aral salmon, big ich and Amudarya and Syrdarya ich in all waterbodies throughout the year, as these species are few and rare, and are on the Red Book of the Republic of Tajikistan.

5.7. It is forbidden to organize muskrat capture and facilities for cultivation of water fowls in the fishery waterbodies without the coordination with the fish protection authorities.

6. Vessels of trade and amateur fishery are registered in accordance with the order established by the Government of the Republic of Tajikistan.

7. The by-catch of fish of non-commercial size is allowed to a level that is below the norms established by the rules of fishery. In case the established norm is exceeded for by-catch fish of non-commercial size, fish capture in the given place is terminated or the fishing gears are replaced with some other type with larger mesh. Fishes prohibited for capture should be released into the waterbody alive.

8. Catches that contain fish of non-commercial measure that violate the present Fishery Rules is confiscated by the fish protection authorities and delivered to fish factories or to the trading organizations under the operating reception prices.

9. Hauling in of the fishing gear, applied with the violation of the fishery rules, and the delivery of the confiscated gear, water craft and captured fish up to the places of delivery is made by the violator, as ordered by the fish protection authorities.

10. In case of regular violation of the fishery rules and the contract on using a fishery site by the organization to which the site is allocated, the contract may be terminated in accordance with the established order, and before the cancellation of the contract its validity can be suspended by the fish protection authorities. The fishing ticket at regular or gross violations of the fishery rules can be taken away by the fish protection authorities.

11. Persons guilty of violation of the Fishery Rules of and fish stock protection established by the Provision on the protection of fish stocks and fishery regulation in the waterbodies of the Republic of Tajikistan are held administratively and criminally liable according to the current legislation of the Republic of Tajikistan. The damage caused to citizens by illegal

capture, fishing or destruction of valuable kinds of fish (including capture with the purpose of preparing sturgeon and salmon caviar) in fishery waterbodies is compensated by violators under the rates operating in the Republic of Tajikistan.

12. The force of the present Rules of fishery extends on all fishery waterbodies which are located at the territory of the Republic of Tajikistan, except for the waterbodies of the state hatcheries, feeding, breeding and dekhan farms, and other agricultural enterprises and organization.

13. Commercial size

Minimally admissible fish capture size (cm):

Sazan	30	False osman	18
Gold fish	24	Common catfish	60
Aral asp	45	Pike	28
Pike perch	40	Sabre fish	25
Marinka	20	Trout	25
Seven khramulya	25	Carp	50
Grass carp	50	White-eye bream	20
Common bream	22	Snakehead	24

14. Maximum admissible by-catch of the fish with non-commercial size is no more than 10 percent under the account from the general capture of the protected kinds of fish.

15. Mesh sizes of fishing gear

Minimum admissible mesh sizes of fishing gear (mm)

Name	Seines			
	Bag, mooring buoy	Gear	Wings	Webbing
Seines for the capture of ordinary fish	30	40	45	
Seines for capture melkochastikovyh fish	22	26	32	
Nets: stationary, single-shift, frame, box.				24
Floating, frame, box nets				50
Tyke nets, secrets, kurlands, merejas, cutters and other traps	30		40	
Vandys, fish traps, ropes (gaps between the bars)	35			

ANNEX 3

Technical specifications of live and fresh fish

The present specifications (С.2 ТУ 9240 РТ 00401064.002–99) apply to live and commercial fish, stocking material, fresh pond fish including common carp, grass carp, bighead carp and buffalo, trout, bester, pike perch, asp, common catfish, and snakehead, that are intended for cultivation in ponds, lakes, cages and water basins and sold in shops. Compliance with these specifications is obligatory.

1. TECHNICAL REQUIREMENTS

The weight of the pond fish fry must conform to the standards specified in Table A3.1.

TABLE A3.1

Name	Age	Weight of individual fish (g)		
		Medium	Large	Non-standard
Common carp	Fingerlings and yearlings	15–25	> 25	< 15
Grass carp	Fingerlings and yearlings	20–30	> 30	< 20
Silver carp	Fingerlings and yearlings	20–30	> 30	< 20
Bighead carp	Fingerlings and yearlings	20–30	> 30	< 20
Buffalo	Fingerlings and yearlings	15–25	> 25	< 15

1.2. The weight of live, fresh pond fish must conform to the norms given in Table A3.2.

TABLE A3.2

Name	Age	Weight of individual fish (g)		
		Medium	Large	Non-standard
Common carp	2 and more	250–400	> 400	< 250
Grass carp	2 and more	300–500	> 500	< 300
Silver carp	2 and more	300–400	> 400	< 300
Bighead carp	2 and more	300–400	> 400	< 300
Buffalo	2 and more	250–350	> 350	< 250
Bester	2 and more	500–700	> 700	< 500

1.3. Commercial fish of the lake-river group

TABLE A3.3

Name	Length of each species from mouth to tail (cm)		
	Medium	Large	Small
Common catfish	40–53	> 53	< 40
Sazan	30–40	> 40	< 30
Pike perch	30–40	> 40	< 30
Asp	30–40	> 40	< 30
Aral roach	12–18	> 18	< 12
Common bream	15–22	> 22	< 15
Crucian carp	16–20	> 20	< 16
Sabre fish	16–24	> 24	< 16
Pike	20–30	> 30	< 20

1.4. The organoleptic features of fish must conform to the norm given in Table A3.4.

TABLE A3.4

Name of features	Description
External features	Fish can be of various fatness; scales and an integument of natural coloration. Fish must have no signs of diseases and should not contain either an outer or inner larva or adult forms of helmiths representing health hazard to humans. Insignificant reddening of the coloration of carp and carp forms are possible.
Gill coloration	Red, not slithery.
Eyes	Light coloured, protuberant.
Firmness	Dense.
Tail	Characteristic of fresh fish without petrol or any other foreign smell.

Notes:

1. Acceptable density of the scaly cover is up to 10 percent of the general surface of the fish body.
2. Each catch from each pond must have the veterinary certificate and quality certificate.
Activities aimed at eradicating fish tapeworm disease should be carried out as the sanitary protection of the environment to avoid the receipt of sewer drains into waterbodies, and depuration must be carried out if the fish is detected to be infected with tapeworm larvae.
3. The content of toxic elements, histamines, nitrosamines and pesticides in fish should not exceed the admissible levels established by the medical and biological requirements and sanitary standards of the food staple and foodstuff quality, as set by the authorities of the state sanitary–epidemiological supervision.

2. ACCEPTANCE PROCEDURES

2.1. Fish is delivered in lots. A lot is any quantity of fish in weight up to 1 tonne, in one or several live-fish carriers, registered in one document.

2.2. Fish is accepted for weighing of the whole lot.

2.3. Net weight of the lot is defined by weighing in a mesh stretcher or trellised containers. Then the container is weighed. The difference in weight gives the weight of the fish lot.

2.4. Acceptance of one lot of fish by consumers should be made within no more than one hour.

2.5. The waybill of each fish lot should specify the following:

- name of the facilities and address of the supplier;
- kind and weight of fish;
- date of capture;
- designation of the present specifications; and
- time of shipment.

2.6. The control of the content of toxic elements, histamine, nitrosamines and pesticides is carried out according to the order established by the manufacturer of the production in coordination with the authorities of the state sanitary – epidemiological supervision.

3. TEST METHODS

3.1. To define the weight of one fish from each lot, 25–20 fishes are drawn randomly as a sample. Individuals are weighed in a special dry container (lattice, net). The weight of the container is subtracted from the total weight. The result is divided into the quantity of the fish taken for the test. This is the way to define the average weight of an individual of the delivered lot of fish.

3.2. Organoleptic evaluation of the quality of fish is made visually.

3.3. Definition of flavour qualities of fish is made by trial cooking without application of spices, seasonings or salt. For the trial cooking, three to five individuals from each lot are selected. Cooking should be done in a clean pot and water containing no extraneous smells and tastes.

3.4. In case of nonconformity of any parameter to the requirements of the present specifications, another sample is drawn from the same lot of fish. The result of the second check applies to the whole lot.
3.5. Preparation of the tests to detect toxic elements in accordance with GOST 26929.
3.6. Definition of the content of toxic elements – in accordance with GOST 26927, GOST 26930 – GOST 26934 or GOST 30178.
The contents of pesticides, histamine, nitrosamines is defined by the methods approved by the authorities of the state sanitary – epidemiological supervision.
4.1. Transportation of fresh fish should be made in special live-fish tanks or other means that assure preservation of fish quality. The tank should be equipped with aeration equipment. All tanks should have the sanitary passport. In each separate container or the compartment of the tank, the fish should be sorted by kind and size. In each container, about 5 percent (under the account) deviations from the requirements of the present specifications are admissible.
4.2. Fresh fish is transported in pure clear water without harmful impurities and poisonous substances. When transporting fish in tanks or other containers, the fish-to-water ratio should be 1:3, and the temperature of the water should not exceed 15 °C. When the water temperature is above 15 °C, the fish-to-water ratio should be 1:4 or 1:5.
4.3. Transport of live fish in live-fish containers without changing the water and additional enrichment by oxygen should not exceed four hours.
4.4. At delivery of fish to a trading network or to the customer, the difference of water temperature in the container in which the fish is transported and that of the container of the receiver (addressee) should not exceed 4 °C.

ANNEX 4

Plans under the Fishery Sector Development Programme in the Republic of Tajikistan, 2009–2015

No	Name	Terms	Responsible agency
1	The organization and fish production on the basis of Nurek reservoir	2009–2010	The Ministry of Agriculture, Agency of Land management and Geodesy, Local executive committees
2	Reconstruction of Baypazinsk fish facilities	2009–2011	The Ministry of Agriculture, Academy of Sciences, Local executive committees
3	Inventory productive sector	Permanent	The Ministry of Agriculture Statistics Department
4	The organization of a breeding centre in Zarafabad region	2009–2011	The Ministry of Agriculture, Agency of Land Management and Geodesy, local executive committees
5	The organization of dekhkan, farmer and joint stock fish facilities in Khatlon and Sagdin regions	2009–2015	The Ministry of Agriculture, Agency of Land Management and Geodesy, Local executive committees
6	The organization and conducting in full power the activity of the fishery facilities Firuz – 1, Kumsangir region	2009–2011	The Ministry of Agriculture, Agency of Land Management and Geodetics, Local executive committees
7	Developing and representations of the investment projects about fishery development and introduction of new modern technologies	2009–2015	The Ministry of Agriculture, The State Committee of Investments and State Property, National Bank of the Republic of Tajikistan
8	Developing and management of normative legal acts about fishery	2009–2011	The Ministry of Agriculture, Ministry of Justice, Institute of Zoology and Parasitology of AS
9	Preservation and augmentation of the new species and breeds	2009–2015	Ministry of Agriculture, Institute of Zoology and Parasitology of AS
10	Organization of industrial fishing in the Republic of Tajikistan	2009–2015	Ministry of Agriculture, Institute of Zoology and Parasitology of AS
11	The organization of the protection of fish resources in the waterbodies of the Republic of Tajikistan	Continuous	Ministry of Agriculture, Ministry of Finance Ministry of Justice
12	Training of zoology engineers – fish farmers	2009–2015	Ministries of Economy and Trade; Finance; Education; and Agriculture

ANNEX 5

Policy and Strategy for Fisheries and Aquaculture Development for Poverty Alleviation In Tajikistan (2010–2025)

The policy and strategy provides the long-term and mid-term guidance to the sector. It is the first fisheries and aquaculture policy since independence of the Republic of Tajikistan. It was prepared with the following aims:

- To guide the long-term sustainable development of the sector,
- To raise the contribution of fisheries and aquaculture to poverty alleviation and food security objectives of the Government,
- To assist fishers and aquaculturists to provide healthy and safe products to the Tajik population,
- To enable fishers and aquaculturists to invest safely and develop their businesses profitably,
- To strengthen collaboration between the Government and private sector entrepreneurs, and
- To increase Governmental and donor support to the sector.

This policy and strategy was approved by the Minister for Agriculture, H.E. Mr Kasimov on November 24, 2010.

I. THE NATIONAL AND INTERNATIONAL CONTEXT

The policy and strategy is based on the main national development frameworks existing in the country, which include the National Development Strategy (up to 2015), Poverty reduction strategy of the Republic of Tajikistan 2010–2012, and the Concept of Agrarian Policy of the Republic of Tajikistan. In addition, at international level the context is provided by the UN Millennium Development Goals (MDGs) and international agreements and conventions related to fisheries, aquaculture and the aquatic environment to which the Government of Tajikistan is signatory.

II. SECTORAL CONTEXT

A diagnosis of the fishery sector, mainly through an analysis of its strengths, weaknesses, opportunities and threats (SWOT), indicates a few strengths, which include the abundance of suitable fishery resources, a legacy from the Soviet Union of good science and technology, the presence of a number of private fishery, fish farming, processing and trading enterprises that have shown receptivity to innovation, and a legal framework already established for fishery management and development. On the other hand, the industry has a weak technology and manpower base owing to the neglect that it had suffered after independence and during the civil strife. The transition to a market economy has not been accompanied by adequate technological and policy support to encourage private sector investment. Sector management, as yet, lacks the private sector mechanism: the country has no union, cooperative society or association of fishers and fish farmers at the national level.

Threats to the productivity of the water resources in terms of suitability for fisheries and aquaculture development come from the use of water for crop (mainly cotton) irrigation and the deterioration of the water resources from various sources of pollution. Water resources suitable for fishery development are mostly managed by other sectors management mechanisms, such as irrigation, and hydropower and the networks of water resource users led by other sectors, not by fishery organizations. This problem of being a secondary user of

water can be addressed by a better integrated management of the agriculture and fishery sector, in which also the hydropower sector should be involved. A poorly managed privatization process and the wrong policies could lead to the concentration of ownership of resources in a very few establishments or individuals. The exclusion of the poorer and weaker segments of the population involvement in and access to fisheries resources is widely considered as undesirable in Tajikistan. The other extreme is that ownership becomes extremely diffused that production units lack the necessary economies of scale to become profitable.

The sector has considerable natural assets and what it needs are effective tools, guidelines and support to improve its economic viability and social and environmental responsibility. In short, the sector needs to prove that it is worth to invest in. A progressive and modernized fishery and aquaculture sector could contribute much more than today to improving national wealth and the social- and economic situation of rural communities.

III. THE POLICY

VISION

The long-term vision for the fisheries and aquaculture sector in Tajikistan is "*To develop sustainable fisheries and aquaculture in Tajikistan which contributes to poverty alleviation, provides social and economic benefits to rural and mountain communities, will be able to meet growing consumer demands for aquatic foods and products that are of high quality, safe, competitively priced and are produced in an environmentally responsible manner, using the existing water resources potential, and with maximum opportunity for profitability in all stages of the product chain*."

MISSION OF MOHII TAJIKISTAN

The Government of Tajikistan established in December 2006 the State Unitary Enterprise (SUE) "Mohii Tajikistan" (hereinafter referred to as "Enterprise"). The SUE was registered with the Ministry of Justice on 24.06.2004. № 001 1062, established in accordance with the Law of the Republic of Tajikistan "On fishery", the Civil Code of the Republic of Tajikistan and the Government of the Republic of Tajikistan on 28 December 2006, # 591.

In line with the vision statement of this long-term policy, the mission of Mohii Tajikistan is "to support the development of sustainable economic opportunities for fisheries and aquaculture in a manner that is environmentally sound, socially acceptable and consistent with applicable laws, regulations and government policies".

GUIDING PRINCIPLES

The implementation of the Policy and Strategy will be guided by the following principles:

A. The development of Fisheries and Aquaculture within the Tajik economy requires a strong nationally recognized Mohii Tajikistan in the public domain working closely together with other institutions – both public and private. In particular, Mohii Tajikistan will focus its resources on its strengths, and within this limitation will seek to improve the conditions for all categories of fishers and fish farmers from large too small.
B. Mohii Tajikistan will support fisheries and aquaculture development in a manner consistent with its commitments to ecosystem-based and integrated management, as set out in national legislation, regulations and policies.
C. Mohii Tajikistan will address issues of public concern in a fair and transparent manner, based on science and risk-management approaches endorsed by the Government.

D. Mohii Tajikistan will communicate with the fishers and fish farmers and be informed by their views on issues and needs pertaining to fisheries and aquaculture development and will respond to the needs in a manner that is solutions oriented.
E. Mohii Tajikistan, recognizing that fisheries and aquaculture are legitimate uses of land, water and aquatic resources, will work with local governments to provide fishers and fish farmers with predictable, equitable and timely access to the aquatic resource base.
F. Mohii Tajikistan will further base its activities in the Fisheries and Aquaculture sector on the internationally accepted principles as set out in the FAO Code of Conduct for Responsible Fisheries.

OVERALL GOALS

The overall goals are divided into economic, social, ecological and institutional goals in order to highlight the four impacts desired from aquaculture and fishery development. The goals are interlinked and complementary. Moreover, it is recognized that in implementing the Policy and Strategy, efforts should be balanced to achieve economic, social, ecological and institutional objectives rather than maximize any single result which may result in negative side effects.

The overall goals for the fisheries and aquaculture sector in Tajikistan are the following:

Social: Alleviate poverty and ensure food security; increase employment while improving gender equity and generate higher incomes and better livelihoods in rural and mountain areas; improve the health and nutrition of the population.

Economic: Increase the production under market economy conditions; increase economic viability in the capture fisheries and aquaculture sector, including profitability of fish farming, fishing, fish processing, fish marketing and trade and support the generation of export earnings.

Ecological: Improve protection, conservation and rehabilitation of aquatic biodiversity and the aquatic environment in general; maintenance and enhancement of the productivity of land, water and available genetic resources.

Institutional: improve the research, educational and management capacity of the national institutions and stakeholders involved in capture fisheries and aquaculture; strengthen linkages, cooperation and coherence of approaches with other sectors.

IV. THE STRATEGY

The strategy contains the timeframe for the practical implementation of the priority overall goals of the policy, a mechanism for supporting the implementation of the strategy, a mechanism for monitoring and evaluating the status of implementation, and the logical planning framework. The logical framework specifies the overall goals of the policy and strategy, the development objectives under each goal, and the specific objectives of the strategy required to attain each development objective.

TIMEFRAME

- The Strategy shall be for a 15 –year period from 2010–2025, subject to a national review process and adjustments every 5 years.

- Implementation plans or programmes (called Development Programmes) will be for shorter periods (5 years).
- A first Aquaculture Sector Development Programme was approved in 2009 and will run from 2009 to 2015. This first plan shall be complemented in line with the objectives as determined in the Strategy. The Development Programmes shall be "rolling" programmes rather than discrete programmes that have a definite life-span.
- Periodic monitoring and review shall be conducted and a next Development Programme will be developed in the last year of the five-year Development Programme to ensure that the next programme can fully benefit from the reviews.

Timeframe for the Strategy, Development Programmes and the monitoring/review process

Year 20...	**09**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
National strategy for the development of fisheries and aquaculture for poverty alleviation in Tajikistan (NSDFA I)																	
NSDFA																	
Development programmes ("implementation programmes")																	
ASDP[1]			ASDP					DPFA 2					DPFA 3				
DPFA[3]				CDPFA[2]													
Review process																	
Reviews																	

[1] ASDP: Aquaculture Sector Development Programme in Tajikistan (2009–2015)
[2] CDPFA: Complementary Development Programme for Fisheries and Aquaculture in Tajikistan (2011–2015)
[3] DPFA: Development Programme for Fisheries and Aquaculture in Tajikistan (2011–2015)

IMPLEMENTATION

The daily implementing of the Strategy will be carried out by Mohii Tajikistan, as lead implementing agency at national level for fisheries and aquaculture development and management in Tajikistan.

Mohii Tajikistan will establish a small unit, which will be called **Strategy Implementation Support Unit (SISU)**. This Strategy Implementation Support Unit will have the following specific tasks and duties:

- Collect and analyze information on the activities and projects carried out under the Strategy and report on the progress made in the implementation of the strategy (against agreed indicators) on an annual base to the National Fisheries and Aquaculture Committee (the monitoring mechanism of the Strategy).
- Draft in cooperation with experts and other interested stakeholders the short- and mid-term specific programmes under the Strategy for the subsectors of aquaculture and capture fisheries (for review and endorsement by the National Fisheries and Aquaculture Committee).
- Support Mohii Tajikistan to attract donors, NGOs and Governmental agencies to support and finance projects and activities under the Strategy and assist Mohii Tajikistan in the proper reporting on the progress of these projects and activities.
- Compile the necessary socio-economic, financial and resource information related to fisheries and aquaculture development in Tajikistan, in support of project formulation under the strategy.

MONITORING

The **National Fisheries and Aquaculture Committee (NFAC)** will be established on the basis of (and replace) the Capture Fisheries Council. It will have the following specific tasks and duties:

- Provide scientific and technical advice to Mohii Tajikistan on the implementation of the strategy.
- Assess and evaluate the implementation progress of the strategy (against agreed indicators) based on the annual reports of the Strategy Implementation Support Unit.
- Review and endorse the short- and mid-term specific implementation programmes under the Strategy for the subsectors of aquaculture and capture fisheries as prepared by the Strategy Implementation Support Unit.
- Prepare modifications and updates to the Strategy when necessary and work in a participatory manner with all key stakeholders on the follow-up of the strategy.
- Assist regional/district structures to implement development at ground level and hold discussions with farming communities to gauge current levels of interest in aquaculture and fisheries within each of the regions/districts.
- Assist in compiling the necessary socio-economic, financial and resource information related to fisheries and aquaculture development in Tajikistan.
- Provide advice on capture fisheries coordination and management (to guarantee a sustainable level of exploitation and sustainable practices of exploitation)
- Respond on behalf of the sector at large to requests from Mohii Tajikistan, the Ministry of Agriculture or the Parliament of Tajikistan, for advice on strategic issues related to capture fisheries and aquaculture development and management.

DEVELOPMENT OBJECTIVES

The development objectives for the Tajik fisheries and aquaculture sector are organized under four development axes. The objectives are the following:

AXE 1 – RESPONSIBLE USE AND PROTECTION OF AQUATIC LIVING RESOURCES

Rational: Only a responsible use of living aquatic resources can ensure that present and future generations will benefit from aquatic resources as sources of food, employment, income, recreation or indirect benefits. Responsible use requires enhancing the management framework and practices for sustainable fisheries and aquaculture development, guided by the FAO Code of Conduct for Responsible Fisheries.
Protection of fish habitats, aquatic biodiversity and the environment, preservation of water quality and integrated, shared and precautionary use of water resources are key elements to ensure that development objectives of this strategy can be sustainably achieved and that future generations can enjoy the benefits generated by the aquatic resources.

1.1 Strengthen and/or develop management strategies and plans for fish farming, capture and culture-based fisheries
1.2 Support the integrated use of water resources
1.3 Conserve the aquatic biodiversity and protect all waters inhabited by endangered fish species

AXE 2 – INCREASE SOCIAL AND ECONOMIC RETURNS FROM RESPONSIBLE FISHING AND FISH FARMING

Rational: Increasing the production from fisheries and aquaculture activities in a sustainable manner will generate important social and economic returns to the country. Increasing fisheries and aquaculture production will contribute to rural poverty alleviation, the achievement of food security and national nutritional and gender objectives and the general economic conditions in Tajikistan. An increase in production will directly benefit the enterprises in the sector and the livelihoods of their employees and their families.

2.1 Develop responsible fish farming
2.2 Develop responsible fisheries and culture-based fisheries
2.3. Improve the fisheries and aquaculture sector investment climate for the private sector

AXE 3 – STRENGTHEN THE LEGAL, POLICY AND INSTITUTIONAL FRAMEWORKS FOR FISHERIES AND AQUACULTURE

Rational: Efficient, accountable, knowledgeable private and public institutions and stakeholders are required to support and guide the responsible development of fisheries and aquaculture. For the improvement of governance in fisheries and aquaculture it is essential that appropriate legal and institutional frameworks will be put in place. The institutional capacity in the fishery sector needs to be enhanced so that fisheries institutions (in a large sense) are able to guide the development of the sector in an effective and sustainable manner and work towards the achievement of specific objectives for the future. Institutional frameworks will only be effective if suitable policy and legal frameworks are established at the same time in support of the sector.

3.1 Reinforce institutional and human capacities to manage and support fisheries and aquaculture
3.2 Rehabilitate research and educational capacities
3.3 Enhance the scientific and information basis for fisheries and aquaculture management
3.4 Modernize the legal, regulatory and policy framework for fisheries and aquaculture
3.5 Enhance regional and international cooperation on fisheries and aquaculture issues

AXE 4 – IMPROVE POST-HARVEST AND TRADE

Rational: The availability of and access to fish and fisheries products for the Tajik population decreased tremendously since independence. Most fish processing and cold storage facilities have closed and the number of companies involved in fish trade is now very limited. It is important to rehabilitate the post-harvest and trade sector, by integrating the sector in Tajik modern society. Only then the fisheries and aquaculture sector will be able to provide consumers with high quality, healthy and safe products as demanded by them for affordable prices and competitive with the world market.

4.1 Develop responsible fish processing, marketing and trade
4.2 Promote the consumption of highly nutritious, healthy, high quality and safe fish and fishery products in Tajikistan

SPECIFIC OBJECTIVES

The specific objectives are designed with the purpose to achieve each of the development objectives of the Strategy. The specific objectives for the fishery and aquaculture sector in Tajikistan over the period 2010–2025 are the following:

AXE 1 – RESPONSIBLE USE AND PROTECTION OF AQUATIC LIVING RESOURCES

1.1 Strengthen and/or develop management strategies and plans for fish farming, capture and culture-based fisheries

Specific objective 1.1.1 Develop at least 3 management plans (on a water body, territorial and integrated basis) for capture fisheries, culture-based fishery and fish farming based on sound analysis of water body biological potential and local economic and social conditions. These first management plans will serve as learning process for further extension and development of management plans.

Specific objective 1.1.2 Demonstrate and develop co-management models and equitable fishing rights system for fish farming, capture and culture-based fishery in support of the developed management plans.

Specific objective 1.1.3 Strengthen and further develop the Monitoring, Control and Surveillance system (MCS) to combat illegal, unreported and unregulated (IUU) fishing activities and improve compliance with rules and regulations.

1.2 Support the integrated use of water resources

Specific objective 1.2.1 Increase (formal) collaboration between the fisheries and aquaculture sector and other water resource using sectors (hydroelectricity, construction of new reservoirs, agriculture, irrigation, transport, tourism, environment, etc).

Specific objective 1.2.2 Develop mechanisms, tools and best practices for shared and integrated use of water resources and test them in some waterbodies for future dissemination at larger scale after approval by the Government of Tajikistan.

1.3 Conserve the aquatic biodiversity and protect all waters inhabited by endangered fish species

Specific objective 1.3.1 Develop and implement a protocol for the responsible introduction of new species for fish farming or culture-based fisheries and for the transfer of life fish in order to protect aquatic biodiversity and endogenous species.

Specific objective 1.3.2 Develop and implement (together with the all relevant institutions and partners) a national programme on fish habitat rehabilitation and protection.

Specific objective 1.3.3 Develop and implement (together with the all relevant institutions and partners) a national programme for restocking of indigenous fish species that are currently endangered (and/or on those species on the red-list).

Specific objective 1.3.4 Collaborate with neighbouring countries on the protection of transboundary aquatic ecosystems, by ensuring responsible fisheries and aquaculture practices in Tajikistan, and by development and implementation of transboundary fisheries management plans.

AXE 2 – INCREASE SOCIAL AND ECONOMIC RETURNS FROM RESPONSIBLE FISHING AND FISH FARMING

2.1 Develop responsible fish farming

Specific objective 2.1.1 Obtain national-level self-sufficiency in fry, fingerling and fish feed production through the development of infrastructure and strengthening of private sector fish hatcheries, fish nurseries, fish feed factories and the marketing chain for fish products.

Specific objective 2.1.2 Increase the diversity in species cultured, with emphasis on indigenous fish species and those that are preferred by the consumers.

Specific objective 2.1.3 Transfer successful (low-cost) production technologies from neighboring countries and develop technologies that support environmentally sustainable aquaculture and fisheries.

Specific objective 2.1.4 Improve the farming and management capacities and skills of private enterprises and fish farmers through development and training in better management practices (BMPs), fish health management and environmental protection measures.

Specific Objective 2.1.5 Establish effective procedures to undertake environmental impact assessment and monitoring for large scale aquaculture enterprises, with the aim to minimize adverse ecological changes.

2.2 Develop responsible fisheries and culture-based fisheries

Specific objective 2.2 .1 Increase inland fisheries production through development of culture-based fisheries and other restocking activities (in at least 3 natural waterbodies and reservoirs) that are economically feasible and environmentally sustainable.

These activities may include, amongst others: introduction of new species; stocking natural and artificial waterbodies, including with material originating from aquaculture installations; fertilization; environmental engineering including habitat improvements and modification of waterbodies; altering species composition including elimination of undesirable species or constituting an artificial fauna of selected species. The lessons learned from the 3 waterbodies will be used to develop best practice manuals and extend cultured based fisheries to other waterbodies throughout the country.

Specific objective 2.2.2 Ensure that fish used for restocking (particularly non-native and genetically altered fish) does not damage the genetic diversity and integrity of aquatic ecosystems by adoption and application of appropriate management measures.

Specific objective 2.2.3 Support the establishment of a facilitating industry for capture fisheries, including construction and import of vessels and fishing gear that comply with national regulations and safety requirements, the introduction and strengthening of modern ice-making, cold storage and freezing equipment and the development of proper landing places in the main fishing areas.

Specific objective 2.2.4 Involve recreational fishers associations in the management of waterbodies and protection of aquatic living resources that are of (potential) use to the fisheries sector as a whole; particularly those waterbodies that are difficult to manage under conventional management systems.

2.3. Improve the fisheries and aquaculture sector investment climate for the private sector

Specific objective 2.3.1 Demonstrate that aquaculture and capture fisheries enterprises are "bankable" (through success stories), and support the access to and availability of suitable, sector specific, (micro-) finance, credit, and investment services for the sector

It is also important that financial institutions are encouraged to provide fishers, fish farmers and fish processors access to credit, micro-finance, based on adequate business plans, investment plans, feasibility studies and tailored to the specific needs of the sector.

Specific objective 2.3.2 Decrease and eventually remove import duties and tariffs for essential fisheries and aquaculture equipment and fish feeds and fish feed ingredients that are not available in the local market.

Specific objective 2.3.3 Develop appropriate economic incentives for fish producers, fish processors, wholesalers and retailers in the fishery sector in support of increasing investment in the sector, such as improved land and water property legislation and registration, improved access rights to water and long-term lease constructions for land and water resources that are essential for the sector.

Specific objective 2.3.4 Ensure the availability of and access to specific risk management, disaster prevention and mitigation support and insurance services for the fisheries and aquaculture sector.

These services are essential, as the sector is prone to natural and man-made disasters, such as the cold spill in the winter season of 2007/2008 which caused a mortality of over 50 percent in the one-year fingerlings and high broodstock mortality, and the (flash) floods that destroyed and damaged various fish farms in 2010, causing high losses of investment and reduced aquaculture output in that year. Linkages with existing national disaster preparedness and emergency support programmes are important for the sector to tap into the knowledge and resources available under these programmes.

AXE 3 – STRENGTHEN THE LEGAL, POLICY AND INSTITUTIONAL FRAMEWORKS FOR FISHERIES AND AQUACULTURE

3.1 Reinforce institutional and human capacities to manage and support fisheries and aquaculture

Specific objective 3.1.1 Increase the institutional capacity of Mohii Tajikistan, the Tajik Agrarian University and the Academy of Science of Tajikistan to deal with all aspects of fisheries and aquaculture development and management, through high quality human capacity development of the staff of these institutions, as well as recruitment of new, highly skilled and competent experts in a range of fisheries and aquaculture related subjects.

A critical assessment of the current status of knowledge and experience of those working in fisheries and aquaculture, including an analysis of the training needs and weaknesses in regards to the implementation of this national strategy shall be conducted to develop a proper program of capacity building with targeted interventions.

Specific objective 3.1.2 Enhance the organizational structure and functioning of Mohii Tajikistan including collaboration and implementation of joint-plans and programmes with other institutions directly and indirectly involved in fisheries and fish farming management and development.

Specific objective 3.1.3 Support the establishment and strengthening of fishers and fish farmers in organizations, associations and fisheries cooperatives and enable them to protect the interests of the sector ante the government and to act as legal representatives of the private fisheries and aquaculture sector as a whole and counterparts of Mohii Tajikistan in discussion with the government.

These organizations (trade unions, cooperatives and other associations) should be developed and strengthened so that they are able to defend the interests of their members, attract resources for the social development of their communities and cooperate with the National Fisheries and Aquaculture Committee (NFAC) and other institutions in the management and protection of coastal aquatic living resources.

Specific objective 3.1.4 Develop an extension and technical advisory service in support of the private sector fisheries and aquaculture needs.

This extension and technical advisory service should be able to assist farmers with advice on reproduction of fish, growth and feeding of larvae, fry and fingerlings, maintenance of broodstock, fish farming and culture-based fishery activities in general, fish health management and water quality management, access to financial services, etc. This extension and technical advisory service will be established under collaboration between Mohii Tajikistan, the Tajik Agrarian University and the Academy of Science, taking advantage of the strengths of each of these partners and it will collaborate and integrate its services as much as possible in wide agriculture and rural extension services as are existing in the country. It is foreseen that the specific extension services given to poor farmers/fishers will be delivered on a cost-recovery basis, while private entrepreneurs will be charged market rates.

3.2 Rehabilitate research and educational capacities

Specific objective 3.2.1 Develop and implement a joint fisheries and aquaculture research and development (R&D) programme in support of sectoral development and management.

Specific objective 3.2.2 Improve the current fisheries and aquaculture capacity building and education programme.

The national research and development (R&D) and educational programmes would aim to promote fishery and fish farming related activities, strengthen innovation, develop technical skills and enhance human capacities in general in support of the management of the sector. The programmes shall include all necessary aspects (such as biology, ecology, technology, traditional knowledge, environmental, economic, social and nutritional science…) and identify gaps that the current research and educational system can't fulfill to further develop the necessary human and technical capacities (in coherence with the objective 3.2).

Specific objective 3.2.3 Train researchers, specialists, and technicians and improve their professional and technical skills for research, extension and the management of the fishery (aquaculture, culture-based fishery, and capture fisheries) sector.
Specific objective 3.2.4 Strengthen collaboration between national and foreign educational and research institutions to reinforce education programmes, support research capacities and develop technology transfer.

3.3 Enhance the scientific and information basis for fisheries and aquaculture management
Specific objective 3.3.1 Put in place a fisheries statistical system that compiles fisheries, aquaculture, fisheries employment and fish and fisheries products trade data and information.
It should involve the collection, analysis and dissemination of data and information on the status and trends of the fishery and aquaculture sector. This statistical system shall be established in close collaboration with the State Committee on Statistics and will include information gathering, treatment, exchange mechanisms and archiving. It will be used also as management information system in support of the development and monitoring of management plans.

3.4 Modernize the legal, regulatory and policy framework for fisheries and aquaculture
Specific objective 3.4.1 Establish a practical legal framework for the fishery and aquaculture sector, properly linked with other sectors, which enables the sector to grow in a sustainable manner with minimum administrative and management costs attached.
Specific objective 3.4.2 Enhance and update the regulatory framework (rules and regulations) as the national management strategy evolves, and management plans for fish farming, capture and culture-based fisheries are developed and tested and norms and standards for the functioning of stakeholders in the sector are introduced.

Specific objective 3.4.3 Support the participation of Tajikistan in relevant international agreements, conventions and voluntary guidelines on fisheries and aquaculture and work towards amendment (when necessary) of the national laws and regulations on fisheries and aquaculture to bring these in line with international best-practices.
Specific objective 3.4.4 Modernize, review, amend and keep up-to-date this Policy and Strategy and the various implementation programmes and plans under it.
Effective collaboration among the members of the National Fisheries and Aquaculture Committee (NFAC) is essential in the implementation of the Policy and Strategy.

3.5 Enhance regional and international cooperation on fisheries and aquaculture issues
Specific objective 3.5.1 Increase regional and international cooperation on fisheries and aquaculture issues through membership of the Central Asian and Caucasus Fisheries and Aquaculture Commission, the FAO Committee on Fisheries and its sub-committees and other relevant international and regional commissions.
Specific objective 3.5.2 Collaborate with international intergovernmental agencies, bilateral and multi-lateral donors and international NGOs in fisheries and aquaculture technical assistance, development and management projects.

AXE 4 – IMPROVE POST-HARVEST AND TRADE

4.1 Develop responsible fish processing, marketing and trade
Specific objective 4.1.1 Develop and implement a nationwide program to improve market facilities, refrigeration and cold storage, which will allow for diversification and improvement product forms, packaging and the quality and safety of the products.
It is particularly important that fish processing and marketing facilities in the rural, mountain areas are developed and that the hygienic conditions in the food markets (including the markets in Dushanbe) are improved. The resulting improvement in product quality will generate a further increase in demand.

Specific objective 4.1.2 Rehabilitate the fishery products processing sector so that it has modern facilities (such as freezers, fillet producers, smokers and canneries) that can add substantial value to the primary products and produce the fish and fisheries products that are of high quality and safe for consumers, in forms and packages that are appreciated by the consumers.
Specific objective 4.1.3 Establish effective cooperation mechanisms in the fishery products marketing chain (vertical as well as horizontal) in order to increase sectoral profitability while producing the fish and fishery products that are demanded by the market.
Specific objective 4.1.4 Gradually develop and implement an HACCP (Hazard Analysis Critical Control Point) protocol along the production chain to ensure safe, high quality, healthy marketed fish and fish products.
The application of the HACCP approach and other international certifications (e.g. ISO) will allow the Tajik fisheries sector to export to major consumer markets in the CIS (Commonwealth of Independent States) countries, Europe and China.
Specific objective 4.1.5 Facilitate access to processing and marketing training courses (including business aspects) with a particular attention to equal gender opportunities.

4.2 Promote the consumption of highly nutritious, healthy, high quality and safe fish and fishery products in Tajikistan
Specific objective 4.2.1 Develop a National Fish Consumption Promotion Strategy (together with the Ministry of Health and nutritional institutes under it) and implement the campaigns under the Strategy to promote fish consumption.
Specific objectives 4.2.2 Strengthen the capacity of the food safety and quality authority (check name of institute) to increase its opportunities to carry out quality and food safety control of aquatic products (for export, import and the domestic market) in an efficient, cost-effective and sustainable manner, using internationally recognized standards and procedures.

ANNEX 6

List of fish species found in waterbodies of Tajikistan by environment

No.	Fish Species	Waterbody				
		Rivers	Lakes	Reservoirs	Springs	Ponds
1.	Fringebarbel sturgeon /spiny sturgeon – *Acipenser nudiventris* (Lovetsky, 1828)	+				
2.	Amu Darya sturgeon/Big Amu Darya shovelnose – *Pseudoscaphirhynchus kaufmanni* (Kessler, 1877)	+				
3.	Dwarf sturgeon/little Amu Darya shovelnose – *Pseudoscaphirhynchus hermanni* (Kessler, 1877)	+				
4.	Syr Darya sturgeon/shovelnose – *Pseudoscaphirhynchus fedtschenkoi* (Kessler, 1872)	+				
5.	Sturgeon bester*	+				+
6.	Aral trout – *Salmo trutta aralensis* (Berg, 1908)	+				
7.	Peled – *Coregonus peled* (Gmelin, 1789)	+		+		
8.	Chir/broad whitefish – *Coregonus nasus* (Pallas,1776)					
9.	Amu Darya trout –*Salmo trutta oxianus* (Kessler, 1874)	+	+	+	-	-
10	Rainbow trout – *Oncorhynchus mykiss* (Walbaum, 1792)	+	+	+	+	+
11	Issyk-Kul/sevan trout – *Salmo ischchan* (Kessler, 1877)					
12.	Aral roach – *Rutilus rutilus (*Linnaeus, 1758)	+	+	+	+	
13.	Zarafshan dace – *Leuciscus lehmanni* (Brandt, 1852)	+				
14.	Dace – *Leuciscus baicalensis* (Dybowski, 1874)	+				
15.	Rudd – *Scardinius erythrophthalmus* (Linnaeus, 1758)	+	+	+		+
16.	Pike asp –*Aspiolucius esocinus* (Kessler, 1874)	+		+		
17.	Asp– *Aspius aspius* (Linnaeus, 1758)	+		+		
18.	Gudgeon – *Gobio gobio gobio* (Linnaeus, 1758)	+				
19.	Seven khramulya/khramulya – *Capoeta capoeta sevangi* (De Filippi, 1865)*	+	+	+	+	+
20.	Turkestan barbel – *Luciobarbus capito conocephalus* (Kessler, 1872)	+	+	+	+	+
21.	Aral barbel – *Luciobarbus brachycephalus* (Kessler, 1872)	+		+		
22.	Common marinka/marinka – *Schizothorax intermedius intermedius* (McClelland, 1842)	+	+	+	+	+
23.	Striped bystranka – *Alburnoides taeniatus* (Kessler, 1874)	+	+			
24.	Spirlin/riffle minnow (bystryanka) – *Alburnoides bipunctatus* (Bloch, 1782)	+	+	+	+	+
25.	Ili marinka/Issyk-Kul marinka– *Schizothorax pseudoaksaiensis pseudoaksaiensis* Herzenstein, 1889	+	+			
26.	Taskent riffle bleak/Tashkent bystryanka – *Alburnoides oblongus* Bulgakov, 1923			+		
27.	Common bream/freshwater bream – *Abramis brama* (Linnaeus, 1758)	+	+	+		
28.	White-eye bream – *Ballerus sapa* (Pallas, 1814)	+		+		
29.	Sharpray/ostroluchka – *Capoetobrama kuschakewitschi kuschakewitschi* (Kessler, 1872)	+		+		+
30.	Ziege/sabre fish – *Pelecus cultratus* (Linnaeus, 1758)	+	+	+		
31.	Common carp/sazan – *Cyprinus carpio carpio* (Linnaeus, 1758)	+	+	+	+	+
32.	Prussian carp – *Carassius gibelio* (Bloch, 1782)	+	+	+		
33.	*Western crested loach* – Paracobitis malapterura *(Valenciennes, 1846)**	+				

No.	Fish Species	Waterbody				
		Rivers	Lakes	Reservoirs	Springs	Ponds
34.	Tibetan stone loach – *Triplophysa stoliczkai* (Steindachner, 1866)	+	+	+		+
35.	*Talas stoneloach* – Nemacheilus paradoxus *(Turdakov, 1955)**	+				
36.	*Eastern crested loach* – Paracobitis longicauda *(Kessler, 1872)*	+	+			
37.	Stone loach – *Barbatula barbatula* (Linnaeus, 1758)	+				
38.	Kashakievitch liach – *Nemacheilus ruscharewitsch**	+				
39.	Bukhara stone loach – *Dzihunia amudarjensis* (Rass, 1929)	+				
40.	Tadzhik loach – *Nemachilus pardalis* (Turdakov, 1941)	+				
41.	Amu Darya stone loach – *Nemacleicus oxianus* (Kessler, 1877)	+				
42.	Gray loach – *Triplophysa dorsalis* (Kessler, 1872)	+				
43.	Aral spined loach – *Sabanejewia aurata aralensis* (Kessler, 1877)	+		+		+
44.	Wels catfish – *Silurus glanis* (Linnaeus, 1758)	+	+	+		+
45.	Channel catfish – *Ictalurus punctatus* (Rafinesque, 1818)	+				+
46.	Turkestan catfish – *Glyptosternon reticulatum* (McClelland, 1842)	+	+		+	+
47.	Northern pike/pike – *Esox lucius* (Linnaeus, 1758)	+	+	+	+	
48.	Turkestan sculpin – *Cottus spinolosus* (Kessler, 1872)	+	+	+	+	
49.	Mosquitofish – *Gambusia affinis* (Baird & Girard, 1853)	+	+	+	+	+
50.	Pike perch – *Sander lucioperca* (Linnaeus, 1758)	+	+	+		+
51.	Grass carp – *Ctenopharyngodon idella* (Valenciennes, 1844)	+	+	+	+	+
52.	Black carp – *Mylopharyngodon piceus* (Richardson, 1846)					+
53.	Silver carp – *Hypophtalmichthys molitrix* (Valenciennes, 1844)	+	+	+		+
54.	Bighead carp – *Hypophtalmichthys nobilis* (Richardson, 1845)	+	+	+		+
55.	Bigmouth buffalo – *Ictiobus cyprinellus* (Valenciennes, 1844)					+
56.	Smallmouth buffalo – *Ictiobus bubalus* (Rafinesque, 1818)					+
57.	Black buffalo – *Ictyobus niger* (Rafinesque, 1819)					+
58.	*Scale carp* – Cyprinus carpio carpio L.*			+		+
59.	Stone moroko – *Pseudorasbora parva* (Temminck & Schlegel, 1846)	+	+	+		+
60.	*Amur goby* – Rhinogobius brunneus (Temminck & Schlegel, 1845)	+		+		+
61.	Snakehead – *Channa argus argus* (Cantor, 1842)	+		+		+
62.	Sharpbelly – *Hemiculter leucisculus* (Basilewsky, 1855)	+		+		+

Notes:

+ Indicates the availability of the species in the waterbody concerned.

* Indicates that the species could not be found in FishBase (www.fishbase.org).

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