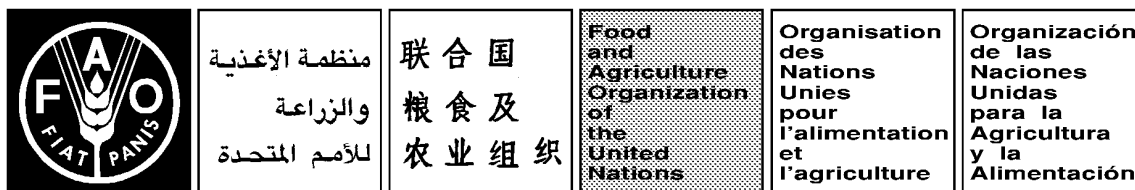


November 2008



**REGIONAL INTERGOVERNEMENTAL MEETING TO INITIATE THE
ESTABLISHMENT OF A CENTRAL ASIAN REGIONAL FISHERIES
ORGANIZATION**

Dushanbe, Tajikistan, 10 -12 November 2008

**Regional Synthesis: The Fisheries and Aquaculture Status and Prospects for Development
in Central Asian and Caucasus¹ countries**

Summary

This synthesis draws information and materials from the various national fisheries sector reviews, national strategy and planning workshop reports and a regional planning workshop, all of which were conducted with the technical assistance of the Food and Agriculture Organization of the United Nations (FAO). Information from web research was added.

The findings of the synthesis confirm the already widely acknowledged (by the governments and technical experts of the region) situation of a fisheries sector that has a strong natural asset in its vast water bodies, a promising base of human resources and the technological legacy from the pre- independence era. At the same time it confirms the deteriorated physical Research and Development capacities, weak institutional-, policy- and legal frameworks, an outdated production infrastructure, a general lack of support to the sector and thus a poorly managed sector. The long list of weaknesses is collectively indicated by the steady and steep decline in production since 1989-90. This is the general picture painted by the strengths, weaknesses, opportunities and threats (SWOT) analysis of the fisheries sector of the region.

It is on this basis that this synthesis includes a short analytical concluding section that clarifies and links the issues, portrays the situation as a cycle that needs to be stopped and reversed, suggests some key and priority issues to address, and outlines a way by which the Central Asian and Caucasus countries could collectively address the issues that they have so clearly identified. The synthesis supports the opportunity for regional cooperation identified by the SWOT analysis.

¹ Covered by this review are the Central Asian republics of Kazakhstan, Kyrgyzstan Tajikistan, Turkmenistan and Uzbekistan, and the Caucasus states of Azerbaijan and Georgia; this version includes some data on Armenia which shall be subsequently updated in a final version.

List of Acronyms

ADB	Asian Development Bank
ARM	Armenia
AZE	Azerbaijan
EC	European Commission
EU	European Union
GEO	Georgia
KAZ	Kazakhstan
KYR	Kyrgyzstan
MARA	Ministry of Agriculture and Rural Affairs of Turkey
PRSP	Poverty Reduction Strategy Paper
SWOT	Strengths, Weaknesses, Opportunities and Threats
TAJ	Tajikistan
TICA	Turkish International Cooperation Administration
TKM	Turkmenistan
TUR	Turkey
USSR	Union of Soviet Socialist Republics
UZB	Uzbekistan

I. Introduction: Brief Overview

The five Central Asian and two Caucasus republics under review in this synthesis have common attributes in terms of fisheries resources and fishery sector performance. These are briefly described as follows:

Resource status

- A fairly high potential for fisheries production from extensive river systems many of which are transboundary and flowing through two or three states, numerous small to large inland waters comprising reservoirs and natural lakes and, in four states, a piece of a large body of water (i.e. the Caspian Sea for Kazakhstan, Turkmenistan and Azerbaijan and the Black Sea for Georgia).
- A fairly wide variety of aquatic animal species (mainly fish) – an average of more than 60 freshwater species found in a country most of which are common to all five Central Asian countries, and more than half of these are of commercial importance.
- A rapid decline in production from fisheries and aquaculture in the last decade of the 20th century, combined with limited or very slow growth of the sector in recent years.
- A number ecological problems impacting on aquatic biodiversity, sustainability of water resources and the well-being of the environment and people, whose extreme manifestation is the present condition of the Aral Sea.
- Pollution of major river systems and draining of a major lake in the case of Armenia.

Governance and technology status

- The legacy of a well-regulated fisheries sector and fairly high production technology standards remaining from before independence in 1991. In a number of countries legal- and policy frameworks for fisheries and aquaculture are being updated and modernized at present, based on this legacy.
- The legacy of a fairly efficient scientific-, technical- and production infrastructure from pre-independence era.
- A technological- and manpower base for fisheries development, which is getting older and weaker, but with high potential.
- Recent initiatives in improving governance, science and technology development to arrest the decline.
- Fisheries sector institutions are being reformed and restructured in line with a market economy situation.
- Inland fisheries production is confronted with many problems including, overfishing (caused by increased poaching because of poverty and unemployment, weak regulations, ignorance of harvest quotas, poor management, poor monitoring and surveillance -mainly because of lack of funding support-, poor coordination among authorities, poor restocking strategies, ecological problems caused introduced species, erratic water levels due to the high level of abstraction of water for irrigation, and chronic financial limitations.

Production status

- A very limited diversity of fish species produced in aquaculture (mainly carp species, trout and sturgeon).
- A limited diversity of production systems used in aquaculture (mainly extensively managed pond systems and some examples of cage culture in reservoirs and lakes).
- Low catches and underutilization of water bodies (including irrigation systems) for capture fisheries and aquaculture production purposes.
- Low production per hectare and low catch per unit of effort in inland capture fisheries.
- Aquaculture and capture fisheries production costs are relatively high as many inputs (e.g. feed, equipment) have to be imported from outside the region.

Supply and demand status

- Very low supply as well as consumption of fish per capita, except Kazakhstan (although its consumption per capita is much lower than the world average) with the shortfall in supply being filled by imports.
- Limited access to and availability of fish and fishery product varieties in the domestic markets (particularly in rural areas).
- Fish and fishery products quality and safety concerns among consumers.
- Limited knowledge among the young generations of how to prepare fish and fishery dishes.

Trade and investment status

- From the standpoint of regional linkages and flow of products, there is little trading among the states in fishery products and input supplies, there is little exchange of information and technology and cooperation in fisheries development is a very recent initiative.
- Intra-regional fish trade, including with Turkey, Russian Federation and China, is limited, due to relatively high customs tariffs and high transport costs.
- Intra-regional trade in life fish, broodstock and eggs and fingerlings for aquaculture is negligible, due to customs and veterinary requirements and limited availability of supply.
- Slowly increasing, but still very low, levels of investment in fisheries and aquaculture development compared to countries in other Asian regions or Central and Eastern Europe.

II. Prospects

The regional status and prospects are described and analyzed in more detail in the following sections².

1. Production and Market Potentials

The region's potential demand for fisheries products is based on the combined population of the five Central Asian and the three Caucasus countries of 77 million (see Table 1). This does not present an extremely large demand but would still be a significant market potential for locally produced fish products.

Table 1. Population of 5 CAR states + Azerbaijan and Georgia

Population, 2008	Kaz	Kyr	Taj	Tkm	Uzb	Aze	Arm	Geo	Total
Millions	15.50	5.35	7.21	5.17	28.26	8.17	2.96	4.63	77.3

Increasing the per capita consumption of fish to 12/kg per year (as recommended by the Academy of Science of the Soviet Union) would require 928,000 tonnes of fish a year. Raising it to only 5 kg/year would still require 387,000 tonnes. Kazakhstan's per capita consumption target is 14.6 kg which the authorities say would require 272,000 tonnes of fish products per year for Kazakhstan alone.

FAO data suggest that fish production in the Commonwealth of Independent States decreased between 1989 and 2006 by over 60 percent (table 2)

Table 2: Fish Production in the Commonwealth of Independent States (tonnes).

Country	1989	2006	Current production as percentage of the 1989 output level
Armenia	7,342	1,406	19.2
Azerbaijan	54,406	4,093	7.5
Belarus	21,457	5,050	23.5
Georgia	148,318	3,075	2.1
Kazakhstan	89,508	35,676	39.9
Kyrgyzstan	1,447	27	1.9
Moldova	8,621	5,082	58.9
Russian Federation	8,246,556	3,456,044	41.9
Tajikistan	3,547	210	5.9
Turkmenistan	52,974	15,016	28.3
Ukraine	981,783	243,885	24.8
Uzbekistan	25,526	7,200	28.2
TOTAL	9,641,485	3,776,764	39.2

Source: FAO (Figis).

² Tables 1, 3, and 4 are consolidated into Appendix Table A, to provide a one-shot view of the supply and demand status and potentials of the 7 countries.

The combined fisheries production of the five Central Asian Republics, from recent national figures (table 3), vary in estimate from 57,000 to 65,000 tonnes, although a certain percentage, from illegal fishing goes unreported.

Considering only the five Central Asian Republics states, a return to 1989 levels of production would supply only around 173,000 tonnes, which is still much lower than the level needed to raise consumption to 5 kg a year and only a third of the volume that would satisfy a per capita consumption of 10 kg/year in these Republics.

Table 3. Production in tonnes (capture and culture) latest figures available compared to 1989 outputs

Production tonnes	Kaz 06	Kyr 07	Taj 05	Tkm 00	Uzb 06	Arm	Aze	Geo (1991)	Total
1989	89,508	1,447	3,547	52,974	25,526	7,349	55,000	69,000	304,349
After 1989	37,500 capture + 190 culture	71.4	285	12,000 total (500 inland)	7,200 total (3,800 aqua)	1,406	42,000 kilka from Caspian 510 kilka and shad in rivers; 354 sturgeon in Caspian sea & rivers 145 inland lakes	400 – inland capture 1,000 – culture (est 2005) 9,800 – marine capture (mainly anchovy)	102,861

Source: National Review reports (FAO together with concerned national agencies).

Meanwhile, around 58,000 tonnes is imported and 36,000 tonnes is exported (Table 4). Azerbaijan exports include some 14,000 kg of caviar.

Table 4. Exports and Imports (in tonnes)

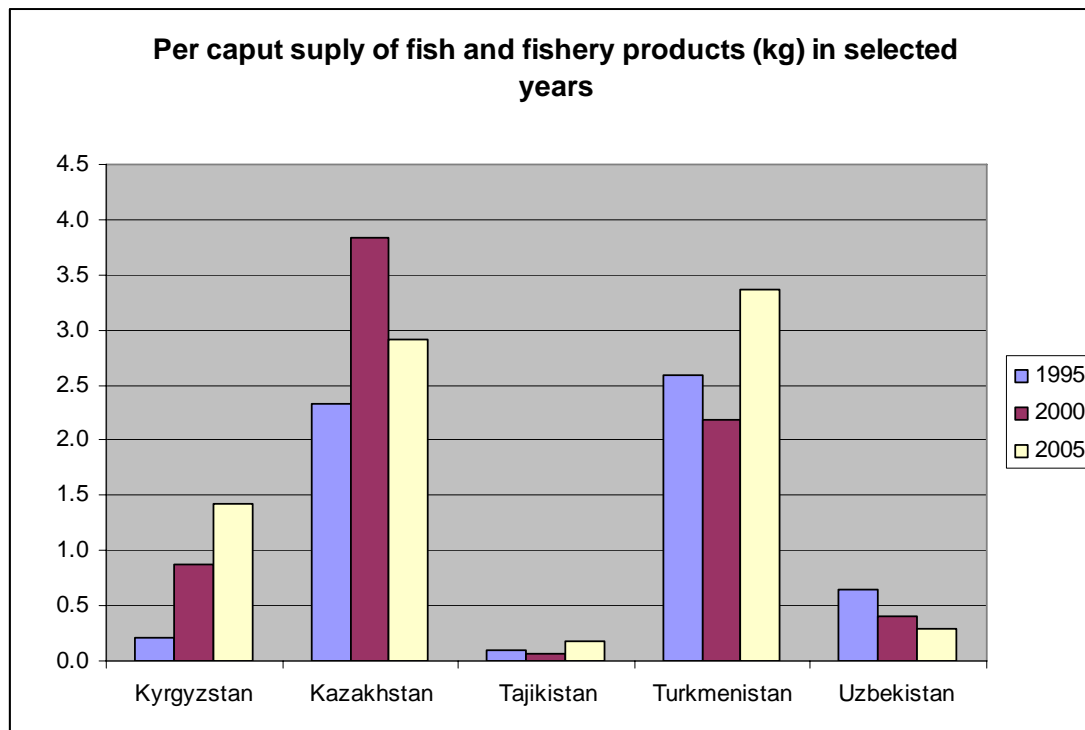
	Kaz 06	Kyr07	Taj 05	Tkm00	Uzb06	Aze 07	Geo 00	Total
Exports	32,505	10.3	818	600	818	851 (tonnes fish), 13905.6(kg caviar)	879	36,852 excluding caviar
Imports	44,182	6,500	1,070	200	1,072 excl canned fish	4167 fish 3887 fish products	4,840	66,000

The collapse of the Soviet Union also caused the end of a well-established chain for the processing, marketing and general distribution of fish in Central Asia. Within a few years the cold storage fish distribution system disintegrated. The availability of frozen marine fish in the markets of Central Asia and the Caucasus decreased rapidly, resulting in large market reliance on fish supply from domestic markets; a supply that also decreased.

Foreign trade relations with neighboring countries (including the Russian Federation) deteriorated in the last decade, causing that imported fish has become rather expensive and was out-of-reach for the majority of the population.

As a consequence the per caput supply of fish and fishery products decreased to respectively 1.6 and 1.3 kg/caput in 1998 in Kazakhstan and Turkmenistan, 0.2 kg/caput in 2002 in Uzbekistan, 0.1 kg/caput in Kyrgyzstan in 1993, and less than 100 grams per caput per year in Tajikistan in the period 1995 to 2002.

Figure 1: Per caput supply of fish and fishery products in kilogrammes in 1995, 2000 and 2005.



Source: FAO Food Balance Sheets of fish and fishery products in live weight and fish contribution to protein supply (accessed in July 2008)

Recent official fish consumption estimations from Kyrgyzstan and Uzbekistan confirm that respectively 0.5 kg/caput per year and less than 0.5 kg of fish is consumed in these countries at present. Figures from Uzbekistan show that fish consumption levels of 5 to 6 kg/caput/year in the late 1980s were not uncommon. As mentioned above, all Central Asian countries national health and nutrition institutions still base their advice with regards to fish consumption of their population on the figure of 12 kg of fish products per person per year as was recommended by the nutrition institute of the Academy of Science of the USSR in the past.

The current high prices of fish compared to beef and chicken make fish generally regarded as a luxury product. There is anecdotal evidence that fish consumption has a significant positive correlation with household incomes. Now Kazakhstan, Uzbekistan

and Turkmenistan show nice economic growth figures (all had GDP growth figures of over 5 percent in 2006), the demand for fish and fishery products shows an increasing trend in the region. This is also reflected in the fish prices at the market; which continue to rise despite poor market infrastructure such as refrigeration, which does not keep maintain fish quality for long.

2. Potential for foreign exchange earnings from fisheries trade

Using trade data as an indication, Table 5 suggests that the fishery products trade balance of the majority of the 7 countries reviewed here is negative. Either significant potential earnings are being lost by the fisheries sector, or potential foreign exchange savings for the state are being lost because of the inability of the fisheries sector to fill domestic needs. The exceptions are Kazakhstan and, surprisingly in this trade statistics, Uzbekistan³. (Azerbaijan's export of caviar is not reflected in these statistics).

Table 5. Value of exports and imports of “fish, crustaceans, mollusks and aquatic invertebrates”, 2006 (in thousand of US\$)

	Kaz	Kyr	Taj	Tkm	Uzb	Aze	Geo
Exports	50,411	19	5	0	494	292	904
Imports	19,794	3,100	244	227	61	1,471	21,683

Source: Trade Competitiveness Map. www.intracen.org/appli1/TradeCom. accessed 05 Sep 08

It can be argued that large parts of the imports by the countries in the region are relatively low value fishery products, including carp products (frozen and fresh whole fish, kilka, frozen and canned herring and sardines). High value marine fish, such as turbot, cod, sole, salmon, tuna, sea bass and sea bream are not much traded. The potential for export of the currently produced fish species from the region to other regions (e.g. Europe, China, USA) seems limited, perhaps apart from sturgeon/caviar and trout (although also these species will encounter stiff competition in the export markets). In terms of earning income from fisheries it is therefore more logical that the Central Asian and Caucasus countries focus on their domestic markets and the market opportunities provided in the region itself.

3. Adjusting to a market economy: setting the essential conditions

The region has had almost two decades of transition and adjustment to a market economy. Policy- and legal reforms have been instituted that focus on privatization with assurance and protection of property rights and private investments, privatization of numerous state enterprises, encouraging competitiveness, removal of subsidies, establishment of credit facilities (as well as insurance in some countries), and promotion of entrepreneurship.

The pace of transition to a market economy differs largely among the Central Asian and Caucasus economies. In some countries the legal framework to support market-oriented

³ In the year concerned, the figure presented for Uzbekistan may have been influenced by re-exports of sometimes illegally imported fish.

policies has been designed to provide a balance between privatization and individual entrepreneurship on one hand and social welfare on the other hand. The legal principles are meant to both encourage and promote the use of economic tools to manage the economy. In general, privatization, market economy and social welfare have become the three cornerstones of the regional governments' social and economic development policies.

4. Fishery Resources and Potentials

a. Water

The current levels of production in the eight countries belie the extent of the water resources in this region (Table 6). The approximate area of their lakes and reservoirs is a staggering 49 million hectares not including the glacier lakes and the biotopes, which are unproductive. Pond culture is being carried out in a mere 22,000 hectares but the numerous rivers and the irrigation channels flow for more than a hundred and fifty thousand kilometers. Fish production levels per hectare of pond systems differ very much. In the Soviet times the average across the USSR was 1.5-1.7 tonnes/ha but the average efficiency in Tajikistan was 2.0-2.5 tonnes per year. They plan to raise this to 3.0 tonnes per hectare for the 3,400 hectares of aquaculture ponds in their 2009-2015 development plan for aquaculture (Khaitov, 2008). Based on Uzbekistan status report, current fish production in reservoirs, lakes and rivers has been 21 kg per hectare while potential productivity is estimated to be an average of 37 kg, in other words actual production is only 57 percent of potential. It is probably much lower in other water bodies in some of the other countries.

A rough assumption of 10 kg/year per hectare increase in fish yield from enhancement and better management of the water resources, would give an additional production from the lakes, reservoirs and ponds of more than 490,000 tonnes of fish. Further assuming another 10 kg a year increase per kilometer of river and main irrigation channel would give an additional 1,500 tonnes for a combined additional production of 491,500 tonnes of fish. This would exceed the potential demand of the region's population at 5 kg per caput per year. Raising the consumption level target to 10 kg/year per caput implies a huge opportunity for the entire fisheries sector in earnings from the domestic markets in the region alone.

Table 6. Water resources

Country	Lakes and reservoirs (km ²)	Ponds and inland bodies for aquaculture (ha)	Rivers and major irrigation channels
Kaz	26,707	5,041	3,912 km
Kyr	7,824	1,047	90,800 km ² river basin
Taj	1,250	3,800 ha of which 3,400 ha are feeding or grow-out ponds (the rest is for seed production)	4,752 km 5850 km irrigation channels, water storage and drainage nets that have fishery value.
Tkm	(35,920 ha or 35.9 km ² main water bodies for re-stocking)	1685 for recreational fishery)	(610 km coastline)
Uzb	10,300	10,000	3,900 km
Arm	1,360 (mainly Lake Sevan)		1,399 km (3 river systems)
Aze	1,261		(825 km coastline) 6,700 km
Geo	287	3,200	(325 km coast) 54,200 km rivers
Total	49,000 km²	25,700 ha	151,400 km

Note: Sources of the above information are from the National Aquaculture Status Overviews and National Fisheries Overviews (www.fao.org/fishery/countrysector). The information on Armenia are from the Wikipedia. http://en.wikipedia.org/wiki/lake_sevan; /wiki/hrazdan river; wiki/aras river; wiki/akhurian river (accessed October 21 2008).

b. Species and potentials

The biological resource of the region rests on more than 60 species of commercial value some of which can be high value species (excluding sturgeon). An average number of 37 species per country are of commercial value and a number of these are common to all the countries in the region. (See tables 7 and 8). The species that have been traditionally cultured, stocked in natural water bodies, or captured are predominated by carps. These have been the mainstays of fishery production in most of the countries. The region has a long experience and a strong scientific base for the breeding and culture technology of carps. One disadvantage – to go by the experience of South Asia - is that carps are generally not much being traded. The technical expertise in breeding carps can be expanded for application to other species such as the silurids, breams, trout and pikeperch. The infrastructure for breeding and hatchery however is in need of rehabilitation in most of the countries.

Table 7. Number of species (and subspecies) in the countries under review

1. Kazakhstan	60/28 commercial
2. Kyrgyzstan	66
3. Tajikistan	64
4. Turkmenistan	57
5. Uzbekistan	73/35 commercial
6. Azerbaijan	97/30 commercial (Caspian and inland)
7. Georgia	69 sp and sub sp on Black Sea territory

Table 8. Common species that have been used for freshwater stocking and culture as well as commonly available marine fish species

	Kaz	Kyr	Taj	Tkm	Uzb	Aze	Geo
<i>Freshwater species</i>							
Common carps (Asian/European)	X	X	X	X	X	X	X
Silver carps	X	X	X	X	X	X	X
Grass carps		X	X	X	X	X	X
Bighead carps	X		X	X			X
Crucian carps	X	X			X		X
Channa sp				X	X		
Catfish (silurids)	X	X	X	X	X	X	X
Breams	X	X	X	X	X	X	
Trout	X	X	X		X		X
Pikeperch spp	X	X		X	X	X	
Perch	X						
Tench	X	X					
Peled	X	X					
Whitefish		X					
Naked/scaled osman		X	X				
Moroco							
Marinka		X	X				
<i>Sea fishery species</i>							
Kilka				X		X	
Sturgeon	X		X	X		X	None reported since 1990
Salmon		X				X	
Anchovy	X						X
Sprats							X
Molluscs							X

The utilization of fish resources in lakes and reservoirs is often based on natural fish (re-) production, which causes low production levels and low catches in these waters.

The Regional Scoping Workshop on the Use of Irrigation Systems for Fish Production in Central Asia, held in Tashkent, Uzbekistan from 17 to 20 July 2007 noted the following with respect to fish production in the region:

- A large part of inland capture fisheries production is based on restocking programmes, following traditional practices, but there are few profitability analyses carried out for such programmes.
- Reservoirs, natural lakes (if part of irrigation systems) and terminal lakes (sinks) are a major resource for fisheries and can rely on natural stocks, artificial stocking or cage culture. Rivers can also be a significant resource for fisheries and aquaculture production.

- The status of natural stocks in the lower parts of the rivers, particularly migratory species, remains unclear. Similarly, the water quality for fish use in these rivers is also uncertain. If water quality is adequate, the priority production systems can include fish ponds, cages and stocking of the canals as well as habitat restoration.

c. Research & Development and Education: Capacity and Opportunities

The infrastructure that used to support inland capture fisheries and aquaculture production has gradually deteriorated since the 1990s. Civil wars, unstable governmental situations, economic reform processes in relation to the change from centrally led economy to market economy (which made investments very risky), limited state support to the sector and lack of resources and inputs for maintenance and repairs are important causes for the decline in infrastructure. As a result, many hatcheries, research facilities, fish landing places, pond systems, cold storage, and processing and marketing establishments do not currently function. This situation was noted by the 2007 FAO-TICA- MARA organized regional workshop in Beymelek. In Research & Development the overall capacity is weak and funding is low. Problems however have been clearly identified.

In terms of the scientific and technical manpower, there is low regional capacity for higher level education in fisheries science. Low enrolment to fisheries and aquaculture studies over the last decade constrains the development of educational programmes catering specifically to the sector. Very few of the national vocational schools and training institutes provide opportunities for training in capture fisheries and there is almost none for aquaculture. Overall, the region has however maintained its strength in training and education in the biological and engineering disciplines, which are essential foundations for technical specializations in fisheries and aquaculture.

An indication of the Research & Development and Educational capacity of the region is provided by B1 (R and D) and Appendix B2 (Education and Training). There is a need for higher investments in improving these R and D and Education infrastructures and programmes. Developing and strengthening the technical manpower base for fisheries development takes a long time. But it is the key to development of the entire sector, and should be given a high priority and strong support.

Among many possibilities, an immediate option can be the development of a regional human development program that involves Turkey, which has a well-established fisheries and aquaculture education system, that includes high schools, vocational high schools, fisheries, marine science and agriculture faculties, and marine science institutes. Turkish institutions offer bachelors, masters and doctoral degrees. The educational institutes in Turkey are generally being harmonized with the EU higher education system; facilitating cooperation and exchange of students with Europe.

Research and development activities are performed by the above-mentioned higher education institutions (faculties, departments and institutes) and MARA research institutes.

As expressed at the Beymelek workshop, Turkey can provide education and graduate study possibilities for students from Central Asian countries. It has sufficient aquaculture know-how in research infrastructure and private sector support services. It can also provide expert assistance in accessing international funds, in particular, EC funds. Similar opportunities exist in the Russian Federation and China; however, language barriers may constrain the wide use of the educational opportunities provided by the latter.

III. Conclusion

This synthesis concludes with another look at the SWOT analysis of the inland capture fisheries and aquaculture sector in the Central Asian region by the Beymelek workshop in 2007.

The SWOT statements from that workshop are, in this paper, reorganized and categorized into broader headings such as Resources, Technological foundation and Facilities in communication for the statements of Strengths; Governance, Institutional support, and Technology and Information for the Statements of Weaknesses; and Regional cooperation, Governance and Investments in the statement of Opportunities. The Threats are classified into Social, Economic and Environmental. The re-organized SWOT appears as Appendix C

A vicious cycle?

The regional SWOT analysis portrays a fisheries sector that suffers from a very low priority in government policies and plans. Therefore it does not enjoy adequate funding support from the State. Technology and manpower base for improving productivity are inadequate. This is then exacerbated by the lack of proper management of the sector. And since there is little government support, and there is little management of its development, there has not been much encouragement for the private sector to invest into fisheries and aquaculture projects and innovations. Therefore productivity has remained low. And so on.

It may be harsh to present this set of linked issues as a vicious cycle but the steadily and rather steep downward slide in production trends in all of the countries from 1989-90 to the present a fair indication.

If that were so, the cycle itself is an opportunity. Crack it and it could turn into a virtuous cycle. The question is where to begin?

State of the Assets, according to the Regional SWOT

A closer look at the Regional SWOT statements shows that the strengths are few and limited to the natural resource assets i.e. the water bodies with the exception of the Aral Sea. As to human and technological capital, the best that can be said is a legacy of a strong historical fisheries background as well as important experience gained during the

former Union of Soviet Socialist Republics (USSR) period; mainly on rearing of cyprinids and sturgeon, plus a potentially dependable supply of a good labour force. The physical assets of both fisheries and aquaculture – for production, research and development, have significantly deteriorated from their previous state before 1990. As to financial assets, the fisheries sector is starved of government support and private investments. .

Recognition and support for the sector

From the above observations, it is clear that the key is the recognition of the social and economic potentials of fisheries. This has been generally expressed by the governments in the various sector status reviews, policy documents, sector programmes and national and regional workshops. National policy and strategies of Kyrgyzstan and Uzbekistan (i.e. the Strategy for Fisheries and Aquaculture Sector Development and Management in the Kyrgyz Republic (2008–2012) and the Aquaculture and capture fisheries development policy and strategy of Uzbekistan (2008-2016) indicate commitment from their governments to the sector's development and management. However, governmental financial support to implementing the policy documents has been limited so far. The governments in the region leave the burden of proof to the fisheries sector. In this case, the sector must show that it is indeed worthwhile investing in by government. How?

Providing persuasive evidence

In the ultimate, the fisheries sector will need to show persuasive evidence that it can significantly contribute to the social, economic and environmental objectives of the nation. In short, success stories are needed that show that capture fisheries and aquaculture are worth investing in for the government and the private sector. The lesson from Asia-Pacific may be instructive: the initial strategy followed by the authorities responsible for aquaculture was to show visible and measurable evidence of aquaculture's contribution to food security objectives, poverty alleviation, and rural employment and export earnings generation; evidence that would appeal to governmental policy makers and ministries of finance. If success could be demonstrated it would become more attractive for policy makers to include aquaculture related interventions and budget support to aquaculture in national development plans and programmes, poverty reduction programmes (e.g. PRSPs, EU Country Strategies), investment programmes (of the World Bank, ADB etc.) and donor funded projects and programmes

The authorities responsible for aquaculture development and management in the Asia-Pacific aimed to demonstrate aquaculture's contribution to the society by focusing on improvement of yields and increase production of aquatic products with the use of better technology. Those better technologies were already known and existing in some countries or other regions. The strategy then was to borrow, exchange and adapt the better technologies to local situations. Research was not the immediate answer because it takes time to come up with results for application; as stressed, the need was for an immediate visible and measurable result. Thus immediate application of known improved technology (e.g. adoption of improved farming systems and Better Management Practices) adapted to the local situations would be a logical solution.

The role of technical cooperation

Technical cooperation in aquaculture between countries was seen as a valuable strategy in large parts of the Asia-Pacific region. It enabled the participating countries to freely exchange expertise and technology. It allowed the borrowing and adaptation of better technologies without the countries having to “re-invent” the wheel. It produced quick results in terms of introduction and dissemination of economically viable, socially acceptable and environmentally compatible aquaculture production systems that contributed to economic growth. In some cases, it generated export earnings. This served to convince the policy makers and Ministries of Finance that it pays to invest in technology development. It also gave time for the R & D sector to further improve on the borrowed technology, develop better technology, and continue refine the farming systems.

The above mentioned regional technical cooperation (conducted FAO through the then NACA regional project) was systematically structured to address these three priority needs:

- increase aquaculture production through effective transfer of established technologies in the region,
- train senior personnel in the planning and execution of aquaculture development and production , and
- help justify government financial support to national aquaculture project.

The **transfer of established technologies** required some research that would:

- Improve on known technology for immediate application to increase commercial production.
- Emphasize on the biotechnical aspects, a high priority in the newly developing field of aquaculture.
- Achieve higher yields and production to provide the justification needed by the government technical departments to request more financial support from their governments. To reiterate, it also allowed time for researchers to produce results to fill the gaps in technology.
- Focus entirely on relevant adaptive and applied research that facilitated increasing production, and worked with universities and academic institutes on the basic problems.

Training. The human capacity development program focused on aquaculture development planning and project implementation, development of production skills, and transfer of improved technology for direct application in national production programs. Training interventions were guided by situation analyses which identified the constraints, needs and solutions in terms of training:

- Constraint: lack of trained personnel with broad-based knowledge and experience in the practical aspects of aquaculture production,
- Solution: Training courses were conducted in the region on topics or techniques needed to establish and support a whole and viable aquaculture system.

Senior aquaculturists and technicians were trained in planning and implementing aquaculture development programs. The training provided them with skills in multidisciplinary approaches to aquaculture development, planning and management.

The key outcomes of the training program were:

- A strengthened human resource base for technology development and production
- Enhanced regional cooperation in aquaculture development by building a human network of expertise in a wide area of aquaculture subjects, and
- A higher priority placed on aquaculture in national planning and policy formulation.

A favorable climate for investment

The technical cooperation and information exchange led to the success stories that were needed to obtain support for the sector from Governments. The technical cooperation and information on success stories also contributed to the lessons and guidelines for government policy and plans addressing governance and management including access and property rights, zoning, and interactions between fisheries, aquaculture and other economic sectors. This resulted in better management and a more orderly development of the aquaculture (and often also the capture fisheries) sector. This improved the climate for investment which, with the demonstrated results from better technologies and improved farming systems, encouraged the private sector to invest their capital and loans in capture fisheries and aquaculture projects. Improvement in the credit and extension services followed because of the increased demand from the private sector for these services. Productivity went up, more economic activities in fisheries and aquaculture were undertaken, successful approaches of innovators were copied and therefore jobs were generated, incomes of aquaculture farmers improved and tax revenues from the fisheries (aquaculture and capture fisheries) sector increased.

To summarize the section, the opportunities for the fisheries and aquaculture sector of the region as presented by the regional SWOT analysis and the experiences from the NACA region both strongly suggest a development strategy that is best shaped and directed by regional cooperation. Individual countries working alone will probably find some success but will definitely find it more expensive and more difficult to overcome the constraints to development of the sector and to take advantage of the opportunities provided by regional cooperation. Regional cooperation also tends to attract more and better collaboration from development agencies and donor organizations, as the paper “Building a Central Asia Regional Cooperation in Fisheries Development” shows.

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Appendix A: Current and potential demand for fish in the countries under review.

	Kaz 2006	Kyr2007	Taj2005	Tkm 2000	Uzb 2006
Population 2008 Total 61.5 Million	15.5 m	5.35 m	7.21 m	5.17 m	28.26 m
Total production (in tonnes)	37,500 capture 190 culture	71.4	285	12,000 total (500 inland)	7,200 total (3,800 aqua)
Exports (in tonnes)	32,505	10.3	818	600	818
Imports (in tonnes)	44,182	6,500	1,070	200	1,072 excl canned fish
Per capita consumption kg/yr	8 (9.4 in towns 7.5 rural areas)	1.3	0.5	1.3	1.0
1989 output	89,508	1,447	3,547	52,974	25,526

	Aze 2007	Geo
Population 2008	8.17	4.63
Production (in tonnes)	74,552- kilka Caspian 510- kilka, shad in rivers; 354 sturgeon Caspian sea & rivers 145 inland lakes	400 – inland capture 1,000 –aquaculture (estimation 2005) 9,800 – marine capture (mainly anchovy)
Exports (in tonnes)	851	879 in 2000
Imports (in tonnes)	4,167	4,840
Per capita consumption	1 kg/year	<2 kg/year
1989 Outputs	55,000	69,000 (in 1991)

Appendix B1: Summary overview of main national institutions involved in research and development (incomplete)

Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan	Azerbaijan	Georgia
<p>State Scientific and Production Center of Fisheries (SPCF), a department of the Ministry of Agriculture</p> <p>Department of Hydrobiology and Water Toxicology of the Institute of Zoology</p> <p>Department of Zoology and Ichthyology, Kazakh National University</p>	<p>Lake Issyk Kul Biological Station of the Institute of Biology of the National Academy of Science</p> <p>Fisheries Research Centre and the Department of Zoology of the Kyrgyz State National University.</p>	<p>Tajik Agrarian University – Department of Ichthyology and Hydrobiology of the Institute of Zoology and Parasitology, Faculty of Ichthyology and Physiology</p>	<p>Before 1991 research on Caspian Sea resources was done by the Caspian Research Institute with a branch, now closed, in Turkmenbashi.</p> <p>Biomelioratsiya: an inter-departmental specialized self-supporting scientific production association</p>	<p>Research Center for the Development of Fishery, in the Uzbek Research-Industrial Center for Agriculture under the Ministry of Agriculture and Water Management.</p> <p>Laboratory of Hydroecology of the Institute of Water Problems</p> <p>Laboratory of Ichthyology and Hydrobiology of the UzAcademy of Science (UzAS)</p> <p>Institute of Bioecology of the Karakalpak Branch of the UzAS</p> <p>Department of Ecology of the National University</p>	<p>Institute of Zoology and Physiology ANAS (Azerbaijan National Academy of Sciences)</p> <p>Department of Reproduction and Conservation of Aquatic Biological Resources (DRCABR)</p>	<p>Marine Ecology and Fisheries Research Institute (MEFRI)</p> <p>The Institute of Zoology at the Georgian Academy of Sciences</p>

Appendix B2: Summary overview of main national institutions involved in Education and Training (incomplete)

Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan	Azerbaijan	Georgia
<p>Kazakh National University Department of Zoology and Ichthyology</p> <p>Agricultural Colleges in Almaty and Astana</p>	<p>Department of Biology, Kyrgyz State National University</p> <p>Institute of Ecology and Nature Management, Kyrgyz University of I. Arabaev</p> <p>Department of Ecology, Kyrgyz Agriculture Academy</p> <p>Department of Biology, Karakol University</p> <p>Department of Fishery, Kyrgyz Agriculture Technical School</p>	<p>Tajik Agrarian University – Dept of Ichthyology and Hydrobiology of the Institute of Zoology and Parasitology, Faculty of Ichthyology and Physiology</p>	<p>None reported</p>	<p>National University of Uzbekistan’s Department of Ecology</p>	<p>Baku State University Biological Department</p> <p>Azerbaijan Pedagogical University</p> <p>Vocational school of Fish Industry</p>	<p>No formal education and training institution.</p>

Appendix C. Re-organized SWOT Analysis for the Fisheries and Aquaculture sector in Central Asia,

1. Strengths

Resources

- Water resources such as rivers, natural lakes, dam lakes have a potential for a more efficient use by inland fisheries and aquaculture.
- Countries of the region have similar biodiversity characteristics (similar aquatic animal species).
- There are relatively low labour costs compared to the Organisation for Economic Co-operation and Development (OECD) countries.
- If well managed, the transboundary water resources allow for migration of species.
- Demographical structure in the region is in favour of the young generation, providing opportunities for demand increase and labour for the sector.
- There is a relatively low occurrence of fish diseases in the region (also as a result of limited recent introductions and extensive production systems used⁴).
- Long-term leasing (at least ten years) of fisheries and renting sites is possible in most cases.

Technology base

- There is a strong historical fisheries background as well as important experience gained during the former USSR period; mainly on rearing of Cyprinids and sturgeon,

Communication

- The common languages in the region, Russian and Turkish, facilitates communication and collaboration. **(NOTE: The Asia-Pacific countries have diverse languages with English as the common medium of communication, but this diversity had not been an impediment to technical cooperation)**

2. Weaknesses

Sector Governance/ Policy, planning and management

- Generally no national fishery sector policies or regulatory frameworks in place that assist the sector in its development in a sustainable manner.
- Fisheries is not a priority sector for government development planning.
- There are generally no fisheries departments nor sufficient financial means available for the administration/management of the sector. Fisheries administrations should be equipped with highly qualified staff and modern means of communication and transport.
- Monitoring of recreational fisheries and restocking practices is lacking.
- Poor and inappropriate fishery resources management is common in the region.

Institutional Support Services

- The fishery sector research institutes in the region do not have the technical and financial capacity to undertake the necessary research to assess fisheries resources and support the development and management of fisheries.
- Extension services are lacking at the regional and country levels.

⁴ The capacity for monitoring and surveillance of fish health is very poor so that the actual levels of fish disease occurrence maybe higher than currently recorded.

- No high-quality fish feeds for aquaculture are being produced in the region.
- There are only a few hatchery facilities for restocking inland waters and aquaculture ponds with fish seed. (Where such facilities exist, they function at low levels of efficiency or are underutilized.)
- There is lack of restocking of inland water bodies or insufficient stocking undertaken by governments and the private sector.
- Capacity is lacking to undertake monitoring, control and surveillance (MCS) of fishing in inland water bodies.
- There is a general lack of essential fisheries infrastructure, such as landing sites, ice plants and cold storage, and of modern fisheries equipment, such as boats, GPS, fish finders and modern, on-board communication equipment.
- There is a general lack of access to credit facilities from banks and incentives (subsidy) from the government in support of fisheries sector development.
- Insurance facilities are not extended to the fisheries sector (in contrast to insurance for the agriculture sector).
- The lack of marketing facilities for fisheries products reduces profitability. (A supply chain approach is lacking and means of transport for fish are generally unavailable.)

Technology and Information

- There is a lack of public awareness on fishery sector aspects and low interest in solving fishery sector problems.
- The collection of fishery statistics is not coordinated properly, and data collection and analysis are not conducted scientifically and systematically, which negatively affects the decision-making processes.
- There is a generally low level of training and education of human resources in the sector.
- There is limited access to knowledge and technology from elsewhere and limited contacts with other regions.
- Per hectare fisheries productivity of inland waters is very low.

3. Opportunities

Regional cooperation

- A regional fishery body or regional network could be established.
- Proven technologies could be transferred and new technologies developed for the region.

Sector governance/policy, planning and management

- National and regional policies and strategic plans for fisheries and aquaculture could be developed.
- Responsibility and authority for fisheries administration could be strengthened by establishing fisheries administrations or departments of fisheries and aquaculture.
- New fisheries laws could be issued or current laws improved. (The creation of a legislative basis for fisheries management combined with strengthening private sector ownership of water bodies and the establishment of a joint venture are key to the development of the sector.)
- Stakeholder participation and involvement in the decision-making process can help to overcome development constraints.
- The FAO Code of Conduct for Responsible Fisheries could be implemented to improve fisheries and aquaculture management and development
- An attractive environment could be created for investors, including foreign investments.

- Illegal, unreported and unregulated (IUU) fishing could be reduced by establishing and improving MCS methodologies.

Investments into sector development

- Active and increasing support and interest in the opportunities may be provided by the sector from TICA, the EC, FAO, World Bank and other bilateral and international development agencies and banks.
- International organizations including NGOs and financial institutions could be involved in development planning of the sector.
- Increasing stakeholder awareness and participation could be increased, and the establishment of fisheries/aquaculture cooperatives and associations supported.
- Grassroots-level projects could be developed and implemented in support of fishery communities and serve as a demonstration for others.
- Infrastructure and support services for fisheries and aquaculture could be improved.
- Demand for fish could be increased through promotional campaigns emphasizing good quality and health aspects.

4. Threats

Social

- Conflicts over the common use of water resources
- Fishers and aquaculturists regard each other as competitors; the concept of teaming up in cooperatives and associations is yet to be developed in many places.
- The balance between fishery production by aquaculture and by capture fisheries is moving rapidly towards the former; reduced catches cause less employment in capture fisheries.

Economic

- The market prices of most of the fish species captured and cultured traditionally are relatively low, causing limited economic feasibility of the fishery activities.

Technical

- Limited fish stock management knowledge and skills among fishers destroy the balance between herbivorous and carnivorous fish.
- The non-availability of commercial fish feeds hampers the development of the sector.
- Water canals used for irrigation are generally old, causing high water losses and spillages, and reducing availability for fisheries.
- The fishing equipment used is generally old and below standard, causing reduced selectivity and negative effects on fishery stocks.
- The lack of good processing facilities, especially packaging facilities, causes food safety concerns related to fish consumption, which is hampering fish consumption growth.
- Market facilities for the marketing of fish are poor in the rural areas. There is often no clean tap water, ice or cold storage, electricity, or clean and hygienic workspace for retailers. This causes food safety concerns and reduced sales.
- In cases where the government is not interested in the sector, it will be hard to elicit interest and support from donor agencies for the sector.

Environmental

- Global warming affects the water resources and may affect aquatic animals and their living environment.

- Construction of hydropower plants/dams (and other weirs) on the rivers of the region causes massive impacts on upstream and downstream migrating fish.