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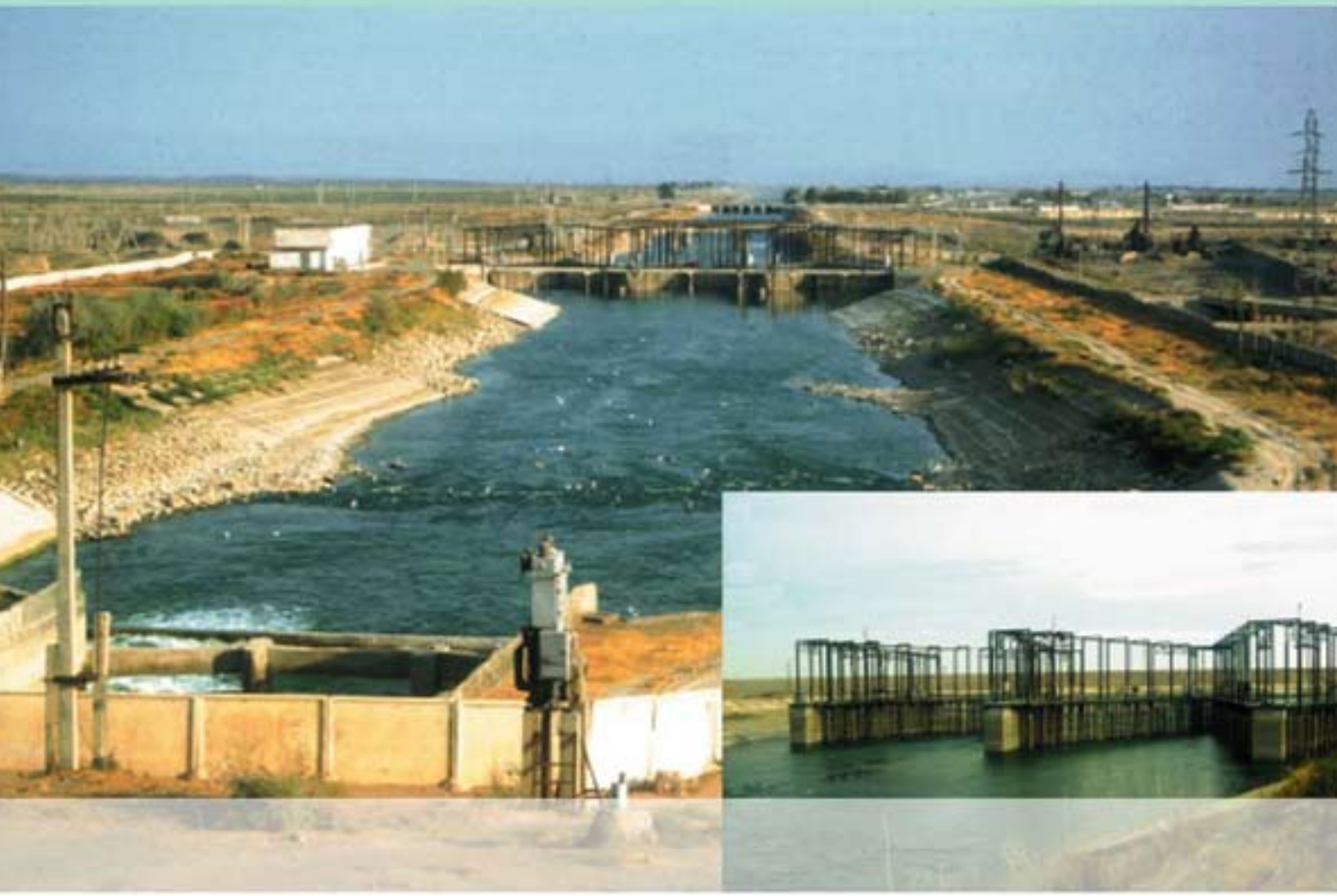
Fisheries in irrigation systems of arid Asia



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This document contains twelve papers presented at the FAO Expert Consultation on the Use of Irrigation Systems for Sustainable Fish Production in Arid Countries of Asia, Almaty, Kazakhstan, 25–29 September 2001. The meeting of experts was organized with the close cooperation of the Kazakhstan Scientific Research Institute of Fisheries, Almaty. The Report of the Expert Consultation is published as FAO Fisheries Report No. 679.

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ABSTRACT

This Fisheries Technical Paper is a companion to the Report of the FAO Expert Consultation on the Use of Irrigation Systems for Sustainable Fish Production in Arid Countries of Asia (FAO Fisheries Report No. 679). The consultation was held at Almaty, Kazakhstan, from 25 to 29 September 2001.

This document brings together twelve papers that review the present use of irrigation systems for fisheries in the countries of the arid belt of Asia, from Turkey to China. The individual papers deal with the following countries and areas: Xinjiang Uygur Autonomous Region (China), India, the Islamic Republic of Iran, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, Turkey and Uzbekistan. While some countries in the arid belt are well advanced in the field of fish production from waterbodies of irrigation systems, others are experiencing major difficulties arising from recent changes in their political and economic systems, particularly Mongolia and the countries of Central Asia. Such countries require major assistance. The document includes a summary of recommendations and proposals for further action, as formulated by the expert consultation.

FOREWORD

The FAO Expert Consultation on the Use of Irrigation Systems for Sustainable Fish Production in Arid Countries of Asia was held in Almaty, Kazakhstan, from 25 to 29 September 2001. The meeting of Experts was organized with the close cooperation of the Kazakhstan Scientific Research Institute of Fisheries (Dr Khismet Ismukhanov, Director). The Expert Consultation was attended by 19 participants from 10 countries: China, India, the Islamic Republic of Iran, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, the Syrian Arab Republic, Turkey and Uzbekistan. Among the participants were two irrigation experts who made possible close interaction on common problems, especially in areas where fisheries interests in water resources have been in conflict with demands from irrigated agriculture.

The major objectives of the FAO Expert Consultation were to review the current achievements and identify constraints in managing fish stocks in irrigation systems of arid countries of Asia, and to assess the potential and develop strategies for further improvement of inland fisheries in water bodies serving irrigation and arising from it.

The arid belt of Asia extends from the Mediterranean to the Pacific, including the following countries: Turkey, the Syrian Arab Republic, Iraq, Iran, southern Russia, countries of Central Asia, i.e. Turkmenistan, Uzbekistan, Kazakhstan, Kyrgyzstan, Tajikistan, and also Pakistan, India, Mongolia and China. In all these countries, with the exception of Mongolia, much of the food production comes from irrigated agriculture and all have inland water resources with harvestable fish stocks.

While FAO and other organizations have been actively promoting the integration of fish production into irrigated small-scale farming systems in high rainfall areas of Asia and Africa, small-scale systems are less common in countries of the arid zone of Asia, especially north and west of India and Pakistan. In these countries large irrigation systems predominate, with water distributed to large command areas for production of food crops and cotton. Such systems include reservoirs, distribution canals, drainage canals, and storages of residual water. Although many reservoirs have been used for fish production with varying success, other types of water bodies have been utilized much less or not at all.

Fishery and agriculture experts from the ten countries who met in Almaty, presented the status of irrigated agriculture and the use for fish production of waterbodies serving irrigation. The agriculture irrigation specialists present allowed for an intersectoral exchange of ideas. This also contributed to a better understanding by agriculture engineers of some problems facing fisheries managers when dealing with fish production in irrigation waterbodies.

Xinjiang Uyghur Autonomous Region, situated in northwestern **China**, is arid, with very low precipitation. Rivers and lakes are fed predominantly by snow and ice melt waters draining from high mountain ranges. Capture fishery, which rapidly developed after World War II, exhausted the available fish stocks and the situation worsened when water from rivers started to be diverted for irrigation to increase crop production for the fast growing population. Fish introductions and species transfers were the first management measures aimed at increasing fish yields in reservoirs and lakes. More recently, fisheries management has concentrated on aquaculture development, which now produces 84.6 percent (47 760 tonnes) of the total fish production in the landlocked Xinjiang Region.

In **India,** crop production from irrigated agriculture has kept pace with the growth of the population: from 51 million tonnes in 1951 (population 361 million) to 200 million tonnes in 1999 (population 1 billion). This can be attributed primarily to the implementation of irrigation projects. India has the largest irrigated area in the world. Man-made reservoirs

harnessing water for irrigation, flood control and hydropower have a combined area of around 40 000 km^2, ranging from less than 1 km^2 to 740 km^2. Fish production from Indian reservoirs has been steadily rising and contributes a significant percentage to the total inland fish production. India has shown promising results during pilot studies of fish production in irrigation canals, and has identified waterbodies resulting from seepage and drainage waters as having good potential for pisciculture.

In **Iran** irrigated lands cover 8 million hectares (ha) and those under dry farming cover 6.5 million ha, but the latter category has been subject to serious damage resulting from the recent drought. Limited water resources and the widespread use of unscientific and traditional irrigation systems, which result in up to three times higher water consumption than actually needed for production of crops, are the major constraints facing agriculture in Iran. There are about 3 500 inland waterbodies. Of these about 730, covering a total area of 508 000 ha, are used for fisheries. During 1995–1999 the annual fish production from these waterbodies averaged 30 000 tonnes, employing over 130 000 fishers. It has been recognized that to keep the fisheries sustainable, regular stocking is necessary. About 600 000 ha of land in Iran is allocated to rice farming. It is planned to further develop integrated rice-carp farming and trout farming during the post-harvest period. Trout farming would follow when the water temperature does not exceed 20 ^oC. Farming in rice fields in 1999 resulted in a harvest of 126 tonnes of fish. The side benefits of this type of culture are fertilization of fields by fish and control of the rice stem borer by carp feeding on it.

In **Kazakhstan** about 70 percent of water is used for irrigated agriculture. Reservoirs in southern and western Kazakhstan serve mainly irrigation, while those situated in the northern half of the country are mostly multipurpose. By the beginning of the 1990s, 2.3 million ha of land were irrigated, plus 1 million ha of irrigated pastures in the deltaic region adjacent to the Aral Sea. Apart from the large number of reservoirs, there are 96 400 km of irrigation canals and 14 900 km of drainage canals. The change from a centrally planned to a market-oriented economy has had a negative impact on land use, resulting in a reduction of irrigated land by about 1 million ha. The system of irrigation canals has deteriorated in a number of places, and no new irrigation systems have been constructed. There has been a drastic reduction in the officially reported fish catches from reservoirs and other waterbodies, in spite of the government maintaining its policy of regular stocking of reservoirs with hatchery-produced fingerlings, as fish hatcheries are still government-owned.

Since much of **Kyrgyzstan** is covered by high mountains, the predominant type of agriculture is livestock production on mountain pastures. Consequently, this Central Asian country has the least developed fishery of all countries in the subregion.

At present, **Mongolia** has no fish production in irrigation systems. In the 1990s, 90 000 ha of land were irrigated, but there are no major reservoirs and irrigation canals which could be utilised for fish production.

In **Pakistan**, 14 million ha are irrigated. There are three major reservoirs, plus 19 barrages, 12 interlink canals and 43 independent irrigation command areas. The total length of main canals is 58 500 km. About 79 percent of the total wheat crop comes from irrigated fields. None of the major dams include fish passes, but some barrages have fish passes which, however, are largely non-functional. Most pumping stations have no fish protection devices and where these are present, they do not function well. In the year 2000, 144 000 tonnes of fish were captured from rivers, reservoirs, natural lakes and irrigation canals; 36 000 tonnes were produced in aquaculture, and about 75 percent of these were produced in fish ponds fed by irrigation canals. There is potential for enhancing fish production in irrigation and multipurpose reservoirs, and also in the at present largely unexploited brackish waterbodies

formed from drainage water. Abandoned irrigation canals are used for fish production and managed as fish ponds. Flood control compartments ranging from 10 to 5 000 ha are naturally stocked with fish during floods, but drained a few months later, which does not allow the fish to grow to market size. With proper management, these structures could be better utilized, perhaps for the production of stocking material.

Turkey has experienced intensive dam construction activity aimed at tapping as much of its water resources as possible, mainly for hydroelectricity and irrigation. Turkey has 8.5 million ha of economically irrigable lands and 151 dams which have been constructed to store irrigation water. The South Eastern Anatolian Project (GAP) is a multipurpose project which comprises 22 dams and is expected to double the current hydropower and agriculture production of Turkey. While major fish produced in waterbodies of irrigation systems are common carp and trout, Turkey intends to initiate breeding, stocking and production of other indigenous fish species.

Uzbekistan uses about 85 percent of the total water runoff for irrigated agriculture, producing mainly cotton, rice and wheat. Water for irrigation is taken from the middle courses of rivers, and drainage water is returned to the rivers further downstream or collected in depressions in lakes without outflow. The total length of irrigation canals is 150 000 km, and drainage canals 100 000 km. Fisheries is practised in numerous bodies of irrigation systems, including waterbodies established from residual water. Much of the fisheries have been privatized, with the former state fishing companies now united under one private management enterprise. Today the major fish production comes from aquaculture in fish ponds established alongside irrigation systems. Twelve of the existing fish farms use irrigation water, and eight use drainage water with salinities of up to 6 g/litre. After a sharp decline in fish production in the early 1990s, fish production in 2000 in all types of freshwater bodies of Uzbekistan reached 9 200 tonnes, of which 6 200 tonnes came from aquaculture and the rest from capture fisheries. However, the fishery potential of irrigation reservoirs is grossly underutilized. The current fish food consumption in Uzbekistan is only 1 kg/person/year.

Fishery management of irrigation reservoirs is best developed in India and Pakistan, where for many years irrigation systems have been a valuable source of fish. Enhancement of fish stocks by stocking, practiced in most countries of the region, has resulted in steady increases in fish production, providing a growing supply to the markets. In countries of Central Asia and in Mongolia fishery management in irrigation and other types of reservoirs has been declining since the dissolution of the Soviet Union. While fish stocks in reservoirs in the countries of Central Asia are presently underutilized, in the Xinjiang Uyghur Autonomous Region of China and in the Syrian Arab Republic fish stocks in reservoirs appear to be overexploited.

Adequate water supply during the critical reproduction and growing periods is a precondition for maintaining fish stocks in irrigation reservoirs. However, due to the priority given to irrigation and often also hydropower production, a satisfactory water supply for fish cannot always be safeguarded. Then other fish stock management methods may have to be applied. The most commonly used method is regular stocking of reservoirs with hatchery-produced fingerlings. Information available for Indian reservoirs indicates that proper stocking of reservoirs significantly contributes to incremental fish production.

Only a few countries use drainage/waste water canals for fish production. Drainage waters have been used for fish production in some parts of India, and information is available from a pilot study in the Syrian Arab Republic. The issue of regular maintenance of drainage canals must be addressed.

Representation of fishery specialists in planning, management and decision-making processes would mean that the interests of fisheries are presented and discussed at a high level. This has not always been the case. Such an approach would contribute to a better understanding of fishery problems faced by other users of the same water resource. As irrigation demands determine the quantities and timing of water discharges, close collaboration is imperative in decisions regarding water allocation and releases. With the ever-increasing demand for water resources, more care must be taken to satisfy all uses, especially for irrigation, hydropower production and fisheries. Reducing water demand for agriculture would have a positive impact on fish stocks and fisheries, especially where current large seasonal agricultural demands cause a major drop in water level damaging the spawning and nursery areas.

On the basis of the papers presented and the follow up discussions, the Expert Consultation put forward a number of recommendations which are published in the FAO Fisheries Report No. 679.

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