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**REGIONAL WORKSHOP ON BEST PRACTICES FOR CAGE
CULTURE IN RESERVOIRS AND LAKES IN CENTRAL ASIA AND
THE CAUCASUS, 5-8 DECEMBER 2017**

BACKGROUND

1. Global fish production peaked at about 171 million tonnes in 2016, with aquaculture representing 47 percent of the total and 53 percent, if non-food uses are excluded (State of World Fisheries and Aquaculture, SOFIA 2018, FAO). With capture fishery production relatively static since the late 1980s, aquaculture has been responsible for the continuing impressive growth in the supply of fish for human consumption. With 5.8 percent annual growth rate during the period 2001–2016, aquaculture continues to grow faster than other major food production sectors. However, the disparity in the level of sectoral development and uneven production distribution remain great among the countries within the regions and across the world.

2. In this regard, CACFish approved an activity in the Second Regional Work Programme to raise awareness and capacity in the Central Asian and Caucasus countries on cage aquaculture in lakes. This document aims to provide information on cage aquaculture as presented in the regional training workshop: “Best practices for cage culture in reservoirs and lakes” held in Elazig, Turkey on 5-8 December 2017.

OVERVIEW OF CAGE AQUACULTURE

3. Historically, the cages that were initially used for producing fish were likely developed in Southeast Asia around the end of the 19th century. Wood or bamboos were used to construct these cages and the fish were fed by trash fish and food scraps. By the 1950s modern cage culture began with the initiation of production of synthetic materials for cage construction. These cages were further developed for marine fish species, primarily salmon, in Northern Europe and eventually adopted in other parts of the world and expanded to use with other marine fish species such as seabass and seabream. Today cages are used to culture several types of shell fish and finfish species in marine, brackish and freshwater bodies. Today the freshwater

cages are used for both food fish and for rearing fry and fingerlings as inputs into the production cycle.

4. Cage culture allows the use of freshwater bodies without losing control of the production process through controlled feeding, disease management, and species management, factors which are not possible with inland capture fisheries. Cage culture in lakes and reservoirs can provide another source of income to rural communities, as well as increased supply of nutritious fish for domestic consumption or marketing.

5. Although cage culture in freshwater has grown in terms of technology and wider use, it should be emphasized that cage culture of fish is not foolproof or simple. To the contrary, cage production can be more intensive in many ways than pond culture and should be considered as a commercial alternative only where open pond culture is not practical or where underutilized lakes and reservoirs are available. Cage culture requires investment in training of the farmer in: intensive feeding, maintenance of equipment, disease control and overall business management, and thus cage culture may not be suitable in all situations, especially where there are small-scale farmers with limited resources.

6. Following are advantages of cage culture, when compared to other fish farming systems:

- easy installation;
- flexibility of management;
- effective use of fish feeds;
- less manpower requirement;
- better control of fish population;
- in emergencies it can be removed from one place to another;
- treatment of disease is much simpler than that of pond culture;
- it requires less investment, because it uses existing water bodies, simple technology and swift return of investment;
- controlling the unwanted reproduction of some species, therefore mixed-sex populations can be reared in cages;
- close observation and sampling of fish is simple and therefore only minimum supervision is needed;
- many types of water resources can be used, including sea, lakes, reservoirs, ponds and rivers;
- fish handling and harvesting are simple;
- fish inside have less chances of being attacked by predators than in ponds or fish runs, especially from Cormorants.

7. Disadvantages of cage culture include:

- stocked fish are easily affected by external water quality problems, e.g. low oxygen levels;
- diseases are a common problem in cage culture; the crowding in cages promotes stress and allows disease organisms to spread rapidly. Wild fish around the cage can transmit diseases to the caged fish and vice-versa;
- formulated feed that meets full nutritional requirements of the species must be used, sometimes through imported pelleted feed, which is expensive;
- during feeding some amount of fish feed passes out through the mesh, therefore, fish require feeding many times a day, and feed accumulating under the cage can cause environmental pollution; in marine cage culture, regulators often require moving of the

cages at regular intervals to allow natural cleaning by the seas, which is not feasible in lakes;

- the high fish density combined with the high feeding rates often reduce dissolved oxygen and increase ammonia concentration in and around the cage, especially if there is no water movement through the cage such as in lakes or reservoirs;
- in public waters, cage culture faces many competing interests and its legal status is not well defined;
- escapees from cages can degrade the genetic material of wild fish population or displace native species if the farmed fish are invasive species.

TRAINING ON CAGE CULTURE IN RESERVOIRS AND LAKES OF CENTRAL ASIA AND CAUCASUS

8. While global inland culture-based production from reservoirs or lake-based cages reached 44 million tonnes (FAO, 2015), the same production reached only 180 000 tonnes in the Central Asian and Caucasus countries (Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan, Ukraine and Uzbekistan). In most of these countries, only a very small proportion of fish production comes from cage culture. However, aquaculture has the potential to play an important role in the countries of Central Asia and Caucasus region that have an abundance of freshwater resources currently underutilized for fisheries and aquaculture production.

9. Under the FAO-Turkey Partnership Programme (FTPP) which financed a project called FishDEV, the FAO Sub-regional Office for Central Asia (SEC) organized three trainings on cage culture:

- “Regional training on the principles of cage culture in reservoirs” in Kyrgyzstan (Issyk-Kul, Cholpon Ata, 22-24 June 2011);
- “Regional Training on the aquaculture production systems including cage culture” in Turkey (Izmir, 2-5 October 2012);
- Regional Ad hoc Training on Trout Culture in Net Cages in Turkey (Soma, Manisa, 25-28 March 2014).

10. During the Fifth Session of CACFish, the Commission approved USD 50 000 for a regional capacity training on cage aquaculture in lakes and reservoirs, to be completed in the intersessional period 2016-2017. In this regard, the Secretariat engaged a Turkish service provider (Elazig Fisheries and Aquaculture Research Institute (ELSAM)), Elazig, Turkey for this activity. The justification for choosing ELSAM as a service provider for the cage aquaculture training was based on three considerations. First, ELSAM, as a non-profit Government institution, was recommended by the Ministry of Food, Agriculture and Livestock of Turkey (Ministry of Agriculture and Forestry now). Second, ELSAM is located in south-east Turkey where intensive cage farming is practiced in reservoirs and lakes. More than 35 000 tonnes of fish are produced in this region in approximately 150 cage farms. Finally, an FAO aquaculture expert visited the ELSAM facilities in October 2017 to inspect the technical and organizational capacity and noted that ELSAM has sufficient capacity, the required expertise and experience to provide a regional training workshop on cage aquaculture, including laboratories and a Research and Development Unit.

11. This CACFish-funded regional training contributed to FAO’s Strategic Programme, namely Objective 2 – Make agriculture, forestry and fisheries more sustainable and productive

and Objective 3 – Reduce rural poverty. The training also contributed to FAO’s Regional Initiative on “Empowering Smallholders and Family Farms for Improved Rural Livelihoods and Poverty Reduction”. The goals of the cage aquaculture training were to:

- establish stakeholder partnerships and build the capacities of local governments;
- develop and implement social and economic strategies in aquaculture and freshwater resource management for food security and poverty alleviation in rural communities;
- accelerate the successful promotion and adoption of freshwater aquaculture technologies in the CACFish region;
- improve cage culture management by fish farmers to increase economic returns as well as reduce the environmental impact of aquaculture in lakes and reservoirs;
- enhance participants’ knowledge and skills on freshwater aquaculture technologies to promote development of this sector in the region.

12. The training was held from 5 to 8 December 2017 at the facilities of ELSAM and close-by farms in Elazig, Turkey. The training was supported by selected cage culture and production experts from Turkish universities, private industry and FAO. Invited participants were government officials, technical experts, and private sector producers from the Central Asian and Caucasus countries. The four-day training provided intensive practical information on:

- principles of cage culture;
- site selection: water quality and location;
- legal obligations and rules of a cage culture system (Turkish example);
- introduction to cage culture components;
- introduction to net cage farms;
- cage construction and mooring;
- capacity selection and required calculations;
- environmental impacts of cage culture;
- feeding behaviour of trout and feed selection.

13. A technical farm visit was arranged and the following topics were demonstrated: net changing, net cleaning, farm management, fish selection, grading and harvesting. The participants visited the following sites during the field visit:

- a commercial cage farm with capacity of 900 tonnes per year,
- a family run cage farm with capacity of 200 tonnes per year,
- an on-site fish feed plant with capacity of 5 tonnes per day,
- a fish processing unit with capacity of 20 tonnes per day,
- a trout hatchery with capacity of 50 million fry per year,
- Research and Development Unit of ELSAM.

14. There were a total of 18 participants from 9 countries: Armenia, Azerbaijan, Kyrgyzstan, Tajikistan and Turkey as CACFish Members and Georgia, Kazakhstan, Uzbekistan and Ukraine as CACFish Observers. Participants expressed appreciation for the high quality of the training by ELSAM and FAO.

RECOMMENDED FOLLOW-UP ACTIONS BY COUNTRIES

15. This regional training illustrated the significant differences between countries of the region in terms of cage aquaculture capacity and development needs. As follow up to the training, each country should assess its own situation for promotion of freshwater cage aquaculture in terms of:
- Legal, technical, economic and social environment of cage aquaculture activities should be assessed to identify obstacles and facilitate development of cage culture production.
 - Similar trainings for stakeholders at national and sub-national level are needed to improve farmer knowledge and raise capacity needed for adoption of cage aquaculture by private sector.
 - Trainings should include national presentations on the status and development potential of cage aquaculture in the countries.
 - Different trainings should be organized for fish farmers and ministry officials, based on their current knowledge and areas of interest/aims of utilizing increased capacities.
 - Environmental considerations should also be shared and discussed in cage culture training.