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GENETIC IMPROVEMENT OF RAINBOW TROUT IN THE ISLAMIC REPUBLIC OF IRAN

March 2020

SDGs:



Countries:

Islamic Republic of Iran

Project Codes:

TCP/IRA/3602

FAO Contribution

USD 330 000

Duration:

14 February 2017 – 31 December 2019

Contact Info:

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Implementing Partners

Iranian Fisheries Organization, Ministry of Agriculture
Jahad.

Beneficiaries

Trout broodstock managers and aquaculturists involved in
production and distribution of rainbow trout.

Country Programming Framework (CPF) Outputs

CPF (2012-2016) Outcome: Sustainable Environment and
Agriculture Management; Food Security; Inclusive
Development and Resilient Economy; Knowledge
Management.



BACKGROUND

In the Islamic Republic of Iran, 23 million people in rural areas (30 percent of the population) depend for their income on the agriculture sector, including forestry and fisheries. The sector's share of gross domestic product has declined in the last two decades and is currently 11.4 percent. Variability of rainfall and natural disasters such as floods, droughts and climate change, have major impacts on agriculture, including the fishery sector.

Iran is the largest fishery producer in the region. It has a coastline of 5 800 km, with a fishery sector based on marine fisheries that includes demersal and pelagic resources in the Persian Gulf as well as clupeid fisheries and valuable sturgeon fisheries in the Caspian Sea. The sector is an important source of foreign exchange, despite being challenged by a lack of coordination and inadequate links with research, and inadequate quality control, processing, conservation and marketing. Inland fishing in Iran is limited; however, aquaculture is emerging and has steadily increased over the last decade.

Aquaculture production in Iran increased from 17 776 tonnes in 1985 to 325 325 tonnes in 2013. The most important farmed species are carp, rainbow trout, white leg shrimp and sturgeon, with sturgeon caviar being the most valuable product. Iran's Sixth Five Year National Development Plan calls for rainbow trout production to expand. Demand for rainbow trout greatly exceeds national supply. In 2013, of the total aquaculture production of 325 325 tonnes, 143 917 tonnes was provided by rainbow trout. The aim of the project was to increase the availability of farmed rainbow trout in order to improve food security and livelihoods for people, especially those involved with producing, distributing and consuming farmed fish.

IMPACT

The project successfully established a selective breeding programme for rainbow trout by providing detailed technical start-up guidance for two centres. As soon as these centres become fully operational, the availability of farmed rainbow trout in the country will be increased, providing improved livelihoods and ensuring greater food security.

ACHIEVEMENT OF RESULTS

The principal outcome was to increase the availability of farmed rainbow trout in Iran. In order to achieve this, the project initiated the establishment of a breeding population of rainbow trout at two centres, or hubs: Kelardasht Hub, belonging to Iranian Fisheries Organization (IFO), and Yasouj Hub belonging to Iranian Fisheries Research Organization (IFRO). The breeding population was based on a base population of animals obtained from six private farms across the country with varied originality, and reared at the Coldwater Fisheries Research Centre (CFRC) at Tonekabon. A breeding plan was developed and the capacity of IFO staff was built through a mix of distance learning, study tours and on-the-job training.

IMPLEMENTATION OF WORK PLAN

Following delays, the project inception workshop was conducted some months after signing the Project Agreement. Procurement of the goods and materials required was held up by over one year, while difficulties were also caused by the unilateral imposition of sanctions by the United States, the search for suitable implementing partners in the country and the recruitment of a long-term international consultant. As a result of these constraints to implementation, a no-cost project extension to December 2019 was granted to enable project activities to be completed.

The project achieved all the envisaged outcomes, with some activities being covered by the financial support of the Government. As a result of this collaboration almost one third of the budget remained unspent at the end of the project.

The envisaged risks comprised a lack of capacity within IFO, the poor performance of the national strain of rainbow trout, reluctance among fish farmers to adopt a new strain of rainbow trout and the possibility of the genetically improved rainbow trout escaping and having an adverse effect on native species. These risks did not materialize.

FOLLOW-UP FOR GOVERNMENT ATTENTION

It is recommended that IFO improve the infrastructure of the two breeding centres in line with the implementation plan provided by the project. A yearly update of the breeding programme is also required with a major revision needed every fifth year to take into account the outcomes and experiences gained over the years, and for the adoption of relevant new technologies and developments within the area of quantitative genetics and genomics, to ensure that the overall programme improves incrementally.

SUSTAINABILITY

1. Capacity development

Following a request by the project, a committee on the genetic improvement of rainbow trout was set up by IFO in 2018. The project also established a collaborative platform which is designed as a flexible informal system that offers an easy entry point for more people to be included, while the partners already on board have indicated that they wish to stay engaged and informed.

The project's sustainability strategy is based on the development of the national breeding plan, which takes into consideration factors required to establish an efficient breeding programme, including capacity-building, that can be self-sustaining in the long term, with minimal support from abroad.

2. Gender equality

Although not specifically highlighted in the Project Document, the issue of gender equality was addressed by the project, which took gender into account when building national teams. Attention was given to ensuring the equal participation of men and women in all activities.

3. Environmental sustainability

All the training and presentations conducted under the project highlighted the importance of environmental sustainability.

4. Human Rights-based Approach (HRBA) – in particular Right to Food and Decent Work

The project focused on the increased availability of farmed rainbow trout in order to improve food and nutrition security and livelihoods for people, especially those involved with producing, distributing and consuming farmed fish, most of whom are located in rural areas. The project will thus have a significant impact on opportunities for rural youth, women and other targeted groups.

5. Technological sustainability

The project introduced various important approaches and tools into the country. The equipment required was developed in the country with the full support of the project. A reasonable number of IFO staff members are now familiar with the concepts and tools introduced. However, as the breeding centres are new, the provision of expert support may be required in the first one or two years.

6. Economic sustainability

The main product of the project is now available in local markets and is affordable to beneficiaries i.e. private hatcheries.



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DOCUMENTS AND OUTREACH PRODUCTS

- ❑ Inception workshop report. 14-15 February 2017. 10 pp.
- ❑ Defining breeding objectives for rainbow trout in Iran. 11 March 2017. 6 pp.
- ❑ Orientation workshop report. 24 May 2017. 17 pp.
- ❑ Short introduction to quantitative genetics and its application in a selective breeding programme for rainbow trout. Bjarne Gjerde. 29 August 2017. 25 pp.
- ❑ On-line training course report. Norwegian Institute of Food, Fisheries and Aquaculture Research (Nofima). January 2018. 6 pp.
- ❑ Training material. CD. FAO. March 2018.
- ❑ Provisional implementation plan for national centres for production of genetically improved rainbow trout. Bjarne Gjerde and Ola Sveen. December 2019. 50 pp.
- ❑ Assessment of genetic variance of rainbow trout in Iran. Iranian Fisheries Science and Research Centre. July 2019 and December 2019. 40 pp.
- ❑ Posters on genetic improvement of rainbow trout. 2019.
- ❑ Conferences on breeding programme: conference booklet, banner, branding, flash drive. 2018 and 2019.
- ❑ Study tour report - Norway (in Farsi). Maryam Nafari. 45 pp.
- ❑ Study tour report - Turkey (in Farsi). Mehdi Samaei. 10 pp.



ACHIEVEMENT OF RESULTS - LOGICAL FRAMEWORK

Expected Impact	Improved food security and livelihoods for people in Iran, especially those involved with producing, distributing and consuming farmed fish		
Outcome	Increased availability of farmed rainbow trout in Iran		
	Indicator	1. Number of populations of rainbow trout genetically improved in Iran available to farmers. 2. Number of hatcheries producing rainbow trout genetically improved in Iran.	
	Baseline	1. 0 2. 0	
	End Target	1. 2 2. 10	
	Comments and follow-up action to be taken	A breeding population for rainbow trout was established at IFO at Kelardasht and IFRO at Yasouj, based on a base population of animals obtained from six private farms across the country with varied originality, and reared at CFRC at Tonekabon. The two breeding nuclei were established using different individuals from CFRC Tonekabon, but should be treated as a common breeding nucleus, through the exchange of genetic material between centres in the coming generations. IFO needs to improve the infrastructure of two centres in line with the implementation plan provided by FAO.	
Output 1	Profile of desired qualities to be incorporated into rainbow trout breeding programme		
	Indicators	Target	Achieved
	Stakeholder workshop on desired qualities of rainbow trout in Iran.	1	Yes
Baseline	0		
Comments	Priority and importance of traits based on stakeholders' scores were selected and incorporated into breeding programme.		
Activity 1.1	Conduct stakeholder workshop on desired qualities of rainbow trout in Iran with participation of women who are involved in sales and distribution of genetically improved farmed fish in local markets to determine qualities to improve by selective breeding		
	Achieved	Yes	
	Comments	A workshop with the participation of various stakeholders was conducted and participants were asked to select preferred traits in a national breeding programme and to complete the related form. Priority and importance of traits based on their scores were summarized in the report.	

Output 2	Framework implementation plan, as well as staff requirements and budget for a national centre for production of genetically improved rainbow trout, is developed		
	Indicators	Target	Achieved
	Capacity development of staff and framework for implementation plan of national centre.	1	Yes
Baseline	0		
Comments	Capacity development and national breeding plan developed.		
Activity 2.1	Draft provisional implementation plan for a national centre for production of genetically improved rainbow trout		
	Achieved	Yes	
	Comments	<p>A breeding plan was developed through consideration of selection of traits to be included in the breeding objective, length of generation interval, design of the breeding nucleus, and missing technologies needed to develop an efficient breeding programme, and the knowledge building required to make the programme self-sustaining in the long term, with minimal support from abroad.</p> <p>The breeding plan needs to be regularly updated (at least annually) as experience develops, with a major revision every fifth year to take into account the outcomes and experiences gained over the years, and for the adoption of relevant new technologies and developments in the area of quantitative genetics and genomics, to enable the overall programme to improve incrementally.</p>	
Activity 2.2	Train IFO staff in selective breeding and traditional animal breeding		
	Achieved	Yes	
	Comments	Training was provided through one-day workshops by international consultants and the Lead Technical Officer (LTO) of the project, comprehensive study tours and on-line course for IFO.	
Activity 2.3	Convene workshop for government officials to review and finalize provisional implementation plan, including budget aspects		
	Achieved	Yes	
	Comments	The workshop was conducted with the participation of the LTO and international consultants, and implementation was started by the Government.	
Activity 2.4	Government workshop to finalize operating plan		
	Achieved	Yes	
	Comments	Several meetings and workshops were conducted by IFO/IFRO to review and finalize the breeding plan and required operational activities for two selected centres.	

Output 3	National strain of genetically improved rainbow trout		
	Indicators	Target	Achieved
	A breeding population based on base population of animals obtained from private farms in Iran.	One national strain.	Yes
Baseline	Six base populations.		
Comments	The plan was developed through consideration of selection of traits to be included in the breeding objective, length of generation interval, design of the breeding nucleus, and missing technologies needed to develop an efficient breeding programme, and the knowledge building required to make the programme self-sustaining in the long term, with minimal support from abroad.		
Activity 3.1	Analyse rainbow trout populations at Kelardasht hatchery for genetic variation, including the origin and selection history of the populations		
	Achieved	Yes	
	Comments	To fulfil this activity, through a Letter of Agreement with Iranian Fisheries Science Research Institute, the collection and registry of samples from six private fish farms, DNA extraction and assessment of quantity/quality of extracted DNA were performed.	
Activity 3.2	Broodstock selection		
	Achieved	Yes	
	Comments	The results of the rainbow trout genome analysis showed different nucleotides and sequences in different sites in the country. According to the results of molecular variance analysis, the genetic variation between populations was significant. The results of this study can be used in the management of breeding stocks and breeding programmes of rainbow trout in Iran.	
Activity 3.3	Creation of selective breeding programme based on traits identified in Activity 1.1 above		
	Achieved	Yes	
	Comments	The breeding programme was defined in close consultation with project stakeholders and with the support of international consultants and LTO. A yearly update of the breeding programme is required.	
Activity 3.4	Selecting genotype broodstock (from Activity 3.2) to be used in selective breeding programme		
	Achieved	Yes	
	Comments	The most important phenotypic and genotypic parameters to be considered in the breeding programme are: standard deviation and mean or coefficient of variability, genetic and phenotypic variation, heritability for each trait (phenotype to genotype ratio) and the correlation between these parameters.	
Activity 3.5	Implement selective breeding programme with monitoring and analysis		
	Achieved	Partially	
	Comments	Considering the requirement of modifications in current infrastructure of two selected centres, the work was started by the Government and is currently ongoing.	
Output 4	On-line training course on basic selective breeding in aquaculture		
	Indicators	Target	Achieved
	Conducting on-line training course.	One training course.	Yes
Baseline	0		
Comments	The course was conducted through a contract with the service provider.		
Activity 4.1	Design an on-line training course for genetic improvement of fish in the Islamic Republic of Iran		
	Achieved	Yes	
	Comments	The course was designed with technical help from Nofima, a well-known research institute for fisheries and aquaculture. Twelve topics in aquaculture breeding and genetics were covered in this on-line training.	
Activity 4.2	Prepare course materials and presentations including videos, animations and queries		
	Achieved	Yes	
	Comments	The course recorded 13 video lectures on 12 topics.	
Activity 4.3	On-line course implementation and evaluation		
	Achieved	Yes	
	Comments	100 participants from Islamic Republic of Iran enrolled in the on-line course, which was open until 30 December to allow students to watch the video lectures and answer all multiple choice or written form exam questions. Participants were evaluated and certificates were awarded to all students that participated in all the activities. In order to ensure the future use of this training, the course was also developed in the form of a CD for those who did not have the chance to participate in the on-line course.	

Partnerships and Outreach

For more information, please contact: Reporting@fao.org

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