“Sustainable Tuna Aquaculture – New Horizons “

CONCLUSIONS AND RECOMMENDATIONS OF

INTERNATIONAL STAKEHOLDER WORKSHOP

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CONCLUSIONS

Although the natural populations of Atlantic bluefin tuna (*Thunnus thynnus*) show clear signs of recuperation, in response to the recently implemented control and recovery programme by the ICCAT, it is obvious that the limitations on captures are going to continue in the future. Therefore, any increase in productivity of this species in order to satisfy the demand in quantity and quality as increasingly required by a growing and selective market, passes to the production of Atlantic bluefin tuna via full life-cycle aquaculture techniques, in the same way as actually occurs with species such as seabream, seabass, turbot or salmon.

The SELFDOTT project has complied amply with the proposed objectives, substantiating the results of reproduction of Atlantic bluefin tuna in captivity obtained in the previous project REPRODOTT and laying down the bases for the production of fingerlings of this species and for the development of more efficient feeds respectful of the environment. Even if the advances achieved in the project can be classified as spectacular, there are still many aspects that must be improved, and, therefore, it is concluded that the large-scale commercial production of this species in a profitable manner is not yet developed sufficiently enough to fuel a new aquaculture industry.

RECOMMENDATIONS

1. Reproduction and Egg Production

The results of SELFDOTT demonstrated clearly that reproduction of Atlantic bluefin tuna in captivity is possible, and production of large numbers of viable eggs can be achieved by maintaining mature fish in cages for a period of a few years.

Spontaneous spawning may result after some years of acclimatization to the captive environment, assuming environmental conditions (mainly annual temperature profiles) are suitable, but also the developed GnRHa-implantation method can be employed in situations when natural maturation, ovulation and spawning fails.

Nevertheless, the results from SELFDOTT also showed that the reproductive process is not entirely normal in captivity (*e.g.*, low gonadosomatic index, low spermatogonial proliferation, high testicular apoptosis) and that further work is necessary to identify the causes for theses impairments, and develop broodstock management procedure to alleviate them. Broodstock nutrition is one area that showed promising results. Furthermore, egg collection was proven difficult in one of the sites throughout the reproductive period, and in both sites under some weather conditions, pointing to the need for further work to improve the reliability of the egg collection activity.

Based on the findings of SELFDOTT in the area of Reproduction and Broodstock Management, we envisage that captive broodstocks will continue to be maintained in sea cages, in association with fattening operations, or if allowed by ICCAT, in association with grow-out operations for other marine fishes. However, we believe that the construction and operation of a land-based facilities (such as the one currently under construction in Spain, managed by the IEO) is still imperative for the further development of commercial-scale larval rearing procedures, which will allow the development of a proper aquaculture industry for the Atlantic Bluefin tuna.

The advantages of such a facility include:

1. provision of a controlled and appropriate thermal regime for the support of reproductive function,

2. extension of the spawning season (a few weeks), by maintaining appropriate spawning temperatures for a longer period of time,

3. establishment of off season reproduction and spawning (a few months), through photo-thermal manipulations.

The extension of the reproduction period and the associated increase of the period of time that eggs are available for larval rearing trials, will allow implementation of more experiments per year and a faster development of the necessary larval rearing methods for the efficient production of fingerlings, in order to establish an Atlantic bluefin tuna aquaculture industry.

An EU Network of Excellence of the various National Research Institutes, Universities and Organization in Europe should be financially supported, allowing also transnational access of International Organizations involved with the domestication of both the Bluefin tuna (Pacific and Southern) as well as other tuna species (*e.g.*, yellowfin tuna, black fin tuna and big eye tuna).

2. Larval Rearing

SELFDOTT has established the knowledge base for larval rearing using an integrated approach (rearing methods and scientific topics), which has lead to real progress in this field. Longer period of egg availability is imperative for a more rapid development of commercial-scale larval rearing procedures.

Besides the very encouraging data obtained in just a few attempts, at the moment there is a lack of repeatability in the key results (*i.e.*, survival, growth, quality and health), which need to be addressed taking advantages from the clear indications delivered by the scientific investigations implemented during the ontogeny. Larval rearing is still at the research stage and has not reached the status of a commercial technology.

3. Nutrition and Diets

The SELFDOTT activities on nutrition have provided a strong foundation for future developments. Special emphasis should be placed on weaning diets and "as early as possible diets" for larvae. An alternative dry diet should be sort to ameliorate the present need for provision of yolk sack larvae for food to the Atlantic bluefin tuna larvae. Development of micropelleted diets adapted to very early weaning window has also to be addressed.

4. Fingerling Management

Fingerling transfer and cage adaptation have been main bottlenecks in SELFDOTT project, as also been seen by other research teams in Australia and Japan. The fingerling stage is extremely sensitive and the development of techniques for handling and transport require special attention.

5. New Legislation

New regulations will be required for the "new products" arising from the sustainable aquaculture of Atlantic bluefin tuna, which may no longer fall under the remit of wild population measures. In this context traceability technologies ("farm to fork") and distinguishing between cultured and wild populations must become standard practice for the industry. Previous legislative models for aquaculture of endangered species may serve as an example.

6. Finance and Funding

Further public funding is required for research to close some of the gaps in our knowledge and overcome some of the remaining bottlenecks. Continuing cooperative industrial support and investment is also necessary to translate research results into commercial technology.

This group strongly recommends that in the future, EU FP calls should address specific problems of the sustainable tuna aquaculture industry.

Proposed Call for follow-up research for the Domestication of the Atlantic bluefin tuna.

Reliable production of Atlantic bluefin tuna eggs and establishment of protocols for the large-scale production of fingerlings and their acclimation to sea cages

This project will substantiate the current knowledge on the larval rearing of Atlantic bluefin tuna, in an effort to establish commercial scale, efficient methodologies for the production of high quality fingerlings for the establishment of a new aquaculture industry in the EU. Integral to this objective will be the enhancement of broodstock nutrition for the production of high quality eggs, the appropriate transport of fingerlings and cage acclimation, as well as the development of suitable, sustainable and environmentally performing grow-out feeds.

In recent years, it has been demonstrated that reproduction of Atlantic bluefin in captivity is possible, and the development of a new aquaculture activity for this species may be possible. The new final product of the aquaculture industry will be a fast growing, high nutritional quality and dress-out percentage fish --“bluefin tuna juvenile™”—which will be produced using appropriate, efficient and sustainable feeds, in a production cycle of <3 years and harvested prior to sexual maturation. This activity will be independent of the wild populations that are facing serious fishing pressure and are currently under a strict programme for recovery, and will not necessarily target the volatile, luxury raw fish market.

The inclusion of ICPC partners is encouraged, as there is expertise in other tuna species around the world that can speed up the process of domestication of the Atlantic Bluefin tuna

Funding scheme: Small collaborative project (4 million EU contribution, 3 years)

Expected impact: This project will establish the methods necessary for the commercial aquaculture production of Atlantic bluefin tuna, thus improving the competitiveness in the EU aquaculture industry and contribute directly to easing the pressure on the wild fishery for this species, which has been overfished in recent decades, and is currently under a very strict control programme to ensure the recovery of the population.