

## **BFTMED**

### **MAJOR IMPROVEMENTS IN OUR KNOWLEDGE OF EASTERN ATLANTIC BLUEFIN TUNA IN THE MEDITERRANEAN (FISHERIES, STATISTICS AND BIOLOGY)**

**EU PROJECT 97/029.**

#### **Interim Consolidate Report**

## **1. CONTEXT AND OBJECTIVES**

With catches reaching 50 000 MT in 1996 and more than 40 000 MT in 1997, bluefin tuna is one of the species whose East stock assessment is difficult, regarding to complexity of fishing and landing aspects, especially in the Mediterranean sea. With the rise of Japanese market demand, new fisheries have been developed and effort in traditional one's increased in the most recent years. Fishermen in a lot of countries, turned toward catches of largest fishes. Mainly purse seiners and longliners exploit Balearic Islands fishing grounds as other well-known reproductive area for bluefin tuna. In this evolving context, created by the free market, data base collection used for the assessment of the stock is more difficult, due mainly to landings in no-foreign ports or transshipping at sea.

To assess the status of north Atlantic bluefin tuna, the International Commission for the Conservation of Atlantic Tunas (ICCAT) requires that contracting states provide catches with more transparency on their origin, length frequencies and, if possible, indices of abundance by age and fishery. There is an evident lack of abundance indices for bluefin larger than 7 years old and indices for younger ages need a more accurate definition of effort, enclosing historical technology and strategy progresses.

Fishing activity may have some influence on reproductive biology. The Ad-Hoc GFCM/ICCAT joint working group on stocks of large pelagic fishes in the Mediterranean sea on the tag recovery network (Messine, 1997) recommends that spawning biomass, sex ratio, age maturity and fecundity, in the spawning grounds be estimated.

Following that context and in the frame of ICCAT monitoring program and previous EEC studies on large pelagic fisheries, the objectives of the project are to further develop the studies already carried out regarding the fishery statistics and the reproductive biology of the bluefin tuna in the Western, Central and Eastern Mediterranean. The above information, besides being required for bluefin tuna stock assessment may well be important for the global management of marine resources.

Regarding the fishery statistics the project takes into consideration the following aspects:

- catch and effort data collection differentiated by gear and area,
- study of the development of fishing fleets and of fishery technologies,
- revision of catch and effort historical data in order to evaluate the trend of the abundance indices considering the evolution of fishery technologies,
- effects of recent prohibition of the use of sighting aircraft in the purse seine fishery in France Spain and in Italy,
- size composition of the catches by area and gear.

For Bluefin reproductive biology, period and length of the reproductive period, their possible variation and their influence on the strength of recruitment are considered important. These items will be evaluated by the determination of sex ratio and sexual maturity using:

- gonado-somatic index,
- macroscopical evaluation of gonadal maturity,
- histological analysis.
- sex hormones,

## **2. PROGRESS OF THE WORK**

### **2.1. Organisation of the work**

#### **2.1.1. Team involved**

- |   |                                  |
|---|----------------------------------|
| 1. IFREMER – Ressources halieutiques<br>Sète - France           | B. LIORZOU<br>J. SACCHI          |
| 2. IEO – Centro oceanografico de Malaga<br>Malaga - Spain       | J.M. DE LA SERNA                 |
| 3. CUM/UdG - Istituto di zoologia<br>Genoa – Italy              | L. ORSI<br>G. PALANDRI           |
| 4. CUM/UdB – Dip. di produzione animale<br>Bari – Italy         | G. DE METRIO                     |
| 5. Aquastudio<br>Messina – Italy                                | A. DI NATALE                     |
| 6. Faculty of Biology – Depart. of zoology                      | K. YANNOPOULOS<br>P. MEGALOFONOU |
| 7. H-H U - Institut für Zoophysiologie<br>Duesseldorf - Germany | C.R. BRIDGES<br>V. SUSCA         |

## 2.1.2. Definition and distribution of tasks

Actions were grouped in 3 main tasks. A recapitulative table, with reference to the terms of the contract, is shown in Tab. 1.

BFTMED distribution of the work								
		1	2	3	4	5	6	7
Tasks	Subtasks	IFREMER	IEO	U. Genova	U. Bari	Aquastudio	U. Athena	U. Dusseldorf
Task 1	<b>Fisheries description</b>							
	fleet	x	x	x	x	x	x	
	gears	x	x	x	x	x	x	
	technology	x	x	x	x	x	x	
	strategy	x	x	x	x	x	x	
Task 2	<b>Catch and effort statistics</b>							
	actual data	x	x	x	x	x	x	
	historical data	x	x	x	x	x	x	
	aerial survey	x						
Task 3	<b>Biological studies</b>							
	size or weight distribution	x	x	x	x	x	x	
	size of first sexual maturity		x	x	x		x	
	reproduction period		x	x	x		x	
	gonado-somatic index		x	x	x		x	
	histological analysis of gonads				x		x	
	histochemical analysis of gonads				x			
	samples collection		x	x	x		x	
	determination of sex hormones							x

Tab. 1.- Distribution of tasks

### 2.1.2.1. Task 1: Fishery description

- general information concerning the fisheries (fleets, gear, technology,.....),
- study of the development of fleets, fishing strategy and technology (Participants: 1, 2, 3, 4, 5, 6)

### 2.1.2.2. Task 2: Catch and Effort statistics

- collection of spatial and temporal data on Catch and Effort differentiated by gear, at landing or (and) on board (Participants: 1, 2, 3, 4, 5, 6),
- historical data : abundance indices will be prepared after reviewing the catches and effort series of data (Participants: 1, 2, 3, 4, 5, 6),
- feasibility study for using aerial surveys to monitor purse seine fishing activity and surface school distribution (Participant: 1)

### 2.1.2.3. Task 3: Biological studies

- study of the size distribution by gear at landing or (and) on -board (Participants: 1, 2, 3, 4, 5, 6),
- Study of the reproductive biology (Participants: 2, 3, 4, 6, 7)

The study of the reproductive biology should yield the following results:

- the size of the fish at the first sexual maturity
- the exact period of reproduction at the actual size of the first maturation

These two results are studied by the following subtasks:

- determination of gonado-somatic index by class size (Participants : 2, 3, 4, 6)
- histological (Participants: 4, 6) and histochemical analysis of the gonads (Participant: 4)
- determination of the sex hormones according to the protocol described later (Participant: 7)

The results obtained from the two first subtasks above will be correlated with third subtask in order to establish the relationship between them for the possible future prediction of sex ratio and sexual maturity from single tissue samples.

### **2.1.3. Discussion of tasks**

These tasks were discussed during a first meeting (Sète, 3 March), with a particular attention related to biological sampling for reproductive study.

## **2.2. Progress and orientation of the tasks**

### **2.2.1. Administrative questions**

Project began on March 1<sup>st</sup> 1998, and first payment corresponding to 40% of the total EEC contribution arrived on April 12<sup>th</sup> in IFREMER Toulon Center. The amount was shared between all participants during April and May. For some reasons that are independent of IFREMER transfer, money arrived in some institutions on June. Greece had great difficulties to be paid.

### **2.2.2. Generalities**

As bluefin fishing season finished in November, a meeting was planned in Rome, 10-11 Dec., to discuss about progresses made in each task of the project and problems encountered during this first year. The recapitulative table of subtasks to be done by each participant (Tab. 1) served as a base for drawing up the situation. Report of the first meeting in Sète was approved. Co-ordinator expressed his concern about great difficulties to joint all participants by Email. Fax could be an alternative solution but everybody has to consult more frequently his mailbox. For exchanges purposes, texts, figures and tables will be sent by Email in Word or Excel format. In difficult cases, text could be sent in RTF or ASCII format. Maps could be in Coreldraw format.

### **2.2.3. Task 1 – Fisheries description**

Every participant present in the Annex a general description of fisheries, gears used in each sectors they control. At this stage, most of participant made an actual state of the situation, including periods and areas of fishing. A general agreement was found in Rome meeting to obtain for each fleet a progressive description. In this field, study about the evolution in the time of fishing equipment and carrying capacity of French purse-seiners fleet is on the right track. Italy seems to have up to now some difficulties to collect the same data.

It is pointed that these data could have an impact for calculate and weight nominal fishing effort of historical series.

A discussion arose on the fact that, in a lot of fisheries, bluefin catches are done as by-catch of others targeted species as swordfish or albacore. The fleet study would take into account that fisheries.

## **2.2.4. Task 2 – Catch and effort statistics**

### **2.2.4.1. Actual data**

All participants agreed that actual data to be collected covers 98 and 99 years. For the interim report, data collected concern 1998. For Italy and Greece, catches data are based on pilot ports. They have to be weighted to the total catch of each sector for the final report. For France and Spain, exhaustive catches are trying to be monitored, by different information sources. Work on 1999 landing will be difficult to complete on Feb 2000 and, based on the 1998 experience, we certainly may forecast, from now on, a delay in the redaction of the final draft report.

A standardisation of the data was one of the major points of discussion under this topic. This standardisation will be done for the final report with the aim of comparing data from the different partners and to have a continuity with previous projects and also to match as close as possible with ICCAT data base. Catches, fleet, fishing effort and catch per fishing effort unit data will be presented as described bellow.

#### ***Bluefin tuna total catches***

##### **- *Catches / gears / month / squares of 5° x 5°***

File structure by year

On one line, each rubric separated by a blank or a tabulation :

- geographical position of the middle of statistical square (quadrant, latitude, longitude),
- bluefin tuna catches,
- month of catches

ex : 1 4230 230 1343 10

##### **- *Catches / port / month***

File structure by year

On one line, each rubric separated by a blank or a tabulation :

- geographical position of the port or if the information exist only by region, geographical position of the middle of the circle where you think that the data will be the best represented (quadrant, latitude, longitude),
- bluefin tuna catches,
- month of catches

ex : 1 4233 227 1105 9

#### ***Fleet***

##### **- *Fleet - all boats targeting bluefin tuna, /month/year***

File structure

On one line, each rubric separated by a blank or a tabulation :

***In number of boats***

- geographical position of the port (quadrant, latitude, longitude),
- number of boats < 10 m,
- number of boats < [10 - 15 m[,
- number of boats < [15 - 20 m[,
- number of boats >= 20 m
- month
- year

ex : 1 4233 227 21 10 5 1 5 98

***In motor power (kW)***

with the same limits than in number of boats

***In gross tonnage***

with the same limits than in number of boats

***Fishing effort***

- ***Fishing effort / squares of 5° x 5° / month***

Effort is reliable to the gear used. If effort is not directed on bluefin tuna, you have to specify it.

File structure by year

- geographical position of the middle of statistical square (quadrant, latitude, longitude),
- effort (in the chosen unit),
- month,
- gear,
- species (BFT for bluefin and, if effort is directed to an other species, put ICCAT code

ex : 1 4233 227 12 5 seine bft

***Catch per fishing effort unit***

- ***Catch per fishing effort unit / squares of 5° x 5° / month***

***In number of fishes***

File structure by year

On one line, each rubric separated by a blank or a tabulation :

- geographical position of the middle of statistical square (quadrant, latitude, longitude),
- catch per effort unit (in the chosen unit),
- month,
- gear,
- species (BFT)

ex : 1 4230 230 212 5 seine bft

### ***In weight of fishes***

same format as for number of fishes

Questions were expressed how to define a nominal effort on purse-seine activities. Day at sea will be taken as the simplest characterisation of effort but studies on technology development as well as fishing or commercial strategy or environmental factors could correct effort series.

### ***Fishing gears***

Description of gears catching bluefin tuna or other species with the number of gear units and a % of use in the year (by port or fishing area)

### ***Fishing areas***

- General map of usual fishing grounds with historical evolution, if it is the case, in the two years of the project and comparison with previous general situations
- General map of fishing grounds spatial evolution by month or with the most accurate scale for the two years of the project.

A full collection of those parameters has to be done only on fleet that target bluefin. All of the partners agreed to make a general description of these parameters for fleet that catch bluefin as by-catch of others species.

It was mentioned that, even if data collection is made on sampling procedure, all parameters have to be weighted to reflect the total catches and effort for the sector studied.

## **2.2.5. Historical data**

Some countries have unexplored historical series of data that could explain long-term variations in bluefin tuna natural abundance. Spanish trap series are well-known but Italy and Greece could exhume data from purse seiners based at Palermo since 1964, longline fisheries since 1990 in the Ligurian Sea, fine data series from two Sardinia traps for 25 years. Accent was expressed about trap series to take into account progressive technology of this gear and the possible alternation in the time between this kind of fisheries and other one's. France is trying to collect and treat long-term data series, but regarding the amount of work to be done, will treat only purse-seine series, trying to apply weighting factors calculated from technology evolution of fleet.

## **2.2.6. Arial surveys**

Effect of current prohibition concerning the use of spotter aircraft during June, after ICCAT recommendation is difficult to appreciate, because of the non-respect of this regulation in 1998.

Contacts were taken during 1998 to get back plotted information from previous professional campaigns. 1997 and 1998 information is available for one spotter Aircraft Company and will be treated in 1999.

A feasibility study will be done by IFREMER in 1999 to analyse how spotter aircraft is working with the boats and if transect observations could be an independent measure of bluefin tuna abundance..

## **2.3. Task 3 – Biological studies**

### **2.3.1. Size or weight distribution**

Results for 1998 are presented for each participant in the Annex. Effort of each one is different, regarding to facilities and human power involved in that task. Ligurian team has some problems to collect data, regarding to a very bad fishing season in 1998, France try to collect, as usual the most complete series of weight/number couples from wholesale fish monger, in order to constitute weight or length frequencies. A more detailed sampling (4086 fishes) was done in a fish monger shop to verify that aggregate information correspond to the reality. Data will be fully exploited for final report. Spain measured 11694 fishes from different fisheries and Aquastudio made main effort with a sample of 5690 individuals in length and 9906 in weight.

### **2.3.2. Size and period at first sexual maturity-gonado-somatic index-histochemical analysis of gonads**

Spain reported more than 1000 gonado-somatic index samples collected in June-July. Results will be presented in the final report. It appears that individuals begin to be mature at 94cm long in late May, presenting some follicles in the gonads. Bari also collected 197 individual for reproductive biology. These observations will have to be compared with sex hormones analysis.

### **2.3.3. Determination of sex hormones**

Sexual Hormones can be easily determined in fish plasma using an ELISA analysis, therefore by measuring hormone levels and at the same time making morphological observations on the gonads the sex, spawning ability and size at maturity can be characterised. The removal of blood samples from these large fish may however be subject to commercial restraints of the fishery making it imperative that a new assay technique using tissue samples be established.

The sex hormone study include the following subtasks:

- Determine the sampling protocol and prepare kits for tissue and plasma/serum sampling
- Develop ELISA assay for Tuna Ketotestosterone and for Vitellogenin
- Measure Ketotestosterone and Vitellogenin in Plasma
- Modify the ELISA analysis for measurement in muscle if time and finance permit
- Determine the levels of stress hormones after capture and investigate their possible correlation with reproduction if time and finance permit.

Due to different reasons (poor samples in Ligurian Sea, difficulties to collect fresh blood) only a few samples were available for first analysis on extraction of tuna steroid hormones, purification of vitellogenin and finally determination of Sex Hormones. Some interesting preliminary results are reported in the German team report in the Annex but further work is needed to confirm them. All the partners that declared their participation to this task have to fill up a table with the 1999 sampling prevision of blood and other tissues. At this date, it seems that participants anticipate some problems to collect samples. This situation has to be solved before May; otherwise we could have some problems to achieve this interesting task.