

**FISHERY, BIOLOGY AND MANAGEMENT OF DOLPHIN FISH (*Coryphaena hippurus*) IN MALTA AND TUNISIA**

REPORT OF THE ACTIVITIES FOR THE YEAR 2000

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**April 2001**



## **1. Introduction**

This document refers to the activities undertaken on the 2000's fishing season and correspond to the proposal submitted on March 2000 to FAO-COPEMED. The activities are related to the following proposed objectives:

- To introduce the COPEMED countries to a responsible management of dolphin fish fishery.
- To acquire data on Malta and Tunisia.
- To obtain a global vision of dolphin fish fishery in Mediterranean waters.

The partial objectives for the reported period are: 1) to establish a framework to study the fishery and 2) to obtain biological samples to determine the stock identity by genetic analysis and to obtain biological data of dolphin fish in the central Mediterranean.

This report was drafted in a workshop held at the IMEDEA and is based on the data collected by Maltese and Tunisian scientists, reflecting the activities for the 2000's fishing season and summarises the main results. The tasks are discussed and the necessary changes and amendments for the following study period are presented.

## **2.Summary of tasks carried out**

### **a. Workshops and coordination meetings**

To develop the objectives an initial workshop was held from July 13<sup>th</sup> to July 14<sup>th</sup> 2000, at the IMEDEA on sampling design and biological sampling. The purpose was to design the adequate sampling strategy, with the participation of the Maltese and Tunisian responsables of the fishery and experts in the Sicilian and Majorca fishery, which provided their knowledge to design the best sampling strategy.

A field visit and check up of the methods used by the samplers was carried out in the main ports in Malta and Tunisia during October 2000 to follow up the developments and discuss the problems found.

The main activities and results of the workshop and of the field visit were reported to FAO-Copemed in due term.

A first year summing up workshop was held at the IMEDEA from 5-6<sup>th</sup> April 2001, where the results obtained by Maltese (Mr.Mattew Camilleri, Mr.Michael Darmanin and Mr.Cedric Camilleri) and Tunisian (Mrs. Amina Besbes, Dr.Amor el Abed) scientists were submitted and discussed. In the workshop participated Mrs. Amina Besbes, Mr.Michael Darmanin, Mr.Cedric Camilleri, Dr.L.Cannizzaro and Dr.B.Morales-Nin. The draft of this report was elaborated jointly and the activities for the next study period were accorded.

## b. Sampling and data gathering

### **Malta**

The study area was divided in three strata 1-East Malta, 2-West-Malta, 3-Gozo (Fig. 1). In each strata one FADs mooring area was selected to be studied (see red circle in Fig.2).

After applications by fishermen to lay FADs were received by the Fisheries department, the characteristics (length, horse power, etc.) of the fleet were collected from the census (year 2000).

When fishermen selected the site they would fish they were asked by interview on the number of FADs they would place, distance between FADs, and distance of last FAD. The position (Latitude, longitude) of the first FAD of each site was given by the Department. The position of the last FAD was extrapolated using these previous data. This information was plotted at the mapping unit of the planning authority (Figs.1&2). Information as to the gear (encircling net) was collected from various sources by a fisheries officer with experience in this field.

Landings were collected on a daily basis per fisherman from sales vouchers effect through the Wholesale fish market.

Three fisherman were selected, one for each stratum, these fishermen carried out length frequency measurements throughout the fishing season on all the fish captured on specific FADs. The same fishermen provided random boxes of fish for biological sampling.

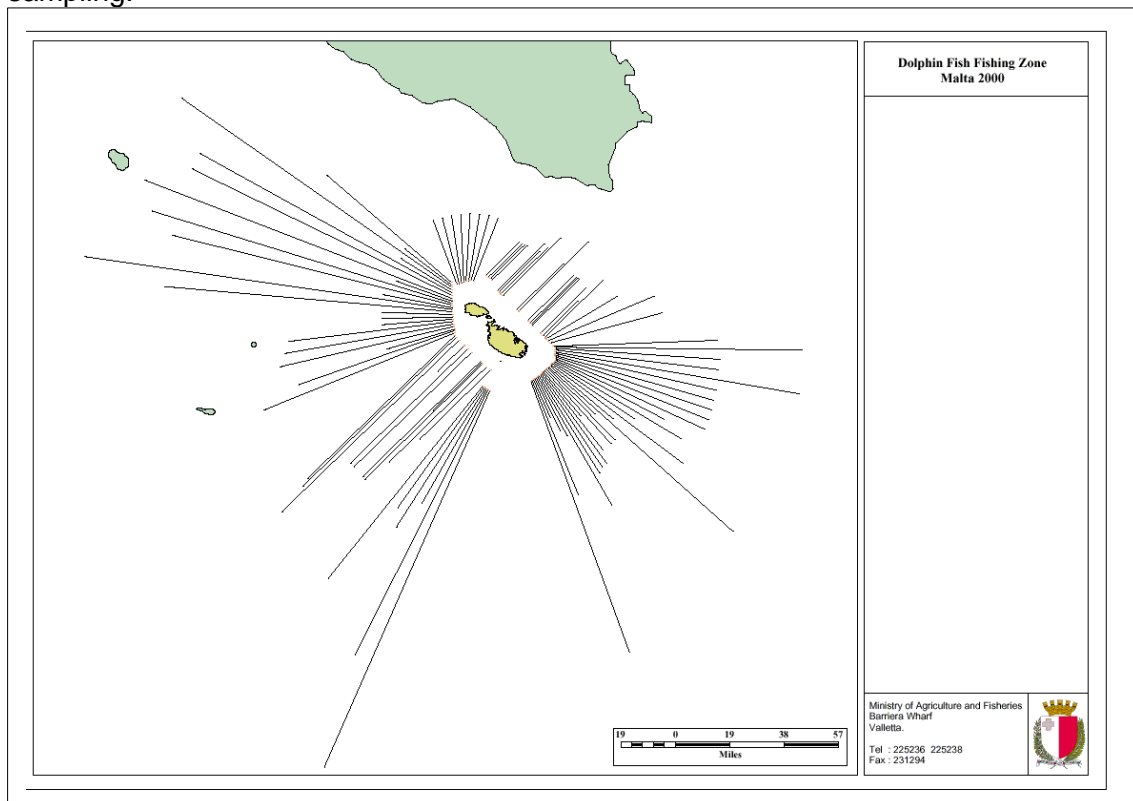


Figure 1. Dolphin fish Fishing Zone Malta 2000

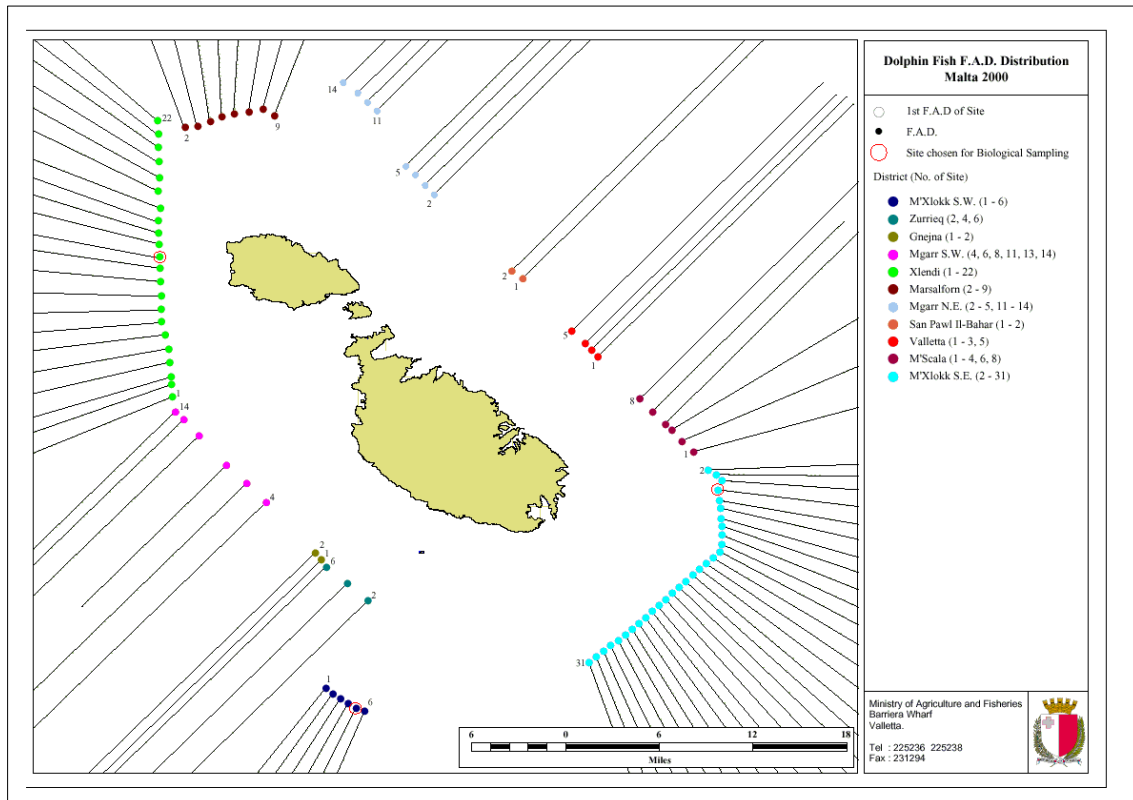


Figure 2. Dolphin Fish F.A.D distribution Malta 2000

**Tunisia**

In the field meeting it was agreed to use the three strata already used in a preliminary study by Zaouali & Missaoui (1999) which are: North comprising from Ghar El Melh to Shidi Daoud, East from Kelibia to Selecta and South with a single port fishing for dolphin fish, Zarzis (Fig.3). The most important stratum is East by the number of ports (11) and effort (240 boats), while the North has 3 ports and 37 boats, and South 1 port and 18 boats.

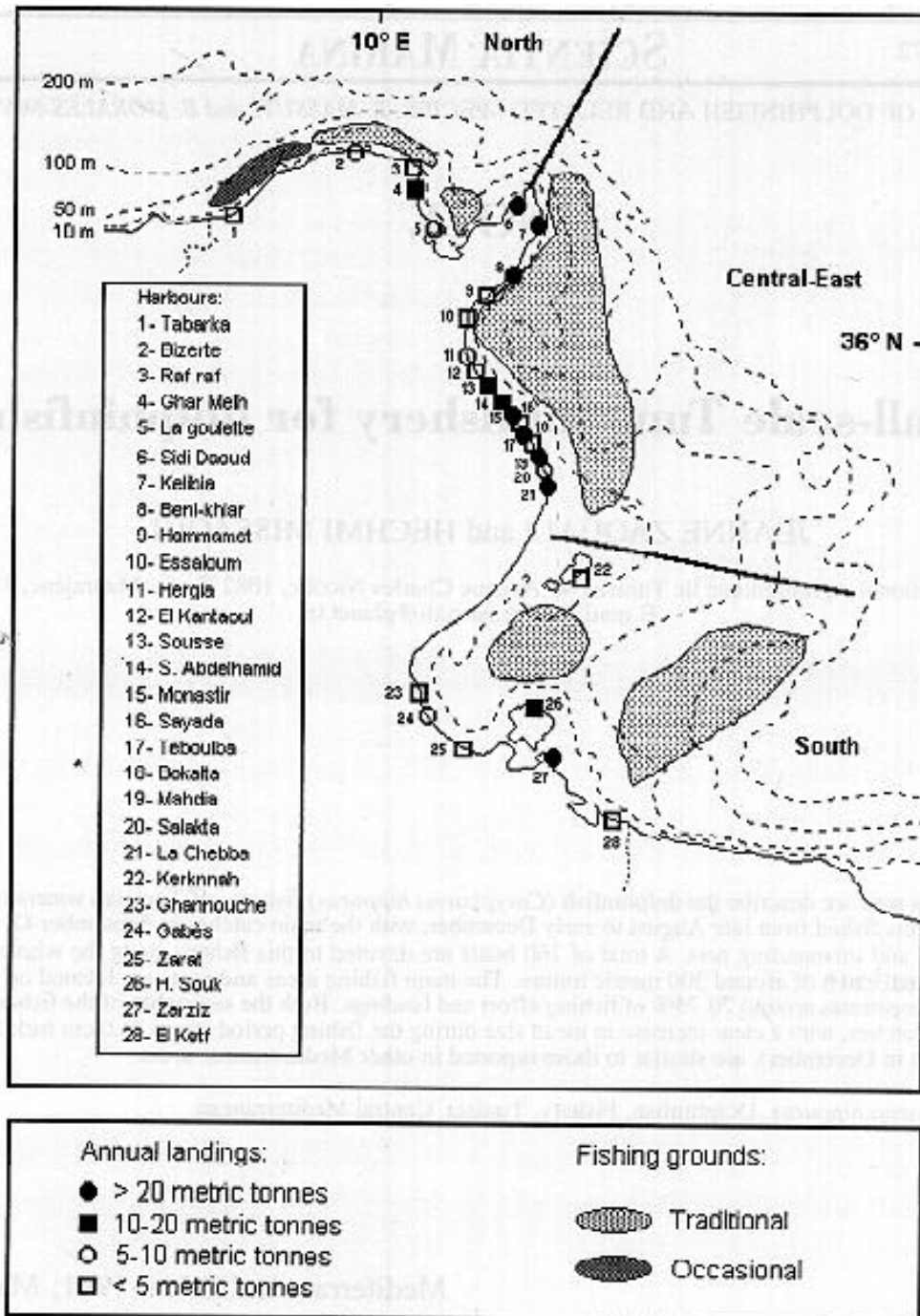


Figure 3. Sampling strata in Tunisia.

## CORY-MALTA&TUNISIA

The length frequency and biological data were collected at two ports (Monastir, Teboulba) with weekly periodicity for the length frequency and monthly periodicity for the biological sampling. The extraction of the otoliths was difficult, so the heads were sent to the IMEDEA for otolith extraction and study. The genetic samples were collected at Zarzis (Southern stratum) on October 2000. The tissue samples were frozen and sent to the University of Girona for isoenzym analysis on February 2001.

The data of effort (number of boats) and boat and gear characteristics were collected at the end of the fishing season.

The captures were collected weekly in the two sampling ports. At the end of the fishing season the landings by port and month, from August to December, were collected by the "Direction Générale des Pêches et de l'Aquaculture DGPA". The market price was also collected weekly.

### **c. Data analysis**

#### ***Malta***

For the length frequency extrapolation from the single sample to the total of the stratum, there was a problem due to the lack of weights of the measured sample. Thus, the length data correspond to the single fisherman by strata and not to the totality of the fleet in the stratum. These results were plotted by stratum and month during the fishing season.

The landings have been sorted by stratum and month, and the fleet characteristics for the fishing period have been summarized by strata. Other metrics of the FADs and boat characteristics have been determined by stratum.

#### ***Tunisia***

The length frequency data were calculated in percentage by the two sampling port and the total for the East stratum with monthly periodicity. The raising facto for the length frequency analysis was obtained from the weight of the sample, the capture of the sampling boat and the harbour landings. The biological data were analysed by month by port and by stratum. The following indexes were determined: sex-ratio, the gonadosomatic index, the hepatosomatic index, condition factor. The length-weight was determined for the fishing season and for the East stratum.

The annual landings data series 1989 to 2000 and the monthly landings for the year 2000 were plotted for Tunisia.

### **d. Results**

#### ***Malta***

The total number of boats registered for the 2000's fishing season was 93 which deployed a total of 15 777 FADs, the mean value of 170 FADs/boat. The fleet was composed of boats of medium size 11.6 m (s.d.=4.29) with marked differences in engine power (mean value=394 Hp, s.d.=265.23). Although the number of boats was higher in stratum 1, the boat size and engine power was much higher in the stratum 3 (Table 1). This is related to the much broader surface covered by the FADs in this stratum (Fig.1) and the high number of FADs deployed by each boat.

Table 1. Summary of the boat characteristics in Malta by stratum.

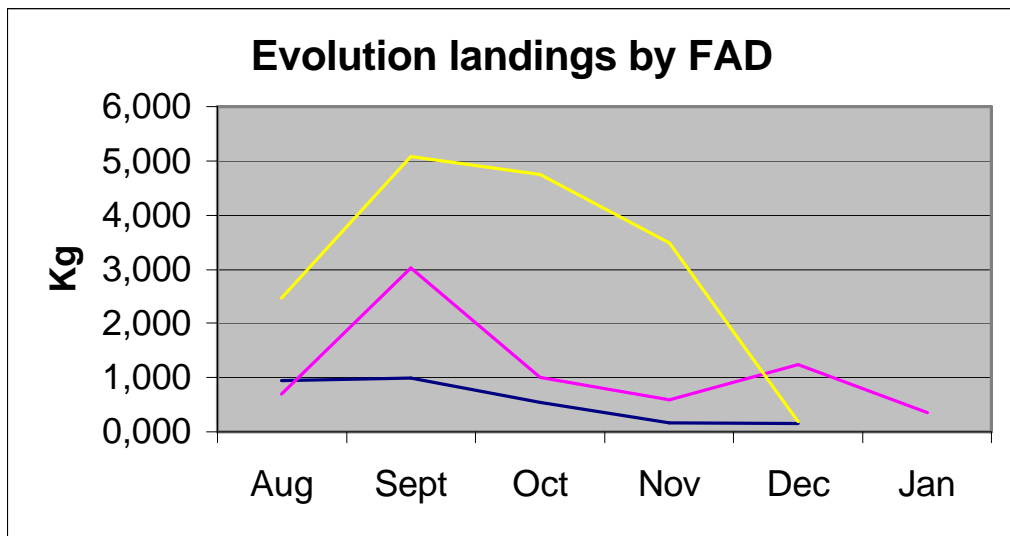
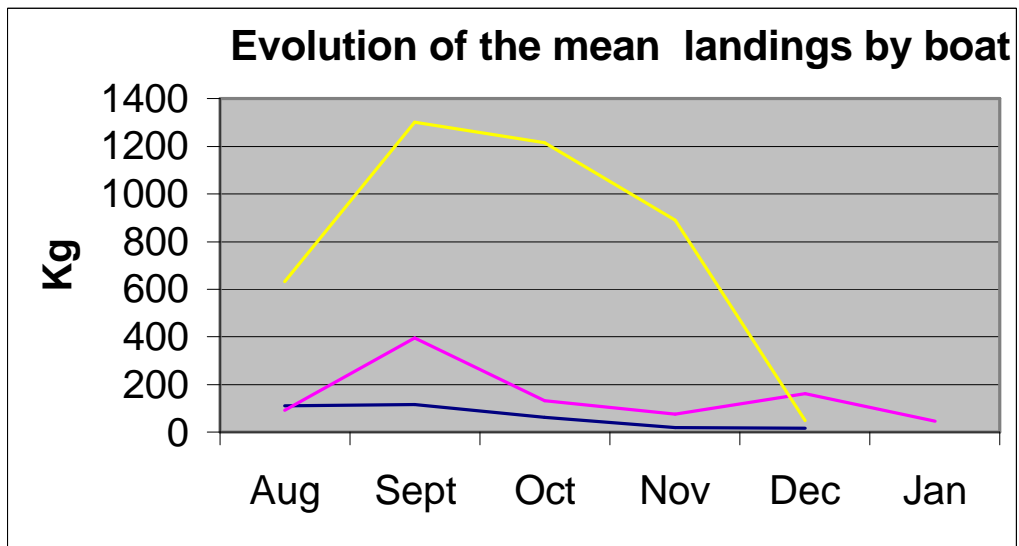
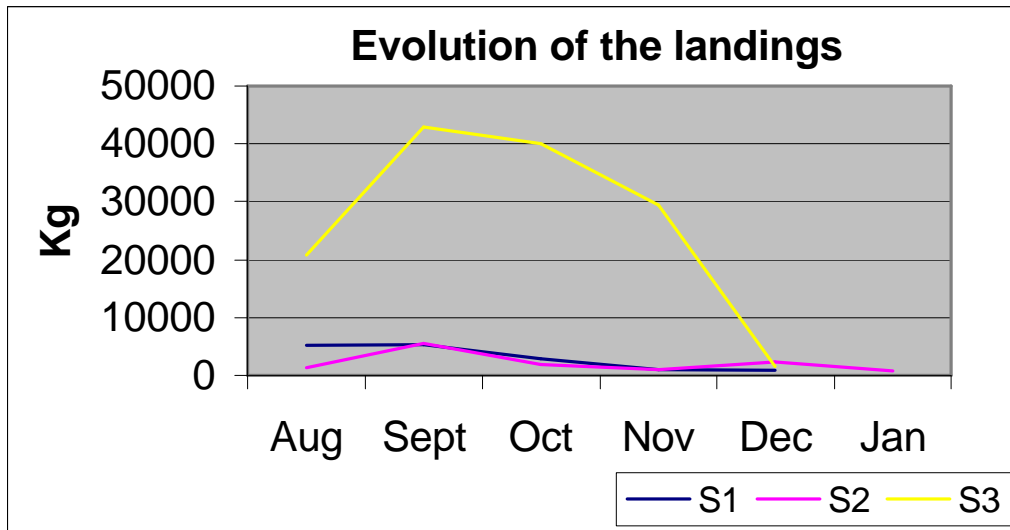
Stratum	N <sup>o</sup> boats	Total FADs	FADs/boat	Boat size (m)	Boat Hp
1	46	5482	130.5	10.3(3.5)	293.6(219.37)
2	14	1842	142	12.6(4.53)	407.21(222.91)
3	33	8453	338	13.45(4.73)	528.63(287.12)

The lampuki encircling net characteristics are given in Table 2.

Used Gear	Surrounding Net
Length m	130-150m
Height m	12m
Number of Meshes	400
Opening of Mesh	26mm (19mm in the bag)
Floats	400-500
Buoyancy	SL8
Number of Leads	40Kg/100m
Netting Material	nylon multifilament
Rtex	9,12,15 (27 in bag)

The fishing season started on August 15<sup>th</sup> and ended in December except in the stratum 2, where the captures extended to January 2001. The total landings were 163 tons which were obtained mainly between September-October (60%), August (17%) and November (19%) had similar landings, while December and January were insignificant (3% and 0.5%, respectively). The main part of the landings were obtained in stratum 3 (83%), with the two other stratum having similar values (9% and 8%, S1 and S2). The evolution of the landings by stratum and month (Fig.4) show the importance of Stratum 3. Due to better measures of effort, the landings have been calculated respect to number of boats and number of FADs, the good landings of Stratum 3 corresponding to Gozo area, are evident in all cases, although Stratum 2 improves with respect to effort (Fig.4).

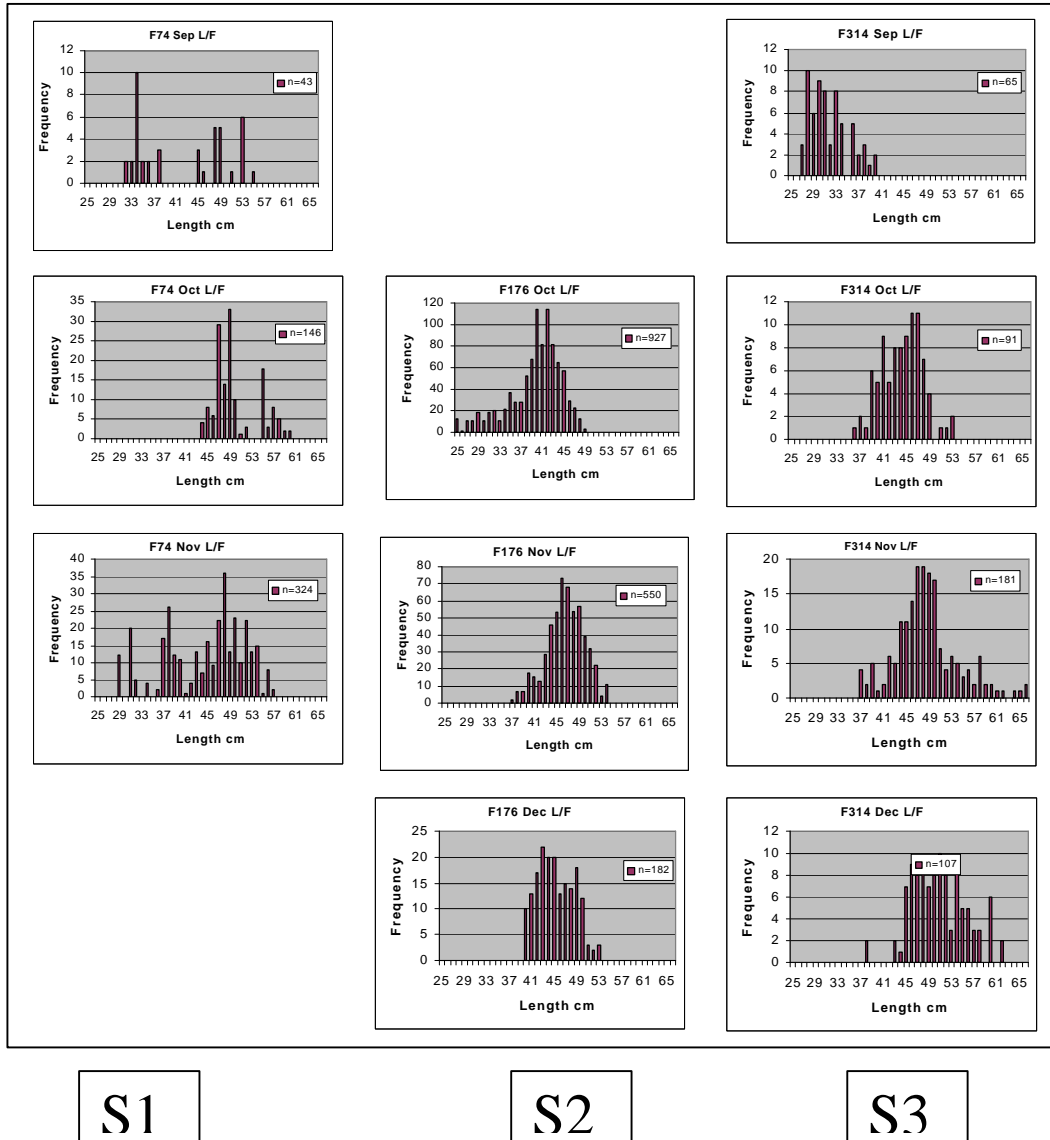
Fig.4. Evolution of the dolphin fish landings along the fishing season by stratum.





The length composition by month and stratum (Fig.5) showed the rapid growth of the species and the incorporation of small dolphin fish in November but only in stratum 1 (Fig.5).

Fig.5. Length composition of dolphin fish landings by month and stratum in Malta.



S1

S2

S3

### ***Tunisia***

The 2000's fishing season has started on July at Monastir harbour and finished at December in Teboulba. During the fishing season 295 boats were registered for the fishery. The total landings in the study period was 669 tons, which were distributed as follows: 85 tons (13%) in the North Stratum, 433 tons in the East (65%) and 151 tons (22%) in the southern stratum. These captures represent a decrease of 30 % regarding the 1999 landings. Probably this was due to the bad weather experienced since September. The prices remained high during the fishing season at a mean of 5 Dinars (3.5 US\$).

The mean boat characteristics are similar in the North and East stratum, boat size (10 m size) and GRT (10 tons) were similar, while in the South the boats are bigger (12 m, 15.5 tons). The boats deploy 30-100 FADs, depending of the boat size. The FADs and gear are similar in the three study strata.

Due to the characteristics of the fishery it was impossible to obtain data on the fleet activity, there is no measure of the days fished or of the exact number of FADs placed by each boat. Another information that is not available is the position of the FADs. The boats carry several gears on board, thus when active they might capture and use different gears in the same trip. This is a big difficulty to determine the effort dedicated to each species.

The minimum size was 17 cm FL at the beginning of the season, reaching 84 cm FL at the end of the fishing season. Which follows the fast growing rate of this species. All this fish were juvenile immature, as the gonadosomatic index has shown. Sexual dimorphism was evident from 40 cm FL upwards, the males showing the typical head structure. The females predominate at the beginning of the season, but on October-November the ratio was close to 50%.

See Annex for more detailed description of the results.

### **3. Conclusions and recommendations**

#### ***Malta***

Due to the difficulties in getting some of the data, we recommend that when applying for the license the fishermen should be bound to provide details on number of FADs, and within a specified time span (2 weeks from opening of season) they should give the position of the last FAD in the site.

To be able to obtain useful fishing effort data we could incorporate information obtained from the proposed catch assessment survey, in particular days at sea, number of successful fishing trips.

Some effort should be made so that landings are recorded relative to craft number so as to avoid confusion between fisherman and owner names. It is hoped that with the implementation of the above mentioned survey, previously unrecorded landings particularly from Gozo, would be included.

As far as the fishermen selected to collect the length frequency data, this information must be collected 1) on a more regular basis (weekly), 2) sample size should be at least 400 fish per stratum per week, 3) the number of boxes of the measured sample must be provided to know the proportion between the sample size and the day capture of the boat.

At present the landings are calculated as a function of number of boxes multiplied by 16 Kg which is the official weight per box according to regulations. It will be in the interest of the fishermen and of the collection of correct data if the weight per box is closer to the actual value. As an alternative, the Department could carry out an exercise to establish the weight per box by month, because the fast dolphin fish growth causes variations between the beginning and end of the fishing season.

The biological sample was too limited. Preparations to: identify fishermen participating, laboratory facilities and staff, should be started well before the beginning of the season in August. The samples should be collected from the end of August and should be done on a twice monthly basis for every stratum. It might be necessary to recruit more technicians to carry out the biological sampling so as to take maximum advantage of the freshness of the sample. Extra attention should be taken to ensure the proper labelling of the samples as regards origin.

Although an enormous effort has been made to compile the data, probably there is a shortage of human resources and attribution of tasks, that do not allow to obtain all the possible profit from the data. Ideally, a coordinator, data entry operator and a biologist should be identified and sufficient time allocated to them to carry out these tasks.

In view of the increase in the number of samples required, collection of fishing effort data at port, and ancillary staff (see penultimate paragraph) appropriate funding should be allocated.

#### ***Tunisia***

Depending of the funds available for the 2001 fishing season, the sampling will be expanded to cover the three stratum. Based on the experience gained on the first year, the following sampling ports have been selected for the second year: North: Sidi Daoud, East the same as in previous year (Monastir, Teboulba) and South the single port fishing for the species (Zarzis). Port samplers should be placed at each sampling port to collect catch, length composition and effort data, as well as the biological samples.

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The data on the fishing gear and boats is satisfactory, the problem remains in the determination of the effort. The capacity of fish concentration by the FADs is not measurable due to the lack of data in real FAD number. This was caused by the late preparation and distribution of the questionnaires, due to the start of the project, which were given to the port authorities with the fishing season started. For the 2001 fishing season an effort will be made to have the questionnaires in the sampling port authorities on spring. The measure of the fleet activity is difficult due to the above mentioned multigear, multifishery activity during the dolphin fish season.

The length sampling has been in some way limited by the feasibility of measuring more than one or two fish boxes on the fishing wharf. Some ways of solving this limitation should be explored.

The biologic sampling from the three study areas will be carried out at Monastir INSTM, thus the safe arrival of the samples and the infrastructure necessary to carry out the sampling should be facilitated. A laboratory to sample the fish would be necessary to facilitate the work. Also, two stages for learning the genetic and ageing techniques would be recommendable.

It is worthing to mention the extraordinaire collaboration of the port authorities whom have helped the data gathering and the contact with the fisherman.

### **General recommendations:**

In both study areas there is a lack of personnel, resources and time allocated to the project to completely cover the objectives. To improve the support on personnel, infrastructure and time, is fundamental for the development of the study in the following period and to cover all the study area, mainly in Tunisia due to the coast extension. Also a clear responsibility and work team structure should be identified in both study areas.

Because the fishery starts in August, resources should be allocated with enough time to be prepared to start sampling at the beginning of the fishery.

Due to the difficulties in getting some of the data, we recommend that when applying for the license the fishermen should be bound to provide details on number of FADs, and within a specified time span they should give the position of the last FAD in the site.

To be able to obtain useful fishing effort data information must be obtained from the proposed catch assessment survey to be developed in Malta and Tunisia, in particular days at sea, and number of successful fishing trips.

The length frequency data must be collected 1) on a more regular basis (weekly), 2) sample size should be at least 400 fish per stratum per week, 3) the number of boxes of the measured sample must be provided to know the proportion between the sample size and the day capture of the boat.

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beginning of the season in August. The samples should be collected from the end of August and should be done on a twice-monthly basis for every stratum. It might be necessary to recruit more technicians to carry out the biological sampling so as to take maximum advantage of the freshness of the sample. Extra attention should be taken to ensure the proper labeling of the samples as regards origin.

During the 2001-2002 fishing period the catch, effort and length frequency should be also be determined in Majorca and Sicily to have a complete picture of the status of this mobile resource that probably constitutes a single Mediterranean stock.

## CORY-MALTA&TUNISIA

### Summary of the observed results:

OBJECTIVE	TASK	PROPOSED DEVELOPMENT	OBSERVED DEVELOPMENT	DEGREE OF COMPLETION
1-Training	To train the local participants	Workshops to train and discuss data. Field visit.	All carried out. Logbooks and instructions provided.	Although the field visit allowed to discuss the framework survey and to train in biological sampling, resource limitation in both study areas did not allow to follow the instructions.
2-Framework study of the fishery	2.1-fishing effort	To determine the number of boats, boat characteristics, number and characteristics of FADs and days worked	The boat characteristics and approx.number and characteristics of FADs at the beginning of the fishing season have been determined.	The effective number of days fished is not known. The number of FADs replaced or lost is also not known.
	2.2-catch composition	To obtain landings, by-catch species and length composition of the capture.	Landings by port and month have been obtained for Malta although Gozo landings are unrepresented. Landings registered only in one stratum in Tunisia. Length-composition incomplete in both areas. By-catch composition unknown..	Incomplete data gathering, more effort should be dedicated to both catch and length composition.
3-Biological sampling	Biological sampling for age and growth and stock studies.	Tissue samples provided. Biological data collected for part of the study areas and season.	Biological sampling only for part of the study areas and part of the fishing season, incomplete data for Malta.	Otoliths have had to be sampled at the IMEDEA due to the difficulty in locating them. Lack of adult specimens will limit the maturity studies.

**ANNEX**

**PROJET FAO.-COPEMED**

**Cory Malta&Tunisia Juin 2000-Mai 2002**

**Résultats de suivi de la Campagne de pêche 2000,  
de *Coryphaena Hippurus* dans la Strate Est Tunisie**

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**INTRODUCTION**

Le présent travail rentre dans le cadre du projet FAO-COPEMED Cory Malta&Tunisia 2000-2001 qui a pour objectif principal l'amélioration de la connaissance de la pêche de la coryphène *Coryphaena hippurus* en Méditerranée et mise en oeuvre de Coopération Internationale nécessaire pour la gestion de cette espèce migratrice. Ce document présente et traite les résultats de la Campagne de pêche 2000, dans la Strate Est de la Tunisie et particulièrement les ports de Monastir et de Teboulba. Ces résultats serviront à l'élaboration du rapport intermédiaire du Projet, qui aura lieu à IMEDEA (Espagne), du 5 au 6 Avril 2001.

**MATERIEL ET METHODES**

Les statistiques des pêches et de la flotille ont été collectées auprès de la Direction Générale de la Pêche et de l'Aquaculture (DGPA) et des différentes Délégations Régionales et ports de pêche impliqués dans cette activité.

Les échantillonnages ont concerné la strate Est et particulièrement les ports de Monastir et de Teboulba. Le suivi des débarquements et des fréquences des tailles des captures était hebdomadaire. Pour chaque spécimen nous avons mesuré la longueur à la fourche (L.F.).

WGHEIRBJLTXHDXDERUDRUH pQ LGGYLGXVRQMUYL 3DDLDXU/  
\$5' 6/ < WRGHGH%( 5 pP pOVH HGMWDGHWGHP DMUW WUP LQHUpSRXIG  
VHQQMIRUP XOMVXYDQMW ) & HM6+, M6\* , VHFQQMHO

IGS =  $Wg \cdot 100 / We$  avec Wg: Poids des gonades et We: Poids éviscéré  
IHS =  $Wf \cdot 100 / We$  avec Wf: Poids du foie  
C.F. =  $Wt / L^3$  avec Wt: Poids total (g) et L: Longueur à la fourche (cm)

Les têtes entières de tous ces specimens ont été conservées au congélateurs, pour servir ultérieurement (lors d'un prochain stage à IMEDEA, Espagne), à prélever les otolithes pour la détermination de l'âge.

Un échantillon prélevé au port de Zazis (state Sud), au mois d'octobre contenant des fragments de muscles, de coeurs et de foies a été concervé au congélateur pour l'étude génétique lors d'un prochain stage à l'Université de Girona en Espagne.

**PRODUCTION**

La figure (1), montre l'évolution de la production de la coryphène en Tunisie (1989-2000). La production globale réalisée en 2000 est de 669 tonnes dont 85 tonnes (13%) sont capturées au Nord, 433 tonnes (65%) à l'Est et 151 tonnes (22%) au sud. Les principales captures ont été faites aux mois d'août et septembre, qui représentent respectivement 36% et 51% du total de la production (figure 2). La moyenne nationale des captures par bateaux est de 2,3 tonnes. La moyenne régionale par bateaux est 2,3 tonnes dans le strate Nord, de 1,8 tonnes dans le strate Est et de 8,4 tonnes dans le strate Sur.

Comparée à celle de l'année précédente la production de 2000, a connu une baisse de plus de 30% , qui s'expliquerait en partie par la persistance du mauvais temps à partir de la fin septembre.

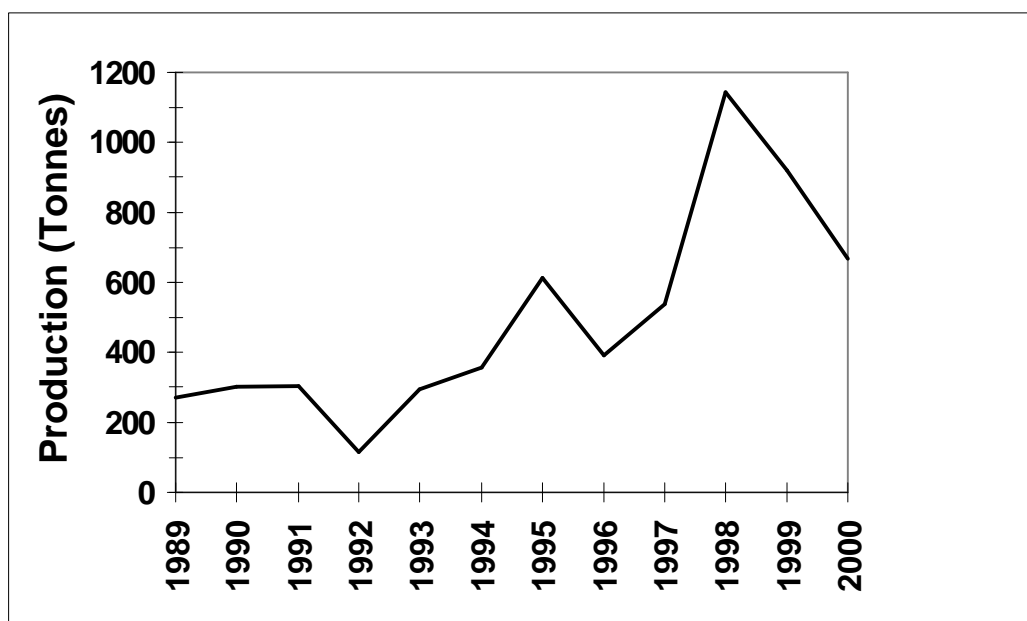


Figure 1. Evolution annuelle des captures *Coryphaena.hippurus* en Tunisie (base de données service des statistiques DGPA)

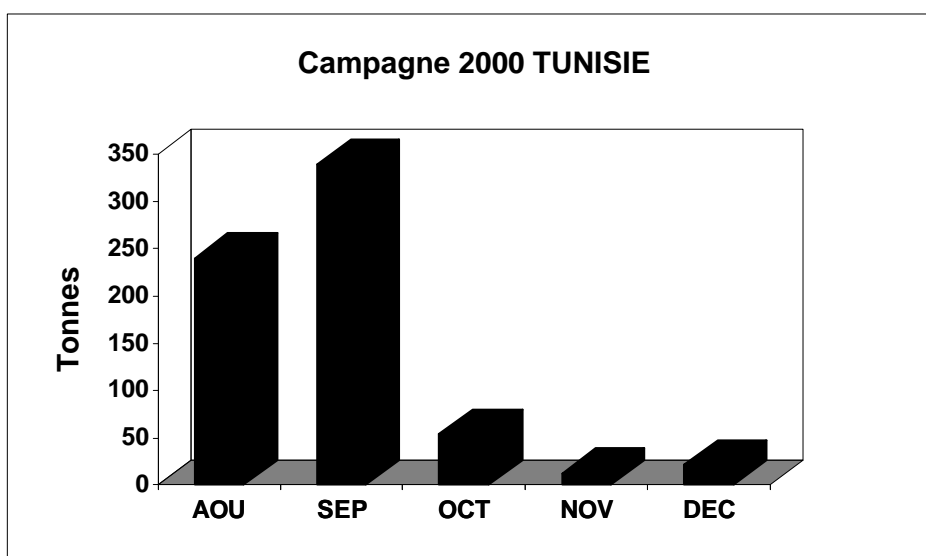


Figure 2. Variation mensuelle des captures de *Coryphaena.hippurus* en Tunisie (base de données service des statistiques DGPA)

FLOTILLE



## CORY-MALTA&TUNISIA

La coryphène fait l'objet d'une importante activité de pêche saisonnière qui touche d'après notre enquête 295 barques côtières, dont 37 unités sont immatriculées au Nord, 240 à l'Est et 18 au Sud. Les caractéristiques des bateaux (longueur totale, tonnage et puissance) sont représentés dans le tableau (1). Les bateaux exerçant dans les régions Nord et Est ont des longueurs moyennes comparables (environ 10 m). Toutefois dans la région Est la longueur moyenne des embarcations varie de 8.8 à 12.5m. Ceux de la région Sud sont par contre plus grands avec une longueur moyenne de 12.3 m. On constate cependant que le tonnage global ainsi que la puissance totale des bateaux diffèrent d'une région à l'autre. Le tonnage global de la région Est (2131 tonnes) est largement supérieur à ceux des régions Nord et Sud (respectivement 348 et 279 tonnes). Il en est de même pour la puissance totale qui est de 15891 CV à l'Est contre 2530 au Nord et 2132 CV au Sud). Ces différences expliqueraient les variations des captures des différentes régions.

**Tableau (1). Flotille pratiquant la pêche de *Coryphaena hippurus* en Tunisie (Nombre et caractéristiques, par port et par strate)**

Ports	Nbre	Longueur (m)		Tonnage (Tx)		Puissance (Cv)	
		Moyenne	SD	Moyenne	SD	Moyenne	SD
<b>STRATE NORD</b>							
Ghar El Melh	12	8.4	1.0	3.9	1.8	43.6	19.3
La Goulette	4	9.4	1.1	7.6	1.2	25	5
Sidi Daoud	21	11.7	1.4	13.3	4.0	90.9	40.0
<b>Total</b>	<b>37</b>						
Moyenne		10.52	1.98	10.23	5.27	74.41	41.08
<b>STRATE EST</b>							
Kélibia	34	9.6	2.4	8.2	5.8	53.5	33.6
Béni Khair	25	10.2	2.5	8.8	5.8	78.0	68.0
Hergla	14	8.8	1.0	5.9	1.5	29.3	2.0
El Kantaoui	02	9.2	0.3	4.9	0.0	35	5
Sousse	30	9.6	1.8	7.3	3.0	40.7	24.4
Monastir	27	10.2	2.5	8.5	4.5	71.1	64.2
Ksibet El Mediouni	02	10.5	0.8	8.2	1.5	45	0
Teboulba	40	12.5	1.3	13.9	3.6	125.5	34.7
La Chabba	30	10.9	1.7	8.8	3.3	66.1	37.8
Mahdia	31	10.6	1.9	9.7	5.1	54.3	33.9
Selecta	5	9.8	0.7			33	6
<b>Total</b>	<b>240</b>						
Moyenne		10.49	2.19	9.29	4.92	67.91	49.97
<b>STRATE SUD</b>							
Zarzis	18	12.3	1.6	15.5	4.7	118.4	62.6
<b>Total</b>	<b>18</b>	<b>12.3</b>	<b>1.6</b>	<b>15.5</b>	<b>4.7</b>	<b>118.4</b>	<b>62.6</b>

## TECHNIQUE DE PECHE

Pour la pêche de la coryphène les pêcheurs utilisent des dispositifs de concentration de poissons ( DCP) appelés "Ganatsi". Ces dispositifs sont constitués d'un cadre trapézoïdal en bois (figure 3), sur lequel sont fixés des feuilles de palmiers dattiers "jrid" ou une bâche opaque en plastique, pour servir d'ombrage. Ces structures dont le nombre varie de 20 à 70, sont placées en lignes parallèles sur la surface de l'eau des intervalles variant de 50 à 80 mètres. Chaque structure est muni d'un lest et d'un

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flotteur. L'ensemble des ganatsi est signalé par des bouées placées aux extrémités. Les DCP, sont mouillés dans les zones traditionnelles de pêche, dont la profondeur est en moyenne de 30 à 60 mètres dans la région Est, mais qui peuvent atteindre les 180 mètres dans certaines régions du Sud (Zaouali et Missaoui, 1999).

Tous les bateaux sont munis d'un sondeur qui permet aux pêcheurs de retrouver l'emplacement de leurs DCP et la capture des poissons se fait alors au moyen d'une seine tournante non coulissante munie d'une poche (figure 4). La senne appelée dans la région Est "lambara" fabriquée en monofilament polyamide de haute densité, fait 200-300 mètres de long et 15-35 mètres de chute (Zaouali et Missaoui 1999). La maille de la poche est de 20-26 mm et celle des filets latéraux est de 40-45 mm.

Les pêcheurs prennent toujours avec eux d'autres engins de pêche comme le filet maillant, pour la capture d'autres espèces.

### **SUIVI DE LA CAMPAGNE DE PECHE 2000 DANS LA STRATE EST.**

Deux ports de la région Est ont fait l'objet d'un suivi de la campagne de pêche 2000, il s'agit des ports de Monastir et Teboulba.

Le tableau (2), illustre les captures par semaine des deux ports et le total des captures en fin de campagne:

A Monastir la pêche a débuté la dernière semaine de juillet et s'est terminée début novembre,

alors qu'à Teboulba elle a commencé en août et a fini en décembre.

Du 26 septembre au 9 octobre il n'y a pas eu de captures aussi bien pour Monastir que pour Teboulba suite au mauvais temps.

Le total des captures réalisé au port de Monastir est de 50.298 tonnes alors qu'au port de Teboulba le total est de 111.192 tonnes c'est donc le double et cela peut s'expliquer par le nombre et les caractéristiques des bateaux qui sont plus importants au port de Teboulba.

Pour l'année 2000 les prix de la coryphène au kilo dans les ports de Monastir et de Teboulba sont restés assez élevés, 5 Dinars Tunisiens (1DT = 0.7 Dollar USA.) en début de campagne (juillet) à 7DT en fin de campagne (décembre). Les prix les plus bas ont été enregistrés au mois d'août entre 2.5DT à 4DT le kilo sûrement en rapport avec l'importance des débarquements réalisés pendant ce mois.

**Tableau 2 : Captures par semaine en kg des ports échantillonnés pendant la campagne de pêche 2000**

Semaines	Port de Monastir	Port de Teboulba
25 juillet- 31 juillet	60	-
1 août- 7 août	700	-
8 août- 14 août	12354	6800
15 août- 21 août	5654	4080
22 août- 28 août	5275	19257
29 août- 4 septembre	4400	9369
5 septembre- 11 septembre	3560	7713
12 septembre- 18 septembre	5722	30395
19 septembre- 25 septembre	8330	2450
26 septembre- 2 octobre	-	-
30 octobre- 9 octobre	-	-
10 octobre- 16 octobre	2200	1290
17 octobre- 23 octobre	600	4000
24 octobre- 30 octobre	443	4770
31 octobre- 6 novembre	1000	5980
7 novembre- 13 novembre	-	2068
Décembre	-	13020
TOTAL	50298	111192

**ECHANTILLONNAGE BIOLOGIQUE****Composition des tailles de captures**

Sur un total de 1552 individus de coryphène mesurés, la taille varie de 17 à 57 cm longueur à la fourche au port de Monastir et de 20 à 84 cm au port de Teboulba (tableaux 3).

Au fil des mois on assiste à une augmentation significative des tailles de capture et une disparition des petites tailles LF <30 à partir du mois d'octobre (figures 5, 6 et 7).

L'évolution de la fréquence des tailles de captures dénote de la rapidité et de la vitesse de croissance de cette espèce.

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**Tableau (3). Composition des tailles de capture de Coryphena hippurus, débarquée aux ports de Monastir et de Teboulba (campagne 2000)**  
Port de Monastir

L.F. (cm)	Juil				Aout				Septembre				Octobre				Novembre				Décembre				Tot ind	Captures totales (Kg)	
	4ème	1ère	2ème	3ème	4ème	1ère	2ème	3ème	4ème	1ère	2ème	3ème	4ème	1ère	2ème	3ème	4ème	1ère	2ème	3ème	4ème	1ère	2ème	3ème			4ème
17	12																									12	0.63
18	96			7																						103	6.41
19	120		8																							128	9.37
20	168	24	7	300	125																					624	53.34
21	90	120	14	400	125																					749	74.17
22	18	144	49	600	375																					1186	135.13
23	12	216	28	400	1000																					1656	215.75
24		72		300	625	100																				1097	162.49
25		56	28	500	2500		300	100																		3484	583.67
26		24	56	300	2000	500	450																			3330	627.91
27		16	28	300	1750	1100	150																			3344	706.55
28			63	200	1000	1500	750	100																		3613	851.87
29			28	300	375	900	1950																			3553	931.23
30			7	500	125	1100	2250	100				120														4202	1219.88
31				300		300	1800					60														2460	788.38
32				100		200	1200				175	90	15													1780	627.77
33				400		200	2850				175	390	30													4045	1565.30
34				400			1050	200			105	240	45													2040	863.78
35				500			1200	100				60	30	30												1920	887.23
36				200		200	750	200			70	60	30	15												1525	767.19
37				200		300	600	700			105	30	45													1980	1081.88
38					125	100	750	700			315	60	30	45												2125	1258.34
39						100	600				70	90	30	15												905	579.57
40							750	300			175		30	15												1270	877.84
41							450	200			105	90	15	30												890	662.73
42					125		300	300			210	30	30	45												1040	832.80
43							150				70	90	45	30												385	330.97
44							150				70		45	30												295	271.80
45							300	300					30	60												690	680.32
46							300						45	30												375	395.07
47							150						30													180	202.34
48							150						30	45												225	269.50
49													30	180												210	267.67
50													45	15												60	81.28
51													30	30												60	86.28
52														30												30	45.74
53														30												30	48.45
54													30													30	51.26
55													15													15	27.09
56													30													30	57.20
57																										0	0.00
58																										0	0.00
59																										0	0.00
60																										0	0.00
61																										0	0.00
62																										0	0.00
63																										0	0.00
64																										0	0.00
65																										0	0.00
66																										0	0.00
67																										0	0.00
Tot	516	680	315	6200	10250	6600	19350	3300	0	0	1645	1410	735	675	0	0	0	0	0	0	0	0	0	0	0	51676	19186.19



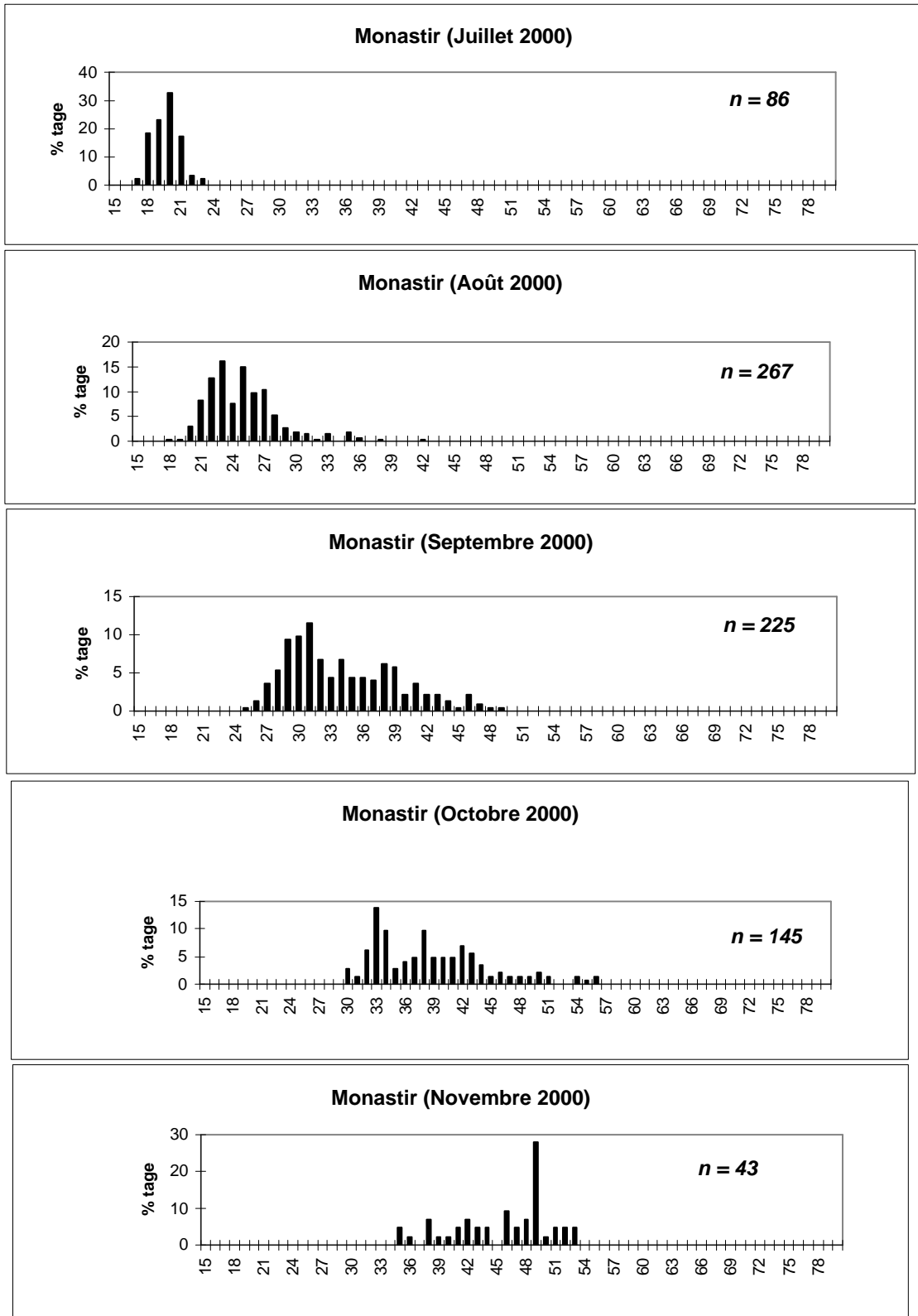


Figure 5. Evolution de la taille (L.F. cm) des captures de *C. Hippurus*, débarquées au port de Monastir (Strate Est Tunisie) pendant la campagne de pêche 2000.

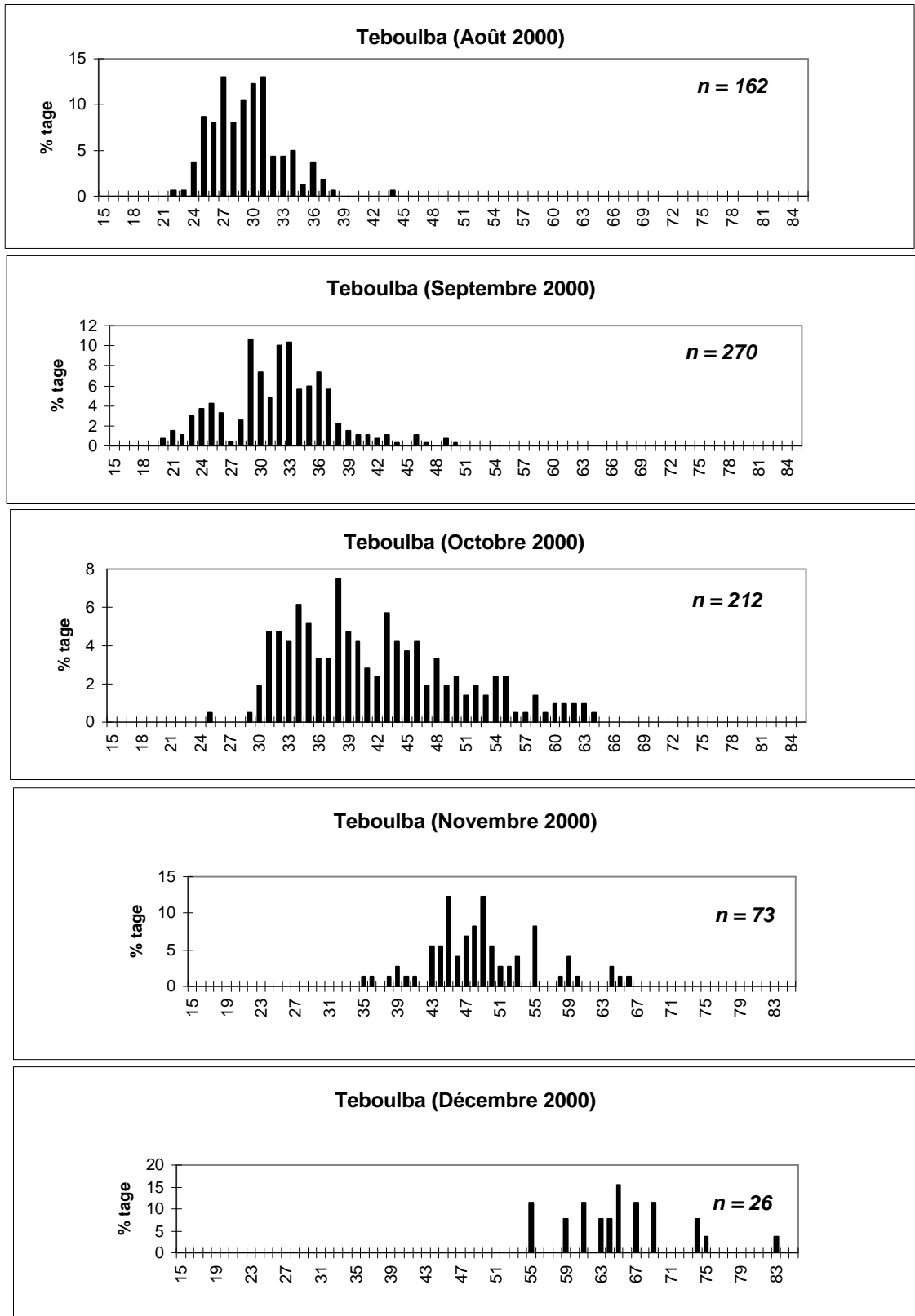


Figure 6. Evolution de la taille (L.F. cm) des captures de *C. Hippurus*, débarquées au port de Teboulba (Strate Est Tunisie) pendant la campagne de pêche 2000.

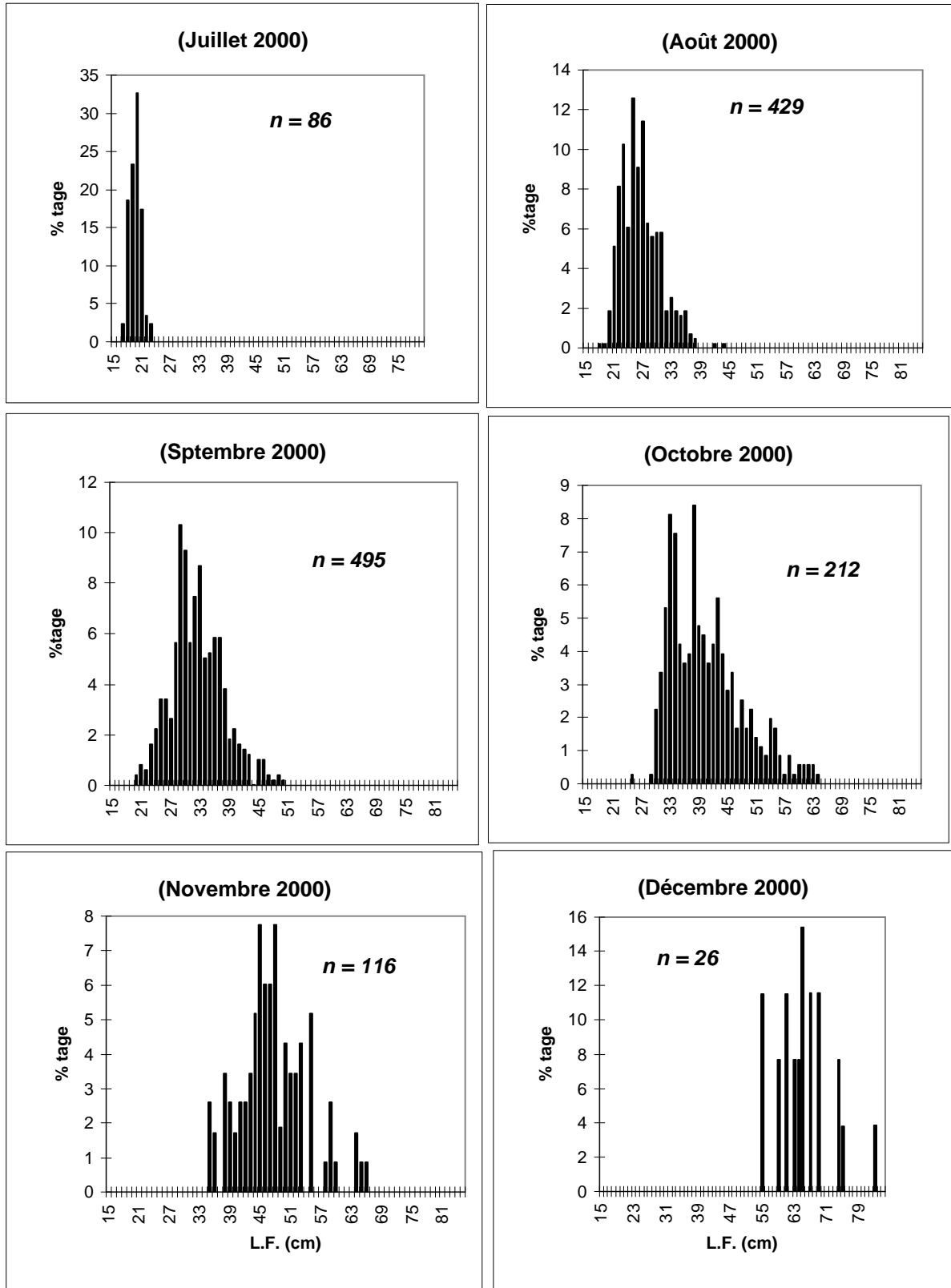
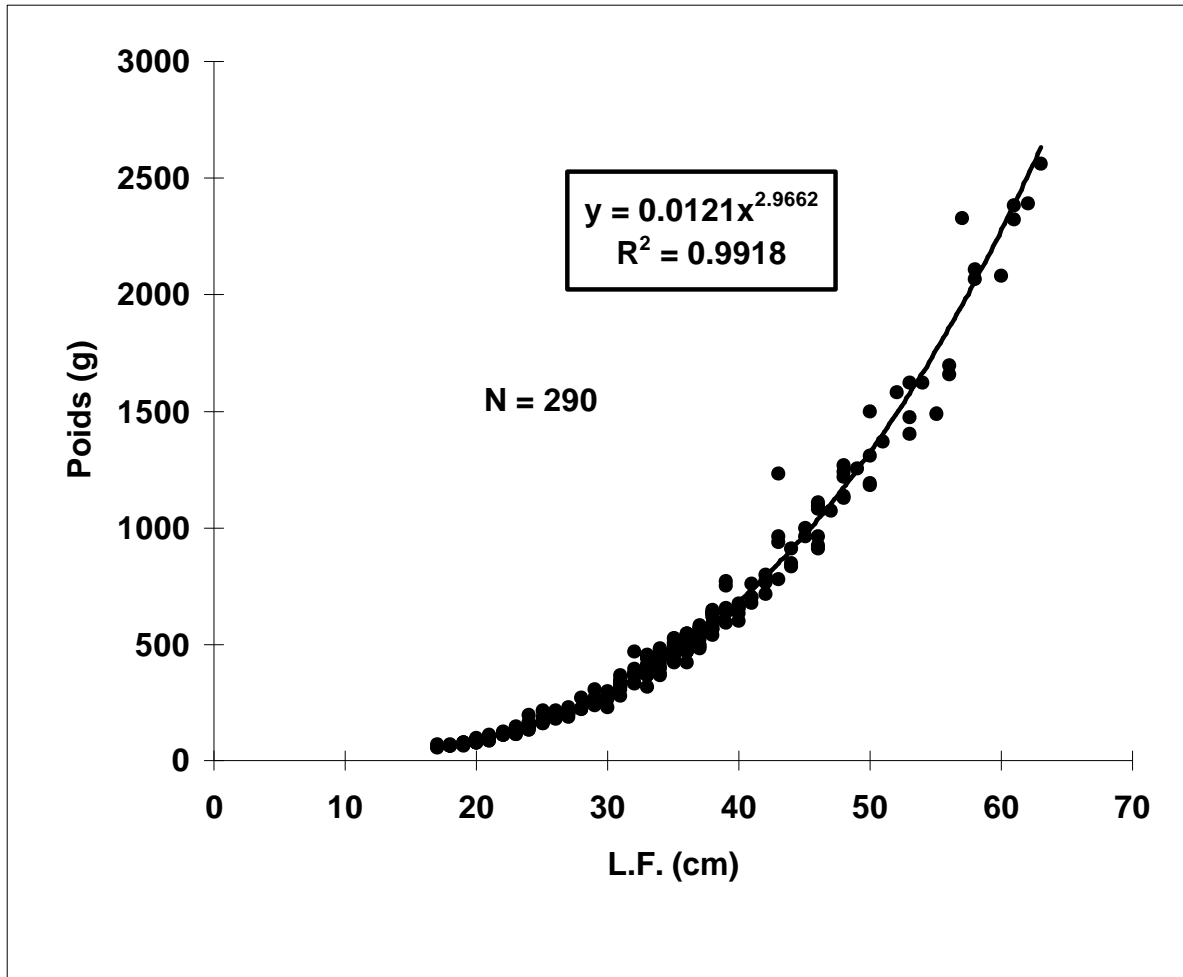


Figure 7. Evolution de la taille (L.F. cm) des captures de *C. Hippurus*, cumulées, des ports de Monastir et Teboulba (Strate Est Tunisie) pendant la campagne de pêche 2000.



L'ajustement de la relation Taille-Poids sexes confondus (figure8: ) aboutit à l'expression:

$$W = 0.0121 LF^{2.9662} \quad (R^2 = 0.9918 \text{ et } N = 290 \text{ individus}).$$



**Fig 8: Relation Taille-Poids des juvéniles de *Coryphaena hippurus* pêchés pendant la campagne de pêche 2000 (Strate Est. Tunisie).**

#### Prélevement d'otolithes

Les têtes de tous les poissons desquels vont être prélevés les otolithes qui serviront ultérieurement à l'étude de l'âge ont été envoyés à IMEDEA Espagne. Un stage de formation en lecture d'âge sera programmé.

#### Sex-ratio

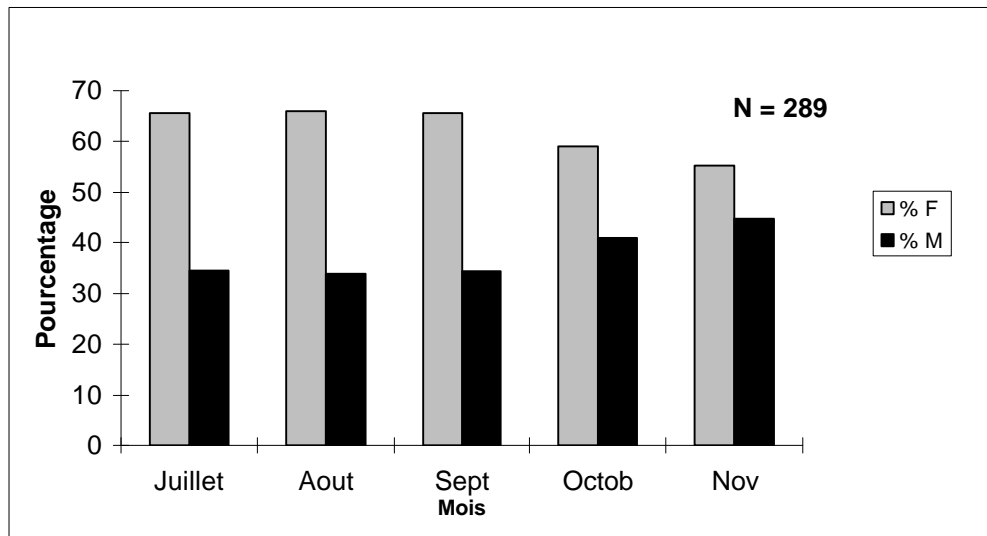
D'un total de 280 poissons étudiés (deux ports confondus) 177 (63.2 %) étaient des femelles et 103 (36.8 %) étaient des mâles (tableau 4). Le sex-ratio est de 2:1 (Femelle: Mâle), donc en faveur des femelles.

Cependant, le sexe de 10 individus dont la  $17 < L.F. < 19$  cm échantillonnés au mois de juillet au port de Monastir n'a pu être déterminé.

**Tableau 4: Proportion des sexes par port et total (Strate Est) de *Coryphaena hippurus* capturée pendant la Campagne 2000.: ( N: Nombre)**

Ports	Taux de Féminité ( F %)		Taux de Masculinité ( M %)	
	N	%	N	%
Monastir	81	61.0	52	39.0
Teboulba	96	65.3	51	34.7
<b>Total Strate</b>	<b>177</b>	<b>63.2</b>	<b>103</b>	<b>36.8</b>

La distribution mensuel des sexes (Figure: 9) montre une prédominance des femelles (2:1) et cela de juillet à septembre. A partir du mois d'octobre la proportion des femelles n'est plus aussi importante, et au mois de novembre on a comme une égalité dans les sexes (1 Femelle: 1Mâle).



**Figure 9. Variation mensuelle du Sex-Ratio (F: Femelle, M: Mâle) des juvéniles de *Coryphaena hippurus* pêchés pendant la campagne de pêche 2000 (Strate Est Tunisie).**

Un dimorphisme sexuel, clair est observé chez la coryphène. A partir de la taille de 40 à 50 cm FL, les mâles développent une crête osseuse qui est inexistante chez la femelle.

Ce dimorphisme sexuel permet la distinction des sexes sans observation directe des gonades chez les individus de cette taille.

**Développement Sexuel**

**-Indice Gonado-Somatique (IGS)**

Les valeurs moyennes du IGS (Tableau:5) des individus pêchés de juillet à décembre sont faibles aussi bien chez les femelles que chez les mâles. L' augmentation de ces valeurs au fil des mois bien qu'elle ne soit pas très importante, elle est en relation avec

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le développement des gonades durant la saison de pêche. Ce sont donc que des juvéniles immatures qui sont capturés pendant la saison de pêche.

**Tableau 5: Valeurs moyennes mensuelles (Xm) du IGS ( : écart type), des femelles et mâles de coryphène pêchés dans la région Est de la Tunisie( Ports: Monastir et Teboulba)en 2000.**

Mois	Monastir			Teboulba			Teboulba			Teboulba		
	N	Xm	s	N	Xm	s	N	Xm	s	N	Xm	s
Juillet	19	0.24	0.07	10	0.14	0.05	-	-	-	-	-	-
Août	19	0.38	0.13	15	0.23	0.13	47	0.36	0.13	19	0.17	0.12
Septembre	20	0.43	0.12	12	0.28	0.14	20	0.45	0.08	9	0.11	0.05
Octobre	23	0.53	0.19	15	0.11	0.11	13	0.56	0.13	10	0.07	0.04
Novembre	-	-	-	-	-	-	16	0.46	0.18	13	0.19	0.08

**- Indice Hepato-Somatique (IHS)**

Les valeurs du IHS (Tableau: ) sont également faibles, varient peu au cours des mois et il n'y a pas de différence significative entre les femelles et les mâles.

**Tableau 8: Valeurs moyennes mensuelles (Xm) du IHS ( : écart type), des femelles et mâles de coryphène pêchés dans la région Est de la Tunisie( Ports: Monastir et Teboulba)en 2000.**

Mois	Monastir			Teboulba			Teboulba			Teboulba		
	N	Xm	s	N	Xm	s	N	Xm	s	N	Xm	s
Juillet	19	1.97	0.25	10	1.76	0.17	-	-	-	-	-	-
Août	19	1.42	0.34	15	1.20	0.35	47	1.47	1.09	19	1.31	0.40
Septembre	20	1.91	0.51	12	2.00	0.24	20	1.71	0.27	9	1.54	0.27
Octobre	23	2.00	0.37	15	1.69	0.47	13	1.65	0.75	10	1.37	0.20
Novembre	-	-	-	-	-	-	16	1.73	0.40	13	1.64	0.23

**- Facteur de Condition (FC)**

Le facteur de condition (FC) ne fluctue pas beaucoup, les valeurs se situent entre 0.010 et 0.011. Néanmoins, il est légèrement plus élevé chez les mâles.

**Tableau 7: Valeurs moyennes mensuelles (Xm) des IGS, IHS et C.F. ( : écart type), des femelles et mâles de *Coryphaean Hippurus* pêchée dans la région Est de la Tunisie ( Ports: Monastir + Teboulba)en 2000.**

Sexe	Nbre	IGS	s	IHS	s	C.F.	s
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<b>Juillet</b>	F	19	0.238	0.075	1.972	0.252	0.0106	0.0005
	M	10	0.144	0.059	1.763	0.166	0.0111	0.0008
<b>Août</b>	F	66	0.365	0.132	1.373	0.430	0.0106	0.0007
	M	34	0.190	0.130	1.258	0.380	0.0111	0.0010
<b>Septembre</b>	F	40	0.440	0.103	1.808	0.412	0.0110	0.0001
	M	21	0.205	0.143	1.804	0.349	0.0113	0.0007
<b>Octobre</b>	F	36	0.540	0.17	1.930	0.66	0.010	0.0012
	M	25	0.180	0.260	1.56	0.41	0.011	0.0009
<b>Novembre</b>	F	16	0.460	0.180	1.728	0.402	0.105	0.0007
	M	13	0.190	0.120	1.643	0.327	0.011	0.0009

### Stade de maturité des gonades

Durant la période d'échantillonnage qui s'étale de fin juillet à novembre, on'a observé 3 stades de maturité chez les femelles et 2 stades de maturité chez les mâles.

#### Femelles:

- **Stade 1:** 15.25% des femelle dont la L.F < 20 cm presentaient des gonades non développées de couleur rouge.
- **Stade 2:** 83 % des individus presentaient des gonades plus développées avec ovaires plus visibles correspondant à un début de maturité.
- **Stade 3:** quelques femelles (1.69%) presentaient des ovaires plus importants de couleur jaune occupant la 1/2 de la cavité viscérale. Les ovocytes sont visibvles à l'oiel nu.

#### Mâles

**Stade 1:** 64% des poissons avaient des testicules fin non développés.

**Stade 2:** les testicules large laitant ont été observé chez 36% des mâles.

### ETUDE GENETIQUE

Un échantillon de poissons provenant du port de Zarzis (port le plus éloigné) a servi pour l'étude génétique.

Des prélèvements de muscle, de foie et de coeur ont été pris de chaque poissons. Ces échantillons ont été envoyés à l'Université de Girona pour être étudiés et un stage dans ce domaine est a programmé.