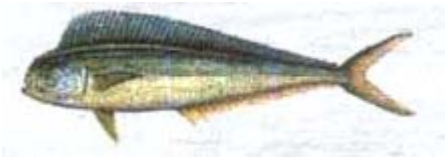
Pilot Study on Dolphin fish 2004



FINAL PROGRESS REPORT

MALTA CENTRE FOR FISHERIES SCIENCES

With the support of FAO Sub-Regional Project COPEMED

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1. Introduction

The Maltese fishery of *Coryphaena hippurus* (dolphin fish) is a well established licensing fishery managed by the Maltese Ministry for Rural Affairs and the Environment through its Fisheries Conservation and Control Division (FCCD) and the Malta Centre for Fisheries Sciences (MCFS).

The FCCD implemented a system for the distribution of lines of FADs around the Maltese Islands and the allocation of one line of FADs per fisherman. This system is based upon the establishment of a specific geographical distribution of the lines by the FCCD (Figure 1). Each line has a number within a district, which belongs to a main port from the area. The total number of lines is 130 and they are distributed into 11 districts. Each registered fisherman with a licence for dolphin fish applies for a line and a lottery takes place. This is an objective method to allocate the lines to the fishermen every year.

The fishing season extends from mid August until end of December. Nevertheless, in some years fishing activity has been recorded in January as well.

The landings from boats over 10m occur always in the fish market in Valletta and those of vessels under 10m take place in different ports around the country. The average landings for the last three years for the whole country are 350 tonnes.

Most Maltese boats fishing for Coryphaena are full time fishermen and just few of them are part timers. There are a few cases where an "association" of boats shares one single line of FADs.

Each vessel has a fishing area (stretch or line) allocated. The fishing operation consists on visiting every FAD, starting from the ones nearest to the coast and moving forward, fishing in those which have a sufficient amount of fish. If the catch is good the remaining FADs will not be visited.

The fishing trip is not always of a standard duration. Two or three days at sea is normal among bigger boats, nevertheless one day trip is usual among the smaller ones and under bad weather conditions.

2. The 2004 Fishery

There are 173 vessels with a registered gear for fishing dolphin fish in the national vessel register. The purse seine without purse line is the gear used for this fishery but is not always registered as the main gear for all vessels fishing for dolphin fish. From the 130 lines, usually not all of them receive applications from the fishermen, and in 2004 around 100 lines have vessels allocated.

Each year the FADs have to be laid down by the fishermen in their respective lines. This operation takes 2 or 3 days over a weekend. This year it took place on the 13th–15th August. The fishery was officially open on August the 16th.

September and October were good months for the fishery reaching the highest landings and price per kilo at the fish market (Table 1). Remarkably, January 2004 registered one of the highest prices per kilo of the year, while the landings were not abundant in weight. August and November were as well good months in terms of landings. The fishing activity dropped during the month of October for the sector of the fleet with boats under 10m, mainly due to weather conditions which have been too rough for this kind of fishery. The trolling lines continued fishing dolphin fish until December although the catches decreased substantially.

The average size of the specimens of dolphin fish increased steadily throughout the season. Some big specimens (>1m) were as well observed at the fish market (mainly caught by long lines for swordfish) and some of them were sampled for biological parameters.

3. The Pilot Study

The program "CORY", in the framework of the FAO COPEMED regional project, studies dolphin fish fishery in Central-Western Mediterranean. The tasks carried out under the program were directed towards the collection of data for studies on the biology

and fleet dynamics, on effort and catch levels, the estimation of the catch length composition and catch-at-age data. A considerable improvement on the knowledge of the biology of the species and the characterization of the fishing activity and exploitation was achieved. A preliminary assessment will soon be carried out by the project team as an attempt to provide guidance on the management of dolphin fish fishery in Mediterranean waters.

Objectives of the project:

- 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 studying the fishery in Malta, Tunisia, Sicily and Majorca during the same fishing season.

4. Data collection

a. Catch & Effort Data

i. Catch Assessment Survey (CAS)

Catch and effort data for vessels less than 10 m of length were collected through the Catch and Effort Survey (CAS). The CAS is a sampling survey which monitors the activity of a fishery targeting dolphin fish with trolling lines and FADs. The sampled values for catch and effort are raised to the total of the country, by stratum (Malta & Gozo), by month and by type of fishing technique (FADs or trolling lines) (Figures 2-4).

This year only landings for the months of August and September were registered for FADs (Tables 2-3), while landings for trolling lines were registered from August to December (Tables 4-8). The segment of the fleet using FADs frequently closes the fishing season if there is a prolonged bad weather period like it happened this year in October whereas the trolling will keep fishing.

In the FADs fishery the main species caught is dolphin fish (~97%) allowing to calculate the CPUEs (Tables 2-3) which values are usually higher in the Gozo stratum. Nevertheless, in the trolling lines the percentage of dolphin fish varies between 0 to 50% being 21.74% the average value (Tables 4-8). Therefore CPUEs cannot be calculated per species since the effort estimated is related to total catch. Nevertheless, values of CPUE per stratum and month are available (Tables 4-8). Effort is calculated in "Number of FADs fished X hours spent fishing" for the FAD fishery and in "Number of hooks X hours spent fishing" for the trolling lines.

The comparison of the catches obtained with the FADs and those obtained with the trolling lines showed higher values for the FADs (Figure 5) proving the higher efficacy of this type of gear.

ii. Fish Market voucher scheme

Daily information of all landings at fish market and activity (effort) is collected through the Voucher Scheme. The landings correspond to vessels over 10 m with licence for dolphin fishery with FADs. The voucher scheme is a census survey. Data on catches and value are available per month (Table 1). More specific data on catches per boat and fishing day (No. of boxes, average weight per box, total weight and price per kilo) has been input in the Database of the project and will be further analysed. Therefore, landing days per boat and month are as well available in a census basis.

b. Fleet & Economic Data

Information about the characteristics of the vessels (GT, overall length and engine power) is updated and available through the National Vessel Register database. The net used to fish in the FADs is the purse seine without purse line which herds the fish into the central part of the net that resembles a cod-end (Figure 6). Gear characteristics (dimensions) were studied taking a sample of boats, but further effort on this matter would be advisable.

Daily fishing effort (No. FADs fished and No. FADs visited) and economic data (No. fishermen onboard, fuel consumption, etc) were collected through questionnaires carried out in the fish market. Annual economic data (Market value of the vessel, maintaining costs and FADs costs) were collected through telephone interviews. Both types of data were often difficult to obtain since fishermen are quite sceptic regarding its use, therefore the data should not be considered very reliable. It is expected that next year the accuracy and precision of this data will improve.

Moreover, it has to be taken into account that the time available to fill up the questionnaires is a critic moment at the fish market when the landing of the catches and the auction take place.

c. Biological Data Collection

The biological sampling procedure was based upon the collection of 3 boxes of dolphin fish every 15 days, from 3 different ports around Malta. The ports were selected according to an even distribution around the islands to cover the whole of the fishing grounds of the country. It has been often difficult to follow this scheme but samples were taken in a periodical way from three ports from three different locations around the islands (North and South of Malta, and one in Gozo). At the same time, three vessels were collecting as many data as possible on fish length to build up an exhaustive length-frequency distribution.

A total of 493 specimens of *Coryphaena hippurus* were sampled and examined at the laboratory. Biological parameters (L, W, sex, maturity stage, etc) were measured and otoliths were extracted for age reading. Stomachs of all specimens were conserved in formalin and will be examined for their contents.

The Length-Frequency distributions of the samples were studied (Figures 7-11) showing that the bulk of the individuals belonged to the 30-48 cm class (Figure 7). The average size increased as the season progressed (Figures 8-11).

The Length-Weight relationship was also studied (Figure 12) and a power regression ($y = 49.961x0.3472$) was found to be the best fit. This regression shows a very

good Coefficient of Correlation (R2 = 0.961) which means that the correlation is strong and positive. Results per month by sex proved that males and females have similar coefficients (Figure 13); the correlation is strong for all months (Figures 14-17).

The distribution of sizes at different maturity stages (Figure 18) shows no specific trend. Significant differences between males and females were not fund (Figures 19-20). Nevertheless, it has been observed an increase of average size with the maturity stage (Table 9).

Seriola dumerili, *Naucrates ductor* and *Polyprion americanun* are bycatch species of the Maltese dolphin fish fishery. They don't represent a big percentage of the catch in the FAD fishery; nevertheless, in the trolling line fishery are often present in higher percentages than dolphin fish (Tables 2-8).

5. Data Analysis

The fishery is being studied at present at a Regional level according to outputs of the 2nd COPEMED Working Group ("Pilot Study on Operational Units for *Coryphaena hippurus* fishery" held at FAO HQ, Rome, 28th and 29th April 2005). Therefore catch, effort and socio-economic data collected during the project will be analysed by country and at regional level with the purpose of "IDENTIFICATION OF OPERATIONAL UNITS FOR THE MANAGEMENT OF A SHARED STOCK".

Specific outputs of the analysis will be:

- Spatial distribution and statistical stratification of the FADs by country.
- Distribution of the fishing industry by fleet segmentation by country (fishing units and fishermen).
- Fishing season by country.
- Geographical distribution and statistical stratification of the fishing industry by fleet segmentation and by port of origin.
- Considerations on management options
- Encompassing economic, biological and fishery statistics issues.

a. The Database

A provisional database for the storage and analysis of the data was shared by all participant countries. The data input posed some problems due to the different formats of the data in the three countries and to the novelty of the project. Moreover, some data were not available and others were found to be redundant. Nevertheless, this exercise provided the basis for the development of a customized database which will facilitate the management of the data. The methodology of the pilot survey will be revised and output formats will be developed to provide further insight for the management of the fishery.

Figures & Tables

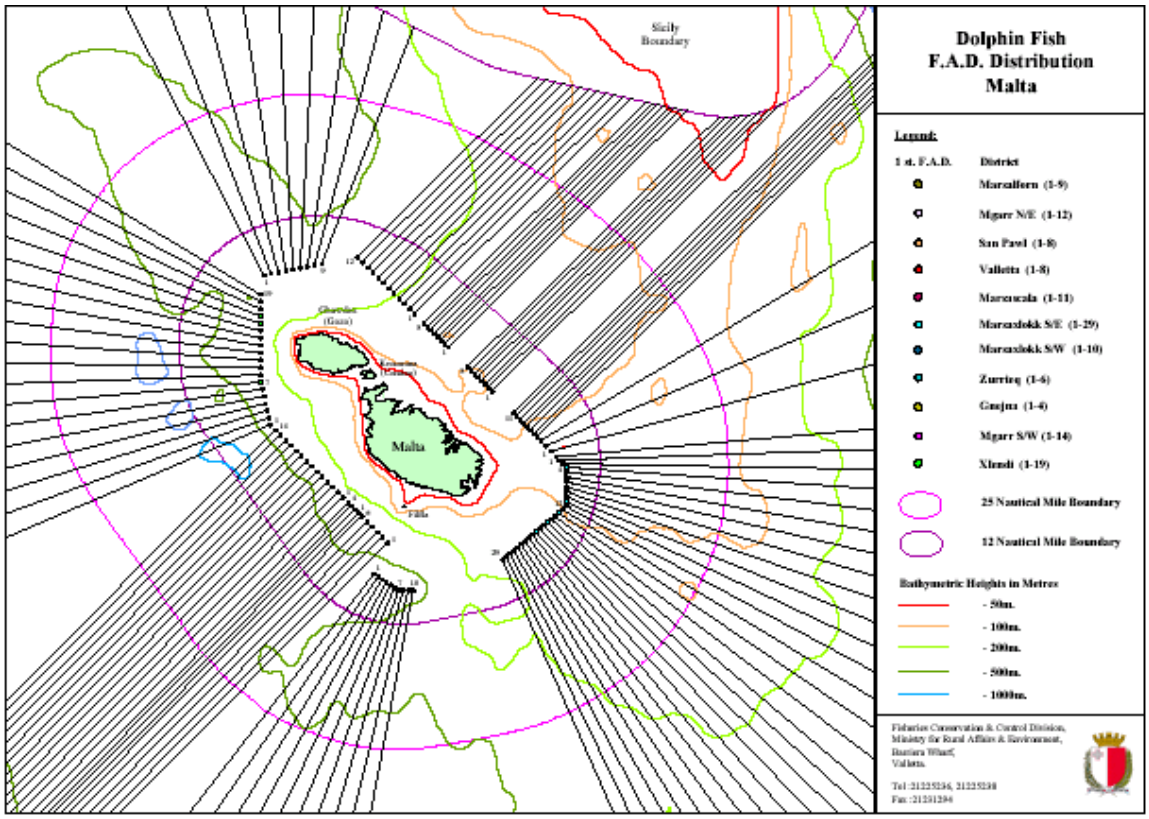


Figure 1: dolphin fish FAD distribution around Maltese Islands.

Table 1: *Coryphaena hippurus* catches per month, Value and Price per kilo.

	DOLPHIN FISH		
2004	Quantity (kg)	Wholesale Value (Lm)	Price/Kg
January	26966	14828	1.82
February	1583	1959	0.81
March	0	0	
April	0	0	
May	99	177	0.56
June	1050	1393	0.75
July	550	819	0.67
August	64999	60827	1.07
September	110353	91797	1.20
October	166816	89983	1.85
November	55485	44663	1.24
December	44799	28969	1.55
TOTAL	**472700**	**335415**	**1.41**

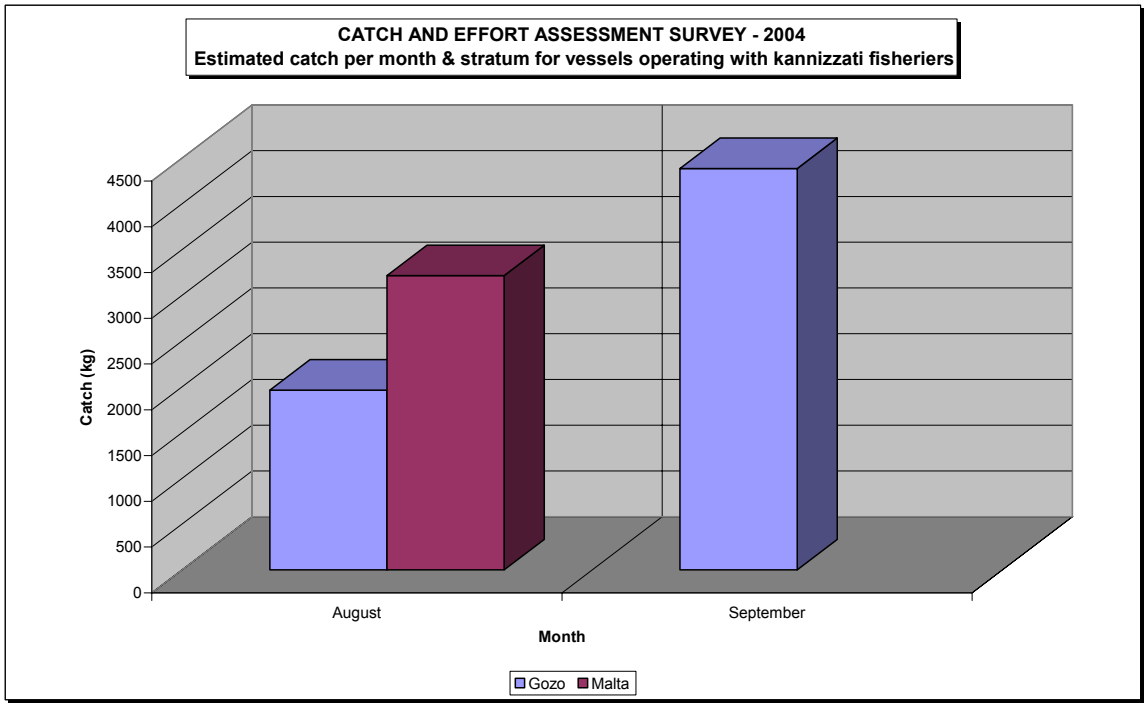


Figure 2: Estimated catch per month and stratum by vessels less than 10 m in length operating with FAD fisheries.

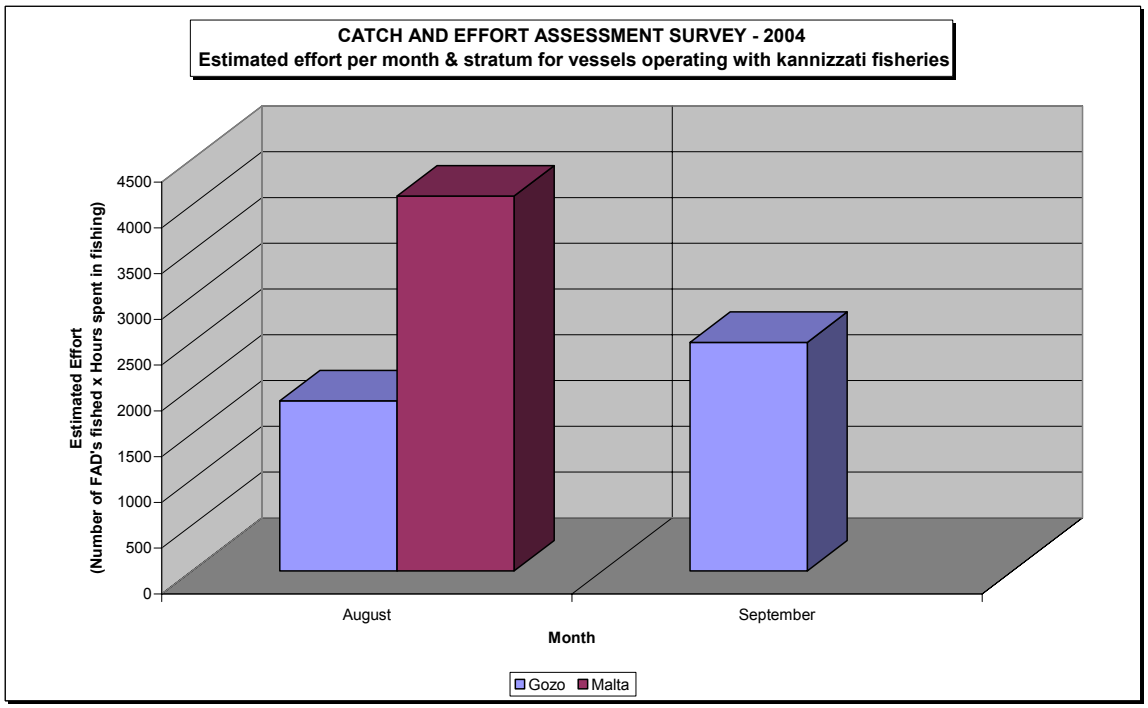


Figure 3: Estimated effort per month and stratum by vessels less than 10 m in length operating with FAD fisheries.

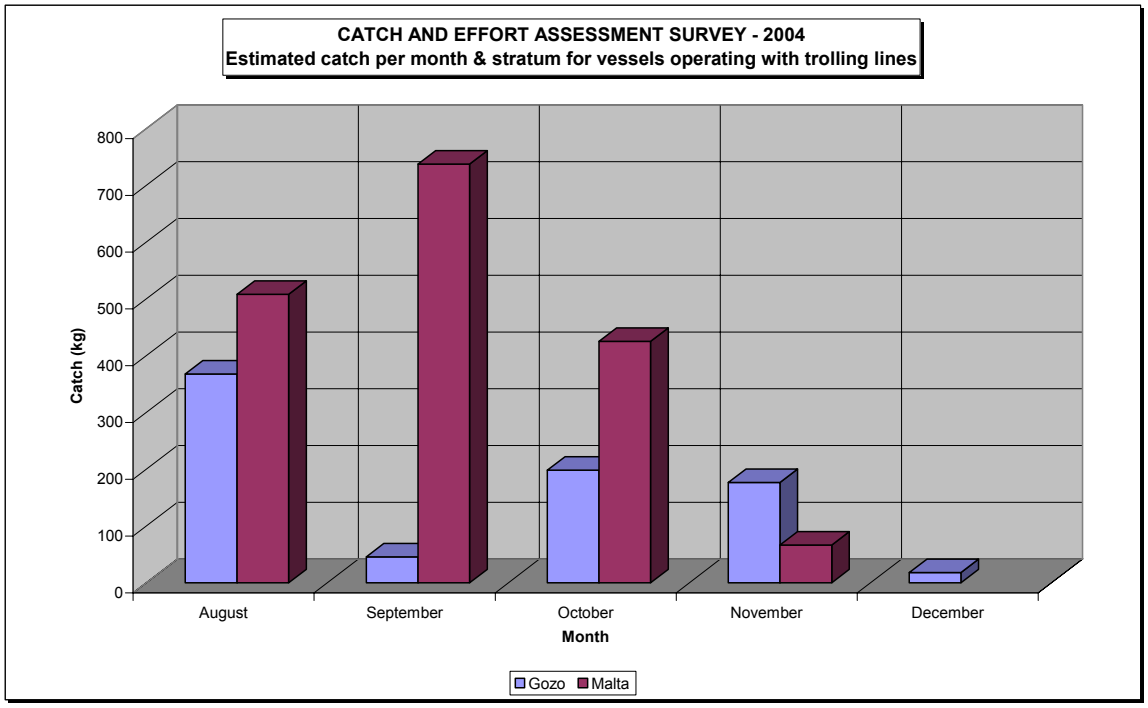


Figure 4: Estimated catch per month and stratum by vessels less than 10 m in length operating with trolling lines.

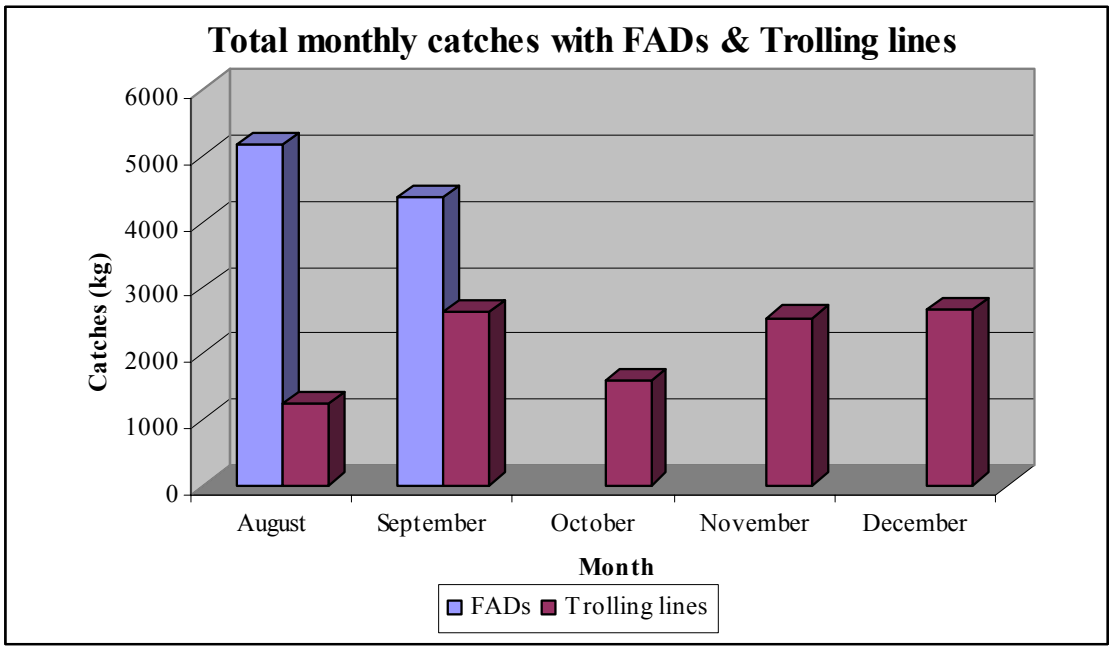


Figure 5: Total monthly catches with FADs & Trolling lines.

Table 2: FADs Fishery (CAS); August 2004.

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Gozo stratum	*Naucrates ductor*	12.4	0.6		
	Coryphaena hippurus	1860	94.6		
	Polyprion americanus	93	4.7		
	Total	**1965.4**	**100%**	**1860**	**1.056**

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Malta starum	*Coryphaena hippurus*	3168.89	98.5		
	Seriola dumerili	48.22	1.5		
	Total	**3217.11**	**100%**	**4098**	**0.785**

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Malta country	*Naucrates ductor*	12.4	0.2		
	Coryphaena hippurus	5028.89	97		
	Polyprion americanus	93	1.8		
	Seriola dumerili	48.22	0.9		
	Total	**5182.51**	**100%**	**5958.89**	**0.869**

Table 3: FADs Fishery (CAS); September 2004.

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Gozo stratum	*Coryphaena hippurus*	4387.5	100		
		4387.5	**100%**	**2500**	**1.755**

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Malta country	-	-	-		

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Malta country	*Coryphaena hippurus*	4387.5	100		
		4387.5	**100%**	**2500**	**1.755**

Table 4: Trolling Lines Fishery (CAS); August 2004.

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Gozo stratum	*Coryphaena hippurus*	367.41	29.5		
	Other species	876.92	70.5		
	Total	**1244.33**	**100%**	**2631**	**0.47294945**

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Malta stratum	*Coryphaena hippurus*	507.74	28.2		
	Other species	1292.96	71.8		
	Total	**1800.7**	**100%**	**45110**	**0.03991798**

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Malta country	*Coryphaena hippurus*	369.18	28.7		
	Other species	875.15	71.3		
	Total	**1244.33**	**100%**	**47742**	**0.02606363**

Table 5: Trolling Lines Fishery (CAS); September 2004.

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Gozo stratum	*Coryphaena hippurus*	45.51	23.7		
	Other species	146.8	76.3		
	Total	**192.31**	**100%**	**1157**	**0.16621435**

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Malta stratum	*Coryphaena hippurus*	737.25	30.3		
	Other species	1692.96	69.7		
	Total	**2430.21**	**100%**	**12419**	**0.19568484**

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Malta country	*Coryphaena hippurus*	782.77	29.8		
	Other species	1839.75	70.2		
	Total	**2622.52**	**100%**	**13576**	**0.19317325**

Table 6: Trolling Lines Fishery (CAS); October 2004.

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Gozo stratum	*Coryphaena hippurus*	198.29	36.3		
	Other species	348.25	63.7		
	Total	**546.54**	**100%**	**3724**	**0.14676155**

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Malta stratum	*Coryphaena hippurus*	425.05	40.8		
	Other species	616.68	59.2		
	Total	**1041.73**	**100%**	**10074**	**0.10340778**

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Malta country	*Coryphaena hippurus*	623.35	39.2		
	Other species	964.92	60.8		
	Total	**1588.27**	**100%**	**13798**	**0.11510871**

Table 7: Trolling Lines Fishery (CAS); November 2004.

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Gozo stratum	*Coryphaena hippurus*	176.62	11.7		
	Other species	1336.34	88.3		
	Total	**1512.96**	**100%**	**1295**	**1.16830888**

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Malta stratum	*Coryphaena hippurus*	66.29	6.4		
	Other species	968.04	93.6		
	Total	**1034.33**	**100%**	**16225**	**0.06374915**

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Malta country	*Coryphaena hippurus*	242.91	9.5		
	Other species	2304.38	90.5		
	Total	**2547.29**	**100%**	**18822**	**0.13533578**

Table 8: Trolling Lines Fishery (CAS); December 2004.

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Gozo stratum	*Coryphaena hippurus*	17.85	50.02		
	Other species	17.84	49.98		
	Total	**35.69**	**100%**	**55**	**0.64890909**

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Malta stratum	*Coryphaena hippurus*		0		
	Other species	2623.88	100		
	Total	**2623.88**	**100%**	**53194**	**0.04932662**

Stratum	Species	Estimated catch (kg)	Percentage distribution	Estimated Effort	CPUE
Malta country	*Coryphaena hippurus*	17.85	0.7		
	Other species	2641.72	99.3		
	Total	**2659.57**	**100%**	**53249**	**0.04994591**

Table 9: Statistical variables for Length measurements at Maturity Stages.

Mat. Stage	1	2	3	4
Length (mm)				
Average	377	411	479	946
Maximum	646	623	1210	1290
Minimum	240	244	260	601
Std. Dev.	79.4	84.9	181.6	487.2

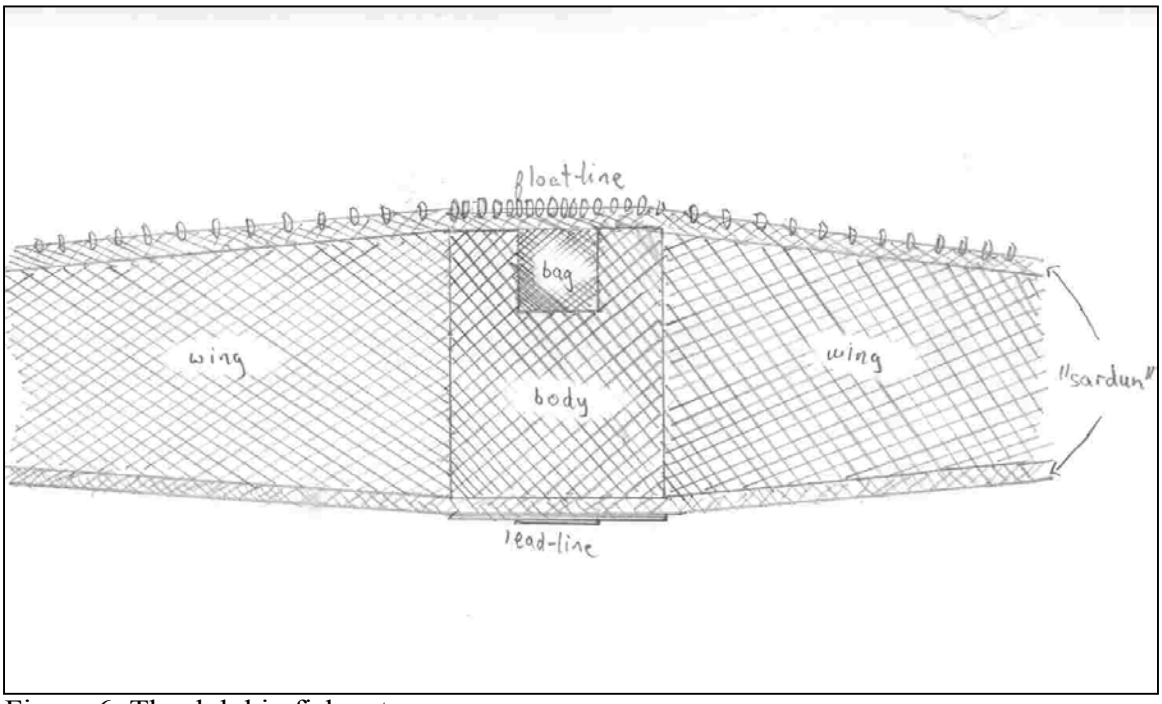


Figure 6: The dolphin fish net.

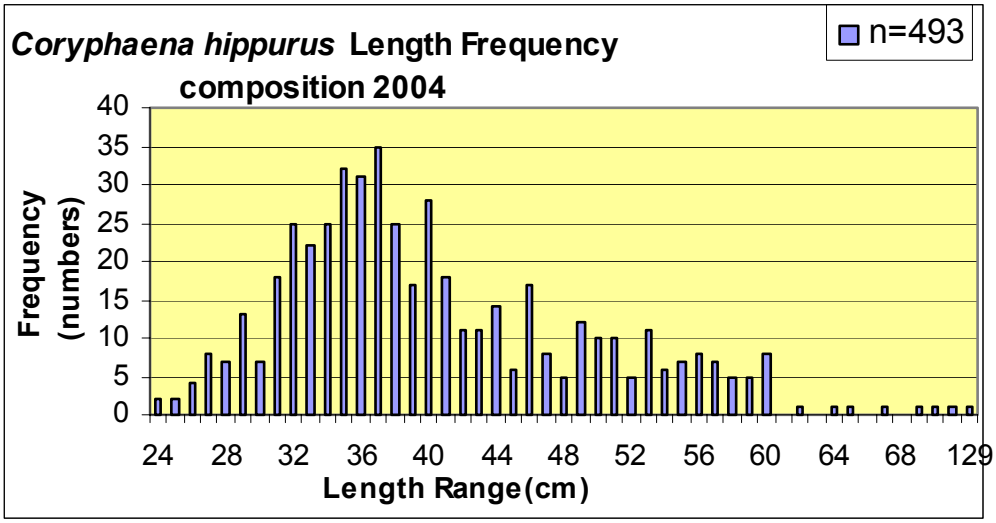
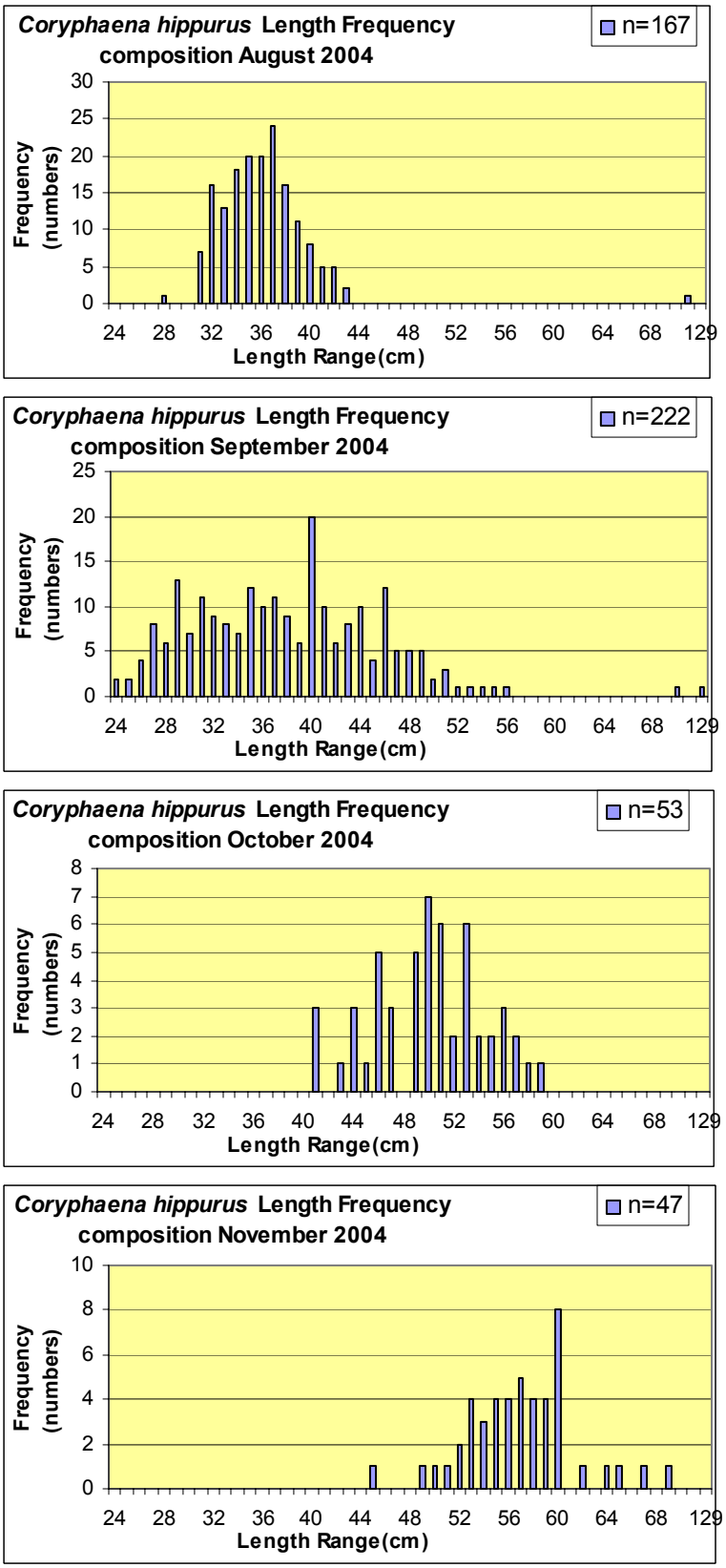


Figure 7: Length Frequency composition total (n = number specimens examined).



Figures 8-11: Length Frequency compositions per month.

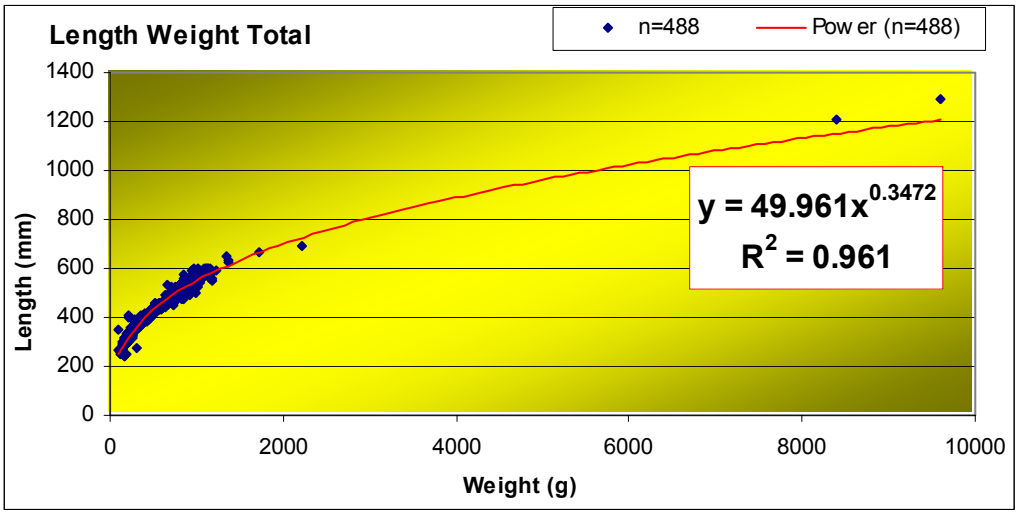


Figure 12: Length-Weight relationship (all specimens included).

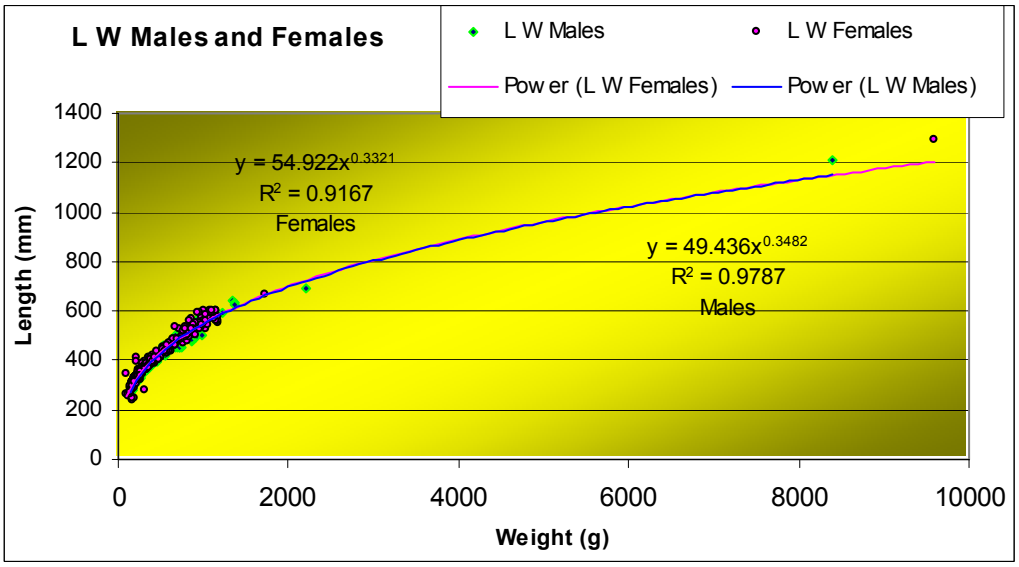
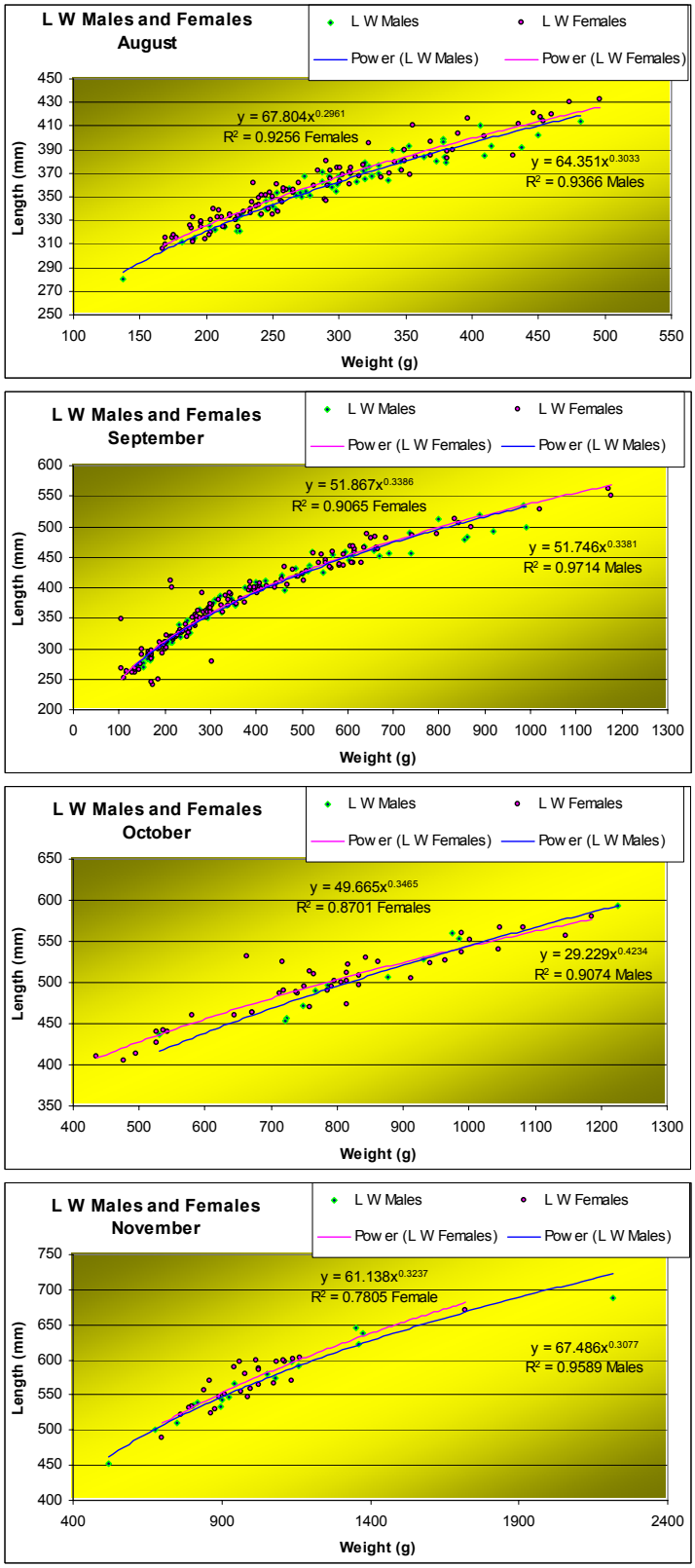


Figure 13: Length-Weight relationship for Males and Females.



Figures 14-17: Length-Weight relationship per month for males and females.

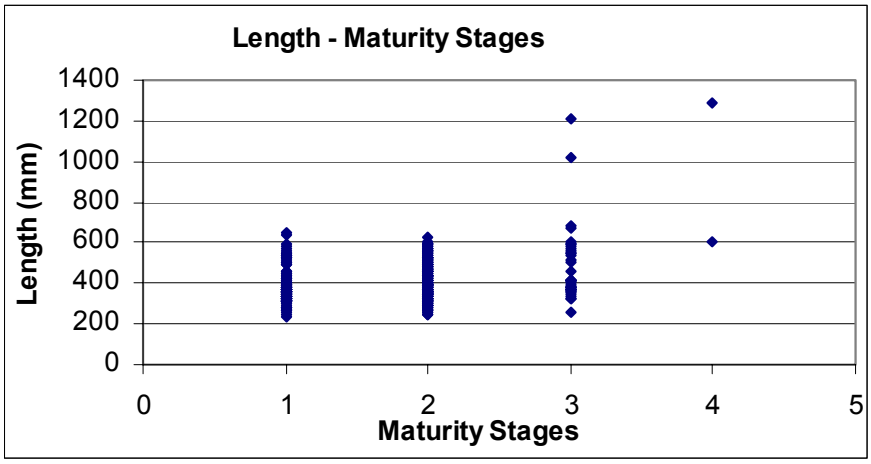
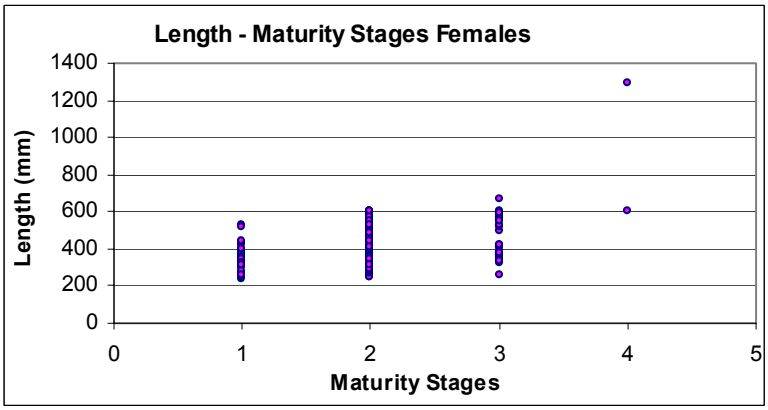
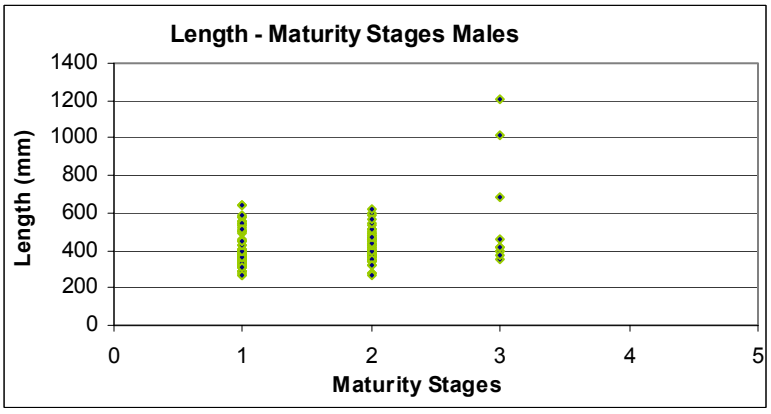


Figure 18: Sizes at different Maturity Stages.





Figures 19-20: Sizes at different Maturity Stages for females and males.