



**Università di Genova**  
Dip. Te. Ris. - Centro di Biologia Marina del Mar Ligure

**CPUE time series and fishery trends of  
pelagic elasmobranch species  
in Italian waters**

**Fulvio Garibaldi**



**GENERAL FISHERIES COMMISSION  
FOR THE MEDITERRANEAN  
COMMISSION GÉNÉRALE DES PÊCHES  
POUR LA MÉDITERRANÉE**



**WORKSHOP ON STOCK ASSESSMENT OF SELECTED SPECIES OF ELASMOBRANCHS IN THE GFCM AREA**  
Brussels, Belgium, 12-16 December 2011

Italian seas are divided on the basis of different O.U, similar to FAO GSA

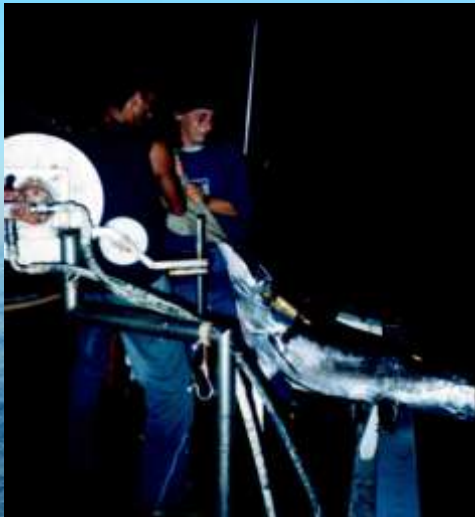


Following this scheme, research programs coordinated at national level started in the late '80. They are generally not based on fishing surveys, but are **mainly** carried out monitoring landings (difference with Medits and Grund)



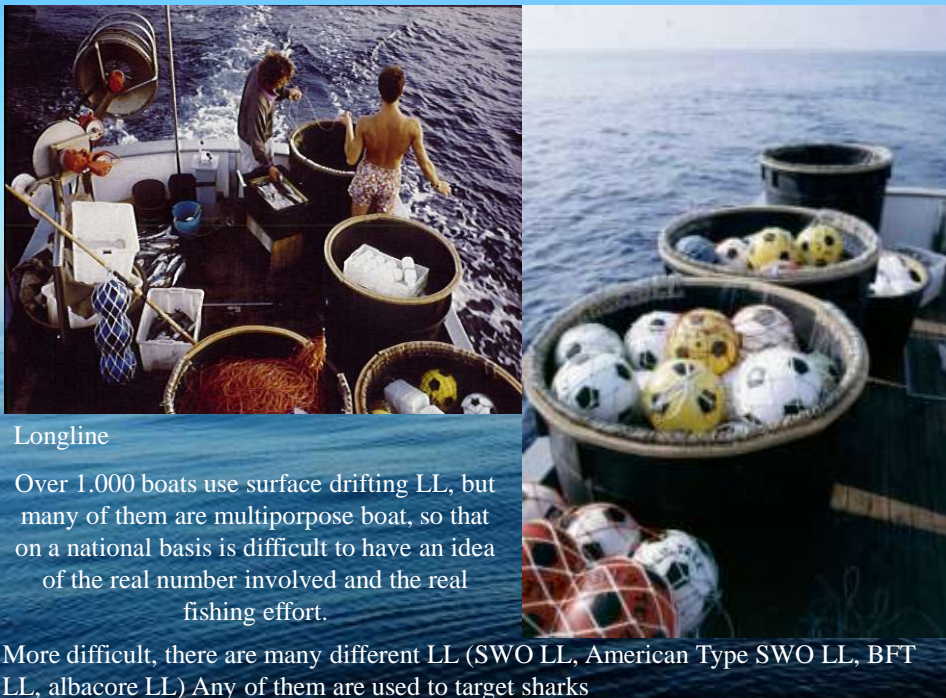
They were funded by the Italian Ministry of the Agricultural Policy and some others by E.U. They were carried out on large pelagic fish species ( mainly swordfish and bluefin tuna).

For pelagic fish, fishing surveys at sea are time and money expensive, but they are the only way to collect biological samples (gonads, stomach contents, etc).



Every year a part of the work was carried out by observers on board for each O.U.

Obviously, in the framework of these programs, all possible data on by-catch species, including sharks, were also collected.



### Longline

Over 1,000 boats use surface drifting LL, but many of them are multipurpose boat, so that on a national basis is difficult to have an idea of the real number involved and the real fishing effort.

More difficult, there are many different LL (SWO LL, American Type SWO LL, BFT LL, albacore LL) Any of them are used to target sharks

## Driftnets

They are officially banned from the E.U. countries from 2002, but in different ways they are still operating, also in rest of the Mediterranean.



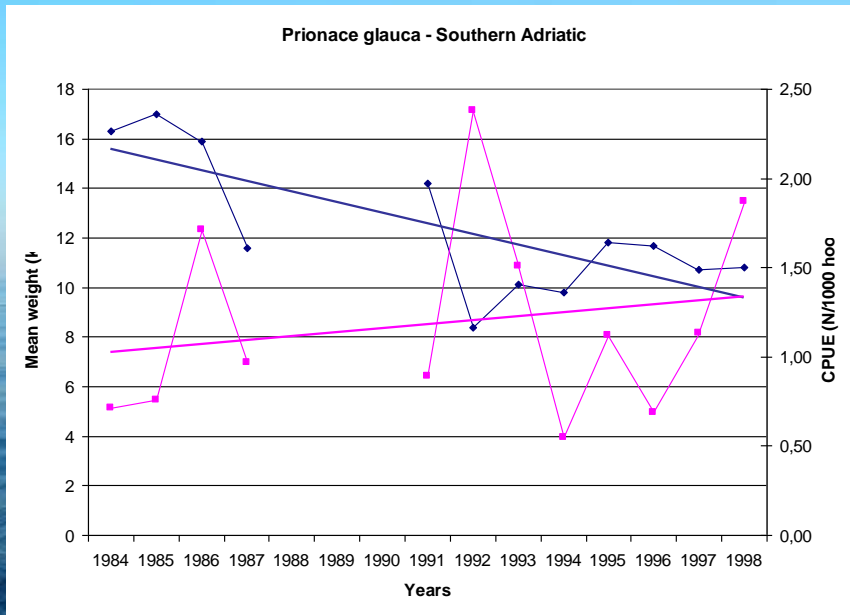
At the moment is not possible defining the number of the fishing boat using DN. The number is clearly reduced comparing the last decade

## *Prionace glauca*

From De Metrio *et al.*, 1984 – Gulf of Taranto

	SWO LL		ALB LL	
	CPUE n	Mean weight	CPUE	Mean Weight
1978	1,5	9,2	0,6	3,3
1979	1,1	47,0	0,6	2,9
1980	1,0	29,9	0,6	2,8
1981	2,2	20,7	0,1	4,5

From De Zio *et al.*, 1998



### *Prionace glauca*

From Di Natale *et al.*, 1998 – Southern Tyrrhenian Sea

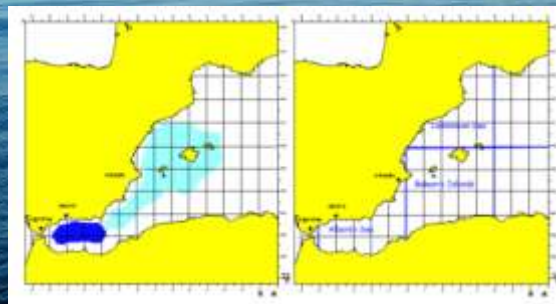
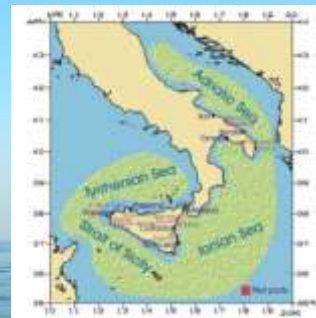
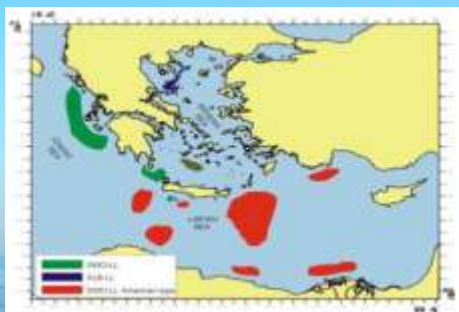
	SWO LL	CPUE n	Mean weight
1998		0,2774907	62,625

## From Tudela *et al.*, 2004 – Moroccan Driftnet fishery in Alboran Sea

Table 18. Catch rate estimates (cpue) for swordfish and the major by-catch species considered. Two different scenarios are presented for pelagic sharks ('low' and 'high'), attributable to the by-catch capture pattern (approx. 2/5 of the fleet) and to the target fishing pattern (approx. 3/5 of the fleet) revealed by gim analyses (see text).

	Period	Capture per fishing operation (N/fishing operation)	Capture per km net set (N/km)
Swordfish <sup>1</sup>	Dec-Sep	8.102	0.810
Loggerhead turtle <sup>1</sup>	Dec-May	0.211	0.026
Dolphins <sup>1,2</sup>	Dec-Sep	0.642	0.060
<i>Prionace</i> (low)	Dec-Sep	0.872	0.117
<i>Prionace</i> (high)	Dec-Sep	1.594	0.121
<i>Isurus</i> (low)	Dec-Sep	0.608	0.059
<i>Isurus</i> (high)	Dec-Sep	1.909	0.145
<i>Alopias</i> (low)	Dec-Sep	0.728	0.092
<i>Alopias</i> (high)	Dec-Sep	1.528	0.117

Only one program expressly dedicated to shark by-catch in pelagic fishery (Project funded by EC 97/50 DG XIV C1) carried out in Greece, Southern Italy and Spain (1998-1999)



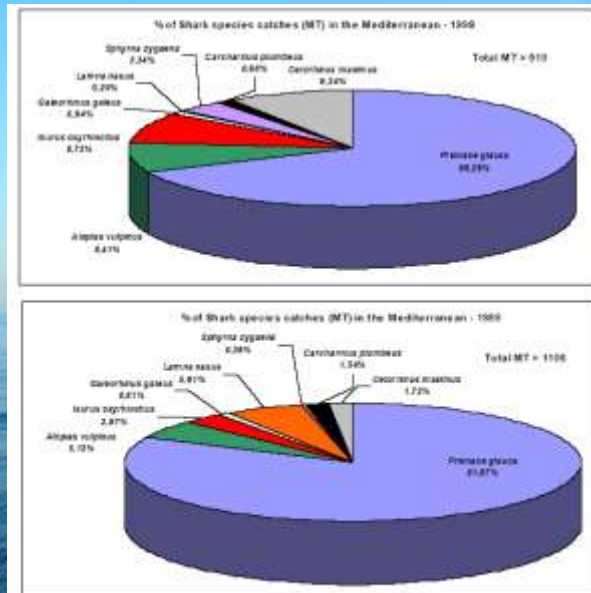


Figure 2.2.4 - Percentage of incidental shark catches by species in the fisheries for large pelagic species in the Mediterranean Sea (Greece-Italy-Spain) during 1998-1999. (Project N° 97/50 DG XIV/C1).

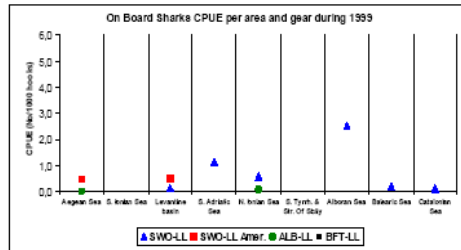
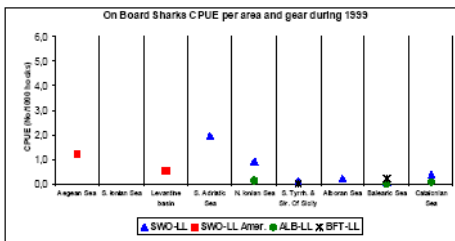
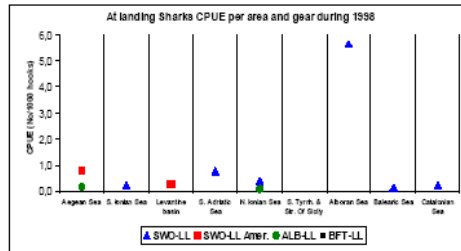
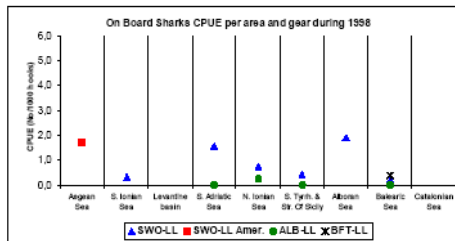


Table 2.2.5 - Fishing effort and shark catch rates by fishing gear (number of fish/1000 hooks or number of fish/1000 meters of net) and areas sampled during the two-year period 1998-99 in the Mediterranean Sea. Shark species include *Prionace glauca* (PG), *Isurus oxyrinchus* (IO), *Alopias vulpinus* (AV) and *Galeorhinus galeus* (GG) (Megalofonou *et al.* unpublished data).

swordfish longline							
Area	Effort (x 1000 hooks)	PG	IO	AV	GG	Other Sharks	Total Sharks
Ionian	1151.0	0.53	0.00	0.001	0.00	0.003	0.53
Levantine	7.0	0.00	0.00	0.00	0.14	0.00	0.14
Adriatic	2061.6	1.00	0.00	0.004	0.00	0.00	1.00
Tyrrhenian	18.5	0.27	0.00	0.00	0.00	0.00	0.27
Straits of Sicily	46.4	0.06	0.00	0.02	0.02	0.11	0.22
Balearic	1168.8	0.07	0.04	0.01	0.003	0.001	0.12
Alboran	1406.7	3.59	0.19	0.008	0.007	0.004	3.80
Catalonian	522.1	0.17	0.004	0.004	0.004	0.004	0.18
driftnet							
Area	Effort (x1000 meters)	PG	IO	AV	GG	Other Sharks	Total Sharks
Ionian	8336.3	0.03	0.00	0.002	0.00	0.001	0.04

### Drift net (from Di Natale *et al.*, 1994)

Species	Scientific name	Total		Area Ligurian Sea		Tyrrhenian Sea	
		number	%	number	%	number	%
<b>SHARKS</b>							
Thresher shark	<i>Alopias vulpinus</i>	4	0.21	4	0.32	-	-
Blue shark	<i>Prionace glauca</i>	8	0.43	3	0.24	6	0.98
Basking shark	<i>Cetorhynchus maximus</i>	1	0.05	1	0.08	-	-
<b>OTHER SELACHII</b>							
Violet stingray	<i>Dasyatis violacea</i>	19	1.02	1	0.08	18	2.93
Devil ray	<i>Mobula mobular</i>	8	0.43	8	0.64	-	-

The CPUE in number of specimen in the area was of 0.005/km for the Thresher shark, 0.009/km for the Blue shark, 0.001/km for the Basking shark, 0.022/km for the Violet stingray and 0.005/km for the Devil ray.

Species	Scientific name	Area Tyrrhenian Sea and Straits of Sicily	
		number	%
<b>SHARKS</b>			
Shortfin mako	<i>Isurus oxyrinchus</i>	2	0.68
Blue shark	<i>Prionace glauca</i>	14	4.74
Smooth hammerhead	<i>Sphyrna zygaena</i>	1	0.34
<b>OTHER SELACHII</b>			
Violet stingray	<i>Dasyatis violacea</i>	27	9.15

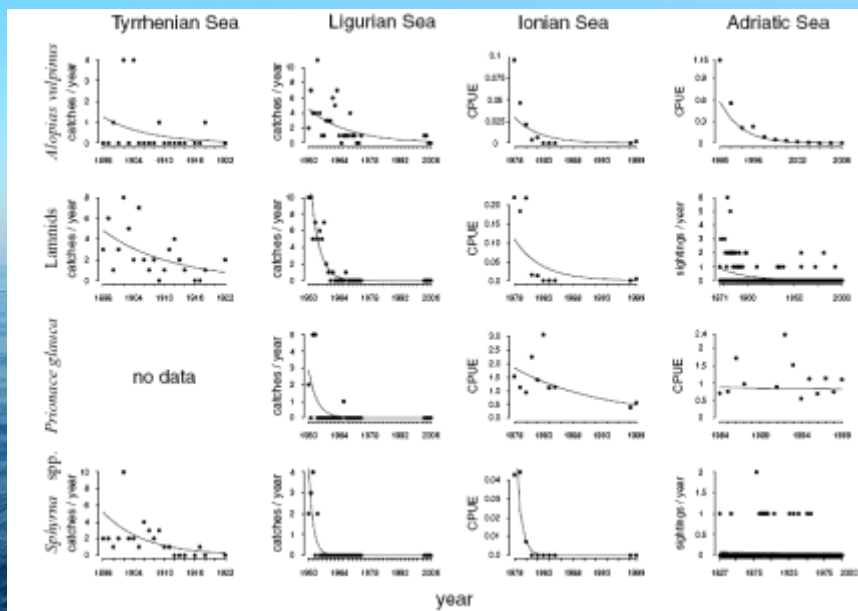
The CPUE in number of specimen in the area was of 0.051/km for the Shortfin mako, 0.358/km for the Blue shark, 0.026/km for the Smooth hammerhead and 0.691/km for the Violet stingray. The fishermen confirm a high



## Megalofonou et al., 2005

Area	<i>P. glauca</i>	<i>I. oxyrinchus</i>	<i>A. vulpinus</i>	<i>G. galeus</i>	Other species
Ionian	0,53	-	0,001	-	0,003
Levantine	0	-	-	0,14	-
Adriatic	1	-	0,004	-	-
Tyrrhenian	0,27	-	-	-	-
Straits of Sicily	0,06	-	0,02	0,02	0,11
Balearic	0,07	0,04	0,01	0,003	0,001
Alboran	3,59	0,19	0,008	0,007	0,004
Catalonian	0,17	0,004	0,004	0,004	0,004
Total	1,24	0,05	0,006	0,003	0,002

## Ferretti et al., 2008



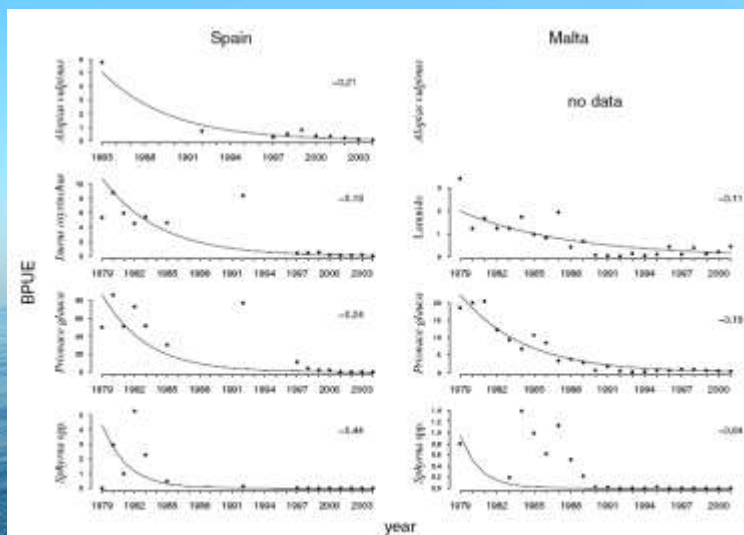


Figure 4. Trends in shark biomass (kg) in the western and central Mediterranean Sea. Data are landed biomass per unit effort (BPUE). Biomass is expressed for Spain as kilograms per 1000 hooks and for Malta as kilograms per unit of gross tonnage (tons). Numbers on the right side of each plot are instantaneous rate of change in biomass.

## Modeling environmental, spatial, temporal, and operational effects on blue shark by-catches in the Mediterranean long-line fishery

By P. Megalofonou<sup>1</sup>, D. Damalas<sup>1</sup>, M. DeIorio<sup>2</sup> and G. De Metro<sup>2</sup>

## Biological characteristics of blue shark, *Prionace glauca*, in the Mediterranean Sea

PERSEFONI MEGALOFONO<sup>1</sup>, DIMITRIS DAMALAS<sup>1</sup> AND GREGORIO DE METRIO<sup>2</sup>

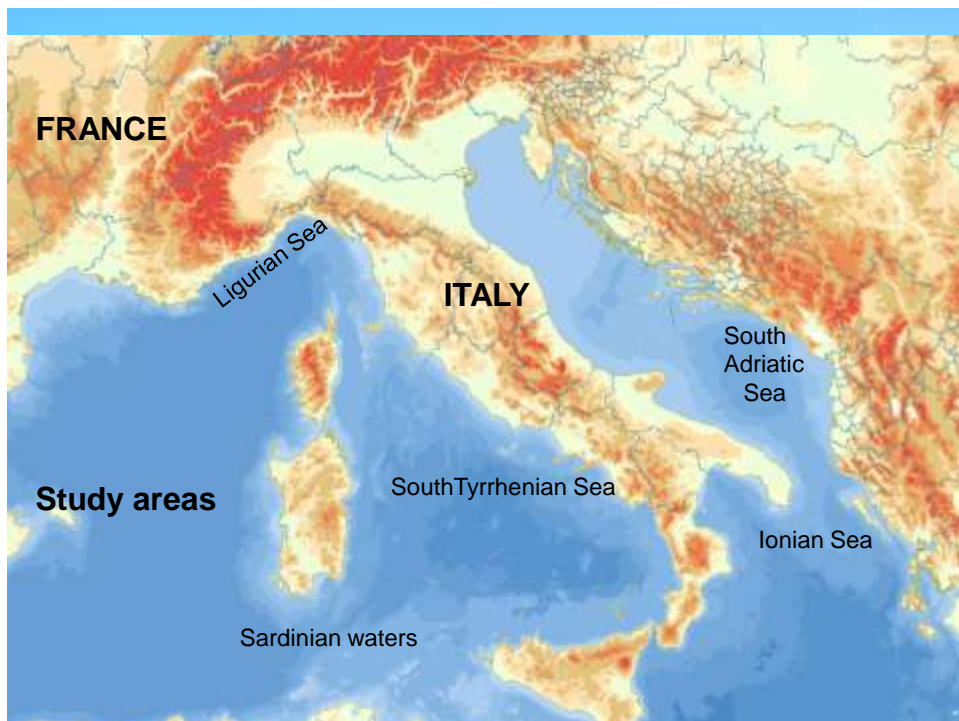


MINISTERO DELL'AMBIENTE  
E DELLA TUTELA DEL TERRITORIO E DEL MARE  
DIREZIONE PER LA PROTEZIONE DELLA NATURA E  
DEL MARE

SOCIETÀ ITALIANA DI BIOLOGIA MARINA

**PROGETTO ELASMOIT**  
**ELEMENTI PER LA VALUTAZIONE DELLO STATO DI**  
**SFRUTTAMENTO E DI CONSERVAZIONE**  
**DEGLI ELASMOBRANCHI DEI MARI ITALIANI**

*December 2009 – December 2010*



Bibliographic database

Sampling both at landings and onboard

Demersal and pelagic species involved

Cartography

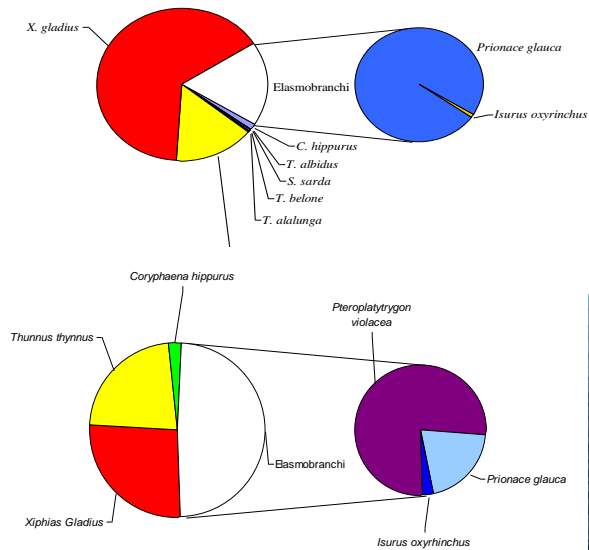
National Action plans  
in the Mediterranean



Specie	Totale sbarcato	
	N	%
<i>Xiphias gladius</i>	322	65,31
<i>Thunnus thynnus</i>	75	15,21
<i>Coryphaena hippurus</i>	5	1,01
<i>Tetrapturus albidus</i>	1	0,20
<i>Tetrapturus belone</i>	1	0,20
<i>Sarda sarda</i>	1	0,20
<i>Thunnus alalunga</i>	1	0,20
<i>Prionace glauca</i>	86	17,44
<i>Isurus oxyrinchus</i>	1	0,20
<b>Totale Osteichthyes</b>	<b>406</b>	<b>82,35</b>
<b>Totale Condricthyes</b>	<b>87</b>	<b>17,65</b>
<b>Totale catture</b>	<b>493</b>	<b>100,00</b>

At landings  
Ligurian Sea  
Onboard

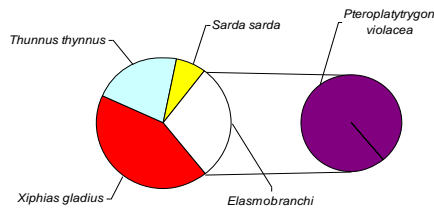
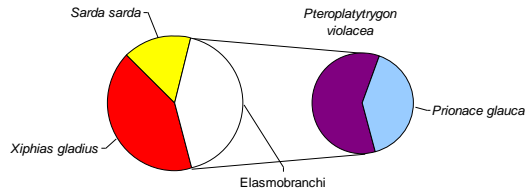
Specie	Totale catture	
	N	%
<i>Xiphias Gladius</i>	21	22,11
<i>Thunnus thynnus</i>	18	18,95
<i>Coryphaena hippurus</i>	2	2,11
<i>Pteroplatytrigon violacea</i>	30	31,58
<i>Prionace glauca</i>	8	8,42
<i>Isurus oxyrinchus</i>	1	1,05
<b>Totale Osteichthyes</b>	<b>56</b>	<b>58,95</b>
<b>Totale Condricthyes</b>	<b>39</b>	<b>41,05</b>
<b>Totale catture</b>	<b>80</b>	<b>100,00</b>



SPECIE	Totale catture	
	N	%
<i>Xiphias gladius</i>	5	41,67
<i>Sarda sarda</i>	2	16,67
<i>Pteroplatytrigon violacea</i>	3	25,00
<i>Prionace glauca</i>	2	16,67
<b>Totale Osteichthyes</b>	<b>7</b>	<b>58,33</b>
<b>Totale Condricthyes</b>	<b>5</b>	<b>41,67</b>
Totale catture	12	100,00

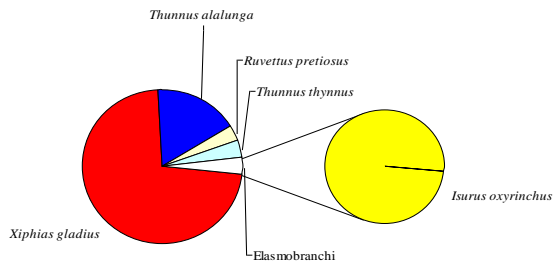
Onboard obs.  
Sardinian waters

Specie	Totale catture	
	N	%
<i>Xiphias gladius</i>	12	42,86
<i>Thunnus thynnus</i>	6	21,43
<i>Sarda sarda</i>	2	7,14
<i>Pteroplatytrigon violacea</i>	8	28,57
<b>Totale Osteichthyes</b>	<b>20</b>	<b>71,43</b>
<b>Totale Condricthyes</b>	<b>8</b>	<b>28,57</b>
Totale catture	28	100,00

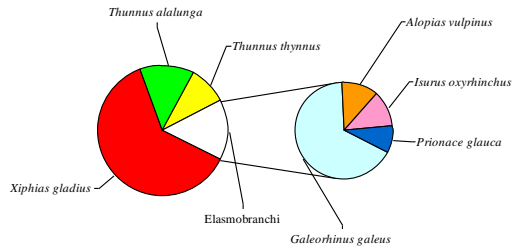


Landings

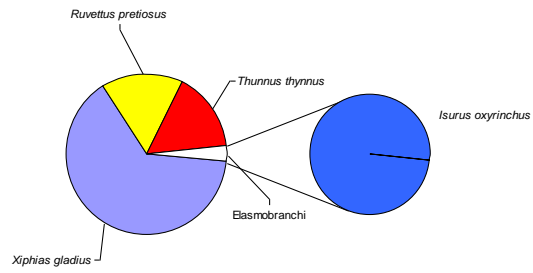
Lampedusa



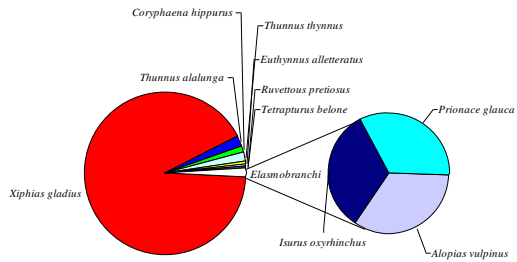
Marsala  
(Sicily Channel)



Aci Trezza  
(Ionian Sea)

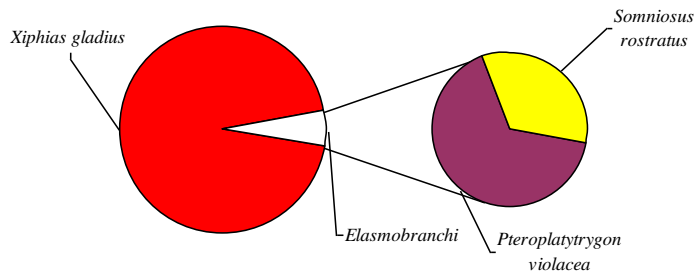


Ponza  
(Tyrrhenian Sea)



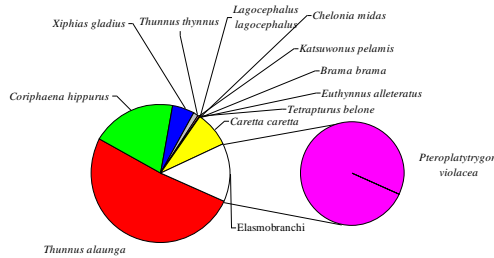
Onboard  
SWOLL

Specie	Luglio (Ionio Centrale)		Agosto (Tirreno Meridionale)		Totale catture	
	N	%	N	%	N	%
<i>Xiphias gladius</i>	33	94,29	17	94,44	50	94,34
<i>Pteroplatytrygon violacea</i>	1	2,86	1	5,56	2	3,77
<i>Somniosus rostratus</i>	1	2,86	-	-	1	1,89
<b>Totale Osteichthyes</b>	33	94,29	17	94,44	50	94,34
<b>Totale Condricthyes</b>	2	5,71	1	5,56	3	5,66
Totale catture	35	100,00	18	100,00	53	100,00

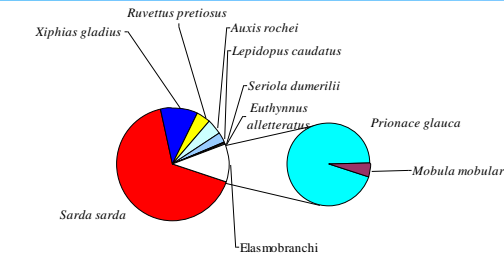


Onboard  
ALB LL

Specie	Agosto (Mar Libico)		Novembre (Tirreno Meridionale)		Totale catture	
	N	%	N	%	N	%
<i>Thunnus alalunga</i>	3080	61,93	454	23,92	3534	51,43
<i>Coryphaena hippurus</i>	1042	20,95	327	17,23	1369	19,92
<i>Xiphias gladius</i>	16	0,32	337	17,76	353	5,14
<i>Thunnus thynnus</i>	4	0,08	57	3,00	61	0,89
<i>Katsuwonus pelamis</i>	10	0,20	-	-	10	0,15
<i>Tetrapturus belone</i>	1	0,02	9	0,47	10	0,15
<i>Euthynnus alletteratus</i>	8	0,16	-	-	8	0,12
<i>Brama brama</i>	1	0,02	5	0,26	6	0,09
<i>Lagocephalus lagocephalus</i>	-	-	2	0,11	2	0,03
<i>Caretta caretta</i>	325	6,54	262	13,80	587	8,54
<i>Chelonia midas</i>	1	0,02	-	-	1	0,01
<i>Pteroplatytrigon.violacea</i>	485	9,75	445	23,45	930	13,54
<b>Totale Osteichthyes</b>	4162	83,69	1191	62,75	5353	77,91
<b>Totale Condricthyes</b>	485	9,75	445	23,45	930	13,54
<b>Totale Reptilia</b>	326	6,56	262	13,80	588	9
<b>Totale catture</b>	<b>4973</b>	<b>100,00</b>	<b>1898</b>	<b>100,00</b>	<b>6871</b>	<b>100,00</b>

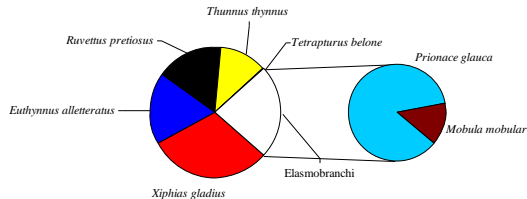


Specie	Totale catture	
	N	%
<i>Sarda sarda</i>	629	66,42
<i>Xiphias gladius</i>	102	10,77
<i>Ruvettus pretiosus</i>	41	4,33
<i>Auxis rochei</i>	40	4,22
<i>Lepidopus caudatus</i>	26	2,75
<i>Seriola dumerilii</i>	5	0,53
<i>Euthynnus alletteratus</i>	2	0,21
<i>Prionace glauca</i>	96	10,14
<i>Mobula mobular</i>	6	0,63
<b>Totale Osteichthyes</b>	845	89,23
<b>Totale Condricthyes</b>	102	10,77
<b>Totale catture</b>	<b>947</b>	<b>100,00</b>

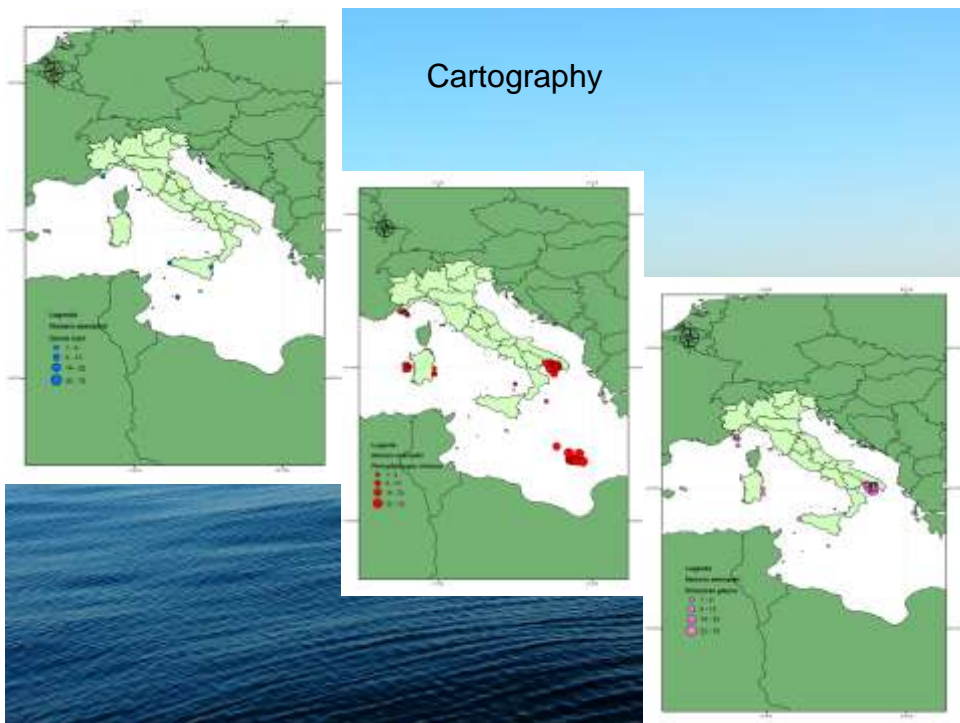
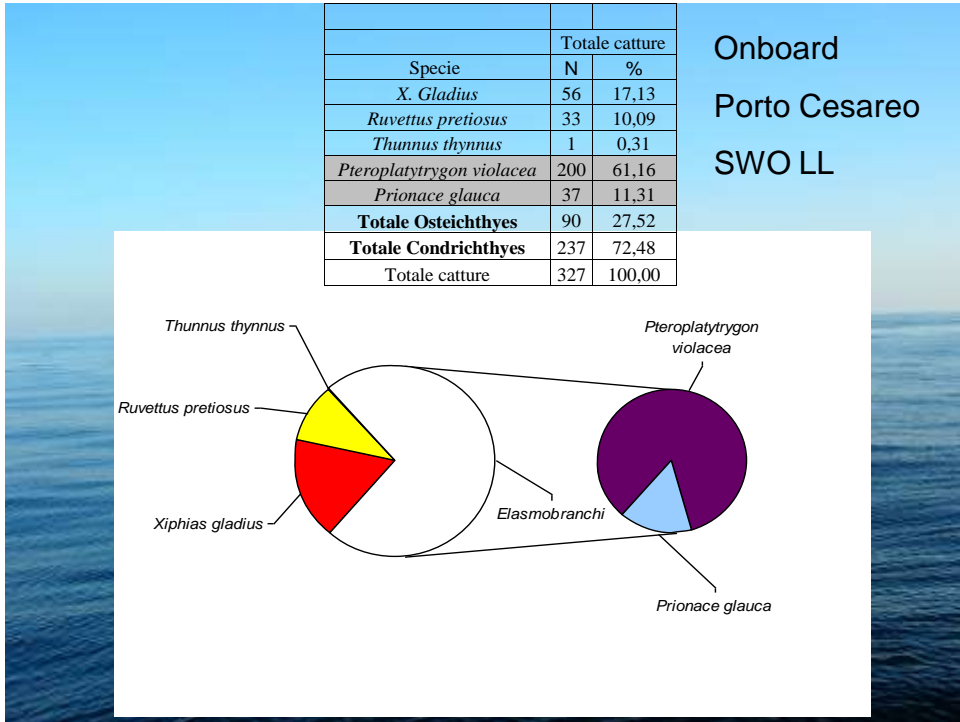


Porto Cesareo

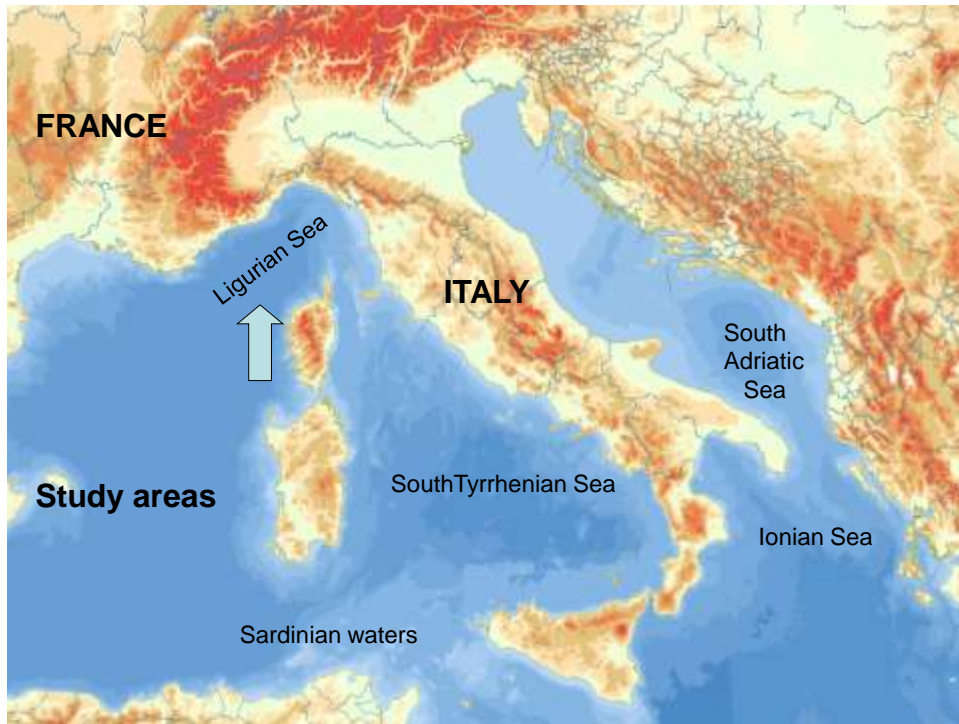
Specie	Totale catture	
	N	%
<i>Xiphias gladius</i>	95	30,55
<i>Euthynnus alletteratus</i>	56	18,01
<i>Ruvettus pretiosus</i>	52	16,72
<i>Thunnus thynnus</i>	36	11,58
<i>Tetrapturus belone</i>	1	0,32
<i>Prionace glauca</i>	61	19,61
<i>Mobula mobular</i>	10	3,22
<b>Totale Osteichthyes</b>	240	77,17
<b>Totale Condricthyes</b>	71	22,83
<b>Totale catture</b>	<b>311</b>	<b>100,00</b>



Gallipoli







### *Ligurian professional swordfish longline fishery fleet*

**Not industrial fishery**

The introduction of hydraulic hauls, radar, autopilot have not brought to an increase of the average number of hooks / set or variation in fishing operations

Since 1990, the gear has been maintaining the same characteristics

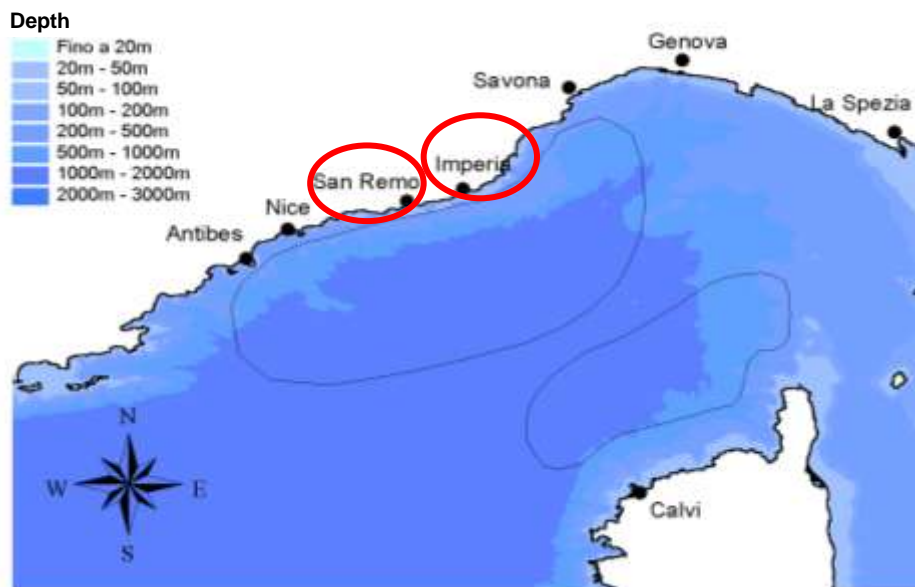
**This issue is really important:**

**in this way it is possible and easier to compare different years, seasons or areas, using historical data sets**



Professional swordfish longline fishery - main Western Ligurian Sea fishing grounds

Imperia and Sanremo represent more than 70% of the SWO longline fishery in the Ligurian Sea



Research programs on swordfish and bluefin tuna, coordinated at national level, started in 1990. They were generally not based on fishing surveys, but were **mainly** carried out by monitoring landings

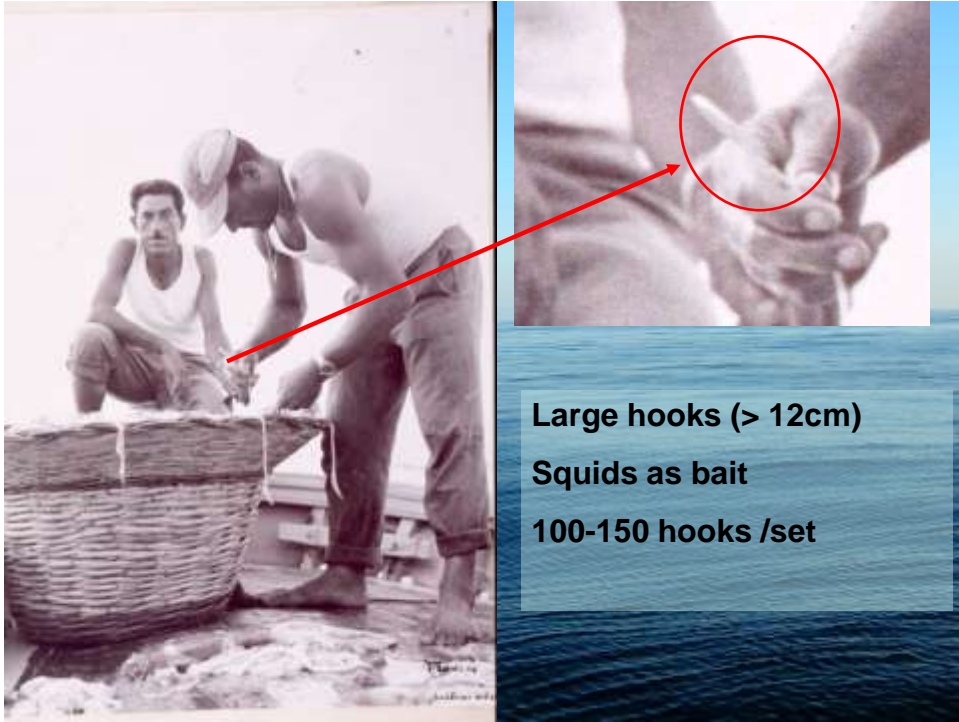


**Elasmobranch by-catch**



**30 August 1964 - 6 Swordfish, 1 BFTuna, 5 Blue sharks – 700kg**

**The origins**



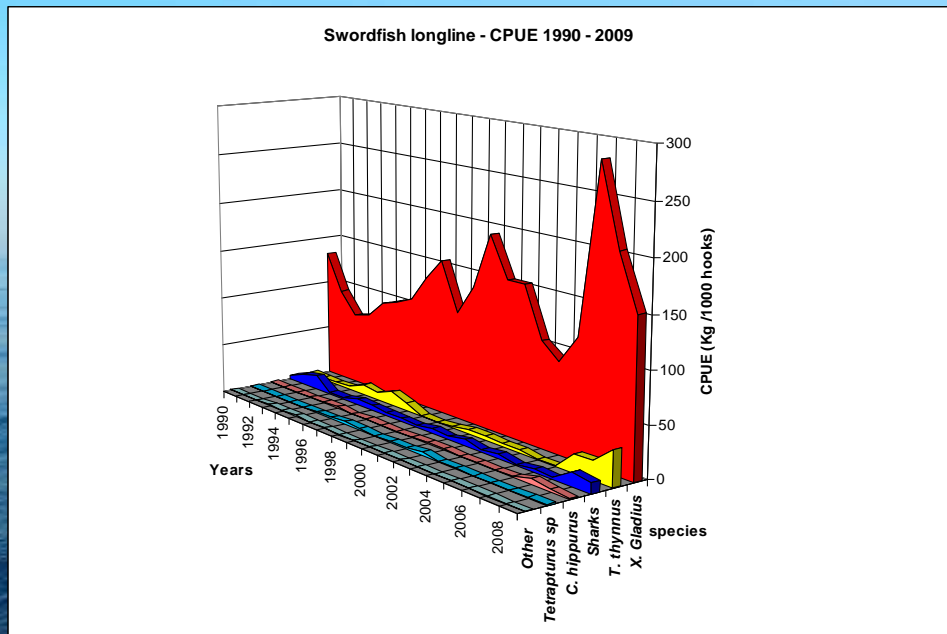
**Large hooks (> 12cm)**  
**Squids as bait**  
**100-150 hooks /set**



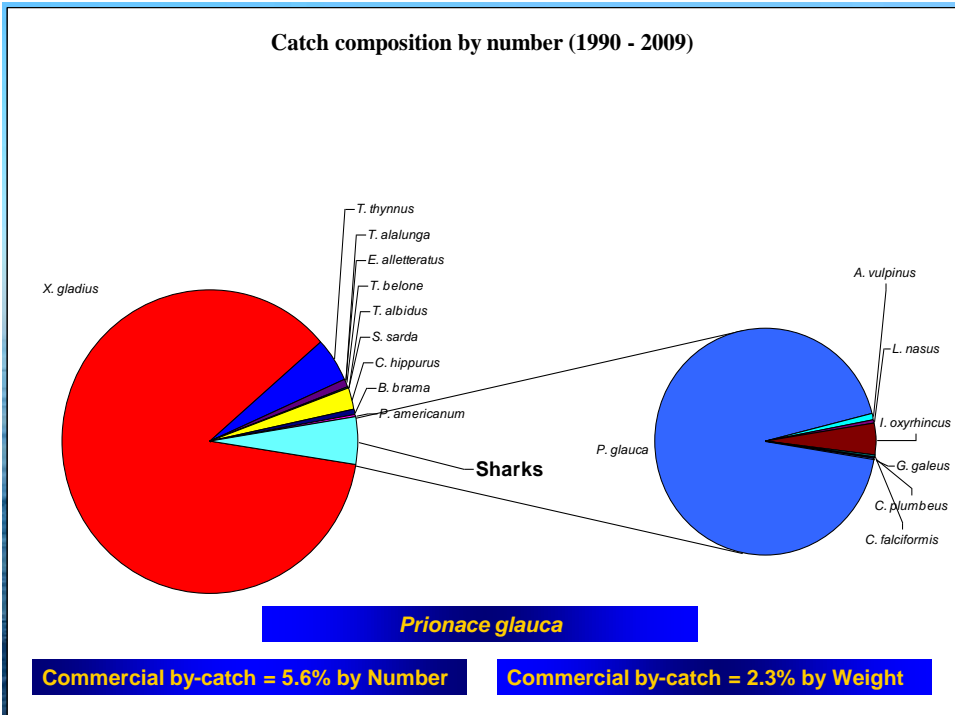
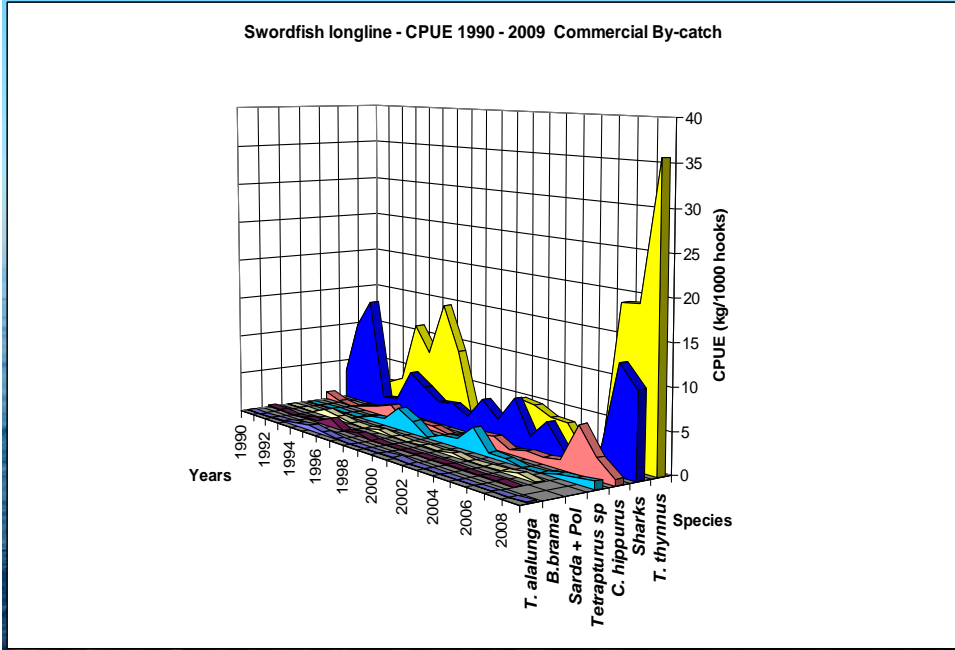
**In the mid 70's steel lines were used specifically to catch pelagic sharks, generally at the beginning of the season (April- May)**



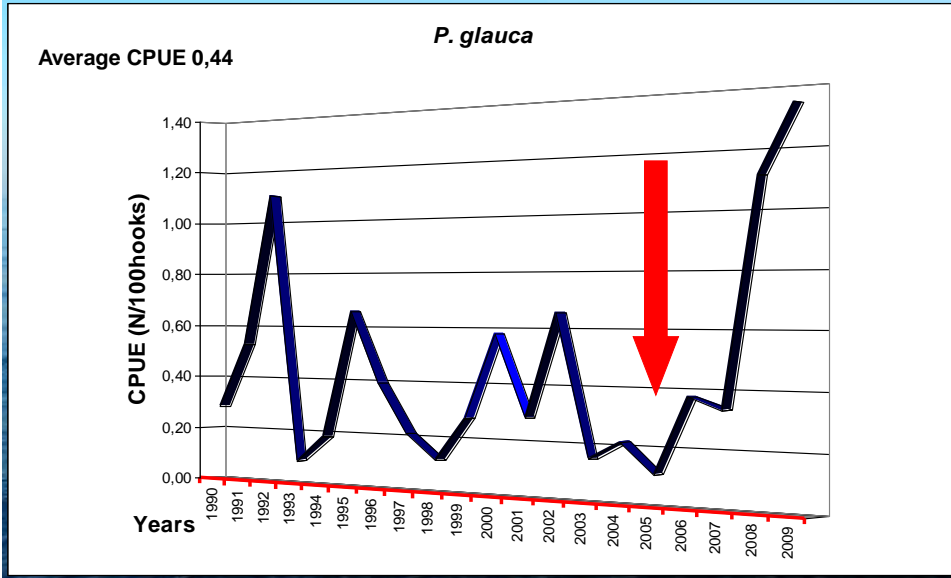
CPUE (kg /1000 hooks) recorded at landings on a daily basis



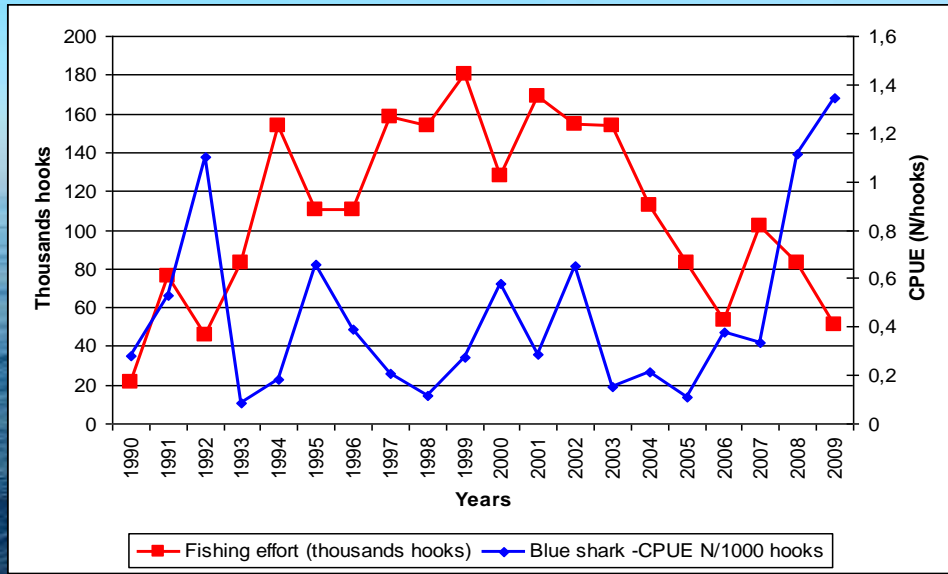
**CPUE (kg /1000 hooks) recorded at landings on a daily basis**



**CPUE values show a recovery during the last 4 years**

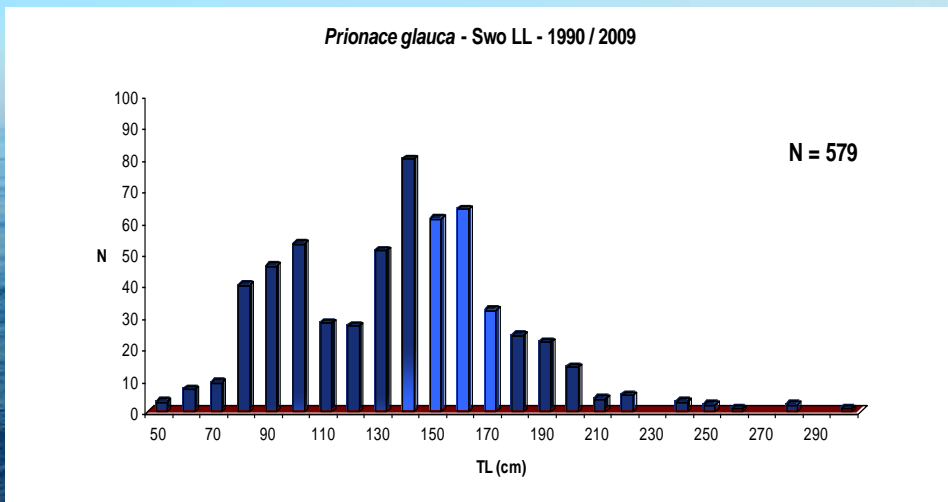


Over the last 6 years we observed a reduction of the fishing effort  
 Also due to the stop imposed by ICCAT on swordfish fishery in 2008 (15 October – 15 November) and 2009 (1st October – 30 November)

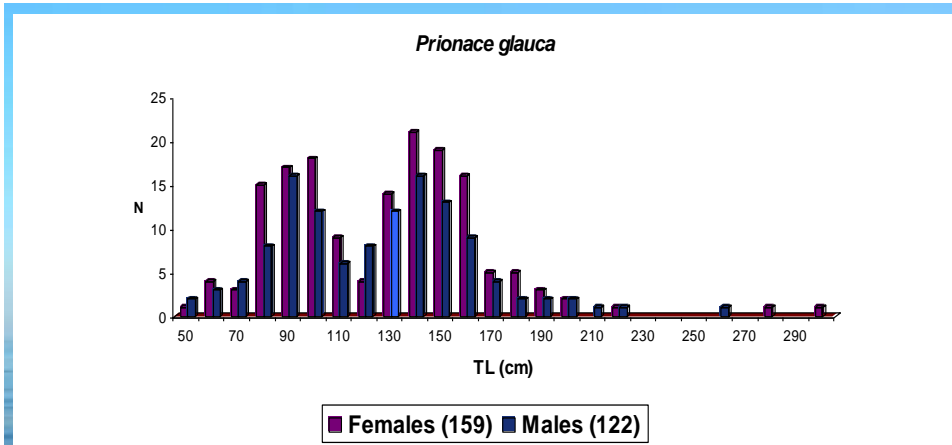


**Min. size 52 cm TL    Max. size 304 cm TL    Av. Size 140,1cm TL**

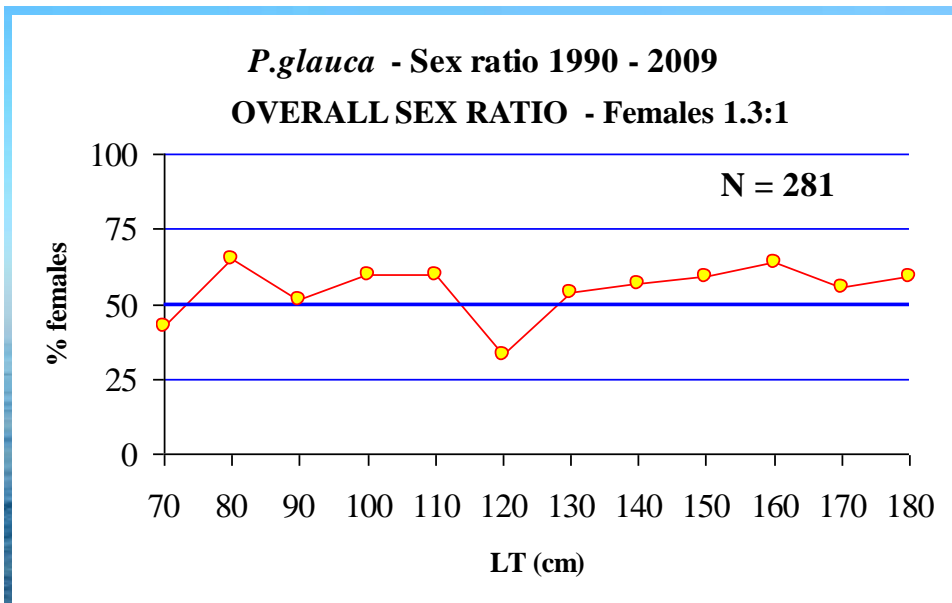
**Sharks < 130cm TL represent 45,6% of total catches by number**





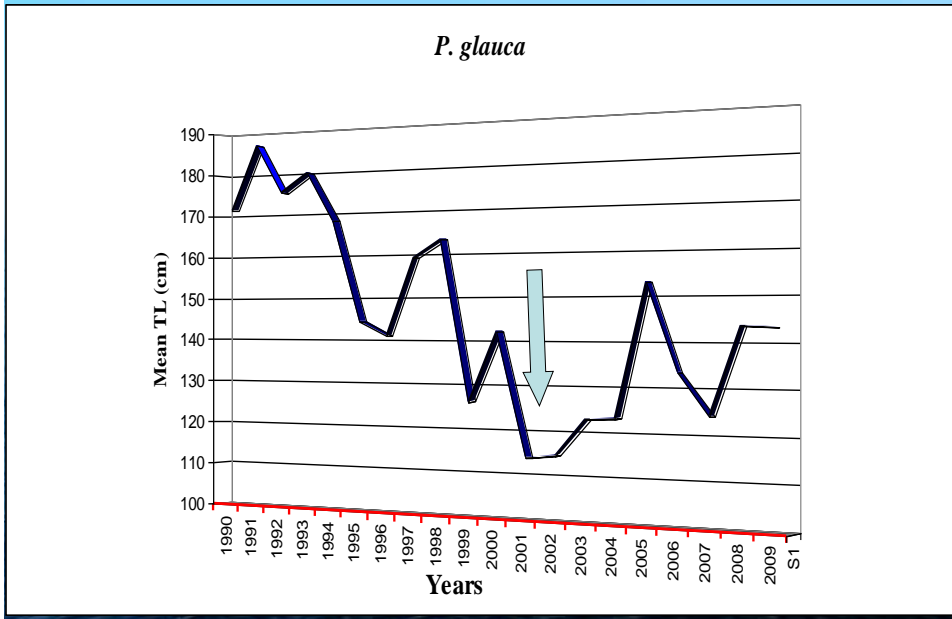


	N	Max. size	Min. size	Av. Size
Females	159	304cm	59cm	128,7cm
Males	122	268cm	52cm	131,5cm

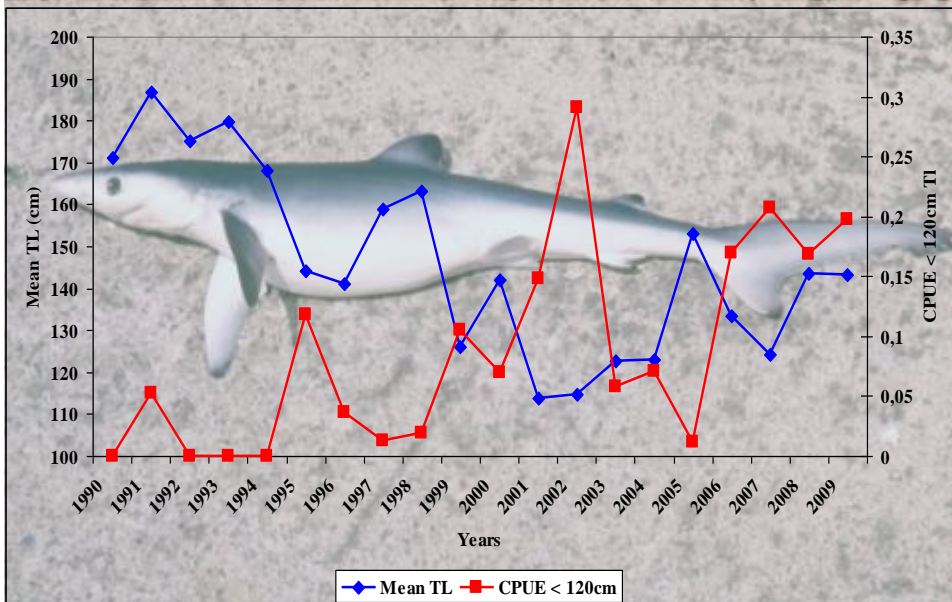


Different from Hemida and Capapè 2003 – 2.52 : 1  
 Megalofonou et al. 2009 – 1 : 1.8

Mean TL - Presence of new born and young of the year is increasing



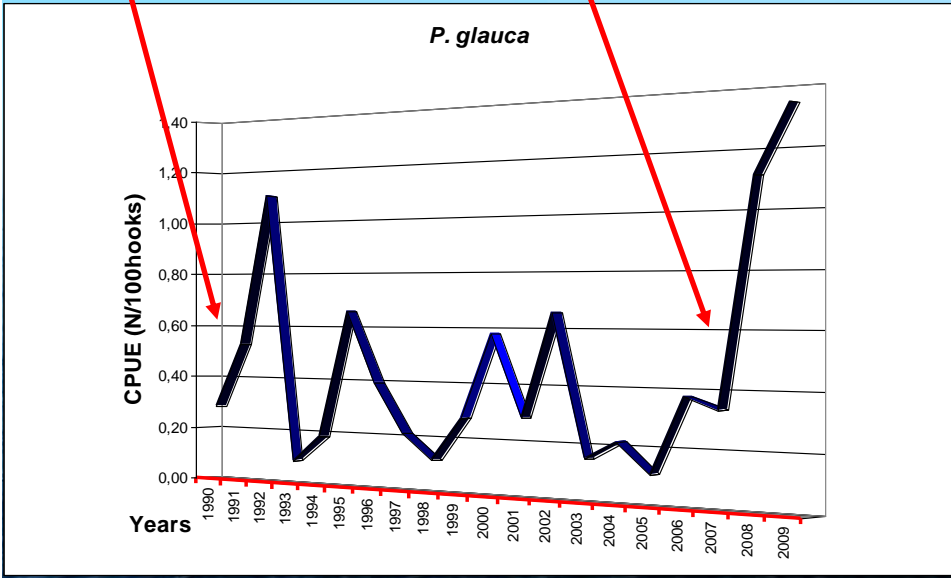
The decrease of mean TL is mainly due to this abundance



Morbillivirus epizootic in 1990-1991

Morbillivirus and/or Toxoplasma epizootic in 2007-2008

**Are they linked to the abundance of BSH?**



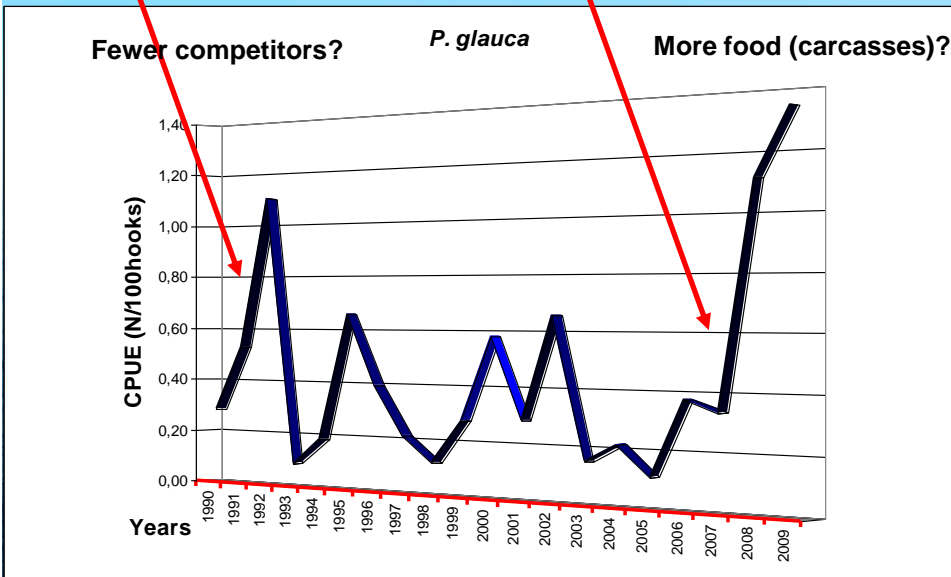
Morbillivirus epizootic in 1990-1991

Morbillivirus and/or Toxoplasma epizootic in 2007-2008

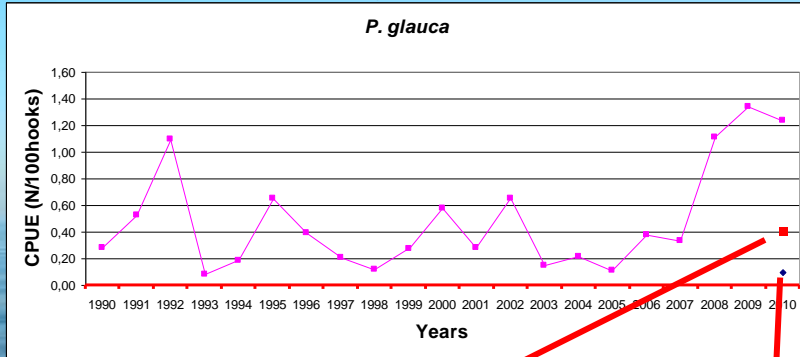
Fewer competitors?

*P. glauca*

More food (carcasses)?



In 2010 was introduced the new mesopelagic LL for swordfish



Thanks for listening !

