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BLUNTNOSE SIXGILL SHARK, *HEXANCHUS GRISEUS* (BONNATERRE, 1788),
IN THE EASTERN NORTH SICILIAN WATERS

Summary. A study of the bluntnose sixgill shark, *Hexanchus griseus* in the Eastern North Sicilian waters (Central Mediterranean Sea), Italy, was conducted over a four-year period through examination of 37 specimens captured in commercial fisheries. Specimens ranged from 182 to 500-600 cm. A specimen caught in December 2000 in the Messina Strait and estimated at 500-600 cm total length may be the largest ever recorded for this species. Analysis of stomach content was performed on 23 specimens; stomachs contained teleosts (60.87% of the stomachs examined), elasmobranchs (4.35%), decapod crustaceans (8.70%), cephalopod molluscs (13.04%), echinoderms (4.35%) and unidentified remains (39.13 %). The sex ratio was 1: 1.69 males to females. Mating scars were observed on the body of a female. *H. griseus* exhibits striking variation in colouration, usually with a high occurrence of dark spots in the buccal cavity. *H. griseus* appears to be an inoffensive species, sometimes approaching divers closely without showing any aggressive behaviour. *H. griseus* was caught most often during March-April, July-August and during October-December, but seems to be present in the study area throughout the year. Specimens were caught in waters depths of 40 to 250 m (more often below 90 m). Two examined sharks were found hosting ectoparasite copepods identified as salmon louse, *Lepeophtheirus salmonis* (Copepoda, Caligidae). Most bluntnose sixgill sharks are taken as bycatch, but a fishery for this species exists in some locations along the Sicilian coast, such as at Torre Faro and Palermo. The fishing gear used are bottom longlines, pelagic longlines, trammel nets and gillnets.

Key words: sharks, Elasmobranchii, fishery, Sicily, Mediterranean Sea

Riassunto. Il Notidano grigio, *Hexanchus griseus* (Bonnaterre, 1788), nelle acque nord-orientali della Sicilia.

Per un periodo di oltre quattro anni è stato condotto uno studio sul notidano grigio, *Hexanchus griseus*, nelle acque della Sicilia Nord-Orientale (Mare Mediterraneo Centrale), Italia, attraverso l'esame di 37 esemplari catturati in operazioni di pesca commerciale. Gli esemplari avevano una lunghezza compresa tra 182 e 500-600 cm. Un esemplare pescato nel Dicembre 2000 nello Stretto di Messina, di lunghezza totale stimata tra 500 e 600 cm, potrebbe essere il più grande mai registrato per questa specie. L'analisi dei contenuti stomacali è stata eseguita su 23 esemplari, rinvenendo teleostei (60.87% degli stomaci esaminati), elasmobranchi (4.35%), crostacei decapodi (8.70%), molluschi cefalopodi (13.04%), echinodermi (4.35%) e resti non identificati (39.13 %). Si è osservato un rapporto tra i sessi pari a 1: 1.69 = maschi : femmine. Ferite da accoppiamento sono state osservate sul corpo di una femmina. *H. griseus* mostra forti variazioni nella colorazione, solitamente con un'elevata quantità di macchie nere nella cavità orale. Il notidano grigio sembra essere una specie inoffensiva, avvicinandosi occasionalmente ai subacquei senza mostrare alcun comportamento aggressivo. *H. griseus* è stato catturato più spesso nei periodi Marzo-Aprile, Luglio-Agosto e Ottobre-Dicembre, ma sembra essere presente nell'area di studio durante tutto l'anno. Gli esemplari sono stati catturati in acque di profondità compresa tra 40 e 250 m (più spesso al di sotto di 90 m). Due degli squali esaminati ospitavano copepodi ectoparassiti identificati come *Lepeophtheirus salmonis* (Copepoda, Caligidae). La maggior parte dei notidani grigi vengono pescati come catture accessorie, ma in alcune località della costa siciliana, come Torre Faro e Palermo, esiste una pesca mirata a tale specie. Gli attrezzi da pesca usati sono palangari di fondo, palangari pelagici, tramagli e reti da posta.

Parole chiave: squali, Elasmobranchii, pesca, Sicilia, Mare Mediterraneo

INTRODUCTION

The genus *Hexanchus* Rafinesque, 1810 (Order Hexanchiformes, family Hexanchidae) includes two species, the bluntnose sixgill shark, *Hexanchus griseus* (Bonnaterre, 1788) and

the bigeyed sixgill shark, *Hexanchus nakamurai* Teng, 1962. Both species inhabit the Mediterranean Sea, but *H. nakamurai* is rare in this area, being recorded on just two occasions (TORTONESE, 1985; ŠANDA & DE MADDALENA, 2003), *H. griseus* is one of the commonest species of large elasmobranchs found in these waters (BARRULL et al., 1999; CUGINI & DE MADDALENA, 2003). *H. griseus* is a large deep-water shark, widely distributed in temperate and tropical seas, usually found deeper than 100 m but ranging from surface to at least 2500 m; young are often found in shallower waters (EBERT, 1994). The size at birth is 56 to 70 cm and the maximum size is at least 482 cm (COMPAGNO, 1984; BARRULL & MATE, 2002). Females mature at about 300 to 482 cm and males at about 300 to 350 cm (COMPAGNO, 1984; BRANSTETTER & MCEACHRAN, 1986; CAPAPÉ et al., 2004; R.A. Martin, pers. comm.). *H. griseus* has nocturnal feeding habits and eats a wide variety of animals including chondrichthyes, teleosts, cephalopods, decapod crustaceans, gastropods, marine mammals and carcasses (COMPAGNO, 1984; EBERT, 1994; BARRULL & MATE, 2000; BARRULL & MATE, 2002).

The bluntnose sixgill shark inhabits the entire Mediterranean (BAUCHOT, 1987; CADENAT & BLACHE, 1981; TORTONESE, 1956; MORENO, 1995; DE MADDALENA, 2001; BARRULL & MATE, 2002). Very recent data confirm its contemporary presence in the Catalan waters (BARRULL et al., 1999), Adriatic Sea (SOLDO & JARDAS, 2002; CUGINI & DE MADDALENA, 2003), Ligurian Sea (DE MADDALENA, 1999; CAPAPÉ et al., 2003; D. Gorni, pers. comm.), Eastern Tyrrhenian Sea, Sardinia (CAPAPÉ et al., 2003; M. Satta, pers. comm.), Ustica (A. Preti, pers. comm.), Algeria (CAPAPÉ et al., 2003) and Lebanon waters (A. De Maddalena, unpublished data).

The captures of sharks along the Italian coast have only rarely been the subject of specific and long-term analysis (DE MADDALENA & PISCITELLI, 2001). However such studies are an important source of data that, if correctly interpreted, significantly increase our knowledge of sharks inhabiting the Mediterranean Sea. Such an investigation permits us to gather fundamental information on occurrence, distribution, relative abundance, diet and fisheries status of many shark species. The Eastern North Sicilian waters, Italy (Central Mediterranean Sea), are particularly frequented by bluntnose sixgill sharks, but the presence of this large elasmobranch in this area has never been previously investigated in detail. For these reasons a study of the bluntnose sixgill sharks captured in these waters has been conducted over a four-year period. The results are presented herein.

MATERIALS AND METHODS

The study area is located in the Eastern North Sicilian waters (Central Mediterranean Sea), Italy, encompassing the Eastern South Tyrrhenian Sea, from Capo d'Orlando to the Messina Strait (including the Eolie Islands), and the Western North Ionian Sea to Taormina (Figure 1).

This study commenced in 2000 and, although still in progress, the results presented herein are those obtained up to August 2003. This program is among the various regional initiatives that began following the formation of the Mediterranean Shark Research Group (MSRG), of which two of the authors (A.C. and A.D.) are active members.

In Sicilian waters, most bluntnose sixgill sharks are taken as bycatch, but a fishery for this

species exists in some locations along the Sicilian coast, such as at Torre Faro and Palermo. This study has been conducted primarily by maintaining contacts with the fishermen working in the area and through examination of the fish caught in and around the Messina Strait. Through these contacts, many specimens reported by the fishermen were added to those that were personally examined by two of the authors (A.C. and T.R.). Additionally, we actively solicited the collaboration and participation of sport fishermen and scuba divers in the study area. The information we gathered on the behaviour of *H. griseus* was enriched by direct observations of specimens in their natural environment by one of the authors (A.C.).

Whenever possible, the following data were collected for each captured specimen: size, weight, sex, stomach contents, fishing gear and bait used for capture, depth, location and date of capture. In some cases it was also possible to collect photographic evidence of the specimens. The size of each specimen was recorded as total length (TOT) measured as a straight line extending from the tip of the snout to the tip of the upper lobe of caudal fin, with the caudal fin in the depressed position; this is also the maximum length (COMPAGNO, 1984). The stomach contents were identified to the lowest possible taxon. Percentage contribution of each prey item in terms of frequency of occurrence (%F) in the stomachs examined was calculated. Microscopic examination of ectoparasites found on the body of two bluntnose sixgill sharks was effected in order to identify the species.

RESULTS AND DISCUSSION

During the study we recorded 37 bluntnose sixgill sharks (Figure 2). Capture locations on the Sicilian coast were Capo d'Orlando, Milazzo, Acqualadrone, Torre Faro, Ganzirri, Pace, Letojanni, Taormina, while in the waters of the Eolie Islands captures were recorded off Lipari and Salina.

The data collected are presented in Table 1. For each specimen the following data are reported: capture date, capture location, sex (M or F), total length (TOT) in cm, weight in kg, stomach contents, fishing gear, bait used, sea's depth and data source (when not directly collected by the authors).

Size

Specimens for which the length was recorded ranged from 182 to 500-600 cm. In December 2000 a large specimen was examined at the fish market in Milano, Italy, where it had been transported following capture in the Messina Strait (L. Piscitelli and R. Malandra, pers. comm.). The total length of the specimen was not accurately measured, because it was brought to the market already cut in two parts, eviscerated and lacking the head and caudal fin. Dr. Luigi Piscitelli, veterinarian at the Fish Market, stated that the shark was so large that its body cavity could have accommodated an adult male. Its weight (without head and caudal fin) exceeded 300 kg. Piscitelli was able to measure the space between the origin of the pectoral fin and the origin of the caudal fin (or length of trunk and precaudal tail). This body part measured 290 cm. Authors compared the measurement taken from this specimen to morphometric measurements taken from bluntnose sixgill sharks caught in Spanish waters (BARRULL

& MATE, 2002). The length of trunk+precaudal tail in *H. Griseus* ranges from 48.7% to 57.8% of total length. Consequently authors were able to estimate the shark total length at 500-600 cm. This specimen exceeded the maximum size reported in the literature for this species (at least 482 cm according to COMPAGNO, 1984). The lengths of the other specimens fell within the ranges previously described for this species.

Diet

Analysis of stomach content was performed on 23 bluntnose sixgill sharks on the total of 37 specimens (Table 2 and Figure 5). All 23 examined specimens contained one or more prey items: no stomach examined had been everted or was empty. The percentage of stomachs containing food (100%) is higher than the 70% recorded from sharks off South Africa (EBERT, 1994). Teleosts, elasmobranchs, crustaceans, molluscs, echinoderms and unidentified remains were found in the stomachs.

Teleosts were found in 14 stomachs (60.87% of the stomachs examined); the following prey items were recorded: red mullet, *Mullus sp.*, European hake, *Merluccius merluccius*, European pilchard, *Sardina pilchardus*, silver scabbardfish, *Lepidopus caudatus*, white seabream, *Diplodus sargus sargus*, salema, *Sarpa salpa*, black seabream, *Spondyliosoma cantharus*, European sprat, *Sprattus sprattus*, swordfish, *Xiphias gladius*, and unidentified teleosts. Elasmobranchs were found in 1 stomach (4.35% of the stomachs examined); the following prey item was recorded: brown ray, *Raja miraletus*. Decapod crustaceans were found in 2 stomachs (8.70% of the stomachs examined); the following prey items were recorded: European spiny lobster, *Palinurus elephas* and unidentified crabs. Cephalopod molluscs were found in 3 stomachs (13.04% of the stomachs examined); the following prey items were recorded: common cuttlefish, *Sepia officinalis*, and common octopus, *Octopus vulgaris*. Echinoderm remains, spines of cidarid sea urchin *Stylocidaris affinis*, were found in 1 stomach (4.35% of the stomachs examined). Unidentified remains were found in 9 stomachs (39.13 % of the stomachs examined).

In the study area, bluntnose sixgill sharks feed principally on bony fish. Prey range from small European sprat and European pilchard to the large swordfish and silver scabbardfish, however the small species are the most common prey. Off Southern Africa EBERT (1994) observed that the bluntnose sixgill shark diet is also related to size. Young bluntnose sixgill sharks measuring less than 120 cm in total length feed almost exclusively on cephalopods and teleosts; specimens between 120 and 200 cm feed mainly on teleosts, chondrichthyans and cephalopods, but also eat marine mammals; specimens measuring over 200 cm feed primarily on cetaceans and teleosts, with cephalopods and chondrichthyans of secondary importance. All but specimens recorded during our study measured over 200 cm (the exceptions, 182 and 196 cm being very close to this size), but no cetacean remain was found in their stomachs (pinnipeds are absent from the study area). Moreover the specimens sampled off Southern Africa showed a marked incidence of small sharks and chimaeras, while both prey items were absent from our sample. These results suggest that there should be considerable variation in the diet of this species from one location to another. We know that many sharks are opportunistic feeders and focus their hunting activity on locally most abundant species, but this regional difference in the diet of *H. griseus* doesn't seem to be attributable only to a different

incidence of the prey. In fact, while pinnipeds are absent from the Sicilian waters, both dolphins and small sharks are very common in the study area.

BARRULL & MATE (2002) observed that longline catches are important food items for *H. griseus*. Even in the area of our study, bluntnose sixgill sharks are often captured while feeding on hooked or netted fish. One of the specimens had a 4-5 kg swordfish in two parts in its stomach. Fishermen told us that they had found swordfish in the stomachs of other bluntnose sixgill sharks. We suspect that this could be the result of scavenging on longline-caught swordfish. Probably, when *H. griseus* ascends from the deeper zones to the surface at night to feed, it encounters the pelagic longlines and feeds on the hooked swordfish. In two other cases, bluntnose sixgill sharks had eaten fishes probably torn from the net (eaten fishes were very fresh and these sharks were caught in nets while they were pursuing prey of the same species).

Sex ratio and reproduction

Of the 37 specimens, 22 were females, 13 males and 2 were of unknown sex. The sex ratio is 1: 1.69 males to females. This numerical dominance of females may indicate some form of sex segregation, however a large sample of adults is required before drawing any such conclusions. Gonads were not examined, and we estimated the reproductive state on the basis of the specimens' size. In fact the only mature bluntnose sixgill sharks recorded were a 500-600-cm specimen of sex unknown and possibly a 325-cm male. No new-born specimen was recorded.

In many shark species the male bites the female during courtship to stimulate copulation. During our study we observed these "love bites" or mating scars on flanks, gill slit region and caudal peduncle of a female.

Colouration

The colouration of *H. griseus* varies widely. We observed specimens ranging from light grey to dark grey to deep black, as well as specimens showing brownish to yellow ochre colouration. These observations were made on freshly caught specimens and cannot be attributed to color change after the sharks' death. Another interesting aspect is the occurrence of dark spots in the buccal cavity of *H. griseus*. These irregular spots around and in the mouth are more abundant in *H. griseus* than in other shark species observed in our waters.

Behaviour

Bluntnose sixgill sharks appear to be inoffensive animals. These sharks can approach divers closely, possibly out of curiosity, and swim around them. We are unaware of any aggressive, unprovoked incidents involving humans in these waters.

One of the authors (A.C.) had two underwater encounters with bluntnose sixgill sharks. In both cases the author was scuba diving alone. The first encounter occurred during a night dive at 9 p.m., on 14 December 2001 off Capo Peloro, in waters 32 m deep. Two bluntnose sixgill sharks estimated to be both about 180 cm long swam at about 10 meters from the diver and 3-4 meters above the bottom. The sharks ignored the diver and swam away. It was impossible to see the sex of both specimens. The second encounter also took place during a night dive, on 21 February 2001. This encounter occurred off Pace at 10 p.m., in waters 22 m deep, with calm sea and a small southwards current. Two bluntnose sixgill sharks, one of which was

a female, about 300 cm long, approached to about 1.5 meters of the author. They swam around the diver, first on the bottom and then 3-4 meters above it. The sharks remained close to the author for almost 5 minutes before departing offshore. Other divers have encountered, photographed and filmed bluntnose sixgill sharks underwater in the Messina Strait, more especially off Pace.

Of the 37 bluntnose sixgill sharks captured, 10 specimens were found in 5 pairs. The fact that bluntnose sixgill sharks often occur in pairs is confirmed by the underwater encounters off Capo Peloro and off Pace mentioned above, as well as by other cases recorded in Italian waters (A. De Maddalena, unpublished data). This behaviour is not necessarily related to reproduction, since the pairs are often composed of either immature specimens or those of the same sex.

H. griseus was caught most often during March-April, July-August and during October-December, although the species seems to be present in the study area throughout the year.

The depth was recorded for 34 captures. The range was 40 to 250 m, with most captures (67.65%) below 90 m.

Parasites

The bluntnose sixgill shark encountered underwater by one of the authors (A.C.) on 14 December 2001 off Capo Peloro had numerous copepods attached to the gill region and to the caudal peduncle. Two of the caught sharks were found with similar ectoparasites, also attached to the caudal peduncle and to the head of their hosts, mostly in the gill region. Microscopic examination revealed the identification of these copepods as salmon louse or sea louse, *Lepeophtheirus salmonis* (Krøyer 1837), belonging to the family Caligidae (Figure 3). *L. salmonis* is well known for its occurrence on most species of salmonids (genera *Oncorhynchus*, *Salmo* and *Salvelinus*) to which it can cause serious lesions, sometimes resulting in diseases and high mortality rate (JOHNSON et al., 1996). The salmon louses that we examined ranged from 14 mm to 20 mm in body length (excluding the egg-sacs, that are about as long as the rest of the body). These copepods showed extreme vitality and high speed. The skin lesions caused by their feeding activities did not appear severe, showing limited areas of skin erosion. However it is possible that sometimes these lesions could lead to secondary bacterial infections resulting in more severe diseases.

Fishery and human consumption

Bluntnose sixgill sharks are often caught by professional fishermen operating in the study area. These large animals offer almost no resistance when hooked. Most bluntnose sixgill sharks were taken as bycatch, caught accidentally while fishing for other commercial species. These sharks were retained and sold for human consumption. The large size of these sharks make them an abundant source of meat, so the species is of interest to fishermen, even though it is sold at a low price (about 8 Euro/Kg). However the fishery for *H. griseus* exists in some locations along the Sicilian coast, such as at Torre Faro and Palermo. As bony fish stocks have been depleted, fishermen have compensated by increasing shark captures, including those of *H. griseus*. There are no regulations or control over the bluntnose sixgill shark fishery in Italy.

The fishing gear used are bottom longlines, pelagic longlines, trammel nets and gillnets.

The baits used are bullet tuna, *Auxis rochei rochei* (Risso, 1810), European sprat, *Sprattus sprattus* (Linnaeus, 1758), Atlantic mackerel, *Scomber scombrus* Linnaeus, 1758, chub mackerel, *Scomber japonicus* Houttuyn, 1782, European flying squid, *Todarodes sagittatus* (Lamarck, 1798) and common octopus, *Octopus vulgaris* Cuvier, 1797.

The bottom longlines in which bluntnose sixgill sharks are often caught are those used for capturing European hakes and groupers. The main line is 4 mm thick. At 8 m intervals, 3.5 m long and 1.2 mm thick monofilament lines are attached, each carrying a hook. The total length of these bottom longlines is usually about 4.5-5 km, with a total of about 600 hooks. The bait used is European sprat.

The pelagic longlines in which bluntnose sixgill sharks are sometimes caught are those used for capturing swordfishes. The main line is 3.0-5.0 mm thick. At intervals of at least 25 m, 10-25 m long and 1.2-mm thick monofilament lines are attached, each carrying a hook. The total length of these pelagic longlines is usually 2-40 km, with a total of 200-1500 hooks. The bait used is Atlantic mackerel, chub mackerel or European flying squid. These pelagic longlines capture bluntnose sixgill sharks far offshore, in waters depth 700-800 m, where the shark is usually hooked at 30-40 m.

In the case of the captures that we recorded off Torre Faro in 2000-2001, the fishing gear is a particular bottom longline that is used only to catch *H. griseus*. This gear comprises a main 5 mm thick line to which, at 30 m intervals, 15 m long and 1.4 mm thick monofilament lines are attached, each carrying a hook. The total length of these bottom longlines is usually about 600 m, with a total of 20 hooks. The bait used is bullet tuna.

The reproductive biology of sharks (long sexual maturation times, low fecundity, long gestation periods and relatively small litter size) makes them extremely vulnerable to such fishing pressure. It is possible that the bluntnose sixgill shark stocks have been able to withstand protracted periods of exploitation better than other shark species because of their relatively large litter size, of 22 to 108 pups (COMPAGNO, 1984). In fact, we note that in this zone, as has been observed along other parts of the Italian coast (CUGINI & DE MADDALENA, 2003; A. De Maddalena, unpublished data), *H. griseus* appears to be relatively abundant, despite the fact that it is a species of conspicuous size. The absence of any other details on the bluntnose sixgill shark fishery in the area does not allow an assessment of the status of their stocks in these waters, however, according to local fishermen and traders, these sharks have greatly declined.

In Italy, bluntnose sixgill shark meat is marketed fresh or frozen for human consumption. It can be found occasionally in the fishmarkets and is consumed in all parts of the Country. It is particularly appreciated in Sicily, where is considered of high quality. Therefore in the study area *H. griseus* is usually destined for domestic consumption and sometimes shipped to other parts of Sicily but rarely to the North Italy (except the two specimens mentioned above that has been observed at the fish market in Milano), where it is not well known and consequently has low market appeal. In Sicily, as it has been reported for other Italian regions (VANNUCCINI, 1999; DE MADDALENA & PISCITELLI, 2001; CUGINI & DE MADDALENA, 2003), the meat of many sharks is marketed under incorrect names and *H. griseus* is sold as "pesce vacca" (cow fish).

CONCLUSIONS

There are large quantities of fish off Sicily and it seems likely that this abundance of potential food is the main reason for the area being a center of relative abundance for large predators with a wide prey spectrum such as *H. griseus*. In fact large sharks were ever relatively common in the waters off Sicily, in the Messina Strait and the Sicily Channel, as demonstrated even by data collected on another large predator, the great white shark, *Carcharodon carcharias* (Linnaeus, 1758) (DE MADDALENA, 2002). Despite its occurrence along the Italian coasts, few data existed on the biology and ecology of the bluntnose sixgill shark in this area. As happened for the other shark species, research on *H. griseus* has been neglected in favour of studies of the more commercially important bony fishes. The bluntnose sixgill shark, due to its wide distribution, its wide prey spectrum, and the fact that it has almost no enemy, has an important influence on the Mediterranean marine food chains. This elasmobranch, as predator and scavenger, is a fundamental instrument of natural selection.

At least 42 species of sharks occur in Italian waters, but there is evidence that many of these have strongly declined during the twentieth century (A. De Maddalena, unpublished data). *H. griseus* appears to be fairly common in the study area, however effective management of fisheries is needed in order to avoid a rapid decline in a close future. These management decisions are based on research on the biology, ecology, distribution, abundance and exploitation of the species. There is a critical need for biological information on the life history of sharks in order to improve assessments of stock status and the impact of harvesting. It is also necessary to improve management of fisheries in which sharks constitute a significant bycatch (VANNUCCINI, 1999; WATTS, 2001). This applies to the bluntnose sixgill shark in the Mediterranean area. The analysis we have conducted in the Eastern North Sicilian waters is a first step in this direction.

ACKNOWLEDGEMENTS

Very special thanks to all the people that offered their help in collecting data, photographs and general information for this work: the Donato family, F. Taranto, Sig.ra Greco, Sig. Aricò, Luigi Piscitelli, Renato Malandra, Mauro Cavallaro, Antonella Preti, R. Aidan Martin, Diego Gorni, Mariano Satta, Joan Barrull, Isabel Mate, Farid Hemida and all the other fishermen that gave their contribution in the data collection. Special thanks to Jeremy Cliff, who kindly edited the English text of this work. We also thank the referees for their helpful comments. A particular thanks from Alessandro De Maddalena goes to his wife Alessandra and his son Antonio.

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Table 1. Bluntnose sixgill sharks, *Hexanchus griseus* (Bonmatere, 1788) captured in the Eastern North Sicilian waters, Italy (Central Mediterranean Sea), recorded during our study.

DATE	LOCATION	SEX	TOT (cms)	WEIGHT (kgs)	STOMACH CONTENT	GEAR	BAIT	DEPTH (ms)	SOURCE
10 April 1985	Torre Faro	F	286	-	-	bottom longline	European sprats and Atlantic mackerels	230-250	-
10 April 1985	Torre Faro	F	302	-	-	bottom longline	European sprats and Atlantic mackerels	230-250	-
17 July 1991	Acqualadrone	F	ca. 350	-	unidentified remains	trammel net	-	ca. 50	-
11 April 1999	Letojanni	F	276	-	octopus remains and unidentified teleost remains	bottom longline	European sprats	ca. 70	-
27 May 1999	Ganzirri	M	203	-	unidentified teleosts	bottom longline	Atlantic mackerels	ca. 80	-
29 October 2000	Pace	F	293	-	European pitchards and red mullets probably torn from the net	gillnet	-	ca. 80	-
December 2000	Stretto di Messina	-	500-600	>300	-	-	-	-	L. Piscitelli and R. Malandra (pers. comm.)
11 December 2000	Torre Faro	F	250	-	cidarid sea urchin spines	bottom longline	bullet tunas	ca. 180	-
11 December 2000	Torre Faro	F	263	-	common cuttlefish remains	bottom longline	bullet tunas	ca. 180	-
15 May 2001	Taormina	M	182	-	unidentified remains	bottom longline	European sprats	110	-
13 July 2001	25 miles NW of Salina (Eolie Is.)	F	-	150	ca. 4-5-kg swordfish and unidentified remains	pelagic longline for swordfish	European flying squid	-	F. Taranto (pers. comm.)
Mid-July 2001	25 miles NW of Salina (Eolie Is.)	-	-	ca. 80-100	-	pelagic longline for swordfish	European flying squid	-	F. Taranto (pers. comm.)
26 October 2001	Milazzo	F	-	54	-	trammel net	-	ca. 80	Aricò (pers. comm.)
28 October 2001	Milazzo	M	-	78	-	bottom longline	European sprats	ca. 120	Greco (pers. comm.)
6 November 2001	Milazzo	M	-	39	-	bottom longline	European sprats	ca. 100	Greco (pers. comm.)
6 November 2001	Milazzo	F	-	91	-	bottom longline	European sprats	ca. 100	Greco (pers. comm.)
14 December 2001	Torre Faro	F	239	-	parts of common cuttlefish and unidentified teleost remains	bottom longline	bullet tunas	ca. 130	-
21 December 2001	Torre Faro	M	325	-	unidentified remains	bottom longline	bullet tunas	ca. 140	-

18 April 2002	Lipari (Eolie Is.)	M	196	70	parts of silver scabbardfish and European sprats (the bait)	bottom longline for European hake	European sprats	ca. 180	-
13 July 2002	Lipari (Eolie Is.)	F	-	150	unidentified remains	bottom longline	European flying squids	ca. 120	-
21 November 2002	Lipari (Eolie Is.)	M	-	120	a white seabream and unidentified remains	trammel net	-	ca. 100	-
21 November 2002	Lipari (Eolie Is.)	F	-	90	unidentified teleost remains	trammel net	-	ca. 100	-
4 December 2002	Lipari (Eolie Is.)	F	210	81	unidentified teleost remains	trammel net	-	ca. 50-60	-
21 February 2003	Lipari (Eolie Is.)	M	276	-	unidentified remains	bottom longline	octopus	64	-
16 March 2003	Lipari (Eolie Is.)	M	215	-	unidentified remains	bottom longline	European sprats	75-80	-
16 March 2003	Lipari (Eolie Is.)	F	250	90	a salemma, a white seabream and some red mullets, probably torn from the net	trammel net	-	ca. 40	-
24 March 2003	Milazzo	M	221	-	an about 2-kg silver scabbardfish and unidentified teleost remains	trammel net	-	ca. 130	-
24 March 2003	Milazzo	F	253	-	a brown ray	trammel net	-	ca. 130	-
29 October 2003	Milazzo	M	291	-	European hake remains and unidentified remains	bottom longline for European hake	European sprats	ca. 250	-
6 November 2003	Milazzo	F	310	-	European spiny lobster remains and parts of a black seabream	trammel net	-	130	-
16 November 2003	Milazzo	F	361	-	unidentified crab remains and parts of some red mullets	trammel net	-	ca. 150	-
20 June 2003	Capo d'Orlando	F	260	90	-	bottom longline	Atlantic mackerels	130	-
13 July 2003	Milazzo	F	-	72	-	gillnet	-	90	-
20 July 2003	Milazzo	F	-	103	-	bottom longline	Atlantic mackerels	86	-
7 August 2003	Milazzo	M	-	65	-	bottom longline	European sprats	95	-
16 August 2003	Milazzo	F	-	121	-	gillnet	-	140	-
23 August 2003	Lipari (Eolie Is.)	M	-	96	-	bottom longline	octopus	130	-

Table 2. Percentage composition of prey items given by frequency of occurrence (%F) found in the stomachs of bluntnose sixgill sharks in the Eastern North Sicilian waters.

PREY ITEM	%F
Teleostei	
<i>Mullus sp.</i>	13.04
<i>Merluccius merluccius</i>	4.35
<i>Sardina pilchardus</i>	4.35
<i>Lepidopus caudatus</i>	8.70
<i>Diplodus sargus sargus</i>	8.70
<i>Sarpa salpa</i>	4.35
<i>Spondylisoma cantharus</i>	4.35
<i>Sprattus sprattus</i>	4.35
<i>Xiphias gladius</i>	4.35
unidentified teleosts	26.09
Elasmobranchii	
<i>Raja miraletus</i>	4.35
Crustacea	
<i>Palinurus elephas</i>	4.35
unidentified crabs	4.35
Cephalopoda	
<i>Sepia officinalis</i>	8.70
<i>Octopus vulgaris</i>	4.35
Echinoidea	
<i>Stylocidaris affinis</i>	4.35
Unidentified remains	39.13

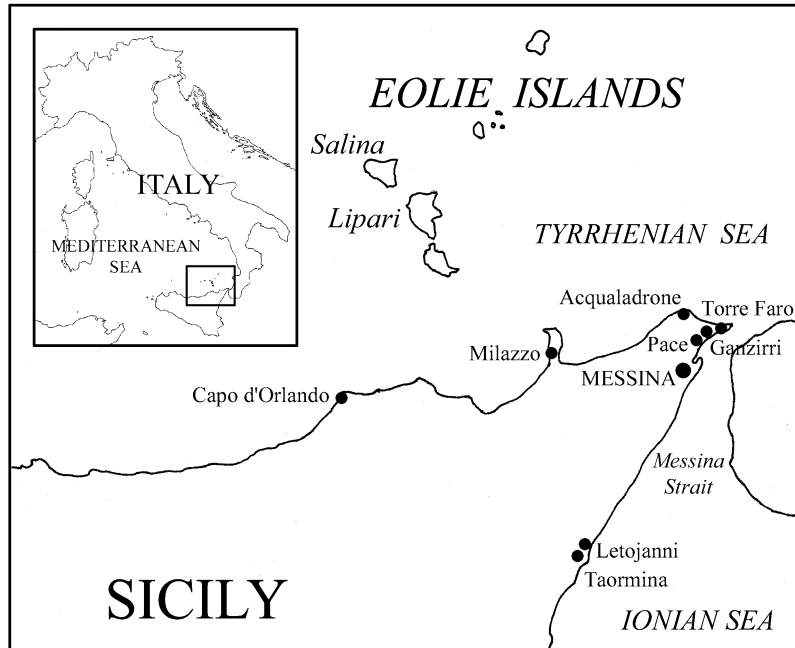


Fig. 1. Area of the Eastern North Sicily, Italy (Central Mediterranean Sea), showing the locations of bluntnose sixgill shark captures presented in this work. Drawing by Alessandro De Maddalena.

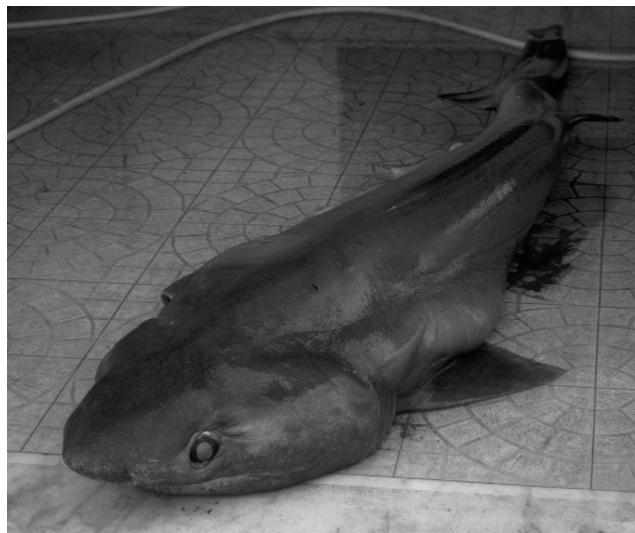


Fig. 2. A 293 cm female bluntnose sixgill shark, *Hexanchus griseus* (Bonnaterre, 1788), caught off Pace, Sicily on 29 October 2000. Photo by Antonio Celona.



Fig. 3. A 14-mm salmon louse or sea louse, *Lepeophtheirus salmonis* (Krøyer 1837) (Caligidae) that was found attached to the skin of a bluntnose sixgill shark, *Hexanchus griseus* (Bonnaterre, 1788). Photo by Antonio Celona.

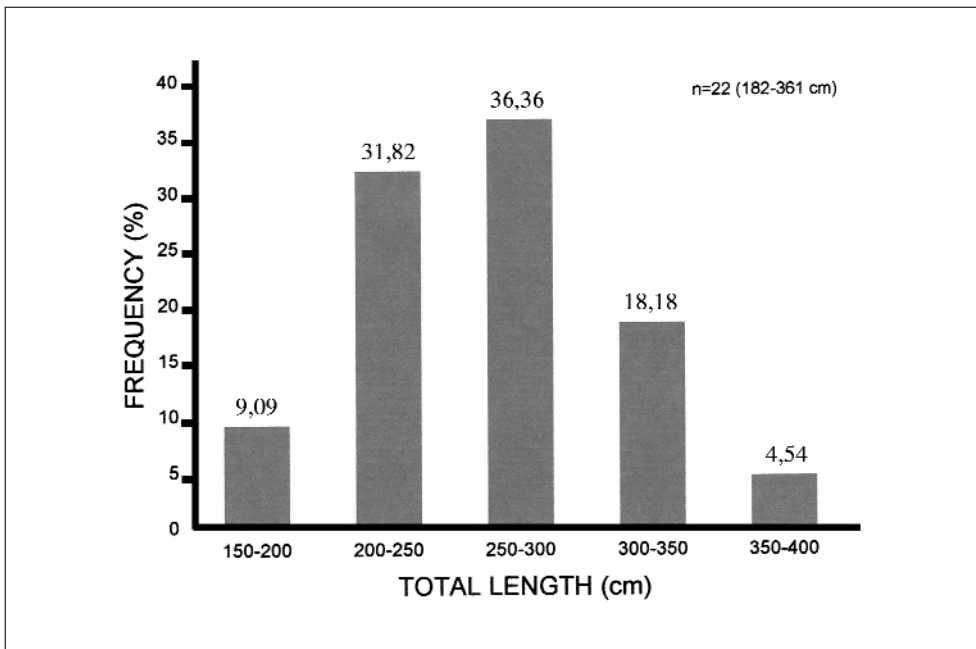


Fig. 4. Length frequency of *Hexanchus griseus* taken between 1985 and 2003 in the Eastern North Sicilian waters.

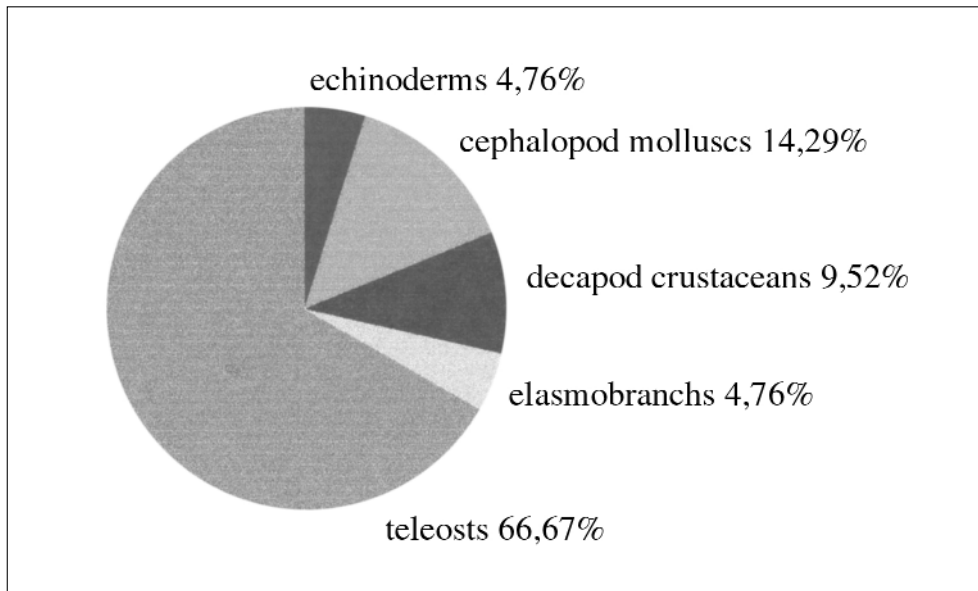


Fig. 5. Prey categories of bluntnose sixgill sharks and their relative importance in the diet.