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## Changes in the catch composition of artisanal fisheries attributable to dolphin depredation in a Mediterranean marine reserve

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### Abstract:

There is increasing evidence from previous studies, and from fishers' observations, that coastal dolphins use fishing nets as an easily accessible feeding source, damaging or depredating fish caught in the nets. This study investigates the impact of dolphin depredation on artisanal trammelnets by analysing the catch composition of 614 artisanal fishing operations in the Bonifacio Strait Natural Reserve (France). Common bottlenose dolphins (*Tursiops truncatus*) attacked, on average, 12.4% of the nets and damaged 8.3% of the catch. However, attacked nets were characterized by statistically significantly higher catch per unit effort than unattacked ones. Catch composition also differed significantly after dolphin attacks; benthic-pelagic fish were more represented and reef-associated fish less represented. Our results suggest that (i) dolphins are attracted by high fish densities in the fishing area and/or nets, and (ii) their attacks induce specific fish-avoidance behaviour, according to the fish position in the water column. Although dolphins depredate a small part of the catch, damage to nets, not yet assessed in this area, could weaken the benefits that reserves can provide to artisanal fisheries.

**Keywords:** artisanal fisheries, bottlenose dolphin, catch composition, catch per unit effort, depredation, interactions with fisheries, marine protected area

## **Introduction**

Fish are among the world's most important natural resources (Ormerod, 2003), but because of technical improvements and trade development, fisheries have now reached an unprecedented level of exploitation (Jackson *et al.*, 2001; Ormerod, 2003). Global fish production increased steadily from 19.3 million t in the mid-20th century to 134 million t in 2002; considering only marine fish, it has increased from 16.7 to 84.4 million t over the same period (FAO, 2005). This increasing catch reduces the amount of prey available for natural fish predators such as dolphins. As a response, these top predators have modified their feeding behaviour and intensified direct competitive interactions (Bearzi, 2002).

Interactions between dolphins and fishing nets have been reported for more than a century (Backhouse, 1843), but such events were sometimes described to be cooperative (Busnel, 1973; Pryor *et al.*, 1990; Neil, 2002). At the present time, within the context of fish stock collapse (Jackson *et al.*, 2001; Myers and Worm, 2003), those interactions are considered by the fishing industry as conflicting (Yodzis, 1998), particularly so for small-scale fisheries. Dolphins have actually learned to exploit catches from fishing operations as a new food source (Reeves *et al.*, 2001); they remove fish directly from nets, resulting in a loss of fish for fishers and damage to nets. However, consequences of dolphin interactions with fishing activities have often been neglected (Noke and Odell, 2002), although negative impacts on fisheries have already been reported from Morocco (Zahri *et al.*, 2004), Sardinia (Lauriano *et al.*, 2004; Díaz-López, 2006), and the Balearic Islands (Brotons *et al.*, 2008).

Marine reserves are now considered as management tools and are regarded as potential biomass contributors to fisheries (Russ *et al.*, 2004), although this may not help in all cases to sustain the decline of artisanal fisheries (Gómez *et al.*, 2006). The sustainability of this traditional activity on Mediterranean coasts is a major issue, and the presence of dolphins,

which deplete fish from nets, may bring additional difficulties to fishers. In the Mediterranean Sea, the status of marine resources is considered to range from fully exploited to overexploited (FAO, 2005) and artisanal fishing is declining (Gómez *et al.*, 2006). Because of this, depredation by dolphins may become even more critical. But until now, a lack of data has limited our ability to evaluate the expanse and nature of dolphin-fisheries interactions (Díaz-López, 2006). Indeed, few studies have attempted to fill this gap, and the majority of information is anecdotal or unpublished (Reeves *et al.*, 2001; Bearzi, 2002). Consequently, little is known about the real impact of dolphins on artisanal fisheries.

In this paper, we propose to evaluate the impact of the common bottlenose dolphin (*Tursiops truncatus*) on a Mediterranean small-scale fishery (hereafter in this paper “bottlenose dolphin” will refer to this species). In this area, this species is reported as the most involved in fishing operation interactions and net depredation (Bearzi, 2002; Gonzalvo *et al.*, 2008). We used a large data set collected during three years in the Bonifacio Strait Natural Reserve (BSNR), Corsica Island (France). Our approach is original in that we not only describe the impact of dolphin attacks on each fish species separately, but we are principally interested in working at the assemblage level, while grouping species according to their position in the water column.

## **Material and methods**

### **Study area and data collection**

The BSNR is located around the South of Corsica in the western Mediterranean Sea (Figure 1). Established in September 1999, its marine surface area of 80 000 ha includes four zones of partial protection (12 000 ha), where spearfishing and fishing for urchins are forbidden, and six no-take zones (1 200 ha), closed to all types of fishing activities as well as diving and anchoring (Mouillot *et al.*, 2002).

The artisanal coastal fishery takes place throughout the entire reserve except in no-take zones. Fishing gears commonly used in the BSNR are trammel nets of mesh size varying from 5 to 9 (number of nodes per 25 cm of rope) that are set on the bottom (mean depth: 33.5 m) for 24 h.

The bottlenose dolphin diet is principally composed of miscellaneous fishes and to a lesser extent of cephalopods (Barros and Odell, 1990; Cockcroft and Ross, 1990; Pauly *et al.*, 1998; Blanco *et al.*, 2001; Gonzalvo *et al.*, 2008). Currently, its population around the Corsican coasts is estimated to be about 200-350 individuals (GECM, 2007).

Data were collected by BSNR scientists on board fishing boats during three successive years, from May to August 2004, March to August 2005, and April to October 2006. For each fishing operation investigated, every fish caught in nets was identified at the species level and measured. Here, the term “fish” applies to all molluscs and fish species (osteichthyans and chondrichthyans); crustaceans were not taken into account on the assumption that they are not dolphin prey items (Blanco *et al.*, 2001). Evidence of dolphin attacks and depredation was assessed by the presence of at least one damaged fish on nets (cut behind gills, see Lauriano *et al.*, 2004) and/or new holes (Gazo *et al.*, 2008). Initial length of damaged fish was estimated based on the remains (head or body) still present in nets after dolphin attacks. Other collected information consisted of net length, net mesh size, fishing depth, fishing duration, and whether the net was attacked by dolphins.

Fish weight was estimated using length-weight relationships (Bauchot and Pras, 1980). For each fishing operation, we calculated catch per unit effort (cpue, in  $\text{g p}^{-1} \text{d}^{-1}$ ) for each species, defined as the biomass (in g) of the species caught, standardized per piece of net (p, 50 m) and per fishing day (d, 24 h). We recorded the cpue of the intact fish, the cpue of the fish damaged by dolphins, and the cpue of the fish damaged by other piscivorous predators (such as moray

eels, octopus, and water fleas). For each fishing operation, we then calculated the relative abundance, or occurrence, of each species in the catch as the ratio of the cpue of that species to the cpue of the total catch. Fishing operations with zero catch in nets were considered to be due to gear dysfunction (Maunder and Punt, 2004) and were removed from the analysis.

### **Data analysis**

Our intent was to assess the impact of dolphin attacks on both cpue and catch composition. Since data did not match either to normality conditions (Shapiro-Wilk normality test,  $p < 2.2 \times 10^{-16}$ ) or homoscedasticity (Bartlett test,  $p = 0.04$ ), we used two-tailed Mann-Whitney non-parametric tests for driving the analyses. Firstly, we tested the following null hypothesis: the mean cpue of the total catch in nets attacked by dolphins is equal to the mean cpue of the total catch in nets non-attacked by dolphins. For that, we compared the total cpue of attacked and non-attacked nets. Then, the link between the fish biomass depredated by dolphins and the fish biomass available in nets was estimated using the Pearson correlation coefficient calculated on log-transformed data. Secondly, we tested whether dolphin attacks alter the species composition of catches. For that, we hypothesized that fish species can behave in different ways when facing a predator. To carry out this analysis, fish species were combined according to their position in the water column. Following FishBase (Froese and Pauly, 2007) and Whitehead *et al.* (1986), we considered four groups: (i) a pelagic group living in mid water and eating prey near the surface; (ii) a benthopelagic group living near the bottom, but eating prey both near the bottom and the sea surface; (iii) a demersal group living close to the bottom and feeding exclusively on it; and (iv) a reef-associated group comprising fish living in reefs. If dolphin attacks do not influence fish behaviour in the vicinity of nets, we do not expect any change in the catch composition of nets under dolphin attacks, i.e. the proportion of each group in the catch would remain the same with or without attacks. We tested this

second null hypothesis on both fish abundance and occurrence, with or without attacks, for each group considered before.

These two hypotheses analyzed together could help us to better understand the features of interactions between dolphins and fisheries (Table 1). An increase or decrease of the cpue in nets, without changes in the catch composition, can be representative of variability in fish availability in the area. Conversely, changes in the catch composition in case of dolphin attacks can be a direct consequence of the interaction. We distinguished 10 combinations of changes in the observed cpue in nets and in the catch composition under the assumption of no gear saturation.

In order to determine which, if any, species can play a role on the observed cpue variability of groups, we analyzed changes in catch at the species level. We estimated the occurrence of each species with or without dolphin attacks; species significantly more represented in nets attacked by dolphin compared to non-attacked nets were considered as “losers”, those under-represented as “winners”, and others as “neutrals”.

## **Results**

We investigated a total of 614 fishing operations, 191 in 2004, 162 in 2005, and 261 in 2006. Overall, 53 species were caught at least once during the study: 47 osteichthyans, 4 chondrichthyans, and 2 mollusc species. We determined that 15 of these species were reef-associated, 18 were demersal, 15 were benthopelagic, and 5 were pelagic (Table 2).

We recorded dolphin attacks and depredation on nets in 76 fishing operations, corresponding to an attack rate of 12.4%. Dolphins damaged a mean of 8.3% of the caught biomass in nets

each time. Fish depredated by dolphins at least once during the study included 23 species, 13 of which representing at least 2% of the cpue dolphins have depredated (Figure 2).

Nets attacked by dolphins had significantly higher values of cpue and displayed a higher mean number of species caught. The mean cpue was  $1147.3 \text{ g p}^{-1} \text{ d}^{-1}$  without attack ( $\text{CI} \pm 105.6 \text{ g p}^{-1} \text{ d}^{-1}$ ), while it was  $1299.2 \text{ g p}^{-1} \text{ d}^{-1}$  in attacked nets ( $\text{CI} \pm 233.5 \text{ g p}^{-1} \text{ d}^{-1}$ ; Mann-Whitney test,  $p = 0.02$ ); the mean species richness increased from 7.2 ( $\text{CI} \pm 0.34$ ) to 10.2 ( $\text{CI} \pm 2.3$ ; Mann-Whitney test,  $p < 0.0001$ ) in non-attacked and attacked nets, respectively (Figure 3).

In non-attacked nets, the most common fish species caught in trammel nets was the large-scaled scorpionfish (*Scorpaena scrofa*), with its mean cpue accounting for 20.7% of the overall cpue (Table 2). The other targeted osteichthyans species were, by decreasing order, the forkbeard (*Phycis phycis*, representing 10.9% of the caught biomass), the common pandora (*Pagellus erythrinus*, 6.1%), the black scorpionfish (*Scorpaena porcus*, 5.1%), the striped red mullet (*Mullus surmuletus*, 4.7%), the brown meagre (*Sciaena umbra*, 4.4%), and the common dentex (*Dentex dentex*, 4.1%). However, in fishing operations characterized by dolphin attacks, there were some representational differences: the common pandora was the most frequently species (12.0% of the cpue), followed by the large-scaled scorpionfish (11.4%), the forkbeard (11.1%), the striped red mullet (9.0%), the common dentex (4.8%), and the black scorpionfish (4.3%).

When considering the damaged species, we observed that dolphins preferentially attacked the striped red mullet (accounting for 25.2% of the damaged cpue) and the common pandora (19.5%), and in a lower proportion, the forkbeard (9.4%), the blotched picarel (*Spicara maena*, 6.2%), and the black seabream (*Spondyliosoma cantharus*, 5.6%, Figure 2). There

was no significant correlation between the biomass damaged by dolphins and the overall fish biomass available in nets (Bravais-Pearson,  $p = 0.13$ ). However, the biomass of common pandora removed by dolphins was positively correlated with this species' biomass available in nets ( $r = 0.34$ ,  $p = 0.022$ ). It was not significant for the other species.

Considering the abundance of the various species groups, we found that, on average, mean cpue was significantly higher in attacked vs. non-attacked nets for benthopelagic ( $p = 0.001$ ) and demersal species ( $p = 0.03$ ). On the contrary, cpue in attacked nets was lower for reef-associated species, although not significantly ( $p = 0.32$ , Figure 4). The occurrence of the benthopelagic group was significantly higher in attacked vs. non-attacked nets ( $p < 0.01$ ), while the occurrence of the reef-associated group was lower in attacked vs. non-attacked nets, albeit not significantly ( $p = 0.72$ ). When examining the impact of dolphin attacks specifically at a species level, we found that 7 species were significantly more frequent, in terms of occurrence in fishing operations attacked by dolphins, of which 3 were benthopelagic and 3 were demersal. These species were termed "losers" due to their over-representation in attacked nets. Included in this group were the common pandora, the forkbeard, and the striped red mullet (Table 2). Other species displayed neither significant increases nor significant decreases in their occurrence in attacked nets (neutral species).

## **Discussion**

Fishing operations subjected to dolphin attacks displayed both quantitative and qualitative differences in catch composition vs. those where no attacks were reported. It is particularly interesting to point out that dolphin attacks were significantly associated with higher cpue values. Silva *et al.* (2002) also noticed that catches in the Azores tuna fisheries were higher when cetaceans were present in the fishing area. This could be explained by the fact that dolphins either (i) only attack nets when catches are important, certainly due to a greater

amount of fish in the area; or (ii) drive the fish into the nets, thereby increasing fish catches and cpue.

In our study, bottlenose dolphins attacked a total of 23 different species consisting of fish and cephalopods (albeit 33% were attacked only once), which are also targeted by the artisanal fishing activity. It is recognized that *Tursiops truncatus* is an opportunistic species and adapts itself to its environment, while having a large dietary spectrum (Corkeron *et al.*, 1990; Bowen and Siniff, 1999; Blanco *et al.*, 2001). Nowadays, knowledge of the bottlenose dolphin in the Mediterranean is scanty (Blanco *et al.*, 2001) and poorly understood. However, the results in this study relating to species depredated by *T. truncatus* are consistent with those obtained by Lauriano and Di Muccio (2002) in Sardinia (close to south Corsica). In both cases, *M. surmuletus* was the most depredated species, followed by *S. cabrilla*, *P. phycis*, and *P. erythrinus*. Moreover, although cephalopods are part of the dolphin diet (Barros and Odell, 1990; Cockcroft and Ross, 1990; Pauly *et al.*, 1998; Blanco *et al.*, 2001), and were also caught in fishing nets, we did not record any depredation on them.

We noticed that the main fish species depredated by Corsican bottlenose dolphins were those constituting the largest part of the fishery catch: *P. phycis*, *P. erythrinus*, and *M. surmuletus*, (leaving aside *S. scrofa*, a venomous fish). According to previous studies, the feeding behaviour of *Tursiops truncatus* depends on many factors, and the available species abundance in nets seems to be one of the most important (Cockcroft and Ross, 1990; Bowen and Siniff, 1999). This can explain dolphin preferences observed in this study. The depredated biomass is rather limited (8.3% of the catch, corresponding in this study to a mean of 609 g for each fishing operation) and represents only a small part of the daily nutritional requirements of an adult bottlenose dolphin, estimated at about 7-10 kg (Corkeron *et al.*, 1990). According to this observation, we can hypothesize that dolphins hunt the greatest

portion of their prey in the water column and only occasionally remove caught fish from nets. Lauriano *et al.* (2004) suggested that bottlenose dolphins actually exhibit a complex feeding strategy, using nets not only as a "supermarket", depredating fish from them, but also as a barrier to stop fleeing prey, while pushing fish toward nets to regroup them.

Studying not only the amount of cpue caught in attacked nets, but also dolphin impact on catch composition, allows us to better understand features of the interactions between dolphins and fishing activities. If dolphin attacks and depredation in nets has no impact on fish behaviour, we would expect any changes in the relative occurrence of each group of species in catches, i.e. pelagic, benthopelagic, demersal, and reef-associated fish. But we found that these groups were represented in different proportions in the catches in response to dolphin attacks. The occurrence of benthopelagic fishes increased significantly, while it was balanced by the corresponding decrease in the reef-associated fish group. Thus, there is evidence that dolphin attacks tend to modify the species composition of net catches. We cannot argue whether dolphins deliberately drive fish into the nets in order to facilitate their depredation, or if their attack generates a panic movement among fish schools. Little is known about the general behaviour of fish facing a predator, but it seems reasonable to expect fish located in the water column, like benthopelagic fishes, which exhibited an increase of their catch in nets, to escape, and to expect a contrasting behaviour for reef-associated fish, which remain hidden in rocks. Since dolphin attacks are associated with both larger catches and changes in the catch composition, the most plausible hypothesis retained to explain the features of dolphin interactions with nets is higher fish biomass in the area and species-specific reaction of fish to dolphin presence (scenario 9 in Table 1). According to this, we can suppose that (i) dolphins are also present in areas with high fish biomass; *Tursiops truncatus* might be attracted by the noise produced by fish, either through school frenzy for food, or through fish trying to escape from nets (Wells *et al.*, 1999); and (ii) that the behaviour of prey

facing dolphin attacks will depend on the fish position in the water column. Moreover, attacked nets also included a larger number of species caught, which is consistent with the above hypothesis.

The rate of attack on fishing nets by bottlenose dolphins in the BSNR (around 12%) is close to the 10% found by Lauriano *et al.* (2004) in Sardinia. These authors considered this value not to be harmful to artisanal fisheries. In our study, dolphins were found to be responsible for damage to 8.3% of the landings, which is much lower than by other predators such as fish and water fleas (J. M. Culioli, pers. com.). Bax (1991) also estimated that depredation on fish by piscivorous fishes far exceeds that from other sources, such as marine mammals and seabirds. Overholtz and Link (2007) also showed that predators consuming the largest proportion of Atlantic herring were demersal fish, followed by marine mammals. Although other predators are responsible for a large part of the damage on caught fish, dolphins, because of their large body size, are seen as the most problematic competitors by fishers (Bowen, 1997; Morissette *et al.*, 2006).

However, a number of other consequences of dolphin depredation have not been evaluated in our study. First, although the amount of fish caught in nets is higher in the case of dolphin attacks, hunting of free-swimming fish by dolphins close to these nets can also be considered as a lost opportunity by fishers. Secondly, depredation of fish directly from nets by dolphins often causes damage to the nets (e.g. holes) (Fertl and Leatherwood, 1997; Bearzi, 2002; Brotons *et al.*, 2008), reducing catching efficiency and capacity (Lavigne, 2003) and resulting in increased repair time and costs (Zahri *et al.*, 2004). Moreover, evaluating the real economic impact of dolphin depredation on artisanal fisheries is necessary. Changes in catch composition also have consequences on the value of landings. Monitoring studies in collaboration with fishers should offer us the possibility to assess these effects.

This study allowed us to better understand how the coastal bottlenose dolphin (*Tursiops truncatus*) interferes with an artisanal Mediterranean fishery located in a marine reserve. Marine protected areas were originally developed to maintain or restore biodiversity, but are now being used to a greater extent for fisheries management. Indeed, the potential benefits of marine reserves in terms of fishing mortality reduction (Jennings, 2001), fish biomass increase (Polunin and Roberts, 1993), and spillover to adjacent fisheries (Goñi *et al.*, 2006) are widely supported (Russ *et al.*, 2004). However, the utility of marine reserves as fisheries management tools is still challenging to demonstrate (Hilborn *et al.*, 2004; Gardmark *et al.*, 2006), and dolphin depredation on fish also targeted by local fisheries may weaken the anticipated effect of the reserve. Some authors have considered that depredation by dolphins on nets is a direct consequence of the reduction in prey availability due to the overexploitation of fish resources (Fertl and Leatherwood, 1997; Bearzi, 2002). Thus, a potential increase in fish resources in marine protected areas could lead to a decrease in interactions between fishers and dolphins.

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**Table 1.** Scenarios based on statistical results for explaining observed significant differences in cpue and the catch composition of nets subject to dolphin attacks (compared to non-attacked events).

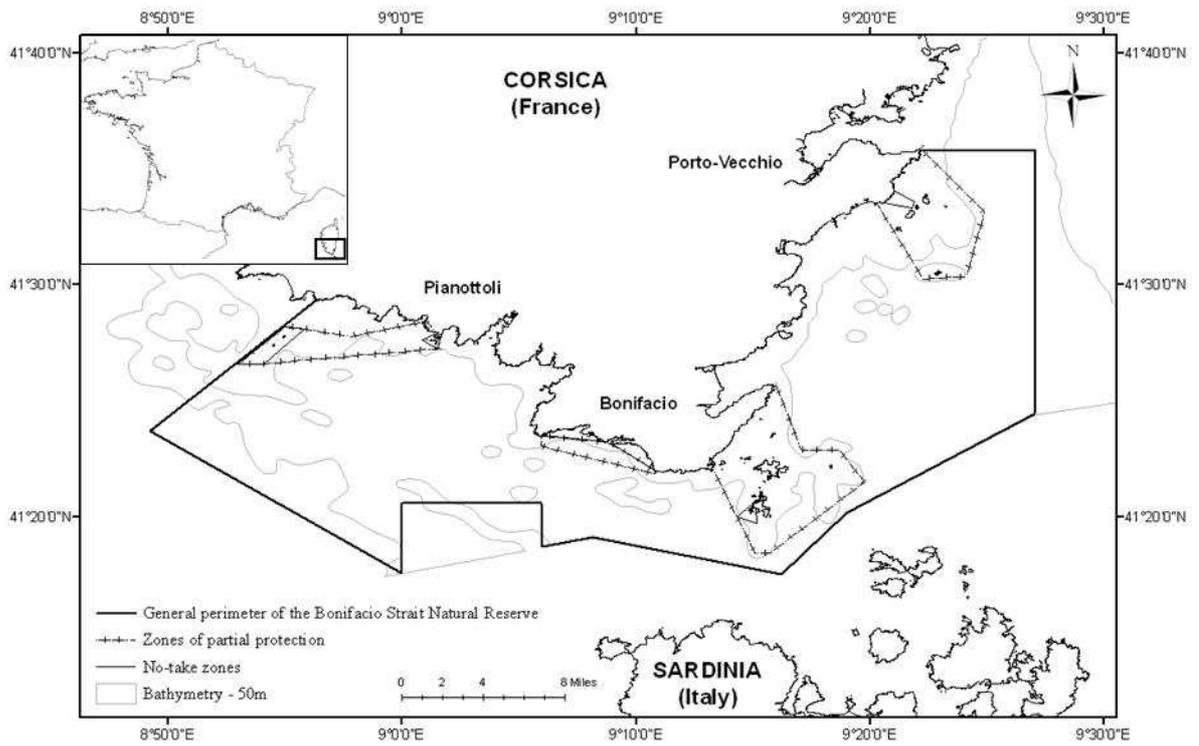
		<b>Catch composition</b>	
		<b>Unchanged</b>	<b>Modified</b>
<b>cpue of catches</b>	<b>Equal</b>	(1) Stable fish biomass in the fishing area. No effect of dolphin presence.	(4) Stable fish biomass in the area and species-specific reaction of fish to dolphin presence.
		(2) Lower fish biomass in the fishing area. No effect of dolphin presence.	(5) Lower fish biomass in the area compensated by free-swimming fish driven by dolphins into the net.
		(3) Higher fish biomass in the fishing area. No effect of dolphin presence.	(6) Higher fish biomass in the area mitigated by immobility or escape of some fish species under dolphin presence.
	<b>Lower</b>	(4) Stable fish biomass in the area and species-specific reaction of fish to dolphin presence.	(7) Lower fish biomass in the area and species-specific reaction of fish to dolphin presence.
		(5) Lower fish biomass in the area compensated by free-swimming fish driven by dolphins into the net.	(8) Stable fish biomass in the area, but immobility or escape of some species under dolphin presence.
		(6) Higher fish biomass in the area mitigated by immobility or escape of some fish species under dolphin presence.	(9) Higher fish biomass in the area and species-specific reaction of fish to dolphin presence.
<b>Higher</b>	(7) Lower fish biomass in the area and species-specific reaction of fish to dolphin presence.	(10) Stable fish biomass in the area, but free-swimming fish driven by dolphins into the net.	

**Table 2.** Description of species statistically over-represented in catches (termed “losers”) in case of dolphin attacks and those present in the same proportion (termed “neutral”). Occ. WA: occurrence of the species in nets in case of dolphin attacks; Occ. A: occurrence of the species in nets in case of dolphin attacks. Occurrence corresponds to the ratio of the cpue of the considered species divided by the cpue of the total catch.

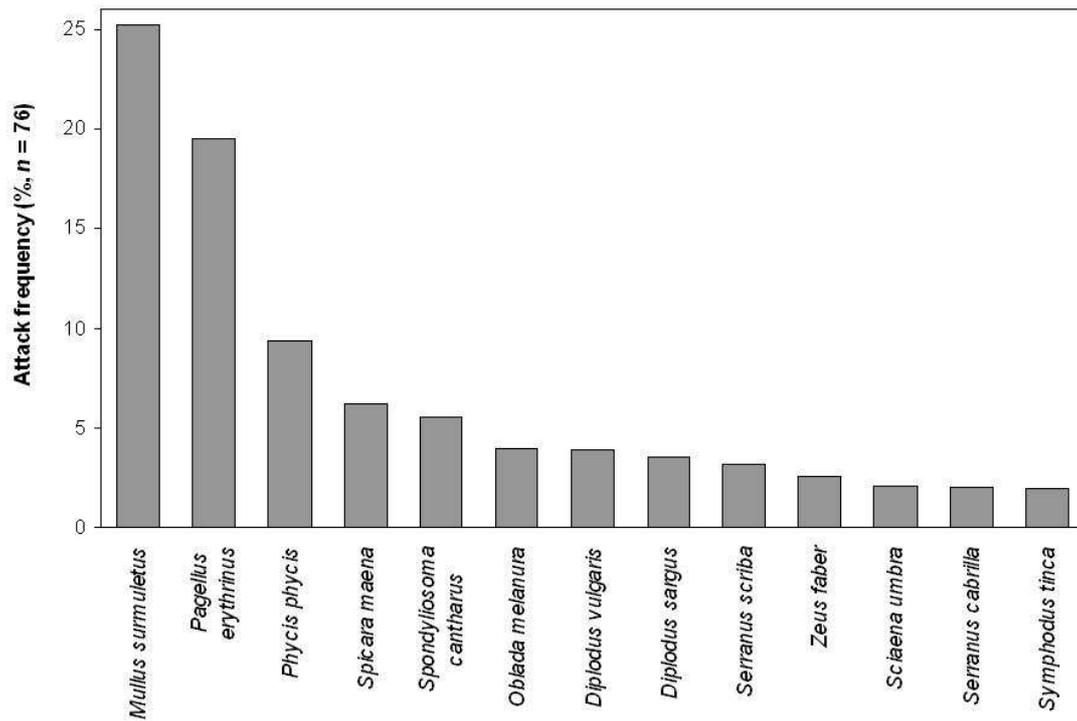
	Species	Occ. WA	Occ. A	Occ. (A - WA)	p-value	Position of the fish species in the water column
<b>Losers</b>	<i>Pagellus erythrinus</i>	6.07	11.98	5.91	0.0001	benthopelagic
	<i>Phycis phycis</i>	10.94	11.06	0.13	0.04	reef-associated
	<i>Mullus surmuletus</i>	4.65	8.98	4.32	0.0000	demersal
	<i>Scylliorhinus canicula</i>	1.36	3.30	1.93	0.017	demersal
	<i>Diplodus vulgaris</i>	1.78	2.75	0.97	0.01	benthopelagic
	<i>Spicara maena</i>	0.33	0.74	0.41	0.016	benthopelagic
	<i>Scorpaena notata</i>	0.23	0.34	0.11	0.005	demersal
	<i>Scorpaena scrofa</i>	20.74	11.37	-9.37	0.10	demersal
	<i>Sepia sp.</i>	7.21	5.75	-1.47	0.97	benthopelagic
	<i>Dentex dentex</i>	4.13	4.85	0.72	0.58	benthopelagic
<b>Neutral</b>	<i>Scorpaena porcus</i>	5.09	4.26	-0.83	0.14	demersal
	<i>Trachinus draco / araneus</i>	1.51	2.86	1.35	0.07	demersal
	<i>Labrus merula</i>	2.17	2.82	0.65	0.49	reef-associated
	<i>Spondyliosoma cantharus</i>	2.60	2.44	-0.16	0.13	benthopelagic
	<i>Raya sp.</i>	2.92	2.20	-0.73	0.83	reef-associated
	<i>Sciaena umbra</i>	4.42	1.93	-2.49	0.53	reef-associated
	<i>Sarpa salpa</i>	0.62	1.71	1.09	0.67	benthopelagic
	<i>Symphodus tinca</i>	1.65	1.68	0.03	0.48	reef-associated
	<i>Muraena helena</i>	0.56	1.45	0.88	0.70	reef-associated
	<i>Uranoscopus scaber</i>	0.80	1.42	0.62	0.22	demersal
	<i>Pagellus acarne</i>	0.43	1.34	0.91	0.19	benthopelagic
	<i>Torpedo marmorata</i>	1.47	1.05	-0.42	0.50	reef-associated
	<i>Diplodus sargus</i>	0.77	1.04	0.27	0.61	demersal
	<i>Octopus vulgaris</i>	2.01	1.04	-0.97	0.96	reef-associated
	<i>Scomber sp.</i>	0.50	1.01	0.52	0.85	pelagic
	<i>Sarda sarda</i>	0.56	1.01	0.45	0.56	pelagic
	<i>Merluccius merluccius</i>	0.79	0.96	0.17	0.26	demersal
	<i>Lophius piscatorius</i>	1.04	0.91	-0.13	0.90	demersal
	<i>Serranus cabrilla</i>	0.45	0.88	0.44	0.051	demersal
	<i>Labrus viridis</i>	0.69	0.87	0.17	0.90	reef-associated
	<i>Serranus scriba</i>	0.49	0.80	0.31	0.31	demersal
	<i>Zeus faber</i>	1.16	0.80	-0.36	0.39	benthopelagic
<i>Epinephelus marginatus</i>	1.36	0.68	-0.68	0.78	reef-associated	
<i>Sphyaena sphyaena</i>	1.07	0.66	-0.41	0.93	pelagic	
<i>Labrus bimaculatus</i>	0.53	0.62	0.09	0.90	reef-associated	
<i>Pagrus pagrus</i>	2.41	0.43	-1.99	0.91	benthopelagic	
<i>Boops boops</i>	0.38	0.35	-0.03	0.05	demersal	
<i>Oblada melanura</i>	0.04	0.30	0.26	0.51	benthopelagic	
<i>Bothidae / Soleidae</i>	0.15	0.30	0.14	0.43	demersal	

<i>Conger conger</i>	0.55	0.27	-0.28	0.85	reef-associated
<i>Diplodus annularis</i>	0.18	0.22	0.04	0.19	benthopelagic
<i>Trigla lucerna</i>	0.18	0.15	-0.02	0.66	demersal
<i>Trachurus sp.</i>	0.40	0.14	-0.26	0.90	pelagic
<i>Sparus aurata</i>	0.01	0.13	0.12	0.87	demersal
<i>Scyliorhinus stellaris</i>	0.34	0.06	-0.28	0.93	reef-associated
<i>Diplodus puntazzo</i>	0.63	0.05	-0.58	0.60	benthopelagic
<i>Mugil cephalus</i>	0.30	0.02	-0.28	1.00	benthopelagic
<i>Symphodus sp.</i>	0.02	0.01	-0.02	0.75	demersal
<i>Synodus saurus</i>	0.07	0.01	-0.06	0.93	demersal

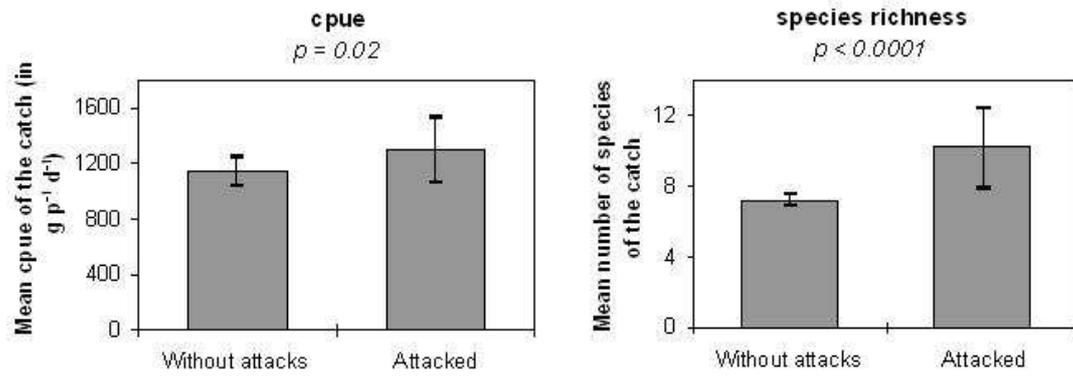
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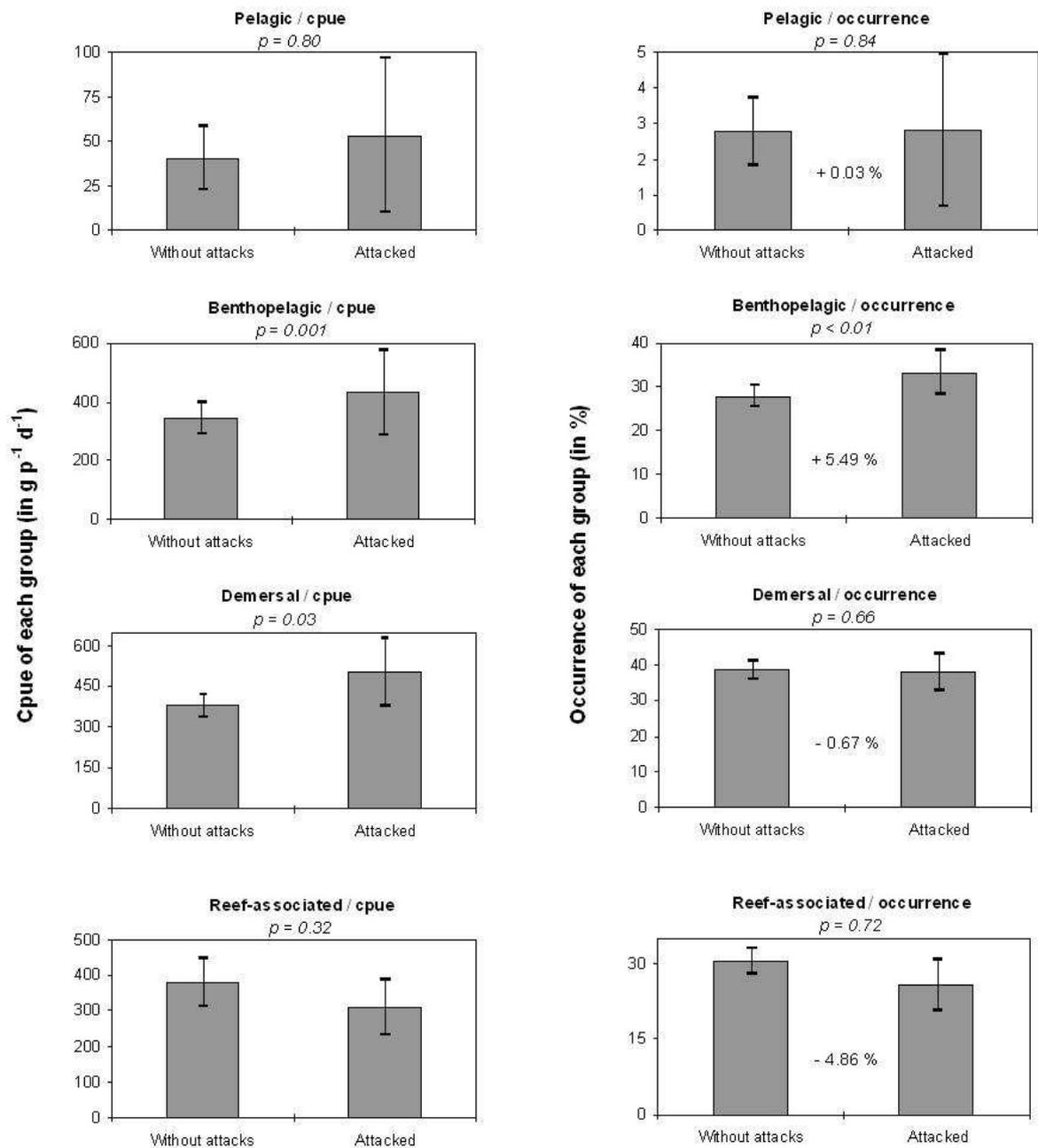
**Figure 1.** Geographic location of the study area: the Bonifacio Strait Natural Reserve in South Corsica, France.



**Figure 2.** Species depredated by the common bottlenose dolphin (*Tursiops truncatus*) from artisanal fishery nets (only species represented in at least 2% of the damaged biomass).



**Figure 3.** Mean cpue (in  $\text{g p}^{-1} \text{d}^{-1}$ ) and mean species richness (in number of species) caught on non-attacked and attacked nets by bottlenose dolphins in the Bonifacio Strait Natural Reserve artisanal fishery (two-tailed Mann-Whitney non-parametric test). Error bars represent confidence intervals ( $\alpha = 0.05$ ).



**Figure 4.** Cpu (in  $g\ p^{-1}\ d^{-1}$ ) and occurrence (in %) of each group, based on the species' position in the water column, in non-attacked and attacked nets by bottlenose dolphins (two-tailed Mann-Whitney non-parametric test). Error bars represent confidence intervals ( $\alpha = 0.05$ ).