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Economic Assessment of Dolphin Depredation Damages and Pinger Use in Artisanal Fisheries in the Archipelago of Egadi Islands (Sicily)

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Abstract

In this study, an economic analysis of the effect of pingers as "anti-depredation" devices on artisanal fisheries and dolphin depredation was performed. By comparing the data of the gross Profit Per Unit Effort (PPUE) over 29 fishing days for two identical nets (900-m long, one was equipped with pingers, and the other did not have pingers), was assessed the following: the different production trends of the nets (Advantage of Production, AP) and the Return Of Investment (ROI) for the purchase of the pingers. Considering the difference in the PPUE values of the two nets, the frequency of the dolphin interaction, and the effort of fishing activities, was assessed the one-year economic losses (ED) due to dolphin depredation. Moreover, was assessed the economic damage caused by the destroyed area of the nets.

The AP over 29 fishing days for the use of the pinger net with respect to the control net is 25.7 Euros for each 50 m of net. The ROI for the initial investment of the pingers (4 pinger = 800 Euro) is 50 fishing days, and the ED is 1400 Euros. The damages suffered by the control and the pinger nets were 33 m^2 (90 Euros) and 22 m^2 (91 Euros), respectively.

The analysis of the results demonstrates that the critical factors that determine the success of the pinger technology could be represented by the return of investment (ROI) and the use of the economic incentives provided by the European Fisheries Fund (EFF).

Keywords: Dolphin, bottom gill nets, profit per unit effort, advantage of production, return of investment.

Introduction

The interaction between dolphins and fisheries is a worldwide concern because it affects both the survival of wild dolphin populations and the livelihood of fishermen (Brotons *et al.*, 2008; Northridge, 1984). Dolphins engaging in depredation activities cause damage to fishing gear and decrease the value and quantity of catches (Reeves *et al.*, 2001; Zollet *et al.*, 2006). Acoustic deterrent devices, such as pingers, have attracted much attention as a possible method to mitigate these problems (Dowson *et al.*, 2013). However, despite their widespread use and the completion of several studies, data on the economic effectiveness of these devices is relatively scarce(Barlow *et al.*, 2003; Buscaino *et al.*, 2009; Carlström *et al.*, 2002; Cox *et al.*, 2001; Dawsons *et al.*, 1998; Leeney *et al.*, 2007; Monteiro-Neto *et al.*, 2004).

The interaction and depredation phenomena of the *Tursiops truncatus* assume a different meaning when studied from an economic point of view. The loss of fish and the damage to the fishing gear represent a risk factor for the fisheries that might be reduced with a specific piece of equipment. However, the lost profits, the costs of fishing gears repairs, and the improvement of the economic performances of the net that uses acoustic deterrent devices have been already assessed in trammel and gill net (Brotons *et al.*, 2008a; Brotons *et al.*, 2008b; Gazo *et al.*, 2008; Gönener *et al.*, 2012; Waples *et al.*, 2012); but no study has performed an economic Return On Investment (ROI) on pingers.

This study aims to analyse the economic impact of an acoustic devices on an artisanal fishery near a Marine Protected Area of the Mediterranean Sea, is located in the Egadi Islands (West Sicily, Italy). In this area, artisanal fishing (long line, gillnet, and trammel nets) with small-size (<12 m) boats is mainly practiced, and the interaction between *Tursiops truncatus* and fishery represents a serious problem for the fishermen and dolphins (Buscaino *et al.*, 2009). These artisanal fisheries, although small, are socio-economically important, particularly during the tourist seasons (from June to October) when the number of tourists significantly increases. In fact, the Egadi

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Archipelagos is a very important tourist destination, and the largest catch and sales of fish products occur during this season. Therefore, to mitigate the interactions between cetaceans and fishing equipment, the use of acoustic devices (pingers) could be important for the Archipelago's fisheries. In 2006, a study demonstrated that the use of a pinger affects the fish catch efficiency and damages bottom gill nets associated with bottlenose dolphins (Buscaino *et al.*, 2009).

In this paper, based on the results of the study cited above, we propose an economic evaluation of the pinger efficiency and the depredation phenomenon. In particular, we used fishing data (biomass of each species caught) and damage to nets to evaluate the following:

- the gross Profit Per Unit Effort (PPUE)
- the production trend of a net equipped with a pinger (pinger net) compared to a net without a pinger (control net);
- the Advantage of Production associated with the use of a pinger (AP);
- the Return of Investment (ROI) for pinger equipment, including the economic incentive provided by the European Fisheries Fund (EFF, 2006);
- the Economic Damage (ED) due to the depredation of dolphins on the seven target species; and

the ED due to destruction of the net.

Materials and Methods

Study Area

The data used in this study was obtained in the period from March to May 2006 in the waters off the Egadi Archipelago (Favignana Island; western Sicily; 37°57'00" N,12°19'00" E) (Buscaino *et al.*, 2009). The waters surrounding the islands are part of a Marine Protected Area (Figure 1). The sea bottoms are characterised by sandy and rocky substrates covered

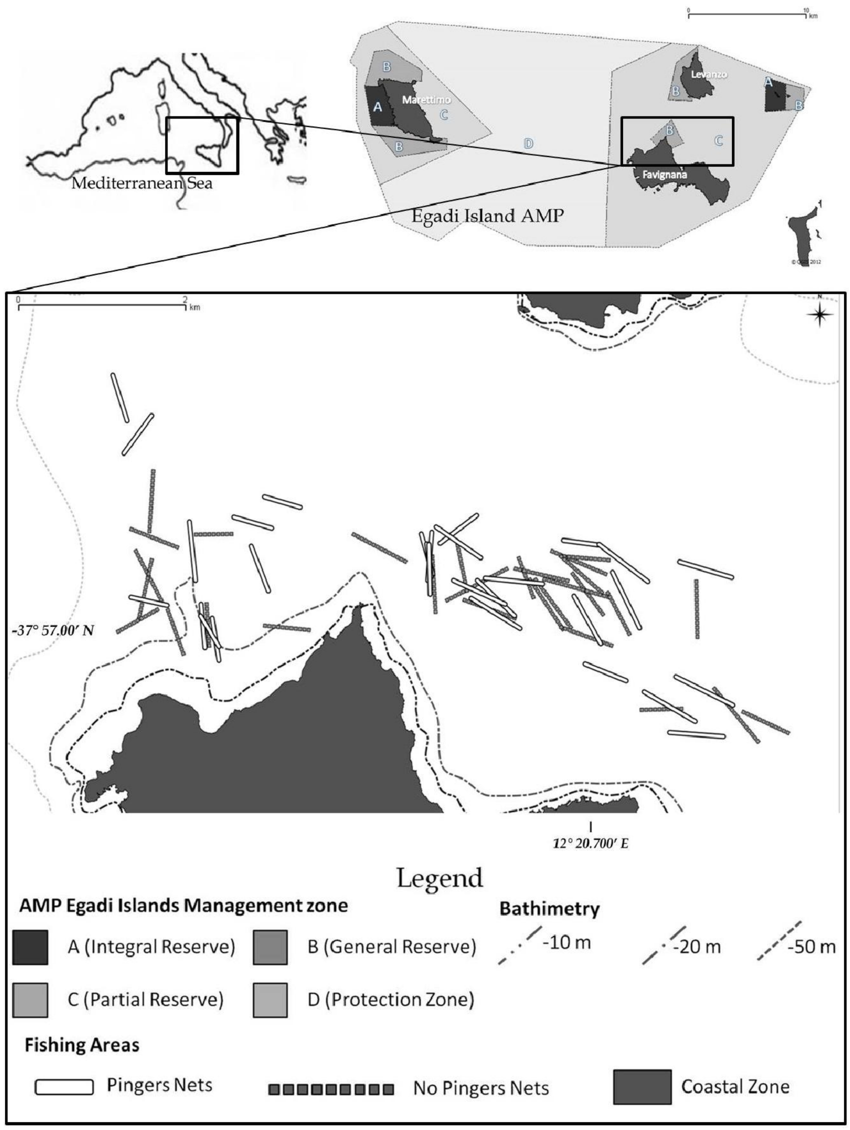

Figure 1. Area of the study – Archipelagos of Egadi Islands (a), Sicily, Italy. The line segments show the start and end points of the hauls obtained with the pinger net (white line) and the control net (dark line).

with extensive oceanic Posidonia meadow (*Posidonia oceanica*) and host a wide variety of flora and fauna. Artisanal fisheries are an important sector of the local economy, and artisanal fishing has been practiced throughout the years in the waters surrounding the islands.

Fishing Activity

The data analysed in this study are part of a study conducted in the island of Favignana with an artisanal fishing vessel (overall length of 9 m, equipped with an inboard 130 kw Fiat Aifo engine), which made daily fishing trips along the coast of the island (Figure 1) (Buscaino et al, 2009). Two identical monofilament bottom gill nets were used during 29 fishing days. The nets, which were 900-m long and 2.2-m high whit mesh size 11 (11 knot in 25 cm of stretched net, equivalent to 3.6 cm for each side of mash), were denoted "pinger net" and "control net". The pinger net was equipped with 4 pingers (model DDD02; STM Ltd. Verona, Italy) positioned at a regular distance of 300 meters. Each pinger had a cost of 200 Euro.

To conduct an economic analysis of the effectiveness of pingers, the base data of the previous study (Buscaino *et al.*, 2009) , which is summarised in Table 1, was used.

Economic Evaluation of the Method used for Catching

To examine the economic effect of using pingers on the catch value, we considered the following parameters:

Gross Profit Per Unit Effort (PPUE)

First, we assessed the economic value of each of the 26 species caught based on the value of the fish landed and sold (Euro/kg) during the study performed by Buscaino *et al.* (2009) (taking the local market price in 2006) (Table 2).

Based on the weight and species of fish caught, the gross Profit per Unit Effort (PPUE), expressed as amount of Euros per the haul from 50 meters of each net (Brotons, 2008), was measured as the following equation (Figure 2):

$$PPUE = \frac{\text{Fishing prize x Kg species catch}}{\text{50 m net . hour}}$$

Advantage of Production (AP)

The AP was assessed by the Production Trend (PT) attained after 29 hauls with each net (Figure 2). The PT was calculated by the sum of the incomes from the sales of the products landed and sold (PPUE) each day of fishing using the following equation:

$$PT_x \sum_{1=i}^{n} PPUE_i \ ,$$

where the subscript n corresponds to the total number of hauls used to calculate the PT. Subtracting the PT of the control from that of the pinger net, it was possible to assess the Advantage of Production (AP) of the pinger net with respect to the control net during the fishing days using the following equation:

$$AP_i = PT_{Pi} - PT_{CTRLi} \ ,$$

where the subscript P refer to the pingers net, the subscript CTRL refers to the control net, and the subscript i is the total number of hauls made up to the i^{th} fishing day.

Return on Investments

The difference of ROI of the "pingers" technology for a fishing company was determined by the AP values. The pinger net was equipped with four pingers, which exhibited a total cost of 800 Euro. The cost to equip a net with pingers has been standardised and expressed in the number of Euros per 50 m of net. The point of intersection between the costs of the pingers and the trendline of the AP allowed us to estimate the number of fishing days required to reach the break-even point between the technology investment and the AP.

Moreover, we evaluated the difference of ROI considering the economic incentive of the European Fisheries Fund (EFF) provided by the European

Table 1. Base data used in this study

Equipment and Data	Specification
2 Gill Nets	Each net was 900-m long and 2.2-m high with mesh size of 11 mm Cost for each net = 900 € (unpublished data)
Pinger	4 pinger = 800 Euro (only the pinger net) (model DDD02; STM Ltd., Verona, Italy)
Fishing Data	Amount of fish captured (kg/h × 900 m set net) per species with the control and pinger nets (see Table 1)
Holes and Tears	Amount and size of the holes and tears in the control and pinger nets (see Fig. 4)
Dolphin Interactions	Dolphin presence around the fishing nets in each haul (see Fig. 3)

Commission for the protection of fishing gear from attack by wild predators (Regulation CE N. 1198/2006, Article 25, paragraph e). The EFF allows companies to buy tools and fishing equipment using a variable advantage scheme depending on the region and the EFF objectives. In Italy, particularly in Sicily, pingers can be purchased from fishing companies with an EFF aid equal to 50% of the product cost. Then, the ROI with the EFF incentives in Sicily correspond to half of the difference of ROI calculated in the absence of the incentive.

Economic Damage

We calculated the Economic Damage (ED) due to dolphin depredation activities using the method reported in other similar studies (Brotons *et al.* 2008c; Bearzi *et al.*, 2011; Gönener *et al.*, 2012; Lauriano *et al.*, 2004). To obtain this indirect estimate of the loss of fish due to the presence of dolphins during the fishing season, we compared the different PPUE (kg € m^{-1} h^{-1}) between the pinger net and the control net for only the seven target species that are mainly caught and sold and that represent 85% of the economic value of the caught species (Table 2).

The formula below allowed us to determine the ED caused by dolphins:

$$ED = \overline{\Delta PPUE_{Int}} * \overline{hour} * days * freq_{\text{int}},$$

where $\overline{\Delta PPUE_{Int}}$ is the average of the differences between the PPUE of the pinger net subtracted by the PPUE of the control net only for the day of the interaction with dolphins and only for the target species, $\overline{hour}$ (2.41 h) is the mean fishing time per haul, days (n = 80) is the number of fishing days per year in which this fishing gear is used, and $freq_{\text{int}}$ (0.38) is the interaction ratio between dolphins and the fishing gear.

For this calculations, the market price and the seasonal economic loss of the caught species was evaluated for seven of the most caught species, as reported by Buscaino *et al.* (2009): 10 €/kg for *Boops boops*, 10 €/kg for *Sardinella aurita*, 10 €/kg for *Trachurus trachurus*, 10 €/kg for *Pagellus acarne*, 15 €/kg for *Scomber scomber*, 15 €/kg for *Spicara maena*, and 10 €/kg for *Symphodus roissali*.

Economic Evaluation of the Fishing Gear Damage

To quantitatively and economically verify the damage suffered by the two different types of net over 29 fishing days, measurements of the surfaces of the

Table 2. Caught fish species and economic parameters evaluated for the pinger and control nets

	Pinger Net 29 hauls				Control Net 29 hauls			
Species	kg	kg/h	€	PPUE kg € $h^{-1}m^{-1}$	kg	kg/h	€	PPUE kg € $h^{-1}m^{-1}$
Boops boops	113.13	1.714	1.131.30	0.945	83.15	1.124	831.47	0.620
Sardinella aurita	64.83	0.982	648.33	0.542	54.69	0.739	546.93	0.408
Trachurus trachurus	35.05	0.531	350.52	0.293	25.69	0.347	256.94	0.192
Pagellus erythrinus	11.59	0.176	115.94	0.097	20.50	0.277	204.98	0.153
Pagellus acarne	14.95	0.227	149.53	0.125	12.02	0.162	120.23	0.090
Scomber scomber	15.59	0.236	233.88	0.195	11.34	0.153	170.06	0.127
Spicara maena	12.25	0.186	183.72	0.154	9.16	0.124	137.45	0.102
Symphodus roissali	12.85	0.195	128.46	0.107	8.99	0.122	89.92	0.067
Mullus surmuletus	6.17	0.093	123.42	0.103	8.73	0.118	174.62	0.130
Spicar asmaris	3.28	0.050	65.60	0.055	7.21	0.097	144.20	0.108
Serranus scriba	4.83	0.073	48.30	0.040	6.34	0.086	63.36	0.047
Trachinus araneus	5.23	0.079	52.31	0.044	4.68	0.063	46.84	0.035
Uranoscopus scaber	0.69	0.011	6.94	0.006	4.55	0.061	45.47	0.034
Sarda sarda	4.39	0.067	43.91	0.037	3.76	0.051	37.62	0.028
Aspitrigla cuculus	2.50	0.038	49.94	0.042	3.05	0.041	60.92	0.045
Synodus saurus	1.79	0.027	17.87	0.015	1.98	0.027	19.82	0.015
Chelidonichthys lastoviza	0.29	0.004	2.88	0.002	1.12	0.015	11.16	0.008
Diplodus anularis	0.38	0.006	3.75	0.003	0.92	0.012	9.23	0.007
Diplodus vulgaris	0.38	0.006	3.75	0.003	0.92	0.012	9.23	0.007
Chelidonichthys lucernus	0.35	0.005	3.45	0.003	0.37	0.005	3.66	0.003
Serranus cabrilla	0.17	0.003	1.74	0.001	0.32	0.004	3.24	0.002
Xyrichtys novacula	0.03	0.001	0.34	0.000	0.29	0.004	2.87	0.002
Scorpaena scrofa	1.14	0.017	11.37	0.010	0.24	0.003	2.41	0.002
Coris julis	0.42	0.006	4.18	0.003	0.23	0.003	2.32	0.002
Scorpaena porcus	0.39	0.006	3.88	0.003	0.14	0.002	1.41	0.001
Zeus faber	4.95	0.075	49.51	0.041	0.00	0.0000	0.00	0.000
TOTAL	317.6	4.8	3434.82	2.870	270.40	3.7	2996.35	2.234

damaged nets and an estimate of the corresponding economic damage were performed. We assess the total damage to the net as following:

Total Net Damages = Cost of 1 m^2 Fishing Net * Net Surfaces Damages in m^2

Moreover, we distinguish between two categories of damage, as described by Buscaino *et al.* (2009): holes with a diameter of less than 20 cm and holes/tears with a diameter of more than 20 cm.

Results

Economic Results for Catching

A total of 52.2 km of net was monitored through 58 hauls: 26.1 km of the net was equipped with pingers and 26.1 km did not have pingers. A total of 26 fish species (Table 2) with a value of 6,431.2 € (pinger net: 3,434.8 €; control net: 2,996. 4 €) and a weight of 588 kg (pinger net: 317.6 kg; control net: 270.4 kg) were caught (see Table 1). The mean economic value of the catch during the 29 fishing days was 118.44±72.5 € for the pinger net and 103.32 ± 69.0 € for the control net (mean ± SD).

Considering all fishing species catch in 29 hauls, the mean PPUE across the two nets was found and higher values were recorded for the net equipped with pingers (3.35±2.52 € kg h^{-1} m^{-1}; mean±SD) compared with the control net (2.47±1.63 € kg h^{-1} m^{-1}; mean±SD).

Figure 2 shows the Production Trend of the control and pinger nets during the 29 fishing days. The PT after 29 days of experimental fishing were 97.24 € kg h^{-1} $m^{-1}$for the pinger net and 71.55 € kg h^{-1} m^{-1} for the control net. Moreover, Figure 2 demonstrates that the PT of the pinger net was 71.55 € (€ kg h^{-1} m^{-1}) after 24 days of fishing with a temporal advantage of 5 days compared with the control net. Figure 3 shown the Advantage of Production of the pinger net with respect to the control net, which was found to be 25.69 € kg h^{-1} m^{-1}. This value indicates that, after 29 hauls (with a duration of 1 hour), each 50 m of net exhibits a difference of 25.69 € with respect to the control net.

The values of the AP allowed us to calculate the trendline that represents the difference in the net incomes between the pinger net and the control net. The trendline obtained from the values of the AP of the pinger net intercepts the two lines (break-even line) that indicate the pinger cost for each 50 m of net with (22.1 €) or without (44.2 €) the incentive provided by the European Fisheries Fund. The intersection between the break-even line and the linear regression line of the AP allows the identification of the number of days needed to reach the break-even point between the investment in the net equipment and the revenues derived from this technical choice. In particular, 50 of fishing days (considering a mean duration of 1 hour per haul) are required to reach the break-even point between the costs of the pingers technology and the AP. In contrast, if the fishing company takes advantage of EFF aid, the break-even point corresponds to 25 fishing days.

Seven of the 26 fish species caught by the pinger net represent 84.59% of the total value, with an economic value of 2,825.74 €, whereas the corresponding percentage for the control net is 75.83%, which corresponds to a value of 2,152 €. The remaining species represented 15.41% of the catch value with an economic value of 609.08 € for the pinger net and 24.17% of the catch value with an economic value of 843.36 € for the control net.

The Economic Damage (ED) due to dolphin

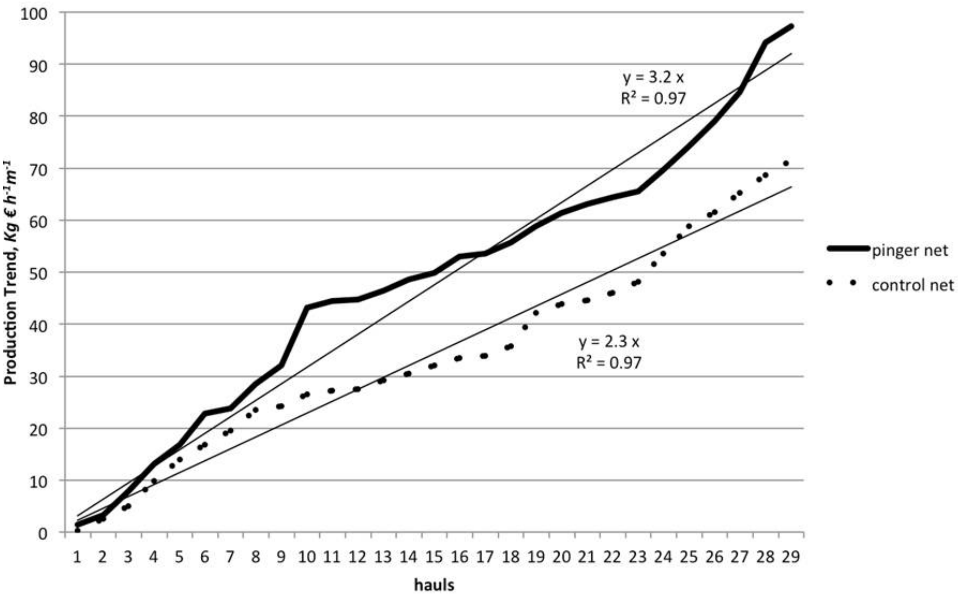

Figure 2 Production Trends of the pinger and control nets during 29 fishing days based on 50 m of net.

interaction in the Egadi Island Archipelago was found to be 77.65 € for 50 m of net in one year.

Fishing Gear Economic Damage

The levels of net damage suffered by the pinger net and the control net after 29 fishing days were similar (Table 3) for total losses of 70.96 € for the pinger net and 79.07 € for the control net. Table 4 summarises the data on the net lost surface and the equivalent value in Euros for the two types of nets during the 29 fishing days.

Discussion and Conclusion

In this study, we assessed the economic advantage of the use of a pinger in the artisanal fishing activity suffered by bottlenose dolphin depredation. First, we assessed the PPUE of the control and pinger nets during 29 hauls. After comparing these PPUE values, we obtained the Advantage of Production for the pinger net. After 29 hauls, the Advantage of Production of 50 m of the pinger net with respect to the control net is 25.69 kg € h^{-1} m^{-1}. Based on the difference between the PPUE of the pinger and the control nets on the day during which dolphin were sighted, we indirectly assessed the one-year Economic Damage caused by the loss of fish due to the depredation phenomenon. However, because there was a significant difference in the catch obtained by the pinger and control nets, we assumed that the dolphins never attack the pinger net. Thus, this method could underestimate the ED if we consider that the dolphin "prefer" to attack the control

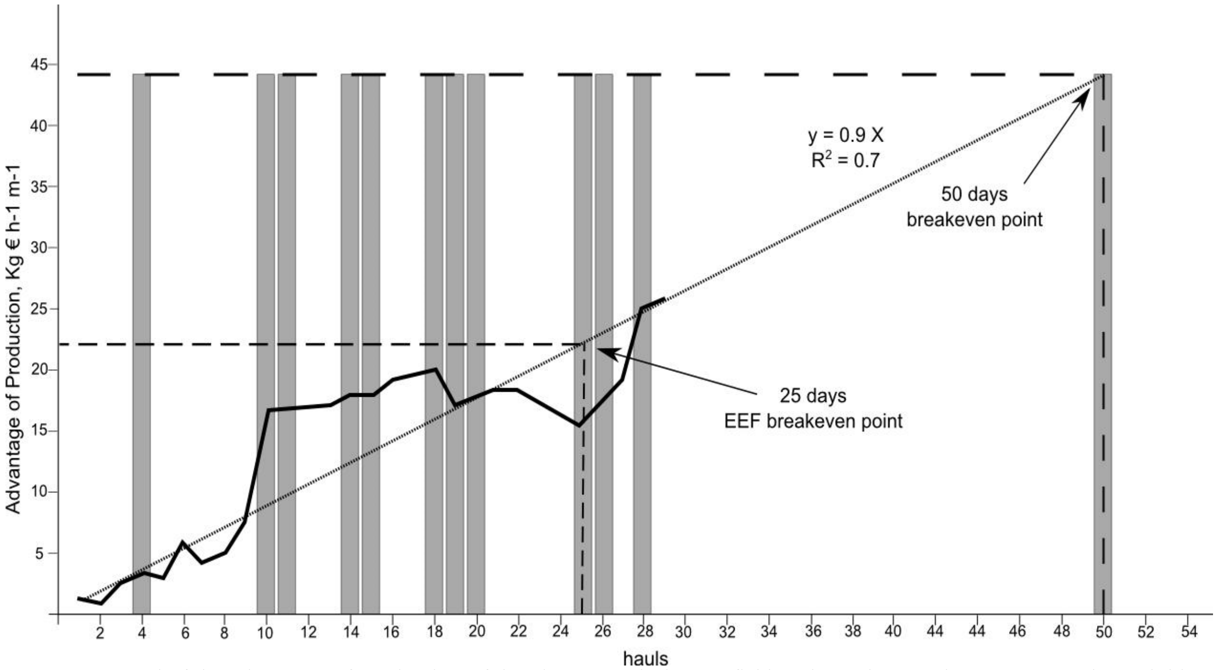

Figure 3. Trend of the advantage of production of the pinger net during 29 fishing days; the gray bar represents the Dolphin presence around the fishing nets (interactions).

Table 3. Assessment of the Economic Damage for 50 m of the control net during the fishing season: $\Delta PPUE_{Int}$ is the mean difference between the PPUE of the pinger net and the PPUE of the control net only for the day of the interaction with dolphins

Target Species	$\overline{\Delta PPUE_{Int}}$ kg € h^{-1} m^{-1}	$\overline{hour}$ h	Days	$freq_{int}$	ED kg € day^{-1} m^{-1}
Boops boops	0.32	2.41	80	0.38	23.41
Sardinella aurita	0.21	2.41	80	0.38	15.20
Trachurus trachurus	0.18	2.41	80	0.38	13.22
Pagellus acarne	0.03	2.41	80	0.38	2.41
Scomber scomber	0.15	2.41	80	0.38	11.27
Spicara maena	0.11	2.41	80	0.38	7.79
Symphodus roissali	0.06	2.41	80	0.38	4.34
Economic Damage (euro)					77.65

(2.41 h) is the mean fishing time per haul, day (n = 80) is the number of fishing days per year, and $freq_{int}$ (0.38) is the interaction ratio between dolphins and the fishing gear.

Table 4. Surface of net damaged and corresponding economic value of the damages for the control and pinger nets

Total surface of net damaged after 29 hauls (m^2)	small hole (<20 cm)	17.34 m^2	26.44 m^2
	hole and tears (>20 cm)	138.77 m^2	147.52 m^2
	TOTAL	156.11 m^2	173.96 m^2
Mean surface of net damaged after 29 hauls per every 50 m of net (m^2)	small hole (<20 cm)	0.96 m^2	1.47 m^2
	hole and tears (>20 cm)	7.71 m^2	8.20 m^2
	TOTAL	8.67 m^2	9.66 m^2
Total cost of the damage in Euros	small hole (<20 cm)	7.88 €	12.02 €
	hole and tears (>20 cm)	63.08€	67.05 m^2
	TOTAL	70.96 €	79.07 €
Total cost of the damage after 29 hauls for each 50 m of net	small hole (<20 cm)	0.44 €	0.67 €
	hole and tears (>20 cm)	3.50 €	3.73 €
	TOTAL	3.94 €	4.39 €

net but also, albeit with a minor force, attack the pinger net. Additionally, in the assessment of the ED of the fishing gear, we considered the destruction of the net surface without taking into account the efficiency of the net decrease in proportion to the number of holes and that the fishermen replace the net before its complete destruction. Based on this "net-surface damaging method", the difference between the pinger net and the control net is negligible (approximately 10 €). Although it is a rare event, any attack on the network pinger by the dolphins is an event to be considered, this would result in a lower cost-effectiveness of this technology.

As reported in other studies (Brotons *et al.*, 2008a; Buscaino *et al.*, 2009; Gönener *et al.*, 2012; Dawson *et al.*, 1988; Broton *et al.*, 2008b; Gazo *et al.*, 2008; Lauriano *et al.*, 2004), the use of sounds emitted by specific acoustic devices can, under some circumstances (Dawsons et al., 1998), deter the approach of dolphins to the fishing gear, which reduces the by-catch, the damage to the fishing equipment, and the loss of fish. In fact, the pinger appears to be one of the few effective methods able to reduce the problem of depredation-interaction (Broton *et al.*, 2008b; ISMEA, 2005).

Unfortunately, the technical-scientific proposals to reduce the depredation activities are not always accepted by fishermen. This resistance is partly due to a lack of knowledge of the functional principles of the operational techniques. The reluctance by the fishermen against the use of pingers could be explained by three main factors: scepticism about the effectiveness of the devices, difficulty in handling/utilisation, and lack of knowledge of the costs/benefits ratio.

This study allowed us to assess the economic damage reported by the fishing equipment and the economic loss of fish products during experimental fishing. Moreover, the data of the economic fishing activities allowed us to evaluate the ROI for the adoption of this technology.

Our results have shown that, during the experimental fishing, the pinger net exhibited a production advantage compared with the control net, which improved the efficiency and effectiveness of the fishing activities. In addition, in 29 fishing days, the pinger net, based on the PPUE, reaches the production levels obtained with the control net five days in advance. This result assumes additional meaning if we consider that the costs that the boat supports during each day of fishing were cut down (e.g., fuel, engine oil, damage, wear and tear of equipment, and crew costs), which would improve the economic and environmental sustainability aspects of the fishing activity.

This evaluation showed that the technological investment of the fishing company requires economic sustainability useful to justify their costs. Particularly in Sicily, the artisanal fishing boats are used an average of 110 fishing days (ISMEA, 2005; ISMEA, 2006). Based on these data and the data collected and analysed in this study, it can be assumed that an artisanal fishing boat with gill nets and PPUE levels similar to those recorded in the presence of predation could recover the investment in the pinger technology in less than one fishing season. In this contest, we have to consider that the data obtained in this study are related to a relatively short period (two months), and longer periods of observation should be considered to exclude any habituation phenomenon between the dolphins and the pinger. However, in many Italian artisanal fishing companies, there is a widespread practice to change the type of gear used during the fishing season (IUCN, 2008; Taylor, 1997). This equipment replacement is associated to the turnover of the target species and consequently to the economic sustainability of the activity (IUCN, 2008). Even in the case under study, the fishing boat worked with gillnets for approximately 3 to 4 months per season/year (80 days) and with trammel nets for the remainder of the fishing season.

The data derived from the experimental fishing allowed us to evaluate the total ED to be 1397 € in 900 mt of net (77.65 € in 50 m units of net; see Table 3), which is the loss of income due to the missed catches of the target species as a result of dolphin depredation.

The results obtained from the economic analysis demonstrate that the critical factors of pinger technology could be represented by the economic aspects of the investment sustainability, the ROI, and the use of economic incentives for the purchase of the equipment. In particular, pingers could also benefit from the aid provided by the EFF in Art 25 “Investments on board fishing vessels and selectivity” that states “The EFF may contribute to the financing of equipment and modernisation works” at comma 6 and “for the protection of catches and gear from wild predators, including through changes to the material of parts of the fishing gear, provided that it does not increase the fishing effort or undermine the selectivity of the fishing gear and that all appropriate measures are introduced to avoid physically damaging the predators” at point e. For European fishermen, this opportunity provided by European Regulations could be the only effective tool that could be used to face the economic losses caused by bottlenose dolphin.

The pingers show advantages on two levels of the problem management. The first is referred to as the behavioural aspect (depredation) and is directly related to the conservation of the naturalness of species (IUCN, 2008), and the second is considered the economic aspect of the product landed and is related to the social and economic aspects of the management process of coastal resources (EFF, 2006).

However, an uncontrolled use of these devices can exhibit effects on cetaceans, such as the possible damage to the auditory system (Marton *et al.*, 2002; Taylor *et al.*, 1997), the removal of the dolphin populations in the fishing area, and the "dinner bell effect" (Richardson *et al.*, 1995). More generally, we have to consider that a massive use of pingers in the fishing area results in an increase in the wide-band frequency noise, which might exhibit a possible negative effect in other organisms, including fish (Buscaino *et al.*, 2010; Slabbekoorn *et al.*, 2010), as described by Buscaino *et al.* (2010), and crustaceans. For example, a recent study showed that lobsters can emits high-frequency sounds (Buscaino *et al.*, 2012) and consequently can perceive some part of the acoustic signals emitted by a pinger. In this direction, a recent study showed that the behaviour and some physiological parameters of an aquatic crustacean can change if exposed to a 0.1-25 kHz sweep (Celi *et al.*, 2013).

As a result, the European Regulations should provide an instrument able to create a register on the use and distribution of this equipment. Indeed, it should be noted that the dolphins are in the IUCN Red List of Threatened Species and are protected by specific Regulations, such as Bonn, Barcelona, and Berne, to prevent by-catch (EUCR, 2004).

The economic effects of fish products or damage to dolphin populations are not the only parameters that should be evaluated to describe and regulate the use of these devices. In fact, for many MPAs, the dolphin presence is intangible assets that are poorly assessed and exploited and is able to become a part of the value chain for the local coastal economy, which includes activities such as dolphin watching, merchandising, and fishing tourism.

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