RESOLVING BOTTLENOSE DOLPHIN-FISHERIES ASSOCIATION PROBLEMS IN MALTESE WATERS, CENTRAL MEDITERRANEAN

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Abstract
Research on bottlenose dolphin, *Tursiops truncatus*, distribution and ecology since 1997 has allowed the comparison of distribution of this species throughout the year in relation to anthropogenic activities including fishing and aquaculture. Bottlenose dolphins have been observed to increasingly forage close to the large tuna-penning zones, South East of Malta. As this area is also a traditional artisanal fishing zone, impacts on the fishing catches due to depredation and net damages by dolphins has caused hostile reactions by some fishermen. The use of pingers has been tested during a pilot research project to keep dolphins away from fishing gear in order to avoid entanglement and avert the increasing negative reactions by frustrated fishermen. Preliminary results indicate pingers may prove helpful to both dolphins and fishermen

Keywords: Cetacea, Fisheries, Conservation, South-Central Mediterranean

Introduction
The Bottlenose dolphin, *Tursiops truncatus* (Montagu, 1821), is one of the most frequently observed cetaceans in the Mediterranean [1]. In Maltese waters this species has been subject of dedicated research since 1997 [2,3,4,5]. Conflicts between fishermen and these dolphins have been increasing as fisheries resources are decreasing and anthropogenic activities are increasing in coastal waters [3,4]. The latter include aquaculture and tuna penning activities. In order to mitigate against dolphin entanglement in increasing congestion of fishing gear and avert detrimental conflicts with frustrated fishermen, a pilot project using Banana Pingers was run to assess the efficacy of these instruments in helping dolphins stay away from trouble.

Materials and Methods
The Banana Pinger used for this pilot study meets the criteria set by the European Union Council Regulation 812/2004 for pingers that can be used at 200m spacing on nets. It produces pings with randomised intervals between pings of 4 to 12 seconds. Each ping last 0.3 seconds and contains a series of frequencies in a random order, with each lasting 20ms or more. The frequencies range from 50 to 120kHz. [6].

Thirty banana pingers were distributed among 3 coastal artisanal trammel net fishermen, which had been monitored for 3 months prior to the use of pingers to assess the extent of the problems with dolphins and the risks to dolphins when depredating from fishing nets. Controls included monitoring both the fishermen using pingers and another 3 fishermen not using the pingers and fishing away from the fishermen with pingers but in similar coastal areas where bottlenose are known to range. For every fishing event, data on fishing position, time, marine species caught, presence or absence of dolphins during fishing and collection of nets, evidence of depredation or damage of nets was recorded and compared.

Results
Field research around the Maltese islands reveal an increasing tendency for specific groups of bottlenose spending more time in tuna-pening zones also utilised by artisanal fishermen in coastal waters. The preliminary results on associations of bottlenose dolphins and trammel fishermen activities have been found to be high with more than 60 to 80% of trammel fishing found to be undertaken in the presence of bottlenose dolphins. After a trial research period using banana pingers staring in 2015, results indicate that trammel net damage and catch depredation by dolphins were both dramatically reduced to 2% and 6% respectively when compared with the original records of damage and depredation before starting the pilot project and in comparison to the controls involving fishing effort running contemporaneously without the use of these pingers. A second phase of this research project is assessing the extent to which seasonality, potential habituation by the dolphins and presence of other anthropogenic activities in the area may influence the sustained efficacy of these instruments.

These research aspects are important especially since occasional feeding of wild dolphins by the tuna-penning operators found in one of the main fishing zones may exacerbate the conflicts between dolphins and fishermen due to their increased presence and the increased possibilities for pinger habituation by these dolphins due to the reward of foraging in this tuna-penning and fishing zone.

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