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Effects of acoustic alarms, designed to reduce small cetacean bycatch in gillnet fisheries, on the behaviour of North Sea fish species in a large tank

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Abstract

World-wide many cetaceans drown incidentally in fishing nets. To reduce the unwanted bycatch in gillnets, pingers (acoustic alarms) have been developed that are attached to the nets. In the European Union, pingers will be made compulsory in some areas in 2005 and in others in 2007. However, pingers may effect non-target marine fauna such as fish. Therefore in this study, the effects of seven commercially-available pingers on the behaviour of five North Sea fish species in a large tank were quantified. The species tested were: sea bass (*Dicentrarchus labrax*), pout (*Trisopterus luscus*), thicklip mullet (*Chelon labrosus*), herring (*Clupea harengus*), and cod (*Gadus morhua*). The fish were housed as single-species schools of 9–13 individuals in a tank. The behaviour of fish in quiet periods was compared with their behaviour during periods with active pingers. The results varied both

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between pingers and between fish species. Sea bass decreased their speed in response to one pinger and swam closer to the surface in response to another. Thicklip mullet swam closer to the bottom in response to two pingers and increased their swimming speed in response to one pinger. Herring swam faster in response to one pinger, and pout and cod (close relatives) showed no behavioural responses to any of the pingers. Of the seven pingers tested, four elicited responses in at least one fish species, and three elicited no responses. Whether similar responses would be elicited in these fish species in the wild, and if so, whether such responses would influence the catch rate of fisheries, cannot be derived from the results of this study. However, the results indicate the need for field studies with pingers and fish. Based on the small number of fish species tested, the present study suggests that the higher the frequency of a pinger, the less likely it is to affect the behaviour of marine fish.

Keywords: Acoustics; Cetaceans; Cod; Ecology; Herring; Noise pollution; Odontocetes; Pingers; Pout; Sea bass; Thicklip mullet; Underwater sound

1. Introduction

World-wide, every year, over 300,000 cetaceans are estimated to drown incidentally in fishing nets (Read et al., 2006). Many small odontocetes drown after accidental capture in gillnets (Lewison et al., 2004). One potential alternative to reducing the incidental bycatch of small odontocetes in gillnets by time and area closures of fisheries, change in fisheries practices, or by fish gear modifications, is to deter the animals from the nets acoustically. The commercially-available pingers used for this produce sounds between 10 and 160 kHz. Field studies with pingers on set gillnets have produced promising results with harbour porpoises (*Phocoena phocoena*; Lien et al., 1995; Kraus et al., 1997; Laake et al., 1998; Trippel et al., 1999; Gearin et al., 2000; Anon., 2000; Barlow and Cameron, 2003), and studies in captivity have shown that pingers elicit avoidance behaviour in porpoises (Kastelein et al., 1995, 1997, 2000, 2001). Behavioural studies in the field also show that porpoises avoid pingers (Laake et al., 1998; Culik et al., 2001). Although pinger use in gillnet fisheries is increasing, the long-term effects of pingers on porpoise bycatch and on non-target marine animals have not yet been studied.

One undesirable side-effect of pingers is local noise pollution, which may disturb marine fauna other than the species targeted. Knowledge of the ability of marine animals to detect sound, and of the effects of sound on them, is limited. Marine animals are likely to be disturbed by anthropogenic noise in their environment, and intense sounds may cause negative physiological, auditory, and behavioural effects (Richardson et al., 1995). Sounds produced by pingers should reduce bycatch of odontocetes and perhaps other species, but should cause minimal noise pollution for other marine fauna.

The use of pingers will become widespread, as they become compulsory in some areas in 2005 and in others in 2007 for EU fishing vessels longer than 15 m. Therefore, before pingers are widely used, their effects on marine animals, and especially fish, should be studied. Pingers developed to reduce odontocete bycatch should not deter the fisheries' target species from the gillnets, and should not deter target or non-target fish from ecologically important areas such as feeding and breeding grounds, or mask their communication sounds.

In some field studies on the effects of pingers on odontocetes, the size of the fish catch in nets with and without pingers has been compared. The effects of pingers on fish [Clupeids,