Available online at www.sciencedirect.com
SCIENCE DIRECT
Fisheries Research 78 (2006) 186–195
FISHERIES RESEARCH
www.elsevier.com/locate/fishres

Bycatch and release of pelagic megafauna in industrial trawler fisheries off Northwest Africa

JaapJan Zeeberg [a,*], Ad Corten [a], Erik de Graaf [b]

[a] *Netherlands Institute for Fisheries Research, Haringkade 1, IJmuiden, The Netherlands*
[b] *Maritiem Nets, Kalkbranderstraat 5, Katwijk, The Netherlands*

Received 25 July 2005; received in revised form 22 December 2005; accepted 2 January 2006

Abstract

The accidental capture of large animals such as sharks, manta rays, sea turtles, and dolphins in pelagic trawler fisheries remains controversial because it threatens biological diversity in many biogeographical regions, including the subtropical eastern North Atlantic. Bycatch rates observed during more than 1400 trawl sets off Mauritania, Northwest Africa, are shown to have been considerable during the past 4 years, with high animal abundance in Summer when the Northwest African shelf is occupied by subtropical water. We demonstrate the urgency for bycatch reduction and evaluate the use of species-selective gear, a conservation method immediately available and immediately effective in waters fished through international access agreements. A modification tested in commercial trawls during the observer program guides pelagic megafauna deflected by a filter to an escape tunnel along the bottom of the trawl. This "excluder" reduces bycatch mortality of the most vulnerable megafauna species by at least 40–100%.

Keywords: Bycatch; Sharks; Dolphins; Selective gear; Conservation management; Biodiversity; Mauritania

1. Introduction

European fisheries off Mauritania, Northwest Africa, are possible through international access agreements and private arrangements that enable between 40 and 70 foreign trawlers to exploit the potential of this highly productive upwelling system. Sardinella, sardine, and horsemackerel are the target species of the European (Dutch and Irish) pelagic fleet, which operates nearly year-round with five to ten freezer-trawlers. These boats are amongst the largest fishing vessels in the world with installed horse power for trawling and freezing between 9000 and 18,000 hp. In the Mauritanian Exclusive Economic Zone (EEZ, 200 n mi) they operate within miles of each other and are often accompanied by dozens of Russian, Lithuanian, and Icelandic trawlers, all together yielding more than 500,000 tons of small pelagic fish per year. With these figures the Northwest African shelf is fully exploited (FAO, in press) and ranks amongst the most productive and most intensively fished areas in the world.

Conservation of biodiversity is largely unregulated in waters of developing countries, depending on the capacity and willingness of the coastal state to monitor and limit the exploitation of its marine resources. The United Nations 1995 Code of Conduct for Responsible Fisheries (http://www.fao.org/fi) provides internationally accepted guidelines for the development and implementation of national fisheries policies, including the use of species-selective gear. From its side, the European Union has approved the UN Convention on Biodiversity (1992) and endorses the Johannesburg agreements (2002) to substantially reduce loss of biodiversity by 2010. This entails a commitment to ensure the sustainability of "external" fisheries, i.e. operating outside EU jurisdiction, by implementing science and instruments adopted for Community waters within the Common Fisheries Policy (Comm. 2002, 637, Chapter 3.1).

While European governments have successfully negotiated fisheries agreements – the agreement with Mauritania is

* Corresponding author. Tel.: +31 255 564 709; fax: +31 255 564 644.
E-mail address: jaapjan.zeeberg@wur.nl (J. Zeeberg).

0165-7836/$ – see front matter © 2006 Elsevier B.V. All rights reserved.
doi:10.1016/j.fishres.2006.01.012

worth €430 million between 2001 and 2006 – there remains a need for concerted action to help implement protective measures in waters fished by the long-distance fleets. The accidental capture and mortality (bycatch) of larger non-target species has drawn both public and scientific attention. While public attention is commonly focused on cetacean mortality, fisheries have been demonstrated to constitute an immediate threat to the regional survival of many shark, sea turtle, and ray species, with no relief currently in sight (Brander, 1981; Spotila et al., 2000; Baum et al., 2003; Myers and Worm, 2003). The sheer size of the pelagic freezer-trawler fishery with net openings up to 90 m × 50 m invites speculation as to the amount of non-target animals killed and the effect on regional marine ecosystems. Elimination of the top predators will impact biodiversity by transforming natural species assemblages and ecosystem processes, and eventually this will jeopardize commercial fish stocks.

This paper presents pelagic megafauna bycatch rates observed during more than 1400 trawl sets off Mauritania, Northwest Africa, between October 2001 and May 2005 (Fig. 1). The monitoring program was part of an experiment to limit bycatch and improve fishing efficiency by using a simple gear adaptation, which enables large animals to escape alive and undamaged, in combination with satellite remote sensing to avoid areas preferentially sought by megafauna species. Protection of marine biodiversity from fisheries commonly focuses on closing off fishing areas ("marine reserves") or seasons, but this must be economically feasible, requiring broad political support and extensive monitoring of fishing activity. In contrast, gear modifications, such as the turtle excluder device (TED) used in USA shrimp fishery (Watson and Seidel 1980) and the Nordmøre-type grid used in Barents Sea shrimp fishery (Isaksen et al., 1990), provide immediate mitigation in areas that need it most. The urgency for bycatch-reducing measures off Northwest Africa remains debatable, due to a paucity of observations over the past ca. 40 years of industrial fishery, preventing the identification of stock trends, and because knowledge on the thresholds and dynamics of megafauna populations is sparse. However, the biological significance of the established take rates, and effects of animal removal at population level can be established for many of the species in this study by comparing with stock trends, abundance estimates, and conservation policies established elsewhere, e.g. in the western Atlantic Ocean.

2. Materials and methods

2.1. Megafauna bycatch rates

The objective of the bycatch-monitoring program was to assess monthly totals and establish whether these warrant mitigation. Bycatch has been identified when taken on board a trawler during the haul process. The bycatch is retained in a "filter grid" designed to prevent entering of large non target-animals into the cod end (Fig. 2). Few animals arrive on deck alive and most suffocate and succumb to water pressure while caught in the filter grid (Fig. 3). The grid is rigged with a zipper junction that enables emptying of the filter outside of the vessel, but the animals are often entangled and are commonly

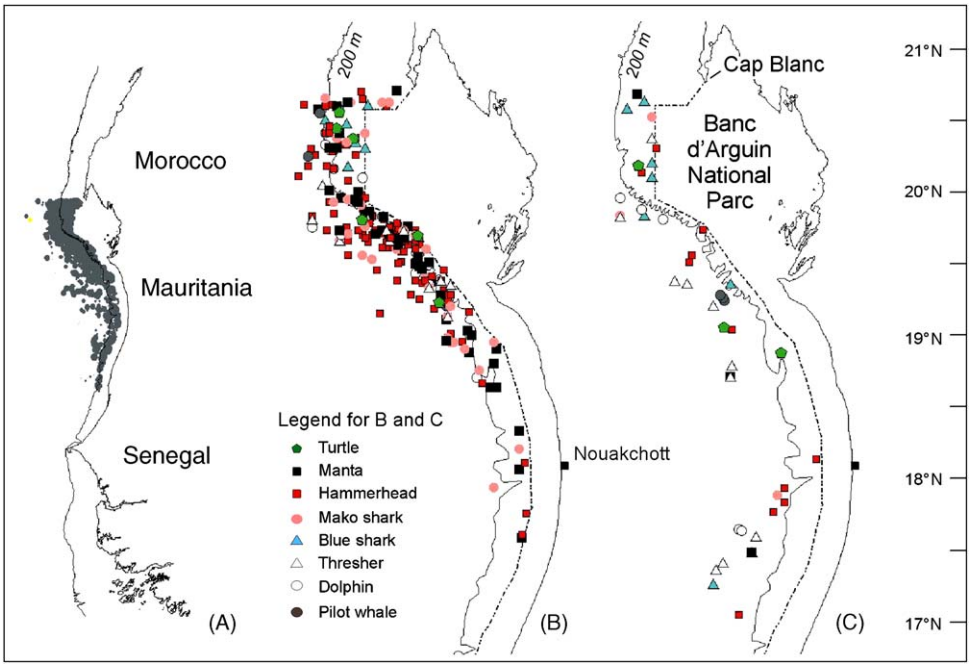

Fig. 1. (A) Fishing effort of one vessel in the Mauritanian EEZ between 2001 and 2005; (B) Megafauna bycatch off Mauritania, Northwest Africa during Summer (JASO) sets: with tropical species moving over the shelf (200 m bathymetry) into water with high primary productivity; and (C) Bycatch during Winter, with dolphins and oceanic sharks over deeper water. Broken line marks the extent of the 12–15 n mi fishing limit.