INTERACTIONS BETWEEN MARINE MAMMALS AND DEEP WATER TRAWLERS IN THE NAFO REGULATORY AREA

Santiago Lens

Instituto Español de Oceanografía
Centro Oceanográfico de Vigo
Fax: 86 492351
E mail: Santiago.Lens@vi.ieo.es

Keywords: Incidental catches, marine mammals, NAFO, trawlers

ABSTRACT

Starting in 1990, a deep water trawl fishery for Greenland halibut in the NAFO Regulatory Area was developed by Spain. At the same time an observer’s program to collect information about the fishery was put in operation. In 1993 and 1994 the observers collected information on sightings and incidental catches of marine mammals.

The observers made 264 sightings of marine mammals, belonging to 10 cetacean and 3 pinniped species, with the sperm whales, the northern bottlenose whale, the pilot whales and the harp seals among the most frequently observed species.

Information about fishing operations and their interactions with marine mammals was obtained in more than 14 000 individual hauls. Their presence in the nets was recorded on 57 occasions. Incidental catches didn’t occur in 46 of the 74 fishing trips observed. The majority of the remaining 37.8% trips registered one catch (n=19) and only on a few trips were there more than one. The rate of sets with incidental catches over the total number of sets observed was 0.31%. A mortality of 42 specimens is reported, belonging to four cetacean species (Atlantic white-sided dolphin, striped dolphin, common dolphin and long-finned pilot whale) four pinniped species (harbour, harp, ringed and grey seals) and unidentified cetacean and pinniped species. The rate of sets with mortality was 0.27%. The 73.8 % of this mortality corresponds to the seals.
The data obtained were compared with the information available from similar fisheries, it being estimated that the Greenland halibut fishery has a relatively low level of interactions and marine mammal mortality.

INTRODUCTION

The Spanish deep water trawl fishery in the NAFO Regulatory Area started in 1990. The Greenland halibut is the target species and grenadiers are the most important by-catch. Initially the fishing area was located in the Flemish Pass (47°N-47°W, approx.) but in the following years extended to the south, covering NAFO Divisions 3L, 3M and 3N (figure 1). Fishing depths are usually between 800 and 1700m. (Junquera et al., 1992). The fleet is composed of two categories of boats: larger boats, with engines between 950 and 2400 HP and a GTW between 280 and 1600 MT and smaller boats, with power between 800 and 1800 HP and a tonnage between 300 and 700 MT. The larger boats have a bigger capacity to trawl against the current and to greater depths than the smaller ones. The fishing gear is a conventional trawl fishing net adapted to deep trawl fishing. The typical net set lasts about 5 hours and the trawling speed is 3 knots.

An observer scheme was in operation from the beginning of the fishery to monitor the fishing activities and to provide biological information about the main species of the fishery. In 1993 and 1994 the observers incorporate into their duties the observations on incidental catches of marine mammals, turtles and sea birds, following the recommendations of several international organizations (ICES, 1996; IWC, 1994). They also made opportunist observations on sightings.

In this paper the data obtained by this observer scheme throughout 1993 and 1994 on sightings and incidental catches of marine mammals are presented.

MATERIAL AND METHODS

The sampling scheme for the study of the fishery had a high degree of coverage, the specific lay out is described in Durán et al. (1996). The observers spent periods of five months at sea, covering one whole fishing trip in the same boat or changing between boats in the fishing area until they had completed that period.

In order to record the interactions between the fishing activities and the marine mammals the observers were provided with an instructions manual, field guides, data forms, measurement tape and photographic equipment. The observers recorded any entanglement or trapping of marine mammals in the fishing gear. Some of the animals caught were in an obvious state of decomposition, indicating that the specimen was already dead when captured and therefore these were not considered true incidental catches.
The observers reported the date, position and set number of the incidental catch along with information on the species incidentally taken. The species, number of animals, observations on the physical state and live releases of the animals were recorded. As far as possible, sex determination, morphological measurements and photograpbis were also made. All other relevant data about the fishing activity were retrieved from the general fishery database. Sightings observations were made opportunistically by the observers, recording the species, number of animals present, date and location of the observation and weather conditions.

RESULTS

Between January 1993 and December 1994, 36 boats were sampled covering 74 fishing trips totally or partially. The interactions of marine mammals with the fishing operations were recorded on a total of 4,726 fishing days and 14,211 sets (table 1).

Marine mammals sightings.
During that period the observers made 264 marine mammals sightings, most of them at short distances from the boats. In some cases the specific level could not be ascertained. Cetacean sightings were much more frequent (80.3%) than the pinniped ones. The sperm whale (*Physeter macrocephalus*) was the most sighted species (23.1%) and dolphins, mainly the common dolphin (*Delphinus delphis*), were also seen frequently. Other species observed regularly were the pilot whales (*Globicephala melaena*) and the bottenose whale (*Hyperoodon ampullatus*). Among the pinnipeds the most frequent species was the harp seal (*Phoca groenlandica*) (figure 2). Considering both the frequency of sightings and the size of the groups, pilot whales and bottenose whale were the most abundant species, followed by common dolphins, sperm whales, harp seals and white-sided dolphins (*Lagenorhynchus acutus*).

Although sightings were made all year round some seasonal trends were detected. Sperm whales were seen from March to November but more frequently in May-June. Ziphiiids sightings concentrate in August and dolphins were sighted more frequently in the period July-October. Pinnipeds were only sighted from November to June, March and April being the months with the greatest number of observations. Sperm whales sightings spread all over the fishing area. Dolphins concentrate on the southeast slopes of the Grand Bank but were also observed in deeper waters south of Flemish Pass. Pilot whales were seen all along the slopes of the Grand Bank. Ziphiiids were sighted in deep waters north of the Flemish Pass and to a lesser extent to the south of the Grand Bank. Seals sightings were mainly made to the north of the fishing area and in the Flemish Pass.

Incidental catches.
The interactions amount to a total of 57 cases with 60 animals involved. Individual animals were caught in each event except in three cases where two specimens entered in the same haul. Thirteen animals: three harbour porpoises (*Phocoena phocoena*), three white-sided dolphins, two unidentified dolphins, three harbour seals (*Phoca vitulina*), one harp seal and one unidentified seal, were in an advanced state of decay.
A total of 47 incidental catches were recorded belonging to four cetaceans and four pinnipeds species. Seals were more frequently caught than cetaceans. Among the seals 21 specimens were not identified, the others were harbour seals (n= 7), harp seals (n=4), grey seals (*Halichoerus grypus*) (n=3) and ringed seals (*Phoca hispida*) (n=1). Among the dolphins there were white-sided dolphins (n=6), striped dolphins (*Stenella coeruleoalba*) (n=2), common dolphins (n=1), pilot whales (n=1) and unidentified dolphins (n=1) (figure 2). Some of the seals were caught alive and released with no evident signs of damage. These were one harbour seal, one harp seal, one grey seal and two unidentified seals.

Seals catches were made all year round but they were more important in the period April-June (69.4%). Dolphins were caught from July to November: the biggest number of cases were recorded in September, coinciding with the period with more small cetacean sightings. Marine mammal takes concentrate in the north of the Flemish Pass (mainly seals catches) and along the southeastern slopes of the Grand Bank (both dolphin and seal catches). The incidental catches usually occur in areas where the same species were sighted, although on the south of the Grand Bank some seals were incidentally caught but they were not sighted by the observers (figure 3). A high percentage (47.8%) of the incidental catches were made in waters less than 900 m. deep, but its significance is reduced by the fact that six of them were made on the same fishing trip. Incidental catches tend to be less important with the increase of the bathymetry. With respect to the daily distribution, the takes of marine mammals were more abundant in the two six-hour periods between noon and midnight.

Incidental catches were not recorded on 46 of the 74 fishing trips observed. The majority of the remaining 37.8% trips registered one catch (n=19) and only on a few trips were there more than one (figure 4). The rate of sets with incidental catches (number of sets with incidental catches divided by total number of sets observed) was 0.31%.

To look at differences between types of boats and years, an incidental catch rate for seal (I_s) and dolphin (I_d) groups was defined as: 

\[ I = \frac{\text{incidental catches/sets observed}}{100} \]  

(table 2). Small boats have an index of seal catches bigger than the dolphin one in both years. The greater boats do not show a regular pattern, because they only caught dolphins in 1993 and only seals in 1994. Altogether there is a similar dolphin index in both types of boats whereas seal catches tend to be greater in the smaller boats. For the whole fleet the rate of incidental catches was greater in 1993 than in 1994. The incidental catch rate for the whole fleet and for both years has a value of 0.33, that is 3.3 specimens were caught every 1,000 hauls made in the fishery in the period studied.

Occasional observations made on the interactions between incidental catches and the trawling operation pointed out that most (five out of eight) of the catches occur at the end of trawling or when the net was being hauled aboard. Three other observations describe seal catches at the setting of the nets, coinciding with the presence of seals astern of the boats.

Five of the animals incidentally caught (all seals) were released with no apparent damage. The fishing activities controlled by the observers produced a mortality of 42 animals. 73.8% of this mortality correspond to the seals. The species with the biggest mortality were the harbour seal and the white-sided dolphin, with six animals dead in each case. Other species with mortality were the striped dolphin (n=2), the common dolphin (n=1), the pilot whale (n=1), the harp seal
(n=3), the grey seal (n=2) and the ringed seal (n=1). Many other seals that died as a consequence of the fishing activities were allocated to unidentified species. The proportion of sets with mortality was 2.7 over 1,000 hauls made in the fishery. The mortality rate per set was 0.003.

DISCUSSION

Fifteen species of marine mammals were identified in the deep water trawl fishing area, coinciding with previous descriptions about the presence of different cetacean and pinniped species. The cetaceans observed belong to oceanic species that at least during part of the year frequent the slopes of the continental shelf looking for food (Reeves and Mitchell, 1988). Most seals species reported by the observers are present in the area of the fishery all year round, while some are migratory (Jefferson et al., 1993). The distribution of the marine mammal catches seems to reflect the range of the species and also the geographic distribution of the fishing effort. The area with the greatest concentration of incidental catches (the limit between Areas 3L and 3M) coincides with the zones of maximum fishing effort (Durán et al., 1996, J. Paz, pers. com.).

The role of marine mammals in the ecosystem, with special reference to the NAFO area was reviewed by Stenson and Sigurjonsson (1995). Northridge (1984; 1991) describes the incidental catches in the trawl fisheries of the northwest Atlantic, mentioning several species of dolphins (bottlenose, Risso’s, white-sided and common dolphin). Other authors enlarge the list of species incidentally caught in Newfoundland and surrounding waters with the pilot whale, and the harp and hooded seals (Platt and Nettleship, 1989; Fairfield et al., 1993; Pemberton et al., 1994).

In the Atlantic mackerel fishery of the United States, Fairfield et al. (1993) report daily pilot whale kill rates ranging between 0.05 and 0.19. In the Greenland halibut fishery the equivalent rate for all species is 0.0088 incidental takes per fishing day. The average rate of seal catches in the trawl cod fishery off Newfoundland is 0.7 seals per set (Pemberton et al., 1994). In the fishery investigated in this paper an incidental catch rate of 0.0032 seals per set was found.

Assuming that the observer effort and the sampling strategy adopted were appropriate to represent the fishing activities in this Greenland halibut fishery it can be concluded that the relative level of interactions and incidental catches of marine mammals in the deep water trawl fishery is low. These first estimations may help to assess the total mortality supported by several cetacean and pinniped species in the NAFO Regulatory Area.

ACKNOWLEDGEMENTS

I am indebted to S. Junquera, J. Paz and P. Durán for their help in obtaining data of the deep water trawl fishery and their comments on this paper. I also want to thank the many observers in the fishing fleet for their effort and dedication.
REFERENCES


### TABLE 1
FISHING EFFORT SAMPLED

<table>
<thead>
<tr>
<th></th>
<th>1993</th>
<th></th>
<th>1994</th>
<th></th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Big</td>
<td>Small</td>
<td>Total</td>
<td>Big</td>
<td>Small</td>
</tr>
<tr>
<td>DAYS</td>
<td>651</td>
<td>1 850</td>
<td>2 501</td>
<td>1 649</td>
<td>576</td>
</tr>
<tr>
<td>HAULS</td>
<td>1 950</td>
<td>5 652</td>
<td>7 602</td>
<td>4 865</td>
<td>1 744</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### FIGURE 2
SPECIES SIGHTED AND INCIDENTALLY CAUGHT
Fig. 3
Incidental catches

Common dolphin
Striped dolphin
White-sided dolphin
Pilot Whale
Unidentified dolphin

Harbour seal
Ringed seal
Harp seal
Grey seal
Unidentified seals
FIGURE 4
FREQUENCY OF INCIDENTAL CATCHES PER FISHING TRIP

TABLE 2
INCIDENTAL CATCH RATES (I_d = dolphins, I_s = seals).

<table>
<thead>
<tr>
<th></th>
<th>Big boats</th>
<th>Small boats</th>
<th>Whole fleet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I_d</td>
<td>I_s</td>
<td>I_d</td>
</tr>
<tr>
<td>1993</td>
<td>0.26</td>
<td>---</td>
<td>0.07</td>
</tr>
<tr>
<td>1994</td>
<td>---</td>
<td>0.25</td>
<td>0.11</td>
</tr>
<tr>
<td>1993+1994</td>
<td>0.07</td>
<td>0.18</td>
<td>0.08</td>
</tr>
</tbody>
</table>