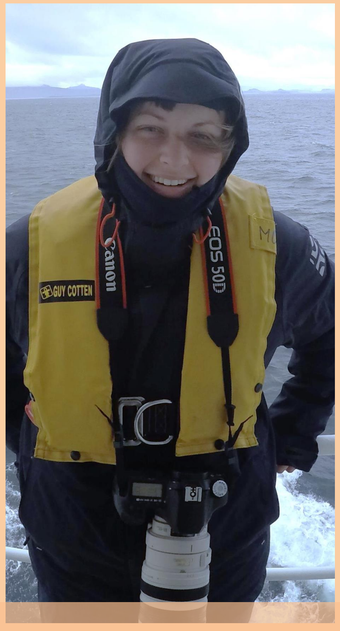


How do fishing practices influence sperm whale depredation (*Physeter macrocephalus*) on demersal longline fisheries?

Anaïs Janc[1*], Gaëtan Richard[1], Christophe Guinet[1], John P.Y. Arnould[2], Maria Ching Villanueva[3], Guy Duhamel[4], Nicolas Gasco[4] and Paul Tixier[2]

[1] Centre d'Études Biologiques de Chizé, CNRS-ULR, UMR 7273, Villiers-en-Bois, France
[2] School of Life and Environmental Sciences, Deakin University, Australia
[3] Laboratoire de Biologie Halieutique (STH-LBH), IFREMER, Plouzané, France
[4] Muséum National d'Histoire Naturelle, UMR 7208 BOREA, Paris, France

*anais.janc@cebc.cnrs.fr

facebook OrcaDepred

twitter #OrcaDepred

© Anaïs Janc

DEPREDATION

ECOLOGICAL CONSERVATION ISSUES

- Habituation to an artificial foraging behavior
- Modification of energy balance
- Increased risks of by-catch
- Lethal responses from Illegal, unreported and unregulated fisheries

© Saint-Thomas Production

- Influence of demographic trajectories of top predators
- Overexploitation of the targeted resources
- Ecosystem consequences

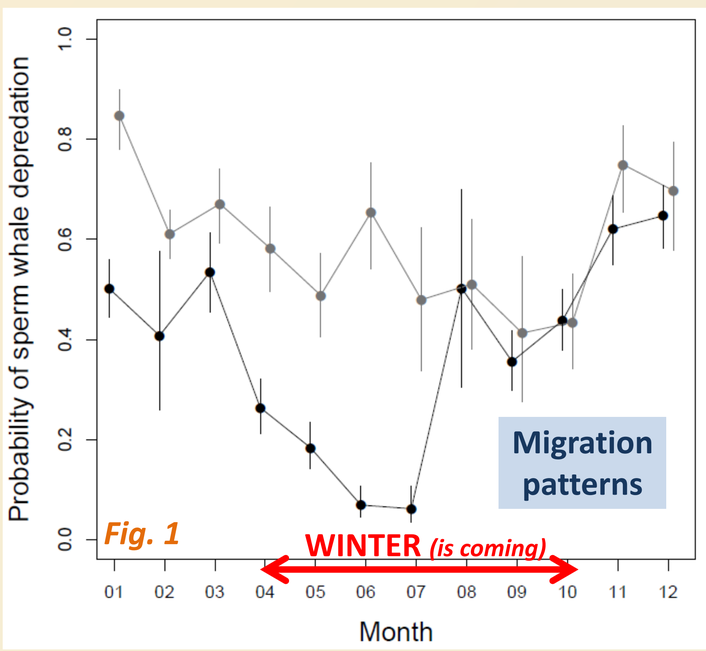
SOCIO-ECONOMIC ISSUES

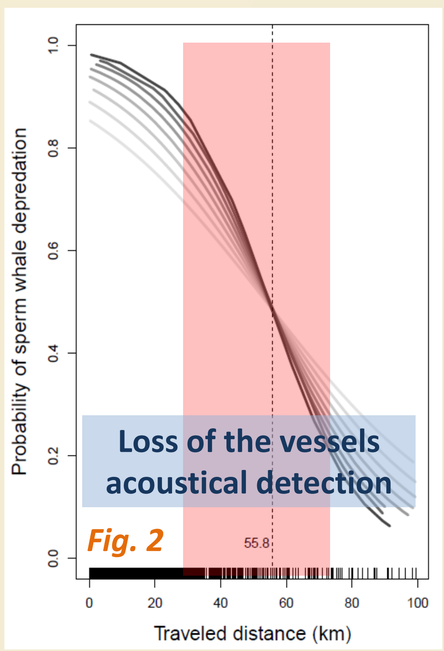
- Catch losses
- Additional fishing time
- Fuel consumption needed to complete fishing quotas
- Implementation of marine mammals avoidance strategies

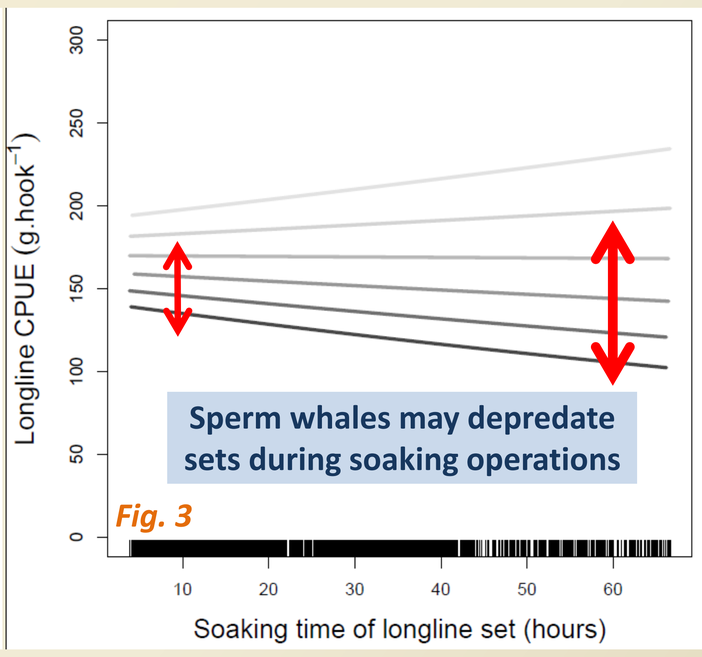
Marine mammal depredation on fisheries (animals removing fish caught on fishing gear) is a worldwide issue involving socio-economic and ecological consequences. Longline fisheries are the most impacted by odontocete (toothed whales) depredation. While technological means have provided limited efficacy in reducing depredation, this study examined the fishing practices influencing both the proportion of depredated longline sets and the amount of fish removed by whales. We used an 8-year dataset from the Patagonian toothfish longline fisheries operating in Crozet and Kerguelen Economic Exclusive Zones (EEZs) (South Indian Ocean) and GLMMs to investigate sperm whale depredation. Sperm whale depredation occurred on 61% of 5,260 sets in Crozet and 41% of 16,902 sets in Kerguelen, and resulted in minimum estimated toothfish losses of 266 tons and 1,281 tons, respectively, in the two areas. The probability of depredation decreased in winter months, increased with depth fished and decreased when vessels travelled over distances of > 60 km from fishing grounds with encountering depredation. These findings suggest the natural spatio-temporal distribution of sperm whales and their ability to follow vessels over limited ranges influence the number of captured fish removals. The amount of depredated toothfish decreased with the speed at which longline sets were hauled and increased with the soaking time of sets suggesting that whales may depredate sets during both hauling and soaking operations. Together, these observations indicate that rate of depredation may be influenced by both aspects of sperm whale ecology and by the conditions of fishing operations and, therefore, a combination of these factors could be employed to implement strategies of avoidance in all fisheries facing similar depredation impacts.

Depredation – Demersal longline – Sperm whale – Patagonian toothfish – Fishing practices

© Gaëtan Richard







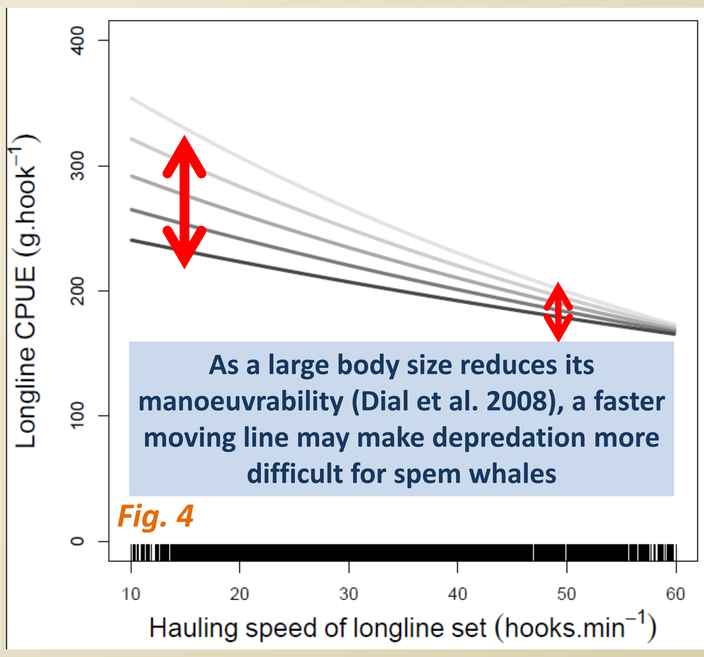


Fig. 1 – Intra-annual variations of the probability of sperm whale depredation to occur during hauling of sets in Crozet (grey) and in Kerguelen (black).

Fig. 2 – Predicted probability of sperm whale depredation to occur during hauling of the second of two successively hauled sets against the interaction effect between the distance travelled by vessels between these two sets and the number of sperm whales depredating on the first set. Each curve corresponds to a given number of sperm whales simultaneously depredating the first set, ranging from 1 (light grey) to 8 (dark grey).

Fig. 3 – Predicted estimates of the interaction effect between the soaking time of longline sets and the number of sperm whales depredating the same set on the toothfish CPUE. Each curve corresponds to a given number of sperm whales simultaneously depredating the first set, ranging from 0 (light grey) to 5 (dark grey).

Fig. 4 – Predicted estimates of the interaction effect between the hauling speed of longline sets and the number of sperm whales depredating the same set on the toothfish CPUE. Each curve corresponds to a given number of sperm whales simultaneously depredating the first set, ranging from 0 (light grey) to 4 (dark grey).

ACKNOWLEDGEMENTS

All the fishery observers and fieldworkers. Special thanks to P. Pruvost, A. Martin and C. Chazeau ("PECHEKER" database, supported by the Ministère de l'Agriculture et de l'Alimentation). Program 109, headed by H. Weimerskirch. The first author was financially supported by a departmental funding allocated directly by the Ministère de l'Éducation Nationale, de l'Enseignement Supérieur et de la Recherche (M.E.N.E.S.R) via the campaign doctoral contracts handicap 2015 (Contract n° 2015-5286).