

MODELING AND MAPPING TROPHIC OVERLAP BETWEEN MARINE MAMMALS AND FISHERIES ON A GLOBAL SCALE: IMPLICATIONS FOR FISHERIES MANAGEMENT

K. Kaschner<sup>a</sup>, R. Watson<sup>b</sup>, A.W. Trites<sup>a</sup>, V. Christensen and D. Pauly<sup>b</sup>

Abstract

The impact of fisheries on marine mammals and other components of marine ecosystems is a major concern. Fisheries - in addition to causing bycatch mortalities – may affect marine mammals through direct and indirect competition for food. We assessed the trophic impact of fisheries on mammal populations on a global scale by quantifying the overlap in resource exploitation in space and time using high-resolution modeling and mapping tools. We developed a generic model to predict the relative probability of occurrence of marine mammal species by relating information about species-specific habitat preferences to average oceanographic conditions in a raster-based GIS model. For each species annual food consumption estimates (specified by food types) was generated from population abundances, sex-specific mean weights, standardized diet compositions, and weight-specific feeding rates. By linking species-specific probabilities of occurrences with estimated consumption, we obtained spatially explicit food consumption estimates (expressed as proportions of total per 0.5° latitude/longitude cell). Superimposing geographically disaggregated fisheries catches (generated by a similar model) allowed the calculation of overlap between catches and consumption. Our model indicates that average consumption of marine mammals in the 1990s was several times higher than total fisheries catches. However, effective spatial overlap and exploitation of the same food types was relatively low, indicating that actual competition between fisheries and marine mammals may be much lower than proposed. We predict the highest overlap in the temperate to polar shelf regions of both hemispheres, though overlap is more pronounced in the North. The mapping of geographical “hotspots” of marine mammal-fisheries interactions will help to identify areas of highest conflict, which may aid in defining critical habitat and efficient MPAs design.

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<sup>a</sup> Marine Mammal Research Unit, Marine Mammal Research Unit, University of British Columbia, Hut B-3, 6248 Biological Sciences Road, Vancouver, B.C. Canada, V6T 1Z4.

<sup>b</sup> Fisheries Centre, 2204 Main Mall, University of British Columbia, Vancouver B.C., Canada V6T 1Z4