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I. TITLE OF PRESENTATION OR POSTER

Marine Debris: More than a low-grade fever for marine mammals and sea turtles

II. AUTHORS AND AFFILIATIONS

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IV. KEYWORDS

Marine mammals, sea turtles, marine debris, entanglement, ingestion, fishing gear, plastic

V. PROBLEM STATEMENT / BACKGROUND INFORMATION

Marine debris is one of the most pervasive pollution problems plaguing the world's oceans. Although, in principle, the problem of marine debris is solvable, evidence indicates that the problem is increasing, with significant implications for ocean wildlife. Numerous studies have reported on the threat that marine debris poses to ocean wildlife. Some cite interactions with individual animals; others are more comprehensive, tracking interaction trends for several species or species groups in a certain area over time. Reliable estimates of the total numbers of interactions are unavailable due to the unknown number and proportion of both unobserved and unreported interactions.

The most recent comprehensive reviews of marine debris impacts on ocean wildlife were Balazs (1985) for sea turtles and Laist (1997) for marine mammals and other wildlife species. They summarized reports primarily from peer-reviewed articles on types and numbers of interactions (entanglement or ingestion), species involved, and debris types. They also reported on which forms of marine debris or types of interactions appeared to be most hazardous to wildlife populations. They concluded that patterns of interactions differed by species, age, and life history, and that entanglement in marine debris was a more common source of mortality than is ingestion of debris for both marine mammals and sea turtles. Both types of interactions may be hindering recovery of certain species.

More recent studies have been published on sea turtle and marine mammal interactions with marine debris, but they continue to provide only a snapshot of the problem and are limited to certain species or geographic areas. The objective of this presentation was to provide a comprehensive and up-to-date global synthesis of available information on the impacts of marine debris on marine mammals and sea turtles. In particular, we sought to determine which species were reported as impacted by marine debris, the type of interaction, types of debris involved in those interactions, and data gaps.

VI. METHODOLOGY

Data collection involved an extensive literature review and requests from researchers resulting in 78 articles or reports on marine debris interactions that have occurred since the earlier reviews. These articles describe everything from interactions with individual animals to region-wide studies. Reports of entanglements in fishing gear are sometimes difficult to ascribe to active vs. passive fishing gear, so we considered only those entanglement reports of entanglements in which authors specified that interactions involved derelict (vs. actively fished)

fishing gear. Summary statistics were derived based on new information in those papers as well as data previously summarized by Balazs and Laist. For each journal article or report, we identified the species affected, type of interaction (ingestion vs. entanglement), and type of debris involved in reported interactions.

For both marine mammals and sea turtles, we summed the number of species reported with marine debris interactions. For marine mammals, species were sorted into one of six taxonomic groups (i.e., orders or suborders of marine mammals), and for each group, we summed the number of species in each of three interaction categories (i.e., entanglement, ingestion, or both) and affected by three broad categories of debris type (i.e., derelict fishing gear, plastic/other material, or both). Debris types were further subdivided into different types of derelict fishing gear (e.g. monofilament line, hook-and-line, etc.) and different types of plastic/other material (e.g., plastic bag, plastic sheeting, etc.). We then summed the number of species in each group reported as either entangled or having ingested debris and calculated the percentage of marine mammal species affected by the different types of debris for four possible interaction categories (entanglement in derelict fishing gear, ingestion of derelict fishing gear, entanglement in plastic/other material, ingestion of plastic/other material). Analysis of sea turtle data was similar, except all sea turtles were considered a single group. Reports consisted of a mix of single event accounts and systematic surveys, so interaction rates could not be determined.

VII. OUTCOMES

Reports of interactions with marine debris were found for all 7 species of sea turtles and 54 of 120 species of marine mammals (IUCN 2010); an increase of 5 marine mammal species and 1 sea turtle species since previous reviews. While entanglement in derelict fishing gear is more commonly reported than ingestion, reports of ingestion of both derelict fishing gear and plastic/other material are increasing, especially for toothed whales and sea turtles.

For marine mammals, debris interactions were reported for 54% (7 of 13 species) of Mysticete (baleen) whales; 32% (22 of 68 species) of Odontocete (toothed) whales; 81% (13 of 16 species) of Otariids (eared seals); 47% (9 of 19 species) of Phocids (true seals); 50% (2 of 4 species) of Sirenians (manatees and dugongs); and the one species of marine Mustelid (sea otter). Overall, more marine mammal species were reported only as entangled in debris (n=25) than only having ingested it (n=18), whereas 11 species had reports of both types of interactions. Interactions with derelict fishing gear only was reported as affecting more marine mammal species (n=18) than interactions involving only plastic/other material (n=13), whereas 23 other species had reports of interactions with both types. Entanglement in derelict fishing gear was reported far more frequently as a species only type of interaction than was ingestion of derelict fishing gear (36 vs. 11 species). For plastic/other material, ingestion was reported far more frequently than it was for entanglement (27 vs. 12 species). The prevalence of different debris types that cause entanglement and ingestion based on the percent of affected marine mammal species is shown in Figures 1 and 2. The most commonly reported types of derelict fishing gear affecting marine mammals are nets, multi-strand rope, and hooks-and-line. The most commonly reported plastic/other material affecting marine mammals are plastic bags, plastic pieces, plastic sheeting, and rubber bands.

For sea turtles, all 7 species had reports of entanglement and ingestion. Interactions with both derelict fishing gear and plastic/other material were also reported for all species. Entanglements involving both derelict fishing gear and plastic/other material were reported for all species, while ingestion of both debris types was reported for 6 out of 7 species (no reports have yet to document ingestion of fishing gear by flatback turtles). The prevalence of different debris types that cause entanglement and ingestion based on the percentage of affected sea turtle species is

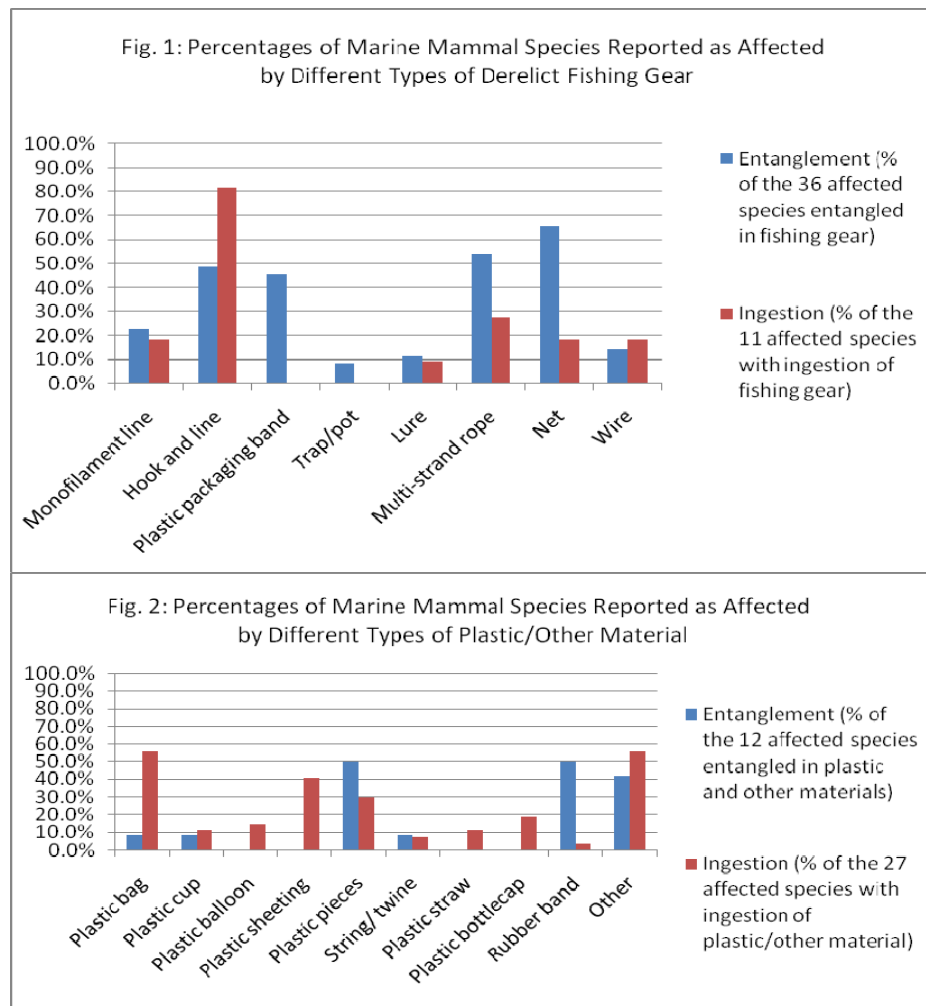
shown in Figures 3 and 4. The most commonly reported types of derelict fishing gear affecting sea turtles are multi-strand rope, nets, hooks-and-line, and monofilament line. The most commonly reported plastic/other materials are plastic bags, plastic pieces, string/twine, and burlap bags. Sea turtles are also commonly reported with ingested tar/oil (although this is not typically considered marine debris).

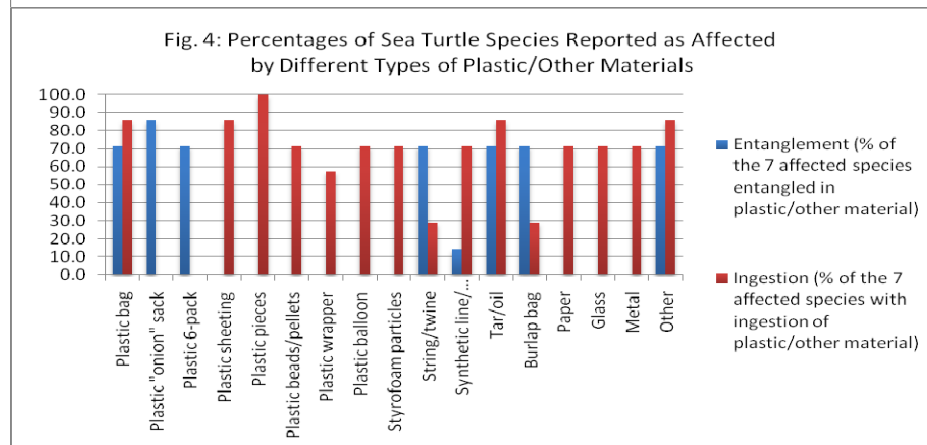
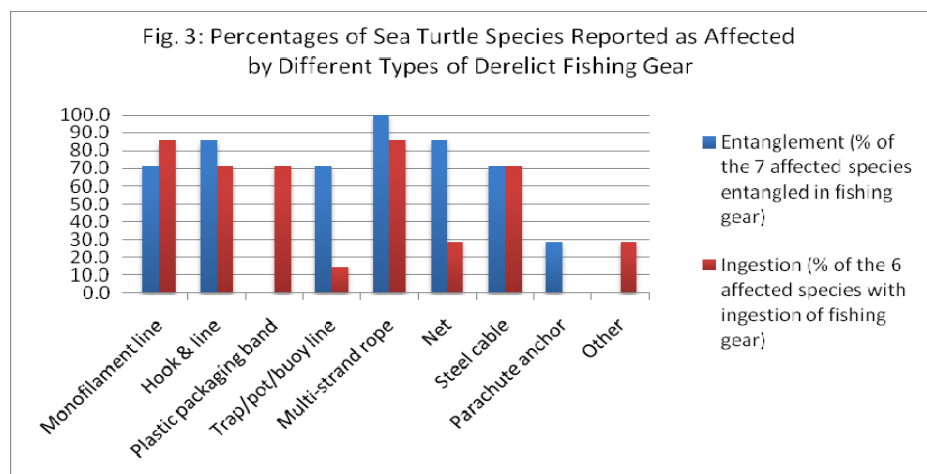
VIII. PRIORITY ACTIONS

Marine mammals and sea turtles become entangled in and ingest all types of marine debris, particularly plastic/other material and derelict fishing gear. UNEP (2009a; 2009b) has recommended development of international policies and regional action plans to minimize all sources and types of debris. To maximize mitigation of impacts on marine mammals and sea turtles, those plans should emphasize efforts to minimize derelict fishing gear (including recreational gear) and commonly ingested plastic items.

Only a handful of studies have attempted to quantify numbers of animals within an area or species affected by debris, or the sex and age classes of species most vulnerable. More comprehensive risk assessments and systematic, routine monitoring of marine debris sources, types, and interaction levels in all marine mammal and sea turtle habitats are needed to address these data gaps. Population level assessments of debris impacts are also needed.

IX. FIGURES AND TABLES





X. REFERENCES

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References for the 78 articles reviewed as part of this analysis can be obtained from the authors.