DYING AT OUR CONVENIENCE

The impact of marine debris on whales, dolphins and porpoises

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INTRODUCTION

Increasingly global in its distribution and pervading even the deep seas and polar regions, marine debris poses a serious threat to marine habitats and wildlife.

The term 'marine debris' refers to solid materials of man-made origin in the marine environment, and encompasses all forms of discarded or lost waste. Estimates indicate that approximately 6.4 million tonnes - equivalent to the weight of 40,000 Boeing-747 airplanes - of marine litter enters the oceans every year, resulting in an estimated 13,000 pieces of litter within every square kilometre of ocean.[1] In hotspots of accumulation, this exceeds 3.5 million pieces of litter per square kilometre.[2]

These quantities are only set to rise; plastics now constitute between 60-80% of marine debris and persist in the marine environment.[3] They may fragment, but do not usually biodegrade, potentially persisting for hundreds to thousands of years.[4] Meanwhile, there is mixed evidence as to whether international legislation has had any impact in stemming debris inputs.[5] Marine wildlife is now paying the price for our throwaway society. Although there is a lack of up to date information on the scale of the problem, it can be very conservatively estimated that each year more than 100,000 marine mammals die from ingesting or becoming entangled in debris.[6] Marine debris has the potential to affect all trophic levels and for its impacts to affect the entire food chain, from planktonic microorganisms through to marine megafauna including cetaceans.[7]

EATING LITTER

In cetaceans, ingestion of debris can have multiple impacts including:

- Complete blockage of the digestive system and starvation;
- Internal injury and disease;
- Inducing the feeling of satiation and reducing the feeding stimulus leading to reduced growth rates and productivity, endocrine disruption and malnutrition;
- Increased pollution loads.

Ingestion of micro-plastics (pieces smaller than 5mm) is an additional source of pollutants for cetaceans. Some pollutants absorb onto small pieces of plastic which are then consumed by animals. Plastics also contain certain substances, such as plasticisers, which may also be transferred through ingestion of particles.[8]

The impacts of marine debris on cetaceans have not been adequately studied, and it is difficult to safely ascribe trends in exposure rates. However, in combination with increasing levels of marine debris in the marine environment, data indicate a worrying increase in ingestion by cetaceans. According to a recent review, ingestion of debris has now been documented in 252 cases, affecting at least 38 cetacean species, 44% of all known cetacean species.[9] It is probable that, to some extent, all species are affected but some populations may be particularly vulnerable, in particular those whose feeding grounds are affected by the accumulation of debris.

Plastics constitute the majority (56%) of the debris recorded as ingested by cetaceans, with derelict fishing gear also a dominant component (27%). Debris items

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TOP:
marine debris found in the stomach of a stranded gray whale.

ABOVE:
Plastic cylinder ingested by gray whale.

ingested range in size from microplastics to large pieces of plastic sheeting or netting.[10]

Examples include:

- Sperm whale: Ingestion of 105 pieces of netting, line and plastic, ranging in size from 10cm2 to 16m2;[11]
- Cuvier's beaked whale: Ingestion of 378 items with a collective weight of 33kg;[12]
- Minke whale: Ingestion of 22 pieces of plastic, equalling a total volume of around 15 litres.[13]

Low detectability

There are often no obvious external signs of ingestion of debris and it has a high potential to remain undetected.[14] If taken at face value, the 252 cases of ingestion recorded in a recent review, and the resulting mortality rates, might be interpreted as an insignificant threat to cetacean populations. However, stranding rates of dead cetaceans are very low,[15] few bodies are adequately examined to allow detection of debris as the cause of death, and thus the real mortality rates are likely much greater. Detection of debris ingestion by some of the whales living in the deepest oceans may be exceptionally difficult as so few bodies are ever seen and yet some of these whales, for example the beaked whales that feed in deep trenches where marine debris might accumulate, may be especially vulnerable.[16]

Ingestion is likely to be a more serious issue than it may appear as evidenced by those studies which have considered larger sample sizes from animals bycaught in nets. These show debris ingestion prevalence rates of 10-27%.[17] Whilst mortality rates are the principal concern resulting from debris ingestion, there may also be significant chronic effects on health which threaten the long-term viability of cetacean populations.[18]

ENTANGLEMENT

Whilst it frequently remains difficult to separate entanglement in active fishing gear from entanglement in debris, some 57 cases of debris-entanglement involving 15 cetacean species have been recorded and the data indicate that this is increasing. Abandoned, lost or discarded fishing gear (ALDFG) causes the majority of entanglements of cetaceans. With ALDFG, there is a high risk of repeated 'ghost-fishing' with nets and lines ensnaring multiple individuals.

Entanglement can often cause progressive debilitation over a period of months or years, resulting in a painful and prolonged progression to death. In lethally-entangled North Atlantic right whales, the average time to death was found to be 5.6 months but in some individuals took up to one and a half years.[19] Beyond the mortality of entangled cetaceans, the welfare implications of entanglements are severe, representing "one of the worst forms of human-caused mortality in any wild animal".[20]

Effects of entanglement can include:

- Immediate mortality through drowning;
- Injury;
- Progressive constriction and tissue damage as individuals grow;
- Limited foraging ability and increased energy expenditure, leading to malnutrition, starvation and consequent impacts on productivity;
- Reduced capacity for engaging in social behaviours, including reproduction;
- Reduced mobility making cetaceans more prone to other threats such as vessel strikes.

Examples include:

- **Bowhead whale:** Approximately 10% of the population suffers from entanglement in fishing gear, of which ALDFG is the main likely culprit.[21] The resulting mortality rates and population impacts are unknown;
- **North Atlantic right whale:** 57% of the population bears evidence of entanglement interactions. Entanglement is identified as one of the factors impeding population recovery.[22] The contribution of ALDFG or active gear to these entanglements is unknown;

Low recovery rates of dead bodies also affect the evaluation of entanglements. Studies of scarring patterns of stranded whales suggest that less than 12% of entanglement interactions are reported.[23] An added problem is that the relative contribution that ALDFG, as opposed to actively deployed gear, makes to entanglement mortalities is unclear because the origin of gear cannot always be determined. In a recent review, records of cetacean entanglement where the origin of fishing gear was unknown or likely included both active gear and ALDFG numbered 2,281, compared to the 57 cases where ALDFG was identified.[24] It is therefore highly likely that under-detection of entanglement in debris occurs due to misidentification of ALDFG as active gear.

CONCLUSIONS

The continual influx of litter from marine and land based sources into our oceans has produced a marine environment in which no region or species may remain unaffected. For cetaceans, the threats posed by marine debris are multiple, ranging from direct injury and mortality as a result of entanglement in, or ingestion of, debris, to secondary effects through transfer of chemical pollutants, habitat degradation and effects on prey populations.

Marine debris interactions are a largely unseen and unquantified threat with respect to cetaceans. Clearly marine debris presents significant animal welfare problems at the individual level and, therefore, warrants attention from marine policy makers. At the population or species level, our low ability to detect debris interactions, combined with the low power to detect changes in population abundance from current estimates, prevents us from determining and quantifying the scale of the impacts. However even low observed rates of entanglement have resulted in population-level impacts in other marine mammal species. The impact of marine debris on cetaceans therefore urgently requires more dedicated research.

Over the last ten years a growing number of governments[25] and inter-governmental organisations – including UNEP,[26] the Convention on Biological Diversity,[27] the Convention on Migratory Species[28] and the Asia-Pacific Economic Cooperation[29] – have formally recognised the need for urgent and co-ordinated action to address this multi-faceted problem and stated an intention to take such actions.[30] However, despite the adoption of a number of international laws and other initiatives dating from 1973 onwards and aimed at reducing inputs of marine and land-based waste into the marine environment, evidence suggests that quantities of debris and debris interaction rates are continuing to increase.[31] Greater effort needs to be made to better understand the risk that ingestion of and entanglement in marine debris poses to cetaceans – both as individuals and populations. The IWC provides an ideal forum for experts to coordinate international monitoring of impacts, develop mitigation and advance international action on this issue with regard to cetaceans.

"Plastics form the majority of the debris recorded as ingested by cetaceans"

BELOW:
Sperm whale stranded in Canary Islands.

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RECOMMENDATIONS FOR THE IWC

We recommend that the IWC holds a workshop on marine debris, the primary aim of which would be to determine how to best investigate quantitatively the ways in which marine debris is affecting cetaceans and how best to monitor and mitigate for these effects. A workshop could also build the foundations for the IWC to undertake future actions on this issue, which could include:

- Dedicated surveys of habitats which may be especially affected, including those in the deep seas;
- Producing a centralized database to collate cases of debris interactions;
- Standardisation of data from strandings networks to allow more certain identification of types of fishing gear and whether gear is active or derelict (i.e. debris) at the time of impact;
- Analysis of global data to determine the rate of interactions, resulting rates of mortality and other fitness-related pathology in order to evaluate population level impacts;
- Identification of which types of marine debris (including different types of fishing gear) are most likely to result in morbidity and mortality of cetaceans;
- Consultation with veterinarians and animal welfare experts to more fully understand the negative health and welfare implications of cetaceans' interactions with marine debris;
- Determination of the prevalence of micro-plastic ingestion, potential toxicological impacts for cetaceans and principle sources of micro-plastics in the marine environment;
- Identification of populations and habitats of highest concern and priority areas for future research;
- Formulation of actions to prevent and mitigate the impacts of marine debris on cetaceans and co-ordination with other relevant IGOs working on marine debris, including UNEP's Honolulu Strategy, to promote synthesis of mitigation efforts.

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27 E.g. Agenda item 6.2 of the 16th meeting of the Subsidiary Body on Scientific and Technological Advice (STAP) to the Convention on Biological Diversity. Montreal, 30 April - 5 May 2012

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