

UNITED
NATIONS



UNEP

**United Nations
Environment
Programme**

EP

Distr.
LIMITED

UNEP(DEC)/CAR WG.27/INF.5
18 July 2005

Original: ENGLISH

Regional Workshop of Experts on the
Development of the Marine Mammal Action
Plan for the Wider Caribbean Region

Bridgetown, Barbados, 18-21 July 2005

**A REVIEW OF FISHERIES BY-CATCH OF MARINE MAMMALS
IN THE WIDER CARIBBEAN REGION**

A REVIEW OF FISHERIES BYCATCH OF MARINE MAMMALS IN THE WIDER CARIBBEAN REGION.

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Introduction

For years, it has been acknowledged that the fishing industry represents an area of human activity that has one of the most profound effects on marine mammals (Northridge 2002). From a fisheries point of view, Alverson et al. (1994) defined “Incidental Catch” as any “retained catch of non-targeted species”; on the other side, the “portion of the catch returned to the sea as a result of economic, legal, or personal considerations is called “Discarded Catch”. Bycatch is then defined as the sum of Incidental and Discarded catch. In this paper, bycatch is defined primarily as the unintended capture or death of marine mammals as a result of interactions with fishing gear.

The effects of the fishing industry on marine mammals have been broadly categorized as “operational” and “biological”. Operational effects include interactions between fisheries and marine mammals that relate to the mechanical process of fishing. Biological effects occur when fisheries may cause changes to the species composition of the marine environment (Northridge 2002).

Management of bycatch is one of the most complex issues that fisheries managers have to deal with, as it involves legal, social, economic and conservation considerations (Rawson 1997). Efforts to assess the impact of bycatch on marine mammal populations –mainly cetaceans- date back to the mid 70’s when the International Whaling Commission (IWC) Scientific Committee’s Subcommittee on Small Cetaceans highlighted a number of regional bycatch problems. In 1990, the IWC convened a workshop on mortality of cetaceans in passive fishing nets and traps, in La Jolla, California. This workshop reviewed causes of incidental mortality of cetaceans and attempted to identify solutions (see Reeves et al. 2005). Additional reviews of worldwide interactions between fisheries and marine mammals were requested to the Food and Agriculture Organization of the United Nations (FAO) by the United Nations Environment Program (UNEP) during the mid 80’s and early 90’s (see Northridge 1992). Finally, at the turn of the century, a Global Bycatch Initiative was launched by the U.S. World Wildlife Fund (WWF) with the purpose of “*reducing bycatch levels to prevent depletion and in some cases extinction, of cetacean populations*” (Reeves et al. 2005).

International and regional agreements such as the Convention on the Conservation of Migratory Species (Bonn Convention), the Convention on Biological Diversity (CBD) and the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention) as well as the Protocol Concerning Specially Protected Areas and Wildlife (SPAW Protocol) of the latter, provide a foundation for conservation of marine mammals in the region. According to the General Obligations agreed by the Parties to this Protocol, “*each Party, to the extent possible, consistent with each Party's legal system, shall manage species of fauna and flora with the objective of preventing species from becoming endangered or threatened*”. On the other side, such instruments as the “*International Code of Conduct for Responsible Fishing*” of the FAO recommend the States to “*collect reliable and accurate data which are required to assess the status of fisheries and ecosystems, including data on bycatch, discards and waste*” (FAO 1995).

In this paper, we review the current knowledge about species affected by fisheries operations in the Wider Caribbean Region (WCR), outline scientific gaps and propose measures for responsible management of fisheries. This review is by no means exhaustive but a starting point for future management of bycatch.

Account of species involved in bycatch.

Recent reviews of interactions between marine mammals and fisheries suggest that the number of cetacean mortalities probably underrepresent the true situation (Fertl and Leatherwood 1997). At a global level, bycatch remains the greatest immediate and well-documented threat to the survival of some species and/or populations (Reeves et al. 2005). Recent estimates indicate that hundreds of thousands of cetaceans die worldwide every year as a result of interactions with fisheries (Reeves et al. 2005). For some species and populations, severe decline in numbers because of bycatch (i.e. vaquita, baiji, North Atlantic right whales, among others) deserve highest priority for conservation efforts (Vidal et al. 1994, see also Table 1 in Reeves et al. 2005).

Despite the increased attention to adequately mitigate the deleterious operational effects of fisheries on marine mammals, few systematic efforts has been made to evaluate and manage such effects in the Wider Caribbean Region (WCR). In practice- little countries in the WCR count on enough resources, expertise and/or technological development for adequate management of issues like this. Most of the research effort has been made in the U.S. Gulf of Mexico, where official Observer Programs gather data on effort, catch and bycatch of marine mammals in trawl, longline and gillnet fisheries (NMFS 2004). Limited research effort has also been made in the Mexican side of the Gulf of Mexico and Caribbean Sea, Colombia, the Dominican Republic, French Guyana, Puerto Rico and Venezuela. Despite these valuable efforts, the magnitude of threat posed to marine mammal populations in the WCR as a consequence of fisheries operations is difficult to asses.

Published information on bycatch of marine mammals in the WCR is scarce. A valuable source of information comes from the reviews by Northridge (1992), Vidal et al. (1994), Naveira (1996), Fertl and Leatherwood (1997), Cardona-Maldonado and Mignucci-Gianonni (1999) and unpublished reports of stranding networks or local cetologists (v.g. Bolaños-Jiménez and Bermúdez 1996, Bermúdez-Villapol and Pombo 2003, Bermúdez-Villapol et al. 2003, Martínez and García-Santana 2003, Bermúdez-Villapol and Sayegh 2005). According to our review, mortality of marine mammal species related to fisheries operations in the WCR includes at least a Mysticeti, 11 Odontoceti and a Sirenian. Species affected are the humpback whale (*Megaptera novaeangliae*), the pygmy and dwarf sperm whales (*Kogia breviceps* and *K. sima*), the estuarine dolphin or tucuxi (*Sotalia fluviatilis*), the short-finned pilot whale (*Globicephala macrorhynchus*), the killer whale (*Orcinus orca*), the Risso's dolphin (*Grampus griseus*), the melon-headed whale (*Peponocephala electra*), the bottlenose dolphin (*Tursiops truncatus*), the Atlantic spotted dolphin (*Stenella frontalis*), the spinner dolphin (*Stenella longirostris*), the common dolphin (*Delphinus capensis*) and the manatee (*Trichechus manatus*) (See Annex 1 for related information).

Background on monitoring and management of bycatch in the WCR.

Methods used for monitoring fisheries in order to evaluate effort, catch and bycatch include: 1) Fishery independent surveys (performed by scientists or management agencies), 2) Fisheries dependent surveys (e.g. review of logbooks completed by fishermen or dealers, samplings at port, etc.), 3) At sea observation (e.g. on-board observer programs, observation aboard alternate platforms or electronic monitoring using video cameras or scanners and 4) information provided by stranding networks (see NMFS 2004). According to the experience of the NMFS (2004), “*all of these methods may contribute to useful bycatch estimation programs but at-sea observation (observers or electronic monitoring) provides the best mechanism to obtain reliable and accurate estimates for many fisheries*”. Also, it has to be taken into account that a successful experience for reducing bycatch of cetaceans as well as providing the scientific and technological foundation for proper management of incidental catches is that of the observer program of the Inter-American Tropical Tuna Commission (IATTC) in the Eastern Tropical Pacific Ocean (ETP) (see IATTC 2003).

Immediate priorities for the WCR.

Existing Observer Programs in the WCR, as those of the NMFS and the Observer Program of the International Commission for Conservation of the Atlantic Tuna (ICCAT 2005), as well as national observer programs could be used as a starting point for monitoring bycatch of marine mammals at a regional level. Such programs offer an excellent platform for sustainable management of both the fisheries and bycatch, on the basis of scientific knowledge, technological development and cooperation between fisheries management agencies, non governmental organizations and fishers or fleet owners. In Venezuela, two independent initiatives focused on monitoring bycatch of marine mammals. First,

the “*Foundation for sustainable and responsible fisheries of Tuna*” (Fundatún-PNOV) cooperates with the IATTC to implement the observer program of purse seiners in the ETP, covering 50% of the effort of the Venezuelan fleet. This organization has presented a proposal for observer programs in the Venezuela Caribbean and Atlantic. On the other side, the Institute for Conservation and Control of the Lake of Maracaibo Basin (ICLAM-MARN) assembled an interdisciplinary team to assess the impact of fisheries on local populations of estuarine dolphin (*Sotalia fluviatilis*) in the Lake of Maracaibo and Gulf of Venezuela. Such initiatives must be encouraged and supported because of its importance in order to adequately assess the magnitude of marine mammal bycatch in this region and –therefore- to be able to propose corresponding mitigative measures. Cooperative efforts have to be implemented among the Parties to obtain information such as species involved, reliable estimates of population size, distribution and migration patterns, population structure, estimates of bycatch and some demographic parameters. Certainly information on the fisheries (type, fishing areas, vulnerability, etc) and fishing effort is also needed. Special consideration must be given to building national capabilities for research and management and funding strategies for such programs, on the basis of the model developed by the IATTC in the ETP.

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Annex 1. Marine mammals affected by gillnet and trawl fisheries operations in the Wider Caribbean Region (WCR).

Species	Locality (Source in brackets. See footnote for references)	Type of fishery		
		Gillnet	Trawl	?
<i>Megaptera novaeangliae</i>	Dominican Republic (1,3,9,12)	X		
<i>Kogia breviceps</i>	Colombia (1,3), Puerto Rico (5)	X		X
<i>Kogia sima</i>	Puerto Rico (5)	X		
<i>Sotalia fluviatilis</i>	Honduras (3), Colombia(3) Surinam (2,3), French Guiana (2,3), Venezuela (13)	X		
<i>Globicephala macrorhynchus</i>	Gulf of Mexico (8)		X	
<i>Orcinus orca</i>	Trinidad (10)	X		
<i>Peponocephala electra</i>	Venezuela (7)	?		
<i>Tursiops truncatus</i>	Honduras (3), Colombia (1,3) French Guiana (3), Gulf of Mexico (8), Venezuela (6)	X	X	
<i>Grampus griseus</i>	Colombia (1,3), Gulf of Mexico (8)		X	
<i>Stenella frontalis</i>	Colombia (1,3), Venezuela (6) Gulf of Mexico (8)	X	X	
<i>Stenella longirostris</i>	Venezuela (4)			?
<i>Delphinus capensis</i>	Honduras (3), Venezuela (6)	X		
<i>Trichechus manatus</i>	Dominican Republic (9, 12), Venezuela (11)	?		?

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2. Van Waerebeek (1990) cit. by Northridge (1992)
3. Vidal et al. (1994)
4. Agudo (1990) cit. by Vidal et al. (1994)
5. Cardona-Maldonado et al. (1999)
6. Naveira (1996)
7. Bermúdez-Villapol and Pombo (2003)
8. Fertl and Leatherwood (1997)
9. Martínez y García-Santana (2003)
10. Ottley et al. (1988) cit. By Vidal et al. (1994)
11. Boher-Bentti pers. comm.
12. Bonnelly de Calventi pers. comm.
13. Bolaños-Jiménez y Bermúdez (1996)