

**Original: English****THE IMPACTS OF FAD USE ON NON-TARGET SPECIES**

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**Abstract**

The authors participated in the Global FAD Science Symposium, March 20-23, 2017, in Santa Monica, California and are presented without affiliation. This paper is one of several from the Symposium and does not represent an exhaustive discussion of the issue but includes points agreed by participants. The participants recognized that impacts of FADs and FAD management cannot be considered entirely independently of harvest strategies, issues related to fishing capacity, ecosystem structure, or management of all other fishing gears in tropical tuna fisheries. None of these points alone will address the management challenges associated with FAD use. The effectiveness of any of these points will depend on the levels of implementation and compliance and need to be connected to processes at the RFMOs. Participants underlined the need for data harmonization, standardization, and availability and stressed the need to develop standardized language and definitions to support consistent interpretation of what conservation and management measures intend to achieve across ocean basins. Participants noted that “best practices” are not necessarily “most practical” and will need to be assessed to determine which are most appropriate to apply in any particular management setting or geographic area. Finally, participants stressed the need for ongoing and close collaboration among scientists, managers, and industry in driving innovative solutions within and across RFMOs. The points presented here are not in an order of priority; priorities and solutions may change on a regional basis.

**Introduction**

As is the case for vessels in most industrial fisheries, tuna purse seine vessels catch and sometimes land non-target species in addition to the tropical tunas that they target. Non-target species typically encountered by vessels fishing in association with fish aggregating devices (FADs) can be generally binned into three taxonomic categories: sea turtles, sharks, and non-target bony fishes. Below, we highlight some of the agreed points from the Global FAD Science Symposium,<sup>1</sup> dividing each taxonomic section into subsections on key information, proven and promising approaches to mitigation, and gaps in the current scientific knowledge on this issue. In addition to the specific points provided below, the value of crew training and communication to the fishing community were highlighted for turtles, sharks, and bony fishes.

**Sea turtles*****Key information***

Sea turtle interactions with purse seine operations fishing in association with FADs are fairly uncommon, and mortality of turtles in purse seining operations is extremely low – more than 90% of sea turtles caught in purse seine nets are released alive. Best practices for sea turtle release are available and have proven successful. However, small numbers of turtles are entangled directly in FADs, either the portion of the FAD at the surface or the submerged netting hanging down into the water column. Priority turtle species may vary by region or ocean basin and should be established for each area, according to the stock condition of the species encountered by purse seine fishing operations. As a result of sea turtles’ unique life history strategy (generally coming onshore only to nest), open ocean fishing operations may be a

source of invaluable information on species or population occurrence at the ocean basin scale, particularly for life stages (juveniles and adults in pelagic environments) where data are generally not available.

### ***Proven and promising approaches to mitigation***

The majority of sea turtle mortalities resulting from purse seine fishing in association with FADs are the result of entanglement in the FAD itself. A proven approach to reducing this mortality involves FAD design. Though there is not a widely adopted definition of non-entangling FAD, it should be considered best practice to construct FADs with little or no risk of entangling sea turtles. This involves reducing the amount of netting used on the portion of the FAD at the sea surface (often called the “raft”) or submerged below. The raft, in particular, should not include netting or should have a canvas cover over any netting, as sea turtles have a tendency to climb on them and subsequently become entangled. Reducing the surface area of the raft may also prevent turtles from attempting to “haul out” onto a FAD. For sea turtles encountered during fishing operations and encircled in the purse seine net, resuscitation/revival has proven successful at increasing survivorship of turtles that are released from the net or from the vessel deck. Some RFMOs already mandate specific care for sea turtles encountered during fishing operations (including mandating the use of recovery tanks on board).

### ***Gaps in current scientific knowledge***

As there are clear, proven methods to reduce or eliminate sea turtle bycatch by purse seine operations or FADs, there are currently no pressing gaps in the scientific knowledge of this issue.

## **Sharks**

### ***Key information***

Sharks make up a small percentage of the catch (0.5% by weight) of purse seine operations fishing in association with FADs, low compared to other tuna fishing gears but higher than purse seine operations fishing on unassociated tuna schools. Though the relative numbers are low, the very large scale of these fisheries means that catch can be significant for some species, primarily silky shark – a common component of purse seine bycatch – and oceanic whitetip shark – less common in the catch but highly vulnerable to overexploitation. Though unintended shark catch is generally higher when fishing in association with FADs, some species (e.g., hammerhead sharks, mobulid rays, etc.) are more common in unassociated purse seine sets. The relative impact of purse seine fisheries on sharks varies by ocean basin. In addition to being captured directly during fishing activity, sharks may become entangled in the FAD itself if it is made of components in the water column that include loose netting with mesh size greater than approximately seven centimeters. The magnitude of this entanglement problem also may vary by ocean basin.

### ***Proven and promising approaches to mitigation***

A proven approach to reducing shark mortality from entanglement in the FAD itself involves FAD design. Though there is not a widely adopted definition of non-entangling FAD, it should be considered best practice to construct FADs with little or no risk of entangling sharks by avoiding using netting or other entangling materials. There are several steps that can be taken to reduce mortality of sharks encountered during fishing operations. Shifting fishing effort from FAD-associated tuna schools to unassociated schools reduces overall shark mortality (but may increase mortality of some sensitive species such as hammerhead sharks and mobulid rays). Avoiding setting on small FAD-associated tuna schools results in a lower bycatch rate since the abundance of non-target species is independent of tuna school size. These proven practices reduce the likelihood that sharks are encountered during fishing operations. Identification and avoidance of shark “hot spots” is a promising approach to further reduce the likelihood that sharks are encountered. For sharks that are encircled in the purse seine net, one promising approach is fishing the sharks out of the net using handline, longline, or other gear. This practice should be

emphasized as encircled sharks are often still in good condition. If a shark makes it onto the deck of the purse seine vessel, there are published, proven practices for safe handling that can increase survival to 20% of individuals that reach the deck. These best handling practices should be implemented in all ocean basins.

### ***Gaps in current scientific knowledge***

In addition to the general data gaps associated with most shark fisheries, there are some specific areas of shark research that are particularly relevant to FAD fishing. Increased knowledge on the biology and life history of silky sharks and oceanic whitetip sharks would be useful in determining new methods to mitigate their bycatch in FAD-associated purse seine fisheries. Information on the FAD colonization rates and behaviors of these sensitive species would be particularly useful. There is a general need for more *in situ* studies on ways to discourage sharks of all species from aggregating to FADs or to scare them away from FADs before commencing fishing operations.

### **Non-target bony fishes**

#### ***Key information***

Non-target bony fishes represent 1-2.5% of the catch (by weight) of purse seine operations fishing in association with FADs, with some variability among ocean basins. Though non-target bony fishes are also caught in unassociated purse seine sets, there are more individuals, higher biomass, and greater diversity of these species caught in FAD-associated sets. There is little to no information on the stock status of most non-target bony fishes, and lack of data makes it difficult for scientists to conduct even rudimentary stock assessments. However, many of these species are considered to be of low conservation concern, as they are fast growing, highly fecund, abundant species. Non-target bony fishes are utilized by the crew for personal consumption or landed for sale in some regions but discarded in others. In cases where local markets for these species have become lucrative, prices may be higher than those for skipjack. As such, these species may be targeted in some areas and should be managed via the ecological approach to fisheries management.

#### ***Proven and promising approaches to mitigation***

There are few proven methods to reducing incidental catch of non-target bony fishes. However, as is the case with sharks, a shift in fishing effort from FAD-associated tuna schools to unassociated schools reduces this unintentional catch, and avoidance of small FAD-associated tuna schools reduces the catch rate of these species. Reducing dead discards and promoting utilization could help improve monitoring, reduce waste, and potentially improve food security in some regions. Increased utilization, though, may lead to conflicts with local, artisanal fisheries and may indirectly encourage targeting by purse seiners of previously non-target species.

#### ***Gaps in current scientific knowledge***

There is a lack of information on stock status for most non-target bony fishes caught in association with FADs. Collection of fisheries-related data for monitoring purposes will help RFMOs determine if and when mitigation measures are needed for any of these species. Research on non-target bony fish release or escape would be useful in determining ways to reduce mortality of these species once they are already encircled in the purse seine net. Investigating the effect of purse seine net mesh size on bycatch rates of these species is one example of research that could improve the management of non-target bony fishes.