

## Mitigation of Sea Turtle Mortality Risks Caused by Drifting Fish Aggregating Devices (DFADs)

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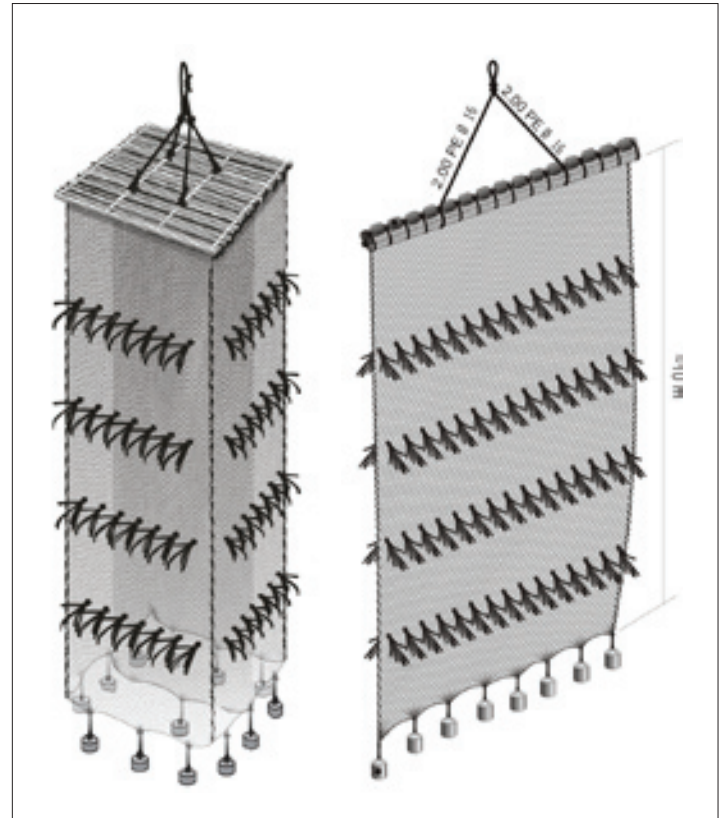
### Introduction

Tunas are among the most important marine fishery resources of the world, with approximately 4.2 million tons harvested in 2007. More than half of the world's tuna catch is produced using tuna purse seine, making it the most important gear in tuna fishing industry. However, during the tuna purse seine operations, fishers need to apply techniques to gather the fish in order to obtain the maximum catch; i.e. fishing with the free swimming tunas, fishing tunas associated with porpoises, and fishing with drifting objects, e.g. Fish Aggregating Devices (FADs), etc. to attract the tunas and allow fishers to easily locate and catch the fishes.

Since 1993, SEAFDEC has been conducting fishery resources surveys and researches to promote tuna and skipjack fisheries in the high sea areas, particularly in the Eastern Indian Ocean. However, as free swimming schools of tuna are rarely found in this area, and the fishing tuna associated with porpoises is not well-accepted by consumers, the use of flotsams, e.g. wood, drifting log, etc., and the deployment of FADs have been important techniques used in gathering the schools of fish during purse seine operations. There are two types of FADs commonly used: the Anchor Fish Aggregating Devices (AFADs) and the Drifting Fish Aggregating Device (DFAD), however DFAD is envisaged to be more suitable considering that in the distant fishing grounds monitoring and maintenance of FADs is rather inconvenient, and AFAD could be lost during storms and strong water current.

### Experiments on the use of DFADs and the incidental catch of sea turtles

DFADs could be generally classified by their floating parts, as the raft type (square) and curtain type designs. Both designs are fixed with "skirt" made of 10-meter used purse

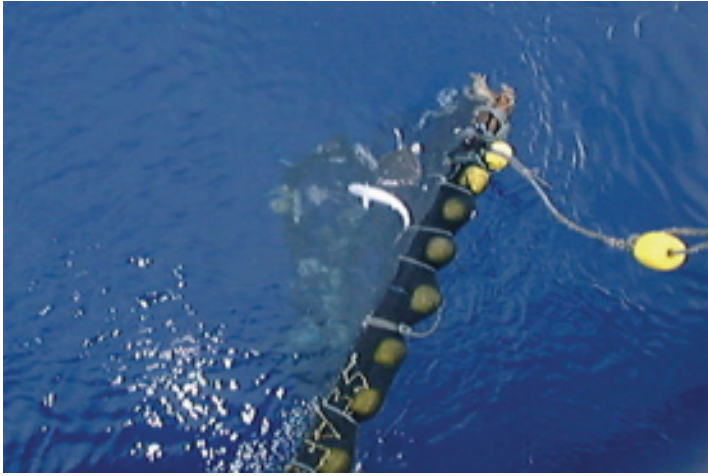


*SEAFDEC Drifting Fish Aggregating Devices (DFADs):  
raft type (left) and curtain type (right)*

seine (or trawl) net panels, and attached with radio buoy or GPS positioning buoy to detect the position of DFADs after deployment. In the Eastern Indian Ocean, DFADs was designed originally for the Japanese R.V. Nippon Maru. The square DFADs with skirts are made of black nylon net with the twine size of 210/d180 and the mesh size of 100 mm. Based on the original DFADs, SEAFDEC attempted to improve the DFADs design by modifying the skirt, using Spanish mackerel gillnet material (green nylon net with the twine size of 210d/18, and the mesh size 100 mm) and black nylon net with the twine size of 210d/42 and the mesh size of 100 mm. With the modified DFADs, experiment was carried out from December 2002 to January 2003 to monitor its efficiency.

It was envisaged that the modified design would enmesh the small fishes around the DFADs and at the same time also attracting tunas and skipjacks around the DFADs. However, from the data collected from the DFADs deployed

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*Dead sea turtle and shark found around the curtain type DFAD*

by SEAFDEC, as well as from other unidentified abandoned DFADs found during the experiment, not only tunas but also other marine animals, e.g. several species of marine turtles (mainly Hawksbill and Ridley's turtles) and unwanted fishes, were incidentally entangled in the DFADs' skirt.

As also observed during the study, mortality of the sea turtles occurred during two steps of the fishing operations. The first was when the turtles entangle in the DFADs' skirt and could not free themselves, and the second was when the net is hauled back to the vessel, where turtles could be injured after having been entangled with net twine during the net hauling.

However, the entangled turtles in the DFADs was found only when the material of the net skirt of DFADs was changed to Spanish mackerel gillnet or to nylon net for the tuna purse seine net body (as experimented by SEAFDEC), while during the fishing operations conducted by the R.V. Nippon Maru, the DFADs with the original skirt design never had any incidental sea turtle catch. It was also observed that the incidental entangling of sea turtles in DFADs are particularly high in



*SEAFDEC crew taking off the sea turtle from the net of an unidentified abandoned DFADs with garbage*



*Unidentified abandoned DFAD with garbage accumulating*

the unidentified abandoned DFAD in the garbage areas where schools of bait fish for sea turtles congregate.

### **Recommendations to mitigate sea turtle mortality from purse seine DFADs**

Based on the analysis of the study, the SEAFDEC research team came up with the following recommendations to reduce the mortality risks of sea turtles from tuna purse seine DFADs:

- Rigid net material should be used to assemble the net skirt of the DFADs while any drifting gillnet materials and tuna netting which is normally used to cover all DFADs, should be avoided. (After the SEAFDEC experiment in 2002-2003, the materials of the DFADs' skirt net used by the M.V. SEAFDEC have been changed to rigid net materials; and since then, not one sea turtle has been entangled in the DFADs.)
- Considering that abandoned DFADs drift with the oceanic current to a garbage area, resulting in high mortality of turtles; lost and abandoned DFADs could be minimized by improving the electronic equipment used in locating the DFADs as well as the durability and buoyancy of DFADs used during rough sea conditions.
- Research should be conducted on the use of alternative materials for DFADs, e.g. biodegradable materials such as coconut or palm leaves, or non-netting materials, to minimize any damage caused when the DFADs are lost or abandoned.
- Research should also be conducted to estimate the number of DFADs deployed in all fishing grounds of the world, in order to assess the mortality of sea turtles that may be caused by DFADs.
- Campaign for retrieving abandoned or lost DFADs in the sea, particularly in the garbage area should be considered and promoted.

