**DRAFT Research Plan**

**Estimating Mortality from Entanglement in Less-Entangling Drifting Fish Aggregating Devices**

**by Vessels of the Micronesia Tuna Purse Seine Fishery**

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**Caveat 1**: If WCPFC18 (the 18th regular session of the Western and Central Pacific Fisheries Commission) amends the tropical tuna CMM 2020-02 to change the restrictions on drifting fish aggregating device (dFAD) designs from the current requirement to use less-entangling designs (if mesh net is used on the raft, then it must have a stretched mesh size <7cm; no netting hanging below the FAD; if mesh net is used on the appendage, then it must also have a stretched mesh size of < 7cm or must be tied in tight bundles or sausages) to a requirement for non-entangling designs (no mesh net) within 1 year (by January 2023) or sooner, then we will discuss with the MSC assessment team the potential of closing out the relevant condition of certification at the annual surveillance audit following the transition to the non-entangling dFADs, and eliminate the necessity to conduct research on entanglement in less entangling dFADs.

**Caveat 2**: Resources limit the research protocol to lifting dFADs out of the water for inspection, and preclude other more rigorous approaches, such as observations by a diver or with an underwater camera to inspect dFADs in place, or to obtain a time series of observations of entanglements over the life of a deployed dFAD. The proposed research approach will only provide a lower bound, conservative underestimate of the species composition and rates of entanglement in less-entangling dFADs because:

* Only rafts and upper sections of dFAD appendages will be observed;
* Organisms captured in dFADs are understood to have a short residency time before falling out of the gear following mortality due to decomposition, depredation and mechanical action.[[1]](#footnote-1) Therefore, observations of entangled organisms provide a snapshot point-in-time estimate of mortalities (where observed entangled catch at a point in time are likely to have been captured within ~1 day) and not cumulative mortalities since the dFAD was deployed. From these data, we will not be able to estimate a decay rate of entangled catch – how long a caught fish or turtle remains in the appendage before being scavenged or falling out of the – which is needed to produce a rate in units of number of entangled organisms per unit of dFAD soak duration.
* During the process of lifting the dFAD out of the water, some of the entangled catch may fall from the gear before being observed.

**Study Objectives**

Meet Condition 7 of the MSC fisheries public certification report on ETP information (PI 2.3.3), “Some quantitative, independently verified information on unobserved mortality of ETP species through entanglement in dFADs should be available to assess the UoA related mortality and impact and to determine whether the UoA may be a threat to protection and recovery of the ETP species”. Specifically, to meet the condition of certification, the study will:

* Identify the specific-specific frequency of entanglement in in less entangling dFADs;
* Estimate point-in-time species-specific entanglement rates in less entangling dFADs;
* Assess whether the (1) dFAD soak duration, (2) dFAD distance drifted, or (3) geospatial location of the set affect point-in-time entanglement rates. E.g., for (1), we will test the hypothesis that up to some threshold, the longer the period of soaking, the higher the number of entangled organisms will be observed at a point in time in less-entangling dFADs; and
* Document the contemporary designs and materials of the dFADs on which sets are made by the vessels of the MSC certified Micronesia tuna purse seine fishery.

**Research Protocol**

Upon completion of a dFAD set, vessels will lift the dFAD out of the water so that at least the upper section of the appendage is visible to the FSM government-assigned observer on the vessel deck. The observer will:

* Record the date, time, latitude and longitude of the vessel when making the dFAD set;
* Take photos of the FAD’s raft and visible section of appendage while lifted out of the water;
* Record an estimate of the number of entangled organisms in the visible section of appendage, to the species level or otherwise to higher taxonomic levels;
* Record an estimate of the number of entangled organisms on the raft, to the species level or otherwise to higher taxonomic levels;
* Prepare a rough illustration of the dFAD design
* Record details on the FAD’s design and materials using the SPC/FFA Regional Observer Programme’s Form Gen-5 (<https://oceanfish.spc.int/en/observer-forms/doc_download/1030-obs-full-ps-workbook>), including whether netting was present on the raft, whether netting was present on the appendage, and if present in the appendage, was it loose, tied into sausages, etc.; and
* UID of the dFAD, if known (if the dFAD was being tracked by the vessel, then the UID can be determined from the satellite buoy data feed).

Vessels covered by the MSC fisheries certificate currently use sausages of netting with a stretched mesh size <7cm for the dFADs that they deploy, but vessels also occasionally make sets on dFADs that they encounter at sea that were deployed by other companies.

**TBD**: Number of dFADs that will be inspected; study period; FSM government agreement to add to observer data recording tasks; acquisition of satellite buoy data to estimate the soak duration and historical geospatial track of each inspected dFAD with known history.

Regarding sample size, note that Filmalter et al. (2013) estimated a daily 0.35 probability of ≥ 1 shark entanglement in an entangling dFAD – and thus we can expect less-entangling FADs to have a potentially much lower probability.

1. Filmalter et al. (2013) estimated that silky sharks remain entangled in entangling dFADs for about 1.2 days before falling out or being predated. [↑](#footnote-ref-1)