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An Overview of The 2011 ISSF/IATTC Research Cruise for Investigating Potential Solutions for Reducing Fishing Mortality on Undesirable Sizes of Bigeye And Yellowfin Tunas, and Sharks, in Purse-Seine Sets on Drifting FADs

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AN OVERVIEW OF THE 2011 ISSF/IATTC RESEARCH CRUISE FOR INVESTIGATING POTENTIAL SOLUTIONS FOR REDUCING FISHING MORTALITY ON UNDESIRABLE SIZES OF BIGEYE AND YELLOWFIN TUNAS, AND SHARKS, IN PURSE-SEINE SETS ON DRIFTING FADS

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A 73-day research cruise was undertaken, during the period of 11 May to 23 July, 2011 to the equatorial eastern Pacific Ocean (EEPO) aboard the Ecuadorian-flag purse-seine vessel *Yolanda L.*, under a charter agreement between the vessel owner and the International Seafood Sustainability Foundation (ISSF), and in collaboration with the Inter-American Tropical Tuna Commission (IATTC). The objectives of the cruise included attempting to develop solutions for reducing the fishing mortality on bigeye and yellowfin tunas, sharks, and other non-target species commonly captured during fishing operations directed at skipjack tuna by purse-seine vessels fishing on mixed-species aggregations associated with drifting fish-aggregating devices (FADs). A focus of the scientific experiments conducted, and overall research objectives is to determine whether the potential exists to develop alternative purse-seine fishing methods to avoid capture of undesirable sizes of bigeye and yellowfin tunas, and other non-target species, while maximizing catches of skipjack tuna.

There were five specific research activities, upon which the scientific committee of the ISSF by-catch program agreed fit within the objectives of the overall project, and should be undertaken during this first cruise to the EEPO.

The first objective was to test different designs of FADs that may not entangle turtles or sharks, including the potential for using biodegradable materials. Ten "ecological" FADs and 51 "standard" FADs were deployed during the routine fishing trip, preceding

the research cruise. Two of the ecological FADs were constructed entirely of natural materials. The other eight ecological FADs had 2" stretch purse-seine mesh net hung from the FADs, in contrast to the 4.5" or larger mesh netting commonly used. All FADs checked during the cruise were evaluated as to their design, condition, presence of any entangled animals, and tuna biomass associated with them. There were no turtles or sharks observed entangled in the netting of any FADs during this cruise.

The second objective was to evaluate the accuracy of the catch predictions by the fishing captain from the tuna aggregations associated with FADs, and the potential improvements in those estimates through the use of additional complimentary equipment and methods. Acoustic and optical surveys of the tuna aggregations were conducted, utilizing a SIMRAD ES70 echo-sounder and SEABOTIX LBV 200 remotely-operated vehicle (ROV) from aboard a 7.5 m workboat, which was carried aboard the purse-seine vessel from which it was launched and retrieved. Pre-set estimates of the species composition, sizes, and quantities of tunas were provided by the captain, based on the information obtained from the sonar on the purse-seine vessel, echo-sounder on the light boat situated adjacent to FADs, and visual observations from the mastman aboard the purse-seine vessel. Tunas loaded aboard the vessel from 9 sets were separated within wells, so as to obtain weights by weight classes of each species within sets, following unloading and sorting at the Starkist cannery in Manta, Ecuador.

The third objective was to determine whether there were spatial and/or temporal differences in the behavior of skipjack, bigeye, and yellowfin tuna within aggregations associated with FADs, in order to reveal potential opportunities for avoiding the capture of undesirable sizes of bigeye, yellowfin, and other non-target species, while maximizing the capture of skipjack tuna. Ultrasonic telemetry experiments were to be undertaken at a minimum of 10 FADs, with a minimum of 30 t of tunas present. Proposed methods included the capture and tagging, with coded acoustic tags, 3 each of skipjack, bigeye, and yellowfin tunas, and continuous acoustic tags, in 3 additional skipjack. Each experiment was to be conducted for a minimum of 48 h. Should a mono-specific skipjack school be observed, while tracking a skipjack tagged with a continuous acoustic tag, to move a distance of 1 nm away from the FAD, the purse-seine vessel would target that school for capture. There were no such sets made during this cruise.

The fourth objective was to investigate the behavior of tunas and sharks captured within a purse-seine net, to determine if species-specific aggregations occur, and the spatial and temporal characteristics of such aggregations, if they exist. The workboat was to remain adjacent to the FAD during a set at pre-dawn. Records from the echo-sounder were to be recorded during the set. Following dawn, the ROV was to be deployed with adequate light to observe and record the behavior of tunas and sharks in the net. Simultaneously, observations would be recorded by video from the mast of the purse-seine vessel of the behavior of the tunas and sharks within the net. Observations and recordings would be conducted for up to 6 h, after the rings

are aboard and at 25% net in water. No experiments were undertaken for this activity because the precautionary requirements stipulated by the captain were not met during the cruise. These included sets on small tuna aggregations, and calm ocean conditions.

The fifth objective was to determine the at-vessel mortality, post-release survival, and the physiological, biochemical, and molecular responses of sharks incidentally captured by purse seiners. The numbers, species composition, at-vessel mortality, and physical condition of sharks loaded aboard the vessel were assessed during the cruise. The physical and physiological condition of sharks immediately after loading, and prior to release, were determined, to characterize the overall impact of capture and handling. The post-release mortality rates were to be determined by directly recording the sharks' vertical and horizontal movement patterns for 30-45 days, using Wildlife computers mini-PAT tags. There were 8 silky sharks tagged and released with mini-PAT tags during the cruise.