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WORKING GROUP ON BYCATCH

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PROPOSALS FOR RESEARCH TO ADDRESS QUESTIONS RELATING TO REDUCTION OF BYCATCH

The June 2000 Resolution on Bycatch, *inter alia,* instructed the Director to develop a research program to further evaluate the use of sorting grids as a means of releasing juvenile tunas from purse-seine nets, and facilitate other research to avoid bycatch, including technological innovations such as acoustic instruments. Recently, the staff had discussions with a government and a fishing company concerning the possibility of a support vessel being used as a platform to investigate questions relating to bycatch reduction. In the event, the vessel was not available and the projects were not pursued. However, the staff believes that the research proposals developed, particularly the first and third, address the requirements of the resolution, and they are presented to the Working Group for consideration as a plan that the staff might pursue.

None of these projects are considered in the regular budget of the IATTC, and additional funds would be necessary to carry them out. No detailed estimates of cost have been made.

PROJECT 1: GEAR AND TECHNIQUES FOR REDUCING BYCATCH

1. OBJECTIVE:

a. To test devices and instruments that can help to reduce the bycatch of small tunas, sharks, and other species during the course of the setting of a purse-seine net on a tuna school.

b. To understand the spatial stratification, both horizontal and vertical, of the different species captured by the net, with the purpose of developing ways to reduce bycatches.

This study will:

- Test at sea the possibility of using a sorting grid to release small tunas, and small individuals of other species, from the net. This is a follow-up to pilot tests performed by the staff at the IATTC's Achotines Laboratory in Panama, which showed that tunas will swim through a grid if they come into close contact with it.
- Test the possibility of developing devices to capture and release individuals of some species (e.g. sharks, small billfishes) from inside the net, and of devices or structures to facilitate and accelerate the release of those individuals that reach the deck of the vessel alive.
- Observe the behavior of the different species and size groups inside the net during the encirclement process. If spatial segregations are observed, it may be possible to use that knowledge to modify the fishing operation and reduce unwanted captures.

The main questions to be answered are:

1. If a sorting grid is deployed in the net, will small tunas swim through it? What proportion will survive?
2. Can sharks and other species be captured and released from the net prior to sack-up? What devices, instruments or tools can be used to do it?

3. What devices, structures or procedures could be used to ease and accelerate the release from the deck of the vessel of individuals which survive sack-up?
4. Are the species and size groups in the schools captured distributed homogeneously inside the net during the set (either in a random stable distribution, or in a dynamically unpredictable mix)? If time is allowed for the fish to calm down after being encircled, will their behavior converge towards some spatial stratification (small individuals closer to the surface, *etc*.)? Can this be utilized to increase selectivity?

2. DESCRIPTION:

A purse seiner and a support research vessel will be required for these studies. Captains and crews would be consulted in advance regarding the feasibility and suggested execution of the experiments, and their advice sought with regard to the devices, instruments and procedures to be used.

Sorting grid: A Norwegian researcher experienced in the use of sorting grids in other fisheries will join the team. Ideally, 3-4 sets on floating objects will be made initially to fine-tune the process of deployment, installation, and recovery of the sorting grid; these sets will proceed normally, except for the addition of the grid. Observations of the escape of fish through the grid will be made from a variety of platforms (ROV, cage, inflatable boat with viewing boxes, etc.) Once the process is established, and if fish are escaping, a small net will be installed on the outside of the grid to catch some of them, and they will be retained in a floating pen. This pen (either towed or assembled at sea) will then be towed to a pre-selected anchoring area, where local researchers will make periodic observations to estimate the mortality rates over a 2-week period, if possible. Ideally the process will be repeated for each of the 3 main tuna species, but if not all are present in a set, the process can be repeated after the first 2-week period. If several cages are used, the replicated experiments could be carried on simultaneously.

Release devices: Some observations suggest that some sharks tend to stay at the surface while encircled. If so, and if other individuals are also accessible, it may be possible to develop devices to capture them and release them alive from the net. One possibility might be a small brailer mounted on a speedboat or panga, if available, but consultations with the fishers will be critical in this project.

Spatial structure: During all the sets a variety of platforms and instruments will be used to observe and describe the behavior of the different species inside the net. During some 5 or 6 sets, designated as observation sets, all activity will be suspended for a period of 30 to 60 minutes after completing encirclement, allowing the individuals and schools captured to return to a quasi-normal behavior. Visual (divers in cages, ROV with video) and acoustic (echosounders) observations will be made for a period of one hour, or until the structure is clear and well-described.

Area of operation:	Equatorial eastern Pacific Ocean between 5°N and 5°S, as close to the coast as possible to facilitate the towing and anchoring of the cage.
Start date:	Preferably in a season when coastal FADs could be used successfully.
Duration:	3 months.
Vessels:	Purse seiner and support research vessel
Materials:	Sorting grids, cages, floating pens, ROV, echosounder, small brailer, other release devices.

Other considerations: Selection of anchorage areas for floating pens; arrangements with local researchers for feeding and monitoring the tunas captured; survival studies using tagged individuals for species which cannot be kept in the pens.

PROJECT 2: TAGGING BIGEYE TUNA (*Thunnus obesus*) CAPTURED BY PURSE-SEINE VESSELS

1. OBJECTIVE:

Tag bigeye tuna captured with purse seines in the equatorial eastern Pacific Ocean with conventional

plastic dart tags, using a support vessel as a platform.

2. DESCRIPTION:

A sample (up to about 5 tons) of tunas caught in sets on drifting fish-aggregating devices (FADs) would be transferred from the purse-seine net to a collapsible floating pen, using techniques similar to those developed for bluefin tuna off Baja California and California. Over a period of 1-2 days the bigeye in the pen would be tagged and released, the pen would then be disassembled and loaded aboard the support vessel ready for the next opportunity for tagging.

Area of operation: Equatorial eastern Pacific Ocean between 5°N and 5°S and between 95°W and 110°W.

Duration: 2 months.

Materials: Collapsible floating pen for the transfer, maintenance, and tagging of up to 5 tons of tunas.

Other considerations: Requires complete cooperation from captains of purse-seine vessels. May potentially provide the foundation for, and only viable means of, tagging large numbers of bigeye tuna in the equatorial EPO. May be useful for developing alternative processing techniques and markets for bigeye caught by purse-seine vessels, such as *sashimi*-grade product.

PROJECT 3: ABUNDANCE AND INTER- AND INTRA-SPECIFIC RELATIONSHIPS OF TUNA SPECIES AND BYCATCH SPECIES ASSOCIATED WITH FADs

1. OBJECTIVE:

Obtain an understanding of the abundance, behavior and acoustic signatures of different tuna species and key bycatch species commonly associated with FADs, and apply this to the development of methods for selective catches of tuna species and reduction of bycatch.

This study will help to understand the movements of tunas and bycatch species associated with FADs in response to changes in the local environment, both physical and biological. Understanding changes in the abundance and the intra- and inter-specific interactions of these organisms may lead to the development of fishing strategies that both minimize bycatch and allow for species-specific selection of the tuna catch. For example, understanding the movements of bigeye and skipjack tunas, sharks and turtles within FAD communities might make fishing strategies possible that would catch the skipjack and exclude the other species. In particular, this study is designed to explore the following questions.

1. Do movements of different tuna species and bycatch species differ within and around FAD communities over the course of a day? For example, do diel changes in abundance differ between tunas and bycatch species or among tuna species? Is there a predictable vertical stratification of tuna species and bycatch species within the community?
2. Are fluctuations in biomass within FAD communities on longer time scales episodic or gradual? Do oceanographic features such as fronts, which are naturally occurring regions of high biomass, contribute significantly to the abundance of small fishes, sharks, turtles, *mahi mahi* and tunas in FAD communities, or does the fauna in FAD communities accumulate largely by random encounters? Are there differences in longer-term fluctuations of biomass between tuna species and bycatch species?
3. Are the presence and abundance of different tunas species, sharks, turtles and *mahi mahi* within FAD communities related to the presence and abundance of smaller fishes such as triggerfish?
4. Can the biomass and movements of tunas and bycatch species within and around FAD communities be determined with acoustic equipment? Are the acoustic signals of the various tuna species and bycatch species sufficiently different to allow the bycatch risk within a particular community to be assessed from shipboard acoustic data?

2. DESCRIPTION:

'Smart' FADs will be deployed for a period of 3 months, and will be tended by a support vessel which will also track tunas and bycatch species fitted with sonic tags.

FADs: FADs will be equipped with GPS, temperature sensors, fluorometers, hydrophones, and video cameras. The temperature sensors, fluorometers, and hydrophones will, in conjunction with the vessel's sonar, be used to assess changes in the physical and biological environment at the FADs over time. The biomass of tunas and bycatch species will be determined from sonar data and video. Hydrophones will be used to evaluate the sounds generated by biological activity at FADs. Divers will also be used to conduct periodic censuses of FAD community species for comparison to sonar and video data, as well as perform any necessary equipment maintenance. Sampling will be conducted from the support vessel, using multi-sensor instrument packages to correlete physical and biological data collected by the sensors attached to the FADs.

Sonic tracking of tuna and bycatch species: A receiver and directional array hydrophone will be installed on the support vessel for sonic tracking of tuna species, sharks and dolphinfish. Drifting arrays of acoustic receivers will also be deployed around FADs so that the location and depth of tagged individuals at FADs can be monitored. Sea turtles will be tracked with radiotracking equipment. Active sonic tracking of bigeye and skipjack tunas, as well as sharks, turtles, and dolphinfish captured in association with FADs will be conducted for periods of 48 hours. Time-depth profiles of tuna and bycatch species will be used in conjunction with sonar and video camera data to evaluate intra- and inter-specific interactions and acoustic signatures of species and aggregations within the FAD community.

Area of operation: Equatorial eastern Pacific Ocean between 5°N and 5°S and between 95°W and 110°W.

Start date: In conjunction with the proposed conventional tuna-tagging experiment.

Duration: 3 months.

Materials: Vemco VR-1 receivers, coded acoustic transmitters, temperature sensors, fluorometers, hydrophones, and video cameras. Some equipment may be available for loan from scientists at other research institutions.