

**International Seafood Sustainability Foundation initiatives to develop and test bycatch mitigation options for tropical purse seine fisheries**

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*Summary*

*The International Seafood Sustainability Foundation (ISSF) has initiated a research program to develop and test technical options to reduce bycatch resulting from industrial tuna fisheries. The initial emphasis will address ways to reduce the incidental mortality of bigeye tuna of undesirable size, oceanic sharks and marine turtles in tropical purse seine fisheries. The ISSF will implement field studies through the full charter of a dedicated purse seine vessel or vessels operating in the Pacific, Atlantic and Indian Oceans over a 24-month schedule, spread over 3 years. Overall project guidance will be provided by the ISSF Scientific Advisory Committee. A Purse Seine Research Vessel Steering Committee is developing the specific projects to be conducted while considering practical input from skippers and industry representatives gained from regional workshops convened by the ISSF. The first research cruise will be in the eastern Pacific Ocean early in 2011.*

**Background**

The ISSF is a global partnership among scientists, the tuna industry and the World Wildlife Fund (WWF) whose mission includes undertaking science-based initiatives for the long-term conservation and sustainable use of tuna stocks, reducing bycatch and promoting ecosystem health. The organization has highlighted six main areas of focus in its Strategic Plan:

- Control and Reduce Fishing Capacity
- Mitigate Bycatch
- Eliminate IUU Fishing
- Expand Data Support
- Advance Performance in Monitoring, Control & Surveillance
- Improve Overall Tuna Stock Health

Participating companies of ISSF include several of the world's largest tuna processing and trading companies. The organization supports a science-based approach to addressing these issues and has assembled a Scientific Advisory Committee chaired by V. Restrepo that includes experts familiar with the RFMOs that deal with tropical tunas and albacore: M. Williams, R. Allen, L. Dagorn, R. Deriso, J. Hampton, G. Scott, and D. Squires.

The ISSF has identified the mitigation of bycatch in tuna purse seine fisheries as a priority area of concern. Folded into the need to reduce bycatch is the issue of minimizing wastage of small tuna that are inadvertently harvested and discarded as well as the incidental take of juvenile bigeye tuna in floating object sets targeting skipjack and yellowfin.

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## **The development of a Research Plan**

### ***The need for a dedicated vessel***

It is not possible to properly and efficiently test technical approaches to bycatch mitigation of purse seine operations using commercial vessel fishing operations in an opportunistic manner. Scientists need to be able to manipulate all spatial, temporal and operational aspects of the set and be able to manipulate and enumerate the catch without regard for its commercial value. This will require full chartering of fully operational purse seine vessels with crew experienced in FAD fishing and particular fishing grounds. Experiments will need to be conducted in all oceans as well to examine the influence of environment, localized productivity and thermal structure on bycatch levels and behavior.

The ISSF plans to do this through the full chartering of a dedicated purse seine vessel or vessels operating in the Indian, Atlantic, Eastern Pacific and Western Pacific Oceans. A dedicated research platform with full commercial expertise will allow experimental operations that vessels would not otherwise conduct for fear of low catches or reduced profitability. Building on the experience established in solving the tuna-dolphin interaction problems of the eastern Pacific, the program will put vessel captains together with scientists to generate testable and economically viable ideas that can be practically tested on the chartered vessel.

### ***Meetings to-date***

In order to begin the process of identifying and mitigation techniques, the ISSF has organized three meetings within the last year.

#### ***Sukarrieta Workshop***

The first meeting, planned and inspired by the late Jim Joseph, was jointly hosted by ISSF and the AZTI, in Sukarrieta, Spain, 24-27 November 2009. The objective of the meeting was to gather tuna scientists, technicians, fishing gear experts, acousticians, biologists and purse seine captains to discuss technical solutions to reducing bycatch resulting from purse seine effort on floating objects, such as FADs (anchored and drifting) and natural floating objects. A report of the meeting can be obtained from ISSF. The meeting succeeded in presenting a number of options for bycatch reduction in purse seine fisheries and obtained a great deal of useful information from the fishing industry, mainly the Spanish Basque fleet. However, options were not prioritized or ranked for testing or funding. The results of this meeting were seen as a partial outcome to be completed more fully with additional regional meetings in different oceans that would fold in experience and opinions from other fleets and fishing communities.

#### ***Taking Stock, Brisbane***

On June 26 this year, ISSF hosted a workshop in conjunction with the Kobe II Bycatch Workshop (K2B) held in Brisbane, Australia June 23-25, 2010. The ISSF meeting complemented K2B by providing information on bycatch related research on tuna purse seine fisheries and plans to move forward in the testing of additional research. Invited speakers presented information summarizing global purse seine fisheries and fleets, purse seine bycatch information and plans for further research including the ISSF plans for field research using a dedicated vessel. More information on the Workshop, including presentations, can be obtained from the ISSF Web Site.

#### ***First Meeting of the Purse Seine Research Steering Committee***

While the overall guidance to ISSF on purse seine research is given by the SAC, it is evident that a more specialized group could assist in developing the necessary details for the research cruises. For this reason, a Purse Seine Research Vessel Steering Committee was set up. This Committee is chaired by L. Dagorn (IRD, Seychelles) and includes experts in various fields from different regions: J. Ariz

D. Bernal, R. Brill, L. Dagorn, M. Hall, K. Holland, D. Itano, G. Moreno N. Ogura, J. Sacchi, and K. Schaefer. The Committee first met in Paris, September 8-10, 2010. The meeting also invited two experts in the western and central Pacific region to attend: P. Sharples and T. Usu. The report of the meeting is attached as **Appendix 1**.

### ***Future meetings***

In parallel to the purse seine research with the dedicated vessel(s), ISSF will host a series of Skipper's Workshops. One of the aims of these is to train purse seine skippers on bycatch mitigation techniques that are known to work. Equally important, the Workshops will serve as a forum where scientists can exchange ideas with skippers about what other techniques may work that are worthy of testing on board the research vessel. As such, the Skippers Workshops will feed into the research plan. It is planned to hold the first workshop in the ICCAT region in Ghana, November 2010. The development of workshop material is being coordinated by AZTI, Spain (see **Appendix 1**).

### **Concluding remarks**

The research plan using a dedicated vessel is an ambitious project. Gross estimates put the cost of the project at \$12 million US\$, assuming that whatever is caught during the experiments can be sold to offset cruise costs. This total cost includes an important component for communications and education. Fundraising is taking place currently, with about half of the costs being committed. Donors include ISSF itself, as well as a series of governments, foundations, NGOs and associations.

At this stage, the project is geared to start with a cruise in the eastern Pacific that will look primarily at mitigating catches of small bigeye tuna around FADs, led by K. Schaefer (see **Appendix 1**). Future cruises will be in the western Pacific, the Indian and Atlantic Oceans.

ISSF hopes that the WPEB committee of IOTC will consider the importance and need for this research and provide support for the initiative.

**Report of the first meeting of the ISSF by-catch PS project**  
*Paris, 8-10 September 2010*

**Summary**

The first meeting of the scientific committee of the by-catch project was held in Paris 8-10 September 2010, gathering 14 expert scientists with a wide range of experience covering several different species, techniques and oceans (see list in Annex 1). The group achieved the three main objectives previously prioritised for the meeting:

- To define a list of research activities that must be conducted onboard dedicated purse seiners in order to find solutions for by-catch mitigation
- within this list, to identify the activities that will be conducted during the project's first cruise, in the EPO
- within the same list, to identify the activities that could be conducted during the second cruise, in the WCPO and possibly in other oceans during 2011.

Priorities were given to solutions to reduce (1) the catch of bigeye tuna (BET) of undesirable sizes and (2) of pelagic sharks, although other by-catch species (turtles, finfish) were also considered. All research activities were classified as either dependent or independent of ocean and vessel type in order to help with the planning of these activities. The scientific protocols for each research activity were discussed for approval/consensus. However, as time was limited, the drafting of detailed scientific protocols for conducting each research activity at sea was assigned to a small task force (composed of a few members of the committee and sometimes including experts from outside of the committee). In addition, for research activities that are to be conducted during the first cruise, the corresponding task forces will provide a list of equipment along with an estimated budget before September 24, 2010.

Kurt Schaefer (IATTC) will be the chief scientist for the first 90-day cruise in the EPO, planned to start mid January 2011. Onboard, he will be assisted by Dan Fuller (IATTC) who will also stay onboard for the entire duration of cruise, and will help him with all research on the mitigation of BET. It was decided to have about three one-month legs for rotation of other scientists onboard who will address the other activities and objectives (mainly concerning the mitigation of shark by-catch). Graduate students from IRD, UMAS, AZTI were already identified for these tasks. It is requested to have a PS that could host 3-4 scientists together onboard. In case space is limited, some solutions (aircon prefab accommodation installed onboard) were suggested. A review of a preliminary list of vessels will be conducted next week by the chief scientist for the cruise (K. Schaefer) and the research coordinator of the project (L. Dagorn).

**Research activities**

The committee reviewed different options (using the report of the Sukarietta meeting and the AZTI report on the research plan as background) and selected research activities that should be conducted during the project in order to achieve the objectives.

	Oceans	Species				Cruises	
	Ocean Vessel*	Small BET	Sharks	Turtles	Finfish	1 <sup>st</sup> cruise (EPO)	2 <sup>nd</sup> cruise (WCPO)
<b>1. Passive mitigation of bycatch</b>							
a. Instrumented buoys (echosounder, etc.)	OD	✓			✓	✓	✓
b. Ecological FADs : (i) turtle -and shark-friendly, (ii) biodegradable FADs	OI		✓	✓		✓	✓
c. Effect of design of FADs on composition of fish aggregations	OD	✓					
<b>2. Avoid catching bycatch before setting</b>							
a. Pre-estimation of bycatch	OD	✓	✓		✓	✓	✓
b. Natural behavior	OD	✓	✓			✓	✓
c. Skippers' ability to catch free-swimming schools of SKJ away from FADs	OD, VD	✓				✓	✓
d. Double FADs	?	✓	✓		✓		
e. Attraction of sharks away from FADs	OI		✓				
<b>3. Release from the net</b>							
a. Natural behavior of fish in the net	OI, VD	✓	✓		✓	✓	✓
b. Behavioral manipulations (e.g. attraction of sharks, small BET, other finfish)	OI	✓	✓		✓		
c. Modifying the selectivity of the gear (e.g. sorting grids, changing mesh size, etc.)	OI, VD	✓	✓		✓		
<b>4. Release from the deck</b>							
a. Best practices for handling sharks onboard	OI, VD		✓				
b. Survival of released sharks	OI, VD		✓			✓	✓

Table I: List of research activities to be conducted during the project. \* OD: Ocean Dependent, OI: Ocean Independent, VD: Vessel Dependent

### 1) Passive mitigation of bycatch

#### a) Instrumented buoys (echosounder, etc.)

The idea is to use instrumented buoys to have remote information on the presence/abundance of by-catch versus catch species. The protocol will concern the groundtruthing of data collected by echosounder buoys attached to FADs through (i) the concurrent collection of depth data of various species at the FAD (tunas, sharks, oceanic triggerfish, rainbow runner, etc.) equipped with pressure sensitive acoustic tags and (ii) the catch of the entire aggregation by a PS.

b) Ecological FADs: (i) turtle -and shark-friendly, (ii) biodegradable FADs

Ecological FADs will be deployed during the project in order to test their life time (in case of biodegradable materials) and their efficiency in attracting tunas without entangling turtles and sharks.

c) Effect of design of FADs on the composition of fish aggregations

First analysis using observer data will be done. Upon results of this analysis, some tests can be performed at sea.

## 2) **Avoid catching bycatch before setting**

a) Pre-estimation of by-catch

Two parallel approaches were discussed during the meeting :

- Groundtruthing the information from the PS' echosounder/sonar by using camera/ROV prior to setting, in order to help fishers better estimate by-catch
- Improving the use of some echosounders (e.g. SIMRAD ES60) by joint collaboration between skippers and scientific acousticians

Both approaches require that the entire aggregation be captured to validate the estimation.

b) Natural behavior of fish at FADs

The objective is to observe whether or not tunas and sharks regularly leave the immediate vicinity of the FAD during a 24-h cycle. This information could be used to target schools with less bycatch (see point 2c). Some of these FADs could be abandoned for long term observations of behavior (which will also allow the study of the ecological trap hypothesis), while others could be fished (Note from the Chair: this last option would only be valid when there is a need to combine activities at sea, such as 1a, 2b and 2c, but when possible, the Chair would recommend that FADs are abandoned).

c) Skippers' ability to catch free-swimming schools of skipjack (SKJ) away from FADs

Results from the study of the natural behavior of tunas around FADs (see point 2b) will provide a basis for determining the best time of day to target free-swimming schools of SKJ after they leave the FAD.

The PS' skipper will be asked to catch schools of SKJ that were observed leaving the immediate vicinity of the FAD while the schools of BET are expected to remain closely associated with the FAD. The idea is to test whether it is possible to use FADs as "providers" of free-swimming schools of SKJ where by-catch is known to be lower. We know that such a strategy could induce more null sets than setting around the FAD but the benefits in by-catch reduction could be significant. Preliminary analysis of observer data seems to suggest that some skippers may have successfully adopted this strategy during the FAD closure in the WCPO this year.

It will be important to validate that the school of SKJ came from the FAD. This could be done through two different approaches:

- During experiment 2b, acoustically tagged SKJ will be actively tracked (Vemco VR28) and the school will be tracked by the PS' sonar
- Other experiments could consist of conventional tagging of SKJ while they are at the FAD and examine if the captured school contains tagged SKJ.

d) Double FADs

This has been recognized by the committee as the most novel idea to be tested with the most unpredictable outcome. The principle is to assess whether any segregation occurs when a single aggregation is exposed to two competing aggregating devices (which has been shown for some terrestrial species). Single FADs with two identical components will be deployed. After some time, they will be visited and split to observe if any species segregation occurs. Failing this, modifications of one of the two components of the single FAD will be tested (e.g. a deep versus a shallow component, see Nelson's double FAD) to find stimuli that could enhance species segregations.

e) Attraction of sharks away from FADs

The idea is to test different stimuli (chum) to attract sharks away from the FAD shortly before the net is set.

**3) Release from the net**

a) Behavior of fish in the net

This activity will provide baseline data for activities 3b and 3c. The skipper will be asked to keep the net open for some time during daylight hours in order to observe the behavior of fish. The behavior will be observed through various techniques including acoustic tagging, sonars, videos (ROV), visual observations from the PS (crow's nest).

b) Behavioral manipulations (e.g. attraction of sharks, small BET, other finfish)

The idea is to test different stimuli (chum) to attract sharks out of the net (when towing the FAD away), or others (e.g. light) to attract fish (e.g. small BET or other finfish) towards an area in the net.

c) Modifying the selectivity of the gear (e.g. sorting grids, changing mesh size, etc.)

Jacques Sacchi will make a review of different options (including sorting grids of different designs, sections of the seine with large square meshes, etc.) and will propose a list of priorities to be tested during the project. As this activity will not be done during the first cruise, the protocols to be tested will be discussed at the second meeting of the committee, along with inputs from 3a that will be done during the first cruise.

**4) Release from the deck**

a) Best practices for handling sharks onboard

For small sharks, the best practices will involve recommendations for manual handling. For larger sharks, some handling equipment will be developed and tested (e.g. the ones proposed within the MADE project).

b) Survival of released sharks

Initially, only the liveliest sharks will be tagged (with pop-up archival tags - PATs) and released as soon as possible to study their survival. The idea is to use MiniPATs from Wildlife Computers (WC) as most of sharks will be small. However, Kim Holland presented the new concept of a survival tag (sPAT) that WC is planning to develop. These tags will be a simpler version of the miniPAT, sending a message indicating the reason why the tag was released, (including post-release mortality). Such tags would be about ½ the price of regular miniPATs. Blood samples will be taken to establish baseline data on stress levels at the time of release.

**Responsibilities**

For each research activity, it is necessary to have a detailed scientific protocol, along with a list of equipment and the associated cost for each cruise. A task force (composed of a few members of the committee and sometimes including experts from outside of the committee) was assigned for each activity as follows:

<b>Research activity</b>	<b>Task force</b>
<b>1. Passive mitigation of bycatch</b>	
a. Instrumented buoys (echosounder, etc.)	G Moreno, L Dagorn
b. Ecological FADs : (i) turtle - and shark-friendly, (ii) biodegradable FADs	G Moreno, D Itano, L Dagorn
c. Effect of design of FADs on composition of fish aggregations	D Itano, G Moreno, L Dagorn
<b>2. Avoid catching bycatch before setting</b>	
a. Pre-estimation of bycatch	K Schaefer, D Itano, G Moreno, L Dagorn
b. Natural behavior	K Schaefer, D Itano, D Bernal, L Dagorn
c. Skippers' ability to catch free-swimming schools of SKJ away from FADs	K Schaefer, D Itano, P Sharples, P Williams, L Dagorn
d. Double FADs	K Holland, L Dagorn
e. Attraction of sharks away from FADs	R Brill, D Bernal, B Seret, F Poisson, Roman, L Dagorn
<b>3. Release from the net</b>	
a. Natural behavior of fish in the net	K Schaefer, K Holland, G Moreno, L. Dagorn
b. Behavioral manipulations (e.g. attraction of sharks, small BET, other finfish)	R Brill, D Bernal, B Seret, F Poisson, Roman, L Dagorn
c. Modifying the selectivity of the gear (e.g. sorting grids, changing mesh size, etc.)	J Sacchi, M Hall, M Ogura, J Franco, L Dagorn
<b>4. Release from the deck</b>	
a. Best practices for handling sharks onboard	J Sacchi, J Franco, B Seret, F Poisson, Roman, L Dagorn
b. Survival of released sharks	D Bernal, R Brill, K Holland, Roman, L Dagorn

Table II: Task forces for each research activity (responsible for writing protocols, providing estimates of equipment and cost) (The Chair, L. Dagorn, is a member of each task force)

### General Considerations

- The committee insisted to inform ISSF that (a part of) the success of the project depends on available funds (provided by the project) to cover research cost. It is not possible to rely on co-funding found by scientists (as for instance it will be difficult to match the timing of funding with proposed cruises) to pay for equipment, tags, travels and sometimes salaries/grants.
- Intellectual property rights : who owns the data ? Who publishes ? Victor Restrepo informed the committee that when a cruise is sponsored by a co-funder, a MoU will be drawn up between ISSF and the other party. But the case of scientists outside the MoU working on the same cruise will need to be addressed.
- Chief scientists must produce a report shortly after the culmination of the cruise for ISSF. The report should be written in such manner that is comprehensible to fishers and industry stakeholders, while retaining data integrity for future peer-reviewed publications. Authorships for scientific publications were not discussed, but common scientific ethic considerations will be applied. However, this should be discussed further.



- It is the mission of the committee to identify the best scientific teams to participate in the cruises. When necessary, open calls can be proposed.
- It is necessary to do some homework before any cruise: look at historical catch data to identify areas/seasons and also to consider local weather patterns, to facilitate the conduction of the proposed research activities.
- Chief scientist should meet with the skipper and the entire crew in advance of departure so that everyone onboard understands the exact objectives of the cruise and activities that will be conducted onboard.
- The committee discussed the possibility of having different types of cruises of varying durations. For instance, some activities (in particular those that are Ocean Independent) such as “Double FADs” or “Modifying the selectivity of the gear” could be carried out during short cruises (e.g. 4 to 6 weeks), as opposed to cruises such as the first two to be performed in the EPO and WCPO.

**Requirements for the first cruise in the EPO (could also apply to other cruises)**

- Scientists will need dedicated working/office area onboard the PS. The vessel should be able to host 3 - 4 scientists onboard. No support vessel is required to host scientists, but potentially prefab accommodation modules if there is not enough room onboard.
- Work boat 24 ft closed cabin aboard the PS for research activities (e.g. tagging, active tracking)

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**Session on skippers’ workshops**

The objective of this meeting was to plan and structure the next skippers’ workshops. The following members of the scientific committee attended this session:

- Laurent Dagorn
- Gala Moreno
- Martin Hall
- David Itano
- Peter Sharples
- Thomas Usu
- John Filmalter (scribe)

AZTI is in charge of coordinating this activity that is essential for the project, which is founded upon the participatory approach (knowledge of fishers and scientists).

A common structure for Power Point presentations between presenters will be drafted by AZTI (using Martin Hall’s presentations as a baseline), along with standardized matrices to compare results between regions/fleets.

The workshops should all follow the same order : present ISSF, show the need for fishers to mitigate bycatch (e.g. Greenpeace campaign), identify issues, gather the participants ideas, show our ideas, get feedback from fishers. AZTI will draft a series of questions that must be addressed at some point during the workshop, either through open dialogue or asked specifically. This draft will be reviewed and completed by other members of this subgroup of the scientific committee.

The workshops should always be conducted by a senior scientist who is well known to the fishers, who should be assisted by someone to take notes. This person will be the person hired by AZTI, except for some cases where language could be a problem (such as France as this AZTI person speaks Spanish and English). The following senior scientists were already identified:

<b>Countries/Fleets</b>	<b>Senior scientist</b>
Spain, Ghana	Gala Moreno
France	Laurent Dagorn
South America (IATTC)	Martin Hall
USA	David Itano (upon conditions)

For the WCPFC, the SPC can be used to establish connections with the skippers. In addition, there is a need to have a small tour in Asia (Japan, Taiwan, China) by some members of this sub-committee to find senior scientists from these countries to assist in conducting workshops.

It was decided to perform at least one workshop in major fleets/oceans before the end of the first cruise (April 2011).

Annex 1 : List of participants

<b>Participant</b>	<b>Institute, Country</b>
Laurent Dagorn	IRD, France
Gala Moreno	AZTI, Spain
David Itano	UH, USA
Martin Hall	IATTC, USA
Javier Ariz	IEO, Spain
Kim Holland	UH, USA
Kurt Schaefer	IATTC, USA
Diego Bernal	UMASSD, USA
Rich Brill	VIMS, USA
Jacques Sacchi	IFREMER, France
Miki Ogura	NRIFSF, Japan
Peter Sharples	SPC, New Caledonia
Thomas Usu	Fisheries, PNG
John Filmalter (LD's assistant)	IRD, France