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Preliminary analysis of the Regional Observer Programme data on FAD design

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Executive summary

The current document presents a preliminary analysis of the data holdings related to the design and activities related to fish aggregating devices (FADs) in the WCPFC-CA. The SPC/FFA form GEN-5 is specifically designed for the collection of information related to the nature of the FAD, the main materials and attachments, the dimensions and information that could allow for the individual identification of FADs. This form can be matched against others that provide information on the vessel activity and, in the case of fishing events, on the catch of target species and the interaction with others.

In general, the coverage on FAD materials and the interaction with bycatch species is very good, but this study identifies that the fate of the FAD is very difficult to ascertain in most of the cases (especially after a set takes place) and that it is not possible to individually track a single FAD due to the lack of a consistent unique identifier (for example, because the observer cannot access it, it simply does not exist, different criteria in the coding of FAD identifier amongst observers, etc.). The buoy number[1] (the field related to FAD identification with a higher coverage in drifting FADs) is only recorded in 52% of the cases, and a large number of these records are unlikely to be unique identifiers. As for anchored FADs, they do not usually have buoys in most of the cases, and FAD markings are available in less than 40% of the objects. Although there seems to be consistency in the identification of FADs within a trip, most of the drifing FADs recorded have its origin in previous trips of the same vessel, but a significant proportion of FAD records also originate from other boats with an inconsistent buoy identifier. In the case of anchored FADs, most of them are deployed by auxiliary vessels.

Therefore, the main recommendation from this preliminary review is the development of a unique identifier system which is essential to track FADs and derive estimates on FAD effort levels, number of FADs used per boat, effect of "fish aggregation" time over catches, etc.

The analysis of the relationship between drifting FAD design and catch composition indicates that the flag of the vessel is, by far, the main factor influencing the presence of bigeye tuna, as well as the percentage of yellowfin plus bigeye, in the catch, even when spatial variables are included in the model (i.e., two fleets fishing on FADs in the same area apparently have a very different catch composition). Although spatial variations within the region level, or operational characteristics (e.g. net depth) cannot be completely ruled out, differential level of reporting among fleets seems to be an important reason for these differences; further review of this result will be undertaken beyond this preliminary analysis. It is likely that there are also differences between vessels and skippers, although the sample size and the number of factors examined did not allow for such a study. Therefore, the compilation of the FAD design information currently collected seems not adequate for the study of bigeye catch mitigation options, and a review and development of an appropriate onboard sampling protocol is recommended to enable accurate estimation of the species composition of the catch at the set level.

Regarding the interaction with other species, FAD design explained on average c. 10% of the variability in the presence of each of the taxa in dFAD sets. It must be noted that the occurrence for most of the

[1] Buoy number in GEN-5 forms refers to the identification number of the radio or satellite transmitting device attached to the FAD.

species is quite low (less than 10%), and the sample size is probably still insufficient given the number of factors studied. Preliminary trials including several environmental variables seem to improve the model fits, and suggest some effects that are worth exploring further (e.g., relationship between FAD depth and silky shark presence, sea surface temperature vs bigeye tuna, etc.).

The implementation of form GEN-5 is very recent and, as the amount and quality of data improves, there will be more opportunity for studying potential ways of reducing the incidental catch of some of the groups of concern. Some of the results of the current analyses can be of help in the further development of the forms and, possibly, contribute to the establishment of a FAD research plan.

Introduction

Fishing on natural (nFADs) or man-made floating objects (Fish aggregating devices, FADs), either anchored (aFADs) or drifting (dFADs), is based on the tendency of some species to aggregate under these structures. This technique has numerous advantages from a fishery perspective, since it largely results in higher catch rates and lower searching times, especially since the development of tracking buoys (Hall and Roman, 2013). However, experimental data have long since identified that the bycatch of non-target species and the catch of juvenile bigeye and yellowfin tuna is significantly higher under FADs than on free-schools sets.

On a global scale, since the early 1990s, purse seine catches of tropical tunas have increased by nearly 60%, which reflected an increase of about 33% in free school catches but nearly an 82% increase in catches made on floating objects. Purse-seine catches of tropical tunas account for 75 to 90 percent of the world production of these species (Hall and Roman, 2013), and nearly 65% of the current purse seine catch is made by fishing on floating objects (Scott and Lopez, 2014).

This figure is also similar in the WCPFC-CA. As an example, the average skipjack catch for the period 2005-2009 in the assessment model region 2 (western equatorial WCPO) was 407,000 mt in the associated fishery and 276,000 mt in the unassociated fishery, while in region 3 (eastern equatorial WCPO) the average was 145,000 mt in the associated fishery and 108,000 mt in the unassociated fishery (Hoyle et al., 2011).

Unfortunately, the development of the purse seine fishery and, in particular, FAD-associated sets has also resulted in a dramatic increase in bigeye tuna, and to a lesser extent yellowfin tuna, juvenile fishing mortality, and a significant reduction in the spawning potential and MSY of the stock (Davies et al, 2014, Harley et al., 2014). Experimental data have also identified that FADs attract a large variety of other marine species like sharks, turtles or other bony fishes (e.g. Castro et al., 2002). Although the bycatch rate of non-target species in the associated purse seine fishery may be lower than for other fishing gears (longline, trawling…), the absolute levels of catch in the purse seine fishery are also a matter of concern. The total discards in purse seine fisheries amount to one to five percent of the total tonnage captured,and tunas of the species targeted amount to over 90–95 percent of those bycatches (Hall and Roman, 2013).

Although some mitigation measures have been studied so far, none of them have proven useful in reducing the bycatch of juvenile bigeye and yellowfin. Therefore, the only management measures implemented in the WCPFC-CA in the latest years are aimed at limiting the number of sets on FADs through temporal closures to this activity (e.g., CMM2008-01), and/or limits on the total number of associated sets allowed (e.g. CMM2013-01).

Some stakeholders have proposed a full ban on FAD-related activities, which would presumably reduce the bycatch of juvenile tunas and non-target species. However, such a measure would likely result in significant catch reductions of skipjack. Therefore, efforts in recent years have concentrated on the development of FAD research and monitoring programmes.

The establishment of the WCPFC Regional Observer Programme and the implementation of the 100% observer coverage since CMM2008-01, together with the development of forms specifically devoted at the collection of information related to FADs, could provide further management options which are beneficial in the reduction of bycatch and less impacting over the fishery activity of the purse seine fleets.

The aims of the current document are to (i) describe the main FAD designs and FAD-related activities currently documented for the different purse seine fleets in the WCPO, (ii) identify the main gaps in data collection and (iii) provide preliminary information on the effect of FAD configuration on catch composition. For a better qualitative description on the types of FADs and its distribution around the different segment fleets, see Itano et al. 2004

Material and methods

The Pacific Islands Regional Fisheries Observer Programme (PIRFO) encompasses has as its main aims providing a series of standards and a certification process that, *inter alia*, ensures compliance with the Regional Observer Programme objectives

The PIRFO has standard protocols for data collection, including a set of forms aimed at gathering the information deemed more important for the management of the stocks and the enforcement of the WCPFC Conservation and Management Measures. SPC and the Pacific Islands Forum Fisheries Agency (FFA) have conducted the biennial Regional Data Collection Committee (DCC) since 1995 and is responsible, *inter alia*, for producing the regional standard observer data collection forms used by the national and regional observer programmes covered by PIRFO, but also beyond (e.g. the Philipines national observer programme). The WFPC ROP Coordinator also participates in the DCC which ensures there is consistency between the regional standard DCC/PIRFO observer data collection forms and the WCPFC ROP minimum data fields. One of the DCC/PIRFO forms, the Form GEN-5 (Appendix A), has been specifically designed for the collection of information related to FAD configuration. Information collected in this form can then be matched against other forms, like form PS-2 (Appendix B), which collects the information on the vessel activity, position, etc.; form PS-3 (Appendix C), which summarizes the set information (catch of target and bycatch species) or form GEN-2 (Appendix D), focused on the interaction with species of special interest.

FAD design, FAD origin and FAD individual tracking feasibility was analyzed by using the information collected under forms GEN-5 of the PIRFO. Information on this form includes the nature of the FAD (man-made or natural, anchored or drifting…), the dimensions (length, width and depth) and the materials (main materials and attachments).

The analysis on FAD related activity is mainly based on the daily log of the observers (PS-2), but also includes information on the origin of the FAD collected in form GEN-5.

Finally, the analysis on the relationship between FAD design and usage with the catch composition, merges information from the two forms mentioned above with forms PS-3 and GEN-2. Given the number of factors analysed and that dFAD records were far more frequent, we focused on dFADs for the current preliminary analysis.

We used generalized linear models to study the effect of different parameters related to dFAD design over the bycatch of certain species and species groups. For the study of presence/absence of a given species in the catch or the proportion of a species in the total catch, we used binomial models, while in the study of the catch rate of the target species we used log-normal glms.

Finally, we studied the effect of different environmental variables over the presence in the catch of bigeye tuna, silky shark (*Carcharhinus falcicormis*) and oceanic whitetip shark (*C. longimanus*). The environmental factors included where ratio of FAD to mixed layer depth, sea surface height, sea surface temperature, distance to seamounts, bathymetry, distance to coast and ENSO index.

Models were selected for each species as a function of the Akaike Information Criterion (AIC), by using the stepwise algorithm implemented in the R function "step".

Results

The current database holds 17,939 records of the GEN-5 forms, from the 2009 FAD closure to the first months of 2014. The number of processed forms versus date is shown in Figure 1. It comprises data from 500 observers of the Regional Observer Programme aboard 264 vessels from 17 nationalities. Figure 2 shows the distribution of records by flag.

Since the FAD closure in 2009, the coverage of GEN-05 processed forms is c. 6% of the associated sets in the WCPFC-CA between 20°N and 20 °S, excluding Indonesia, Vietnam and the Philippines domestic fleets (Figure 3).

FAD designs

GEN-05 forms include information on the nature of the object (natural, man-made, anchored, drifting…), size (length, width, maximum depth) and the presence/absence of 17 different materials, either as attachments or as part of the main object structure.

Excluding the deployment and retrieval activities, 78% (60% drifting, 18% anchored) of the interactions with FADs are with man-made FADs and c. 20% with natural floating objects. When we only take into account fishing activities (sets), natural objects become less impacting. 59% of the sets recorded are on drifting FADs, 15% on anchored FADs, 10% on natural objects, 6% on natural objects with a buoy attached and a 10% unknown). Fishing on natural objects without buoys is therefore around 11% of the total of associated sets. The location of the sets, per FAD type, is shown in figure 4.

The frequency of the interactions, by the nature of the FAD (aFAD, dFAD, nFAD) is summarized in table 1. The observers register two fields related to the nature of object, one when it is found and one when it is left. The type of floating object, or the fate of the object, is sometimes difficult to ascertain from the forms, due to wrong coding or to the intrinsic nature of the activity (e.g., anchoring a drifting FAD, placing a buoy on a natural object, etc.). For the purpose of the analysis of FAD designs, with have avoided those records where the nature of the object is not clear.

Table 2 summarizes the use of materials (main materials and attachments) for dFADs and aFADs. Floats (81 %) and bamboo canes (66 %) are the most frequent main materials used in the design of dFADs, and net hanging below the object (92 %) is by far the most common attachment, usually in combination with chains, cable rings and weights (68%) and or ropes (67%). The configuration of the anchored FADs is more variable. The majority of the records include a Philippines design drum (66%). Chain, cable rings and weights, and cords, are used as attachment materials in c. 70% of the records.

Regarding the combination of materials, the most frequent aFAD main material design recorded consists of only a Philippine design drum (42 %), followed by the use of metal drums, either in combination with Philippine design drums (11 %) or PVC, plastic sheeting, bamboo canes and floats (6%). The main attachment combination in aFADs are chain, cable rings and weights in combination with cords and tree branches (24%); with cords (12 %); with cords, net hanging and sacking (10%); or without any additional attachment (8 %).

As for the dFADs, most of them include floats combined with bamboo cane (25%); just floats (18%); floats with bamboo and plastic sheeting (14 %); and floats combined with PVC and plastic tubing (6 %). The most frequent attachment for dFADs is the net hanging below the object, in combination with chain, cable rings, weights and ropes (22 %); chain, cable rings, weights , ropes and sacking (14 %); with net hanging and ropes only (7 %); and with only net hanging below the FAD (7%).

Regarding the size of the FADs, the coverage of the FAD dimensions varies depending on if it is the length (87 %), the width (78 %) or the depth (73 %). The average dimensions recorded for aFAD and dFAD is given in table 3.

According to the observers records, there is a significant variability in the maximum depth reached by aFADs, generally being very shallow in the Bismark Sea (<5 m deep), moderate in the Solomon Islands area, and deeper in other regions (Figure 5). dFADs seldom reach depths over 60 m east of 180°E, are shallower in archipelagic waters and are highly variable in the remaining region west of 180°E, with some shallow records (< 5 m) and others going beyond 100 m deep.

For the current analysis we have removed records with depth over 200 m and length/width over 10 m. However, it must be noted that the information compiled may require further filtering and the results displayed may be include some artifacts (e.g. some of the aFADs east of 170°E).

Data availability

The fulfillment of a GEN-05 form, does not necessarily imply that all the fields are correctly filled. Table 4 summarizes the rate of coverage of some of the fields identified as potentially important from a management perspective.

The type of FAD was not available (using “as found” and “as left” codes) in c. 17% of the cases, and the FAD depth in c. 27% of the records. Regarding the fields that could allow for FAD individual tracking, the buoy number was the most frequently recorded one in the case of dFADs, with a coverage of c. 52%.

However, this figure is conservative, since it includes a large proportion of records which do not correspond to an unique identifier. In the case of aFADs, most ot the times they do not include a buoy. aFAD markings were recorded in c. 39% of the records.

The coverage of species of special interest was high, over 95% of the records.

Activity related to FADs

Table 5 summarizes the activity codes recorded by the observers in the GEN-05 forms. The main FAD-related activities are the investigation of floating objects (57 %) and fishing (26 %). It indicates that on average fishing roughly occurs 30% of the times a FAD is checked. This value is around 35% for dFADs, 29% for aFADs and 21% for natural objects.

There is a significant difference between the number of FAD deployments and retrievals recorded. This is partially due to the fact that objects are frequently recovered during the set or after being investigated. It seems the coding for indicating a FAD retrieval after a set takes place or after a FAD is investigated is not uniform among observers. Therefore, it is not possible to estimate differences between FAD deployments and recoveries (which might provide information on FAD loss, FAD usage by vessel, deployments while the observer is not on duty, etc…). Around 1% of the records have codes not directly related to FAD activities, and can be considered as wrong.

Origin of the FADs

The majority of dFADs recorded had been deployed in previous trips of the vessel (36.9 %), and 17.6 % are indicated as having its origin in the same trip , although this also includes deployments. 28 % are from other vessels. As for the aFADs, the majority of them had been deployed by an auxiliary vessel (40.6%), 15% in previous trips of the vessel, and only 3.8% during the same trip (table 6).

Regarding fishing activities, 46.2% of the dFAD sets were on dFADs deployed by the vessel in a previous trip, 25.8 % on dFADs deployed by other vessels, and 11.7 % by dFADs deployed in the same trip. 44.8 % of the sets on aFADs were of objects deployed by auxiliary vessels, 16.5% by the vessel in previous trips, 19.1% by other vessels and 4.7% by the vessel in the same trip.

Tracking of individual dFADs

Since many of the aFADs do not incorporate a buoy, the current analysis has been focused only on dFADs. 4897 out of the 9307 (52.6%) records considered as dFADs included a buoy number. Although a thorough screening of the buoy numbers was not made, a significant proportion of the records did not have a unique ID number that allowed for individually tracking of the dFADs. As an example, one third of the records with buoy number consisted of a number lower than 1000 and were not included, as well as others other records that were clearly not valid (e.g. “UNK”, dates, vessel names, etc.). Of the 2549 buoy numbers that remained, 443 were duplicated (appeared two or more times in the database), and the remaining 2106 appeared only once. Overall, 23.3 % of the original records had a valid and duplicated buoy number, but 90% of these duplicates were within the same trip (i.e., 2.5% of the records were duplicated between different trips).

The analysis of the object numbers (the object number is assigned sequentially to the FADs encountered by an observer during a trip) indicates that this field is recorded 92% of the times, and that around 16%

of the objects are recorded more than once during a trip (this figure is similar to the ones on buoy numbers, indicating that buoy numbers are probably consistent within a trip).

Relationship between FAD design and catch composition

The flag of the vessel had, by far, the most important effect over the CPUE of skipjack (table 8, figure 6) and bigeye-plus-yellowfin (table 9, figure 7) catches on dFADs. The skipjack assessment model region (Rice, 2014) also had a significant effect, with slightly larger skipjack CPUEs in the eastern equatorial area and a higher combined bigeye-plus-yellowfin catch in region 5. Some other factors related to the design of the dFAD were retained in the model selection, but with a minor effect in comparison with the flag and the region. The models explained 8% and 13% of the variability in skipjack and bigeye-plus-yellowfin catch rates, respectively.

The analysis of the proportion of bigeye-plus-yellowfin over the total catch yielded similar results (table 10, figure 8) with flag and region being the main factors explaining the variability in the percentage of bigeye plus yellowfin in the catch. The model removed c. 7% of the variability, but the fit of the model to the data was not good (le Cessie-van Houwelingen-Copas test $p<0.01$).

Bigeye was present in c. 59% of the dFAD sets recorded in GEN-05 forms. The logistic model reflected that the main factor affecting the appearance of bigeye in the catches is, by far, the flag of the vessel ($p = 3.3 \times 10^{-26}$). The region was the second ($p = 7.2 \times 10^{-9}$), followed by several components of the FAD design (table 11). The model only removed 11% of the null deviance, but the fit of the data was poor ($p = 0.04$). Figure 9 exemplifies some of the effects of the factors retained in the stepwise model selection.

In the case of the bycatch species, most of the records consist of zero catches, with a very low occurrence of most of the species (table 12). Table 13 summarizes the factors retained in the stepwise model selection for each of the species, together with the p-values, the percentage of the original deviance removed by the model and the goodness of fit of the binomial models. In general, the factors included removed c. 10% of the original variability. Figure 10 illustrates the main effects retained in the case of the silky shark.

Inclusion of environmental variables.

Some preliminary trials including environmental information were made. The occurrence of bigeye, silky shark and oceanic whitetip was analysed against the presence of the different materials and several environmental variables. Table 14 shows the factors retained in each model, the p-values, the percentage of deviance removed and the goodness of the fit.

The inclusion of environmental variables improved the fit and explained more variability. In the case of the bigeye, the flag effect still supersedes any other, but also indicates some effects of environmental variables (e.g. SST) that might deserve further study (figure 11).

As for the silky and oceanic whitetip sharks, the deviance is still high, but some environmental effects are apparent, like the ENSO index over oceanic whitetip catches or the relation between the depth of the FAD and the mixed layer depth in the case of the silky shark (figures 12 and 13).

Discussion

Due to the lower level of observer coverage during the first years (full purse seine observer coverage was adopted in March 2012 through CMM2011-01) and the need to keypunch all the information collected by the observers, the current database comprises around 6% of the associated sets carried out in the area 20°N-20°S since the first FAD closure in 2009. This figure is expected to increase significantly for the most recent period as the forms from the different programmes are received and entered. The data are representative of the fishing activity in the WCPFC Convention Area, although some flags are over (e.g., Korea, Ecuador, China) or under-represented (e.g. US) in the current dataset, taking into account the number of GEN-5 forms processed so far vs the number of sets by flag during the same period.

Current data indicate that most of the interactions and fishing activities relate to dFADs (more than 65% of the sets), while fishing on natural objects is relatively minor (c. 10% of the sets). The structure of the FADs in the Convention Area is highly variable, as Itano et al. reported back in 2004, but some designs seem to prevail over others, probably reflecting the homogeneity within the main fishing fleets.

Drifting FADs are deployed all over the western and central Pacific, while sets over natural objects and, specially, anchored FADs are more restricted to the western equatorial region. There seems to be also a pattern in the depth distribution of the FADs, being generally shallower to the east of 180°E and archipelagic waters, probably reflecting the depth distribution of the mixed layer in the region.

The current dataset seems to indicate that with the information currently collected it is not possible to estimate the number of FADs used by each vessel, since there is a clear mismatch in the number of deployments and retrievals, and a significant proportion of the interactions are with FADs from other vessels (including auxiliary vessels). Additionally, the lack of information on the data transmission capabilities of the buoys attached to the FAD (e.g., buoys with echosounders) makes it impossible trying to get accurate information on the level of effective FAD-associated effort, other than the total number of sets.

It seems not possible either to track single FADs. What would allow for estimating the influence of some factors, like time-at-sea or distance covered over the catches, "fishing capacity" of each single FAD or the degree of FAD sharing among vessels. The low number of buoy numbers duplicated between trips (figure that nevertheless would increase as the coverage of GEN-5 forms improves), together with the fact the origin of the FAD is usually from a different trip of the vessel, suggests that even in the case that buoy numbers were recorded, the different criteria in the coding would make it difficult to match. In any case, the coverage of buoy numbers or external markings seems to indicate that the observer does not have access to this information on most of the occasions (FAD not hauled on board, no external marking, etc). A potential solution that has been proposed and has recently been adopted by the International Commission for the Conservation of Atlantic Tunas (ICCAT Recommendation 11-01 and following bigeye and yellowfin conservation measures) and the Inter-American Tropical Tuna Commission (IATTC Resolution C-13-04) is the development of a FAD logbook, to be filled in by the operators of the vessels, and a FAD identification scheme. This would significantly improve our understanding on the impact of FADs over the ecosystem, including working towards the standardization of effort of a fishery that is significantly impacting on the tropical tuna resources in the WCPFC-CA, and further establishing management options with a better measure of the fishing capacity.

The analysis of the CPUEs shows that the main factor affecting the catch per set is the flag of the vessel. This result is not unexpected, since the average tonnage of the vessels, net sizes, etc. are considerably different among flags, and this is likely to affect the catch rates. Besides, the strategy of the fleets may vary considerably, too (e.g. some fleets may set more often on smaller aggregations, while others use echo-sounder equipped buoys and set less times over larger aggregations).

One of the main concerns in relation to FAD usage, and the driving force for limiting its use through temporal closures and set limits, is the capture of bigeye and yellowfin tuna juveniles. The collection of the information included in Gen-5 form could potentially be useful for considering alternative mitigation measures which are less impacting over the fishing activity. Unfortunately, our preliminary results show that the flag effect, even when spatial factors are included, is the most significant factor explaining differences in bigeye and yellowfin catch. Although variations within the region level, or the effect of operational differences between the fleets, cannot be completely ruled out, it suggest that reporting may vary as a function of the vessel flag. Therefore, although the information on FAD design is accurate and would serve for studying any relationship between design and catch rates, the lack of accurate species catch composition at the set level makes it difficult to undertake such analyses. Taking into account the amount of information observers must record and that the processing of these data implies a considerable amount of resources (debriefing, data entry, processing), it seems sensible to consider other approaches to the issue of potential bigeye and yellowfin bycatch mitigation in relation to FAD design.

The analysis of other species bycatch is complicated due to the low occurrence for most of the species and the number of factors considered. It probably needs of a much larger database and other statistical methods (e.g. working with numbers of fish and using zero inflated negative binomial models). Preliminary results indicate that environmental factors may play an important role on the presence of some bycatch species. Other operational factors not included in the current document (vessels speed, net depth, etc.) might also affect the bycatch of some species and should be included in future studies. Others, like the time that a dFAD is at sea and has to "aggregate" bycatch is also likely to have an impact, but this will be difficult to determine without an unique, standardized FAD identifier system.

Finally, it must be pointed out that we have not taken into account the fate of the bycatch species, which is likely to be influenced by the FAD components (e.g. entangling vs non-entangling FADs). Although some modifications are not likely to reduce the number of interactions, they may have a significant effect on the survival of the species. Review of bycatch species fate in relation to FAD components will be undertaken as a part of the more comprehensive study.

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Table 1.- Frequency of each type of floating object, as found and as left, as recorded by the observers.

Found as	Left as	Count	Frequency	Notes
dFAD	dFAD	5619	31.32	dFAD
aFAD	aFAD	2145	11.96	aFAD
-	-	2142	11.94	Unknown
dFAD	-	1658	9.24	dFAD. This coding usually indicates recovery.
Natural	Natural	1561	8.70	Natural object
-	dFAD	1290	7.19	dFAD. Mainly indicates deployments
Natural with buoy	Natural with buoy	593	3.31	Natural object with buoy attached
Natural	Natural with buoy	571	3.18	Natural object found and left with a buoy attached
dFAD	Other	254	1.42	dFAD, generally indicates a retrieval
aFAD	Other	213	1.19	aFAD. Frequently indicates FAD retrieval
Other	Other	180	1.00	Various. Frequently, live whales.
Natural with buoy	Natural	179	1.00	Removal of buoy from a natural object
Natural	-	176	0.98	Natural object, frequently left as it was or with a radio buoy added.
dFAD	dFAD-changed	170	0.95	dFAD modified before re-deployment
-	aFAD	115	0.64	aFAD. Various activities related.
dFAD	aFAD	112	0.62	dFAD found and anchored
Natural	dFAD	84	0.47	Natural object found and left with a buoy attached

Table 2.- Usage of different materials (%) in the design of drifting (dFAD) and anchored (aFAD) FADs.

	MAIN MATERIALS										ATTACHMENTS					
	Logs tied	Timber, pallets, planks	PVC or plastic tubing	Plastic drums	Plastic sheeting	Metal drums	Philippines design drum	Bamboo/ Cane	Floats/Corks	Other	Chain, cable rings, weights	Cord, rope	Netting hanging below FAD	Bait containers	Sacking, bagging	Coconut fronds, tree branches
dFAD	5	7	12	0	29	0	2	66	81	6	68	67	92	2	43	19
aFAD	2	2	20	1	17	25	66	25	23	3	71	70	32	0	17	35

Table 3.- Average size (± sd) of drifting and anchored FADs (after exploratory analysis of the size distributions, records over 10 m in length or width, over 200 m in maximum depth or with length or widths equal to 0 have not been included in the calculations).

	Depth	**Length**	**Width**
aFAD	25.57±35.77	2.76±0.88	1.16±0.82
dFAD	41.17±24.20	2.37±1.11	1.15±1.04

Table 4.- Rate of coverage of important fields in GEN-05 forms

Parameter	Coverage
Type of FAD	83 %
FAD materials design	95 %
FAD maximum depth	73 %
dFAD log beacon	43%[1]
dFAD buoy number	52 %[2]
dFADMarkings	13 %
aFAD log payao	22 %[1]
aFAD buoy number	6 %
aFAD markings	39%
Object number	89 %
Species of special interest trapped	96 %

[1] The log beacon and log payao numers originate from the old PS-2 forms and is not currently used.

[2] A large number of these records do not seem to correspond to unique buoy identifiers (e.g. one third of the buoy numbers consisted of 3 numeric digits or less, others correspond to vessel names, bear 3 letters or less, etc.)

Table 5- Frequency of each activity code, as recorded by the observers in the GEN-05 forms. Shaded activities are not related to FADs.

GEN-5 Code	Meaning	Freq	Perc
2	Searching	122	0.7
3	Transit	11	0.1
4	No fishing - Breakdown	2	0.0
7	Net cleaning set	1	0.0
8	Investigate free school	27	0.2
11	No fishing - Drifting at days end	8	0.0
14	Drifting - With fish aggregating lights	9	0.1
16	Transhipping or bunkering	2	0.0
H1	Helicopter takes off to search (H1)	6	0.0
H2	Helicopter returns from search (H2)	8	0.0
-	Field empty	15	0.1
1	Fishing	4645	25.9
9	Investigate floating object / log	10168	56.7
10D	Deploy - raft, FAD or payao (10D)	1763	9.8
10R	Retrieve - raft, FAD or payao (10R)	353	2.0
12	No fishing - Drifting with floating object	54	0.3
15R	Retrieve radio buoy (15R)	336	1.9
15D	Deploy radio buoy (15D)	360	2.0
17	Servicing FAD or floating object	33	0.2

Table 6.- Origin of the FAD in all the activities recorded

	dFAD	aFAD
Vessel this trip	1638 (17.6 %)	103 (3.8 %)
Vessel other trip	3435 36.9%)	404 (15.0 %)
Other vessel with consent	1288 (13.8 %)	230 (8.5 %)
Other vessel without consent	836 9.0 %)	249 (9.2 %)
Other vessel (consent unknown)	484 (5.2 %)	117 (4.3 %)
Drifing and found by vessel	643 (6.9 %)	52 (1. 9 %)
Deployed by FAD auxiliary vessel	140 (1.5 %)	1093 (40.6 %)
Origin unknown	446 (4.8 %)	262 (9.7 %)
Other origin	149 (1.6 %)	137 (5.1 %)
Empty field	248 (2.7 %)	45 (1.7 %)
Total	9307 (100 %)	2692 (100 %)

Table 7.- Origin of the FAD in fishing activities recorded

	dFAD	aFAD
Vessel this trip	305 (11.7 %)	35 (4.7 %)
Vessel other trip	1204 (46.2 %)	124 (16.5 %)
Other vessel with consent	422 (16.2 %)	63 (8.4 %)
Other vessel without consent	151 (5.8 %)	56 (7.5 %)
Other vessel (consent unknown)	100 (3.8 %)	24 (3.2 %)
Drifting and found by vessel	181 (6.9 %)	12 (1.6 %)
Deployed by FAD auxiliary vessel	51 (2.0 %)	336 (44.8 %)
Origin unknown	107 (4.1 %)	79 (10.5 %)
Other origin	45 (1.7 %)	15 (2.0 %)
Empty field	41 (1.6 %)	6 (0.8 %)
Total	2607 (100.0 %)	750 (100.0 %)

Table 8.- Anova table of the factors affecting the catch of SKJ in FAD sets.

factors	LR Chisq	Df	p
Region	13.672	2	1.07×10^{-03}
Flag	98.015	16	8.15×10^{-14}
Plastic sheeting	5.985	1	1.44×10^{-02}
Bamboo/Cane	4.807	1	2.84×10^{-02}
Cord/Rope	3.752	1	5.27×10^{-02}
Sacking, bagging	4.389	1	3.62×10^{-02}

Table 9.- Anova table of the factors affecting the catch per set of bigeye plus yellowfin in dFAD sets.

factors	LR Chisq	Df	p
Region	23.786	2	6.84×10^{-06}
Flag	150.107	16	7.44×10^{-24}
FAD depth	17.55	7	1.42×10^{-02}
Plastic sheeting	2.543	1	1.11×10^{-01}
Floats/corks	3.908	1	4.80×10^{-02}
Other	2.941	1	8.63×10^{-02}
Chain, cable rings, weights	15.182	1	9.76×10^{-05}
Cord, rope	10.723	1	1.06×10^{-03}
Coconut fronds, tree branches	11.409	1	7.31×10^{-04}

Table 10.- Anova table of the factors affecting the percentage of bigeye plus yellowfin in FAD sets.

factors	LR Chisq	Df	p
Region	9.74	2	7.7×10^{-3}
Flag	33.752	16	5.9×10^{-3}
Cord, rope	3.142	1	7.6×10^{-2}
Coconut fronds, tree branches	1.566	1	2.1×10^{-1}

Table 11.- Anova table of the factors affecting the presence of bigeye in dFAD sets.

factors	LR Chisq	Df	p
Region	29.457	2	4.01×10^{-07}
Flag	155.976	16	5.15×10^{-25}
FAD depth	18.282	7	1.08×10^{-02}
Logs tied	2.801	1	9.42×10^{-02}
Timber, pallets, planks	9.435	1	2.13×10^{-03}
PVC or plastic tubing	2.049	1	1.52×10^{-01}
Plastic sheeting	5.915	1	1.50×10^{-02}
Cord, rope	2.544	1	1.11×10^{-01}
Sacking, bagging	6.618	1	1.01×10^{-02}

Table 12.- Percentage of records with catches by bycatch species.

	Null records	Positive records	Presence %
Carcharhinus falciformis	1284	801	38.4
Carcharhinus longimanus	2061	24	1.2
Otariidae, phocidae	1941	144	6.9
Elagatis bipinnulata	776	1309	62.8
Rhincodon typus	2079	6	0.3
Tetrapturus audax	2018	67	3.2
Makaira mazara	1895	190	9.1
Makaira indica	1955	130	6.2
Mobulidae	1986	99	4.7
Coryphaena hippurus	1545	540	25.9
Seriola spp	2075	10	0.5
Auxis rochei	2061	24	1.2
Euthynnus affinis	2064	21	1.0
Trachypteroidei	1370	715	34.3
Acanthocybium solandri	1624	461	22.1
Thunnus alalunga	2082	3	0.1
Bramidae	1914	171	8.2
Scombridae	1645	440	21.1
Testudinata	2065	20	1.0
Mammalia	2071	14	0.7

Table 13.- p-values for the factors retained in the final binomial model for each of the species, and goodness of fit of the model (le Cessie-van Houwelingen-Copas test). Low p-values (<0.05) indicate lack of fit.

Species	Region	Flag	FAD depth	Logs tied	Timber, pallets, planks	PVC or plastic tubing	Plastic sheeting	Bamboo/ Cane	Floats/Corks	Other	Chain, cable rings, weights	Cord, rope	Netting hanging below FAD	Sacking, bagging	Coconut fronds, tree branches	% Deviance removed	Goodness of fit (p-value)
T. alalunga	0.11	-	-	-	-	0.08	-	-	0.08	-	-	-	-	-	-	0.18	0.07
Seriola spp	-	-	-	-	-	0.15	-	0.16	0.09	<0.01	-	-	-	0.05	-	0.19	0.15
I. indica	<0.01	<0.01	-	-	-	-	0.03	-	-	-	-	-	-	-	-	0.08	0.83
Auxis rochei	<0.01	-	0.03	-	-	-	-	-	<0.01	-	-	-	-	<0.01	-	0.17	0.73
Bramidae	<0.01	-	-	-	-	0.01	-	-	-	0.02	-	-	-	-	0.13	0.06	0.15
Makaira mazara	<0.01	-	<0.01	-	-	-	-	-	0.01	-	0.06	<0.01	-	-	<0.01	0.06	<0.01
C. hippurus	-	<0.01	-	-	0.10	0.03	-	-	-	0.02	0.11	0.08	-	-	-	0.09	0.23
C. falciformis	<0.01	<0.01	-	-	0.11	<0.01	<0.01	-	-	-	<0.01	0.02	0.02	0.15	0.02	0.06	0.21
E.affinis	<0.01	-	<0.01	-	-	0.12	-	-	-	-	<0.01	-	-	-	-	0.21	0.86
Mammalia	-	-	-	-	-	-	-	-	0.05	-	-	-	-	-	-	0.02	0.00
Mobulidae	-	-	-	-	-	-	-	-	-	-	0.10	0.06	-	-	-	<0.01	0.76
Scombridae	<0.01	<0.01	<0.01	<0.01	-	0.02	-	<0.01	-	-	-	0.12	0.10	-	<0.01	0.12	0.22
T. audax	0.08	-	-	-	0.06	0.01	-	-	-	-	<0.01	-	<0.01	-	-	0.08	0.32
C. longimanus	-	-	-	-	-	0.06	-	-	-	-	-	-	0.05	-	<0.01	0.06	0.17
Rhincodon typus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00
E. bipinnulata	<0.01	<0.01	<0.01	0.06	0.04	-	<0.01	-	-	-	<0.01	-	-	-	-	0.05	0.05
Otariidae, ph.	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	<0.01	0.00
Trachypteroidei	<0.01	<0.01	<0.01	-	-	-	<0.01	-	-	<0.01	-	-	-	0.02	<0.01	0.12	0.45
Testudinata	-	-	-	-	-	-	0.03	0.13	-	-	0.07	<0.01	0.01	-	0.08	0.11	0.36
A. solandri	-	<0.01	-	-	<0.01	<0.01	0.10	<0.01	0.15	-	<0.01	-	-	-	0.11	0.09	0.42
All species	0.11	-	-	-	-	0.08	-	-	0.08	-	-	-	-	-	-	0.18	0.07

Table 14- Effect of dFAD components and environmental variables over the presence in the sets of bigeye tuna (BET), silky shark (FAL) and whitetip shark (OCS).

	BET	FAL	OCS
Region	<0.01	0.02	-
Flag	<0.01	<0.01	-
Timber, pallets, planks	<0.01	-	-
PVC or plastic tubing	0.05	<0.01	0.06
Plastic sheeting	<0.01	<0.01	-
Chain, cable rings, wights	0.04	<0.01	-
Cord, rope	0.06	0.07	-
Netting hanging below FAD	0.12	0.05	0.05
Sacking, bagging	<0.01	-	-
Coconut fronds, tree branches	0.06	<0.01	<0.01
Bathymetry	<0.01	-	-
Distance to seamount	0.02	-	-
ENSO	<0.01	0.05	0.04
depth FAD/ MLD	0.05	<0.01	-
SSH	-	-	0.03
SST	<0.01	-	-
% Deviance removed	0.13	0.07	0.10
Goodness of fit (p-value)	0.43	0.84	0.33

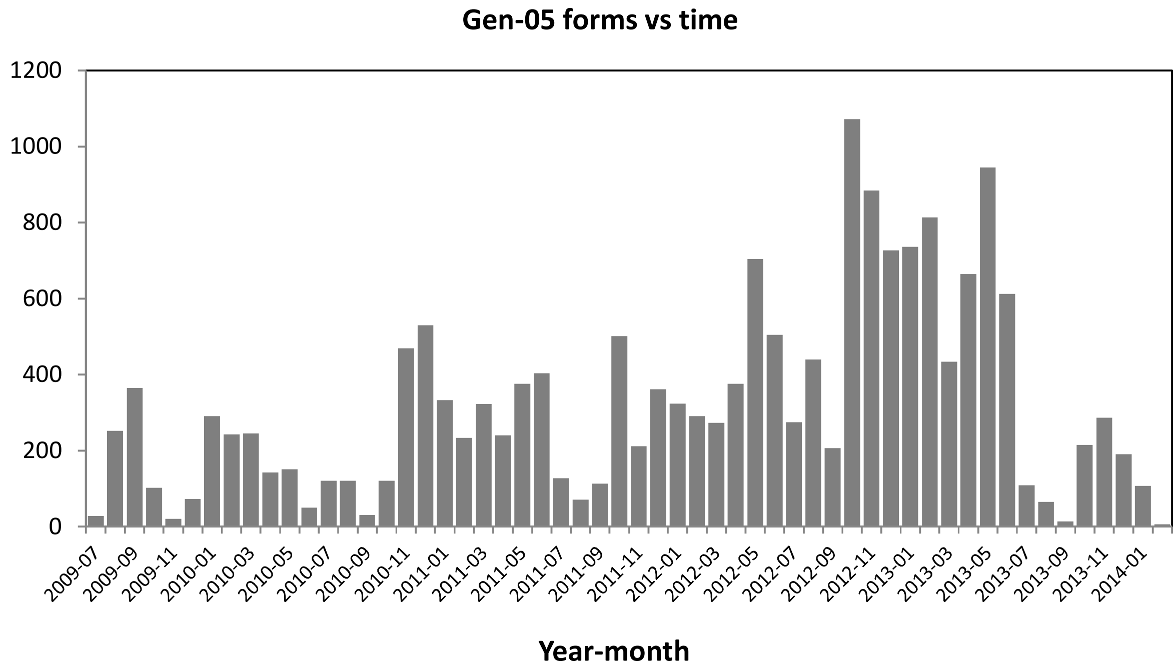

Figure 1.- Number of GEN-05 observer forms processed vs time

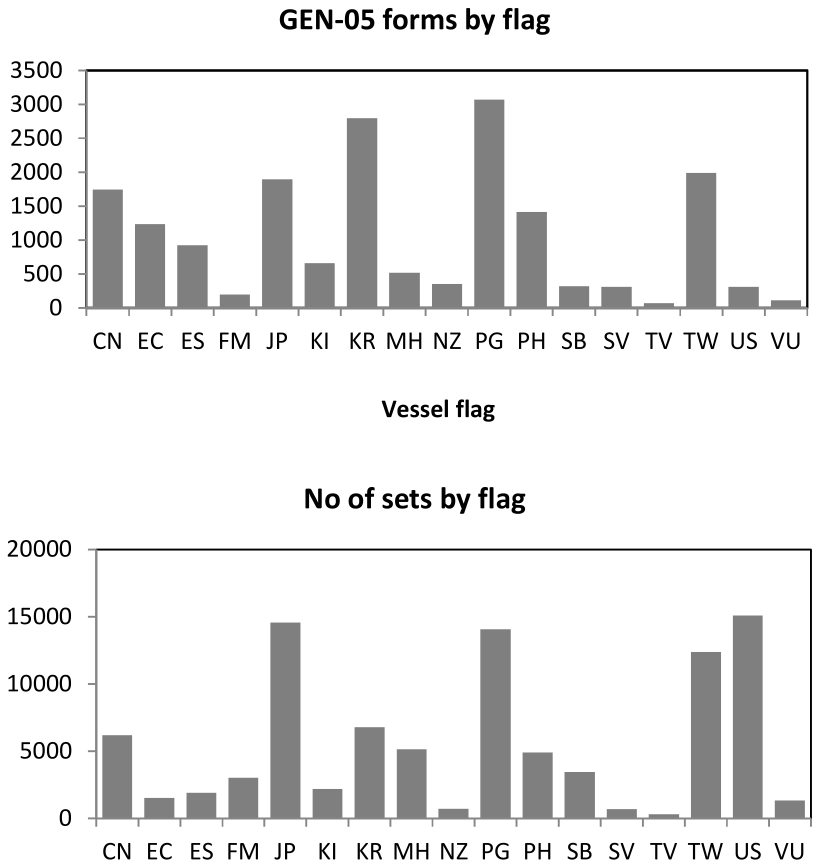

Figure 2.- Number of GEN-05 records and numbers of associated sets by flag in the same period

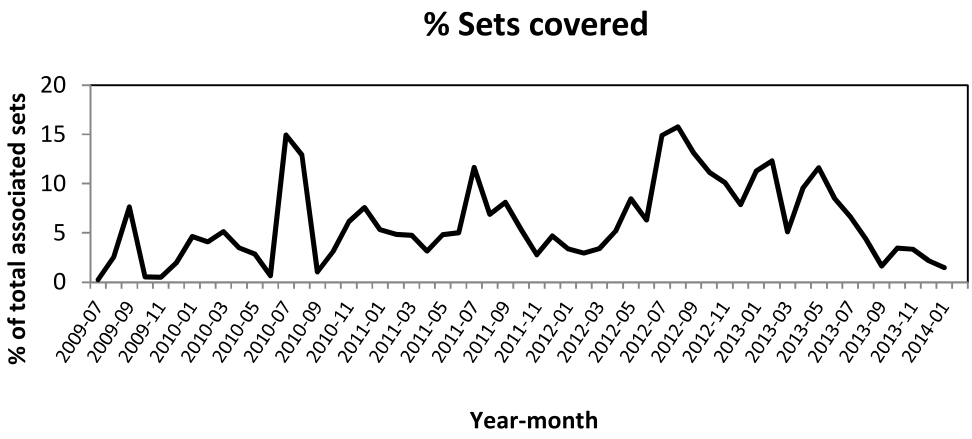

Figure 3.- Percentage of sets covered by GEN-05 forms vs time in the WCPFC-CA between 20°N and 20 °S (excluding Indonesia, Vietnam and the Philippines domestic fleets).

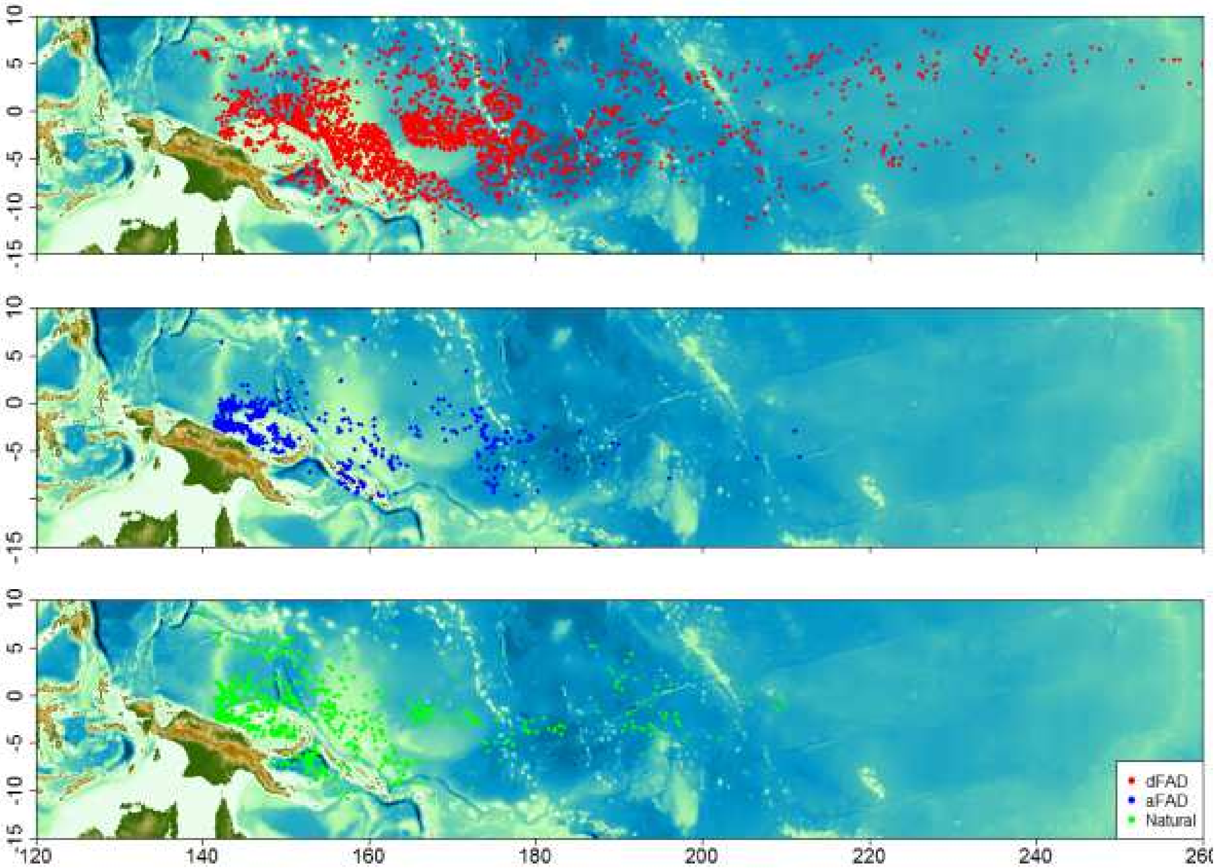

Figure 4.- Location of associated sets recorded in GEN-05 forms by FAD type, as recorded by the observers. dFAD: Drifting FAD; aFAD: Anchored FAD; Natural: Natural FAD.

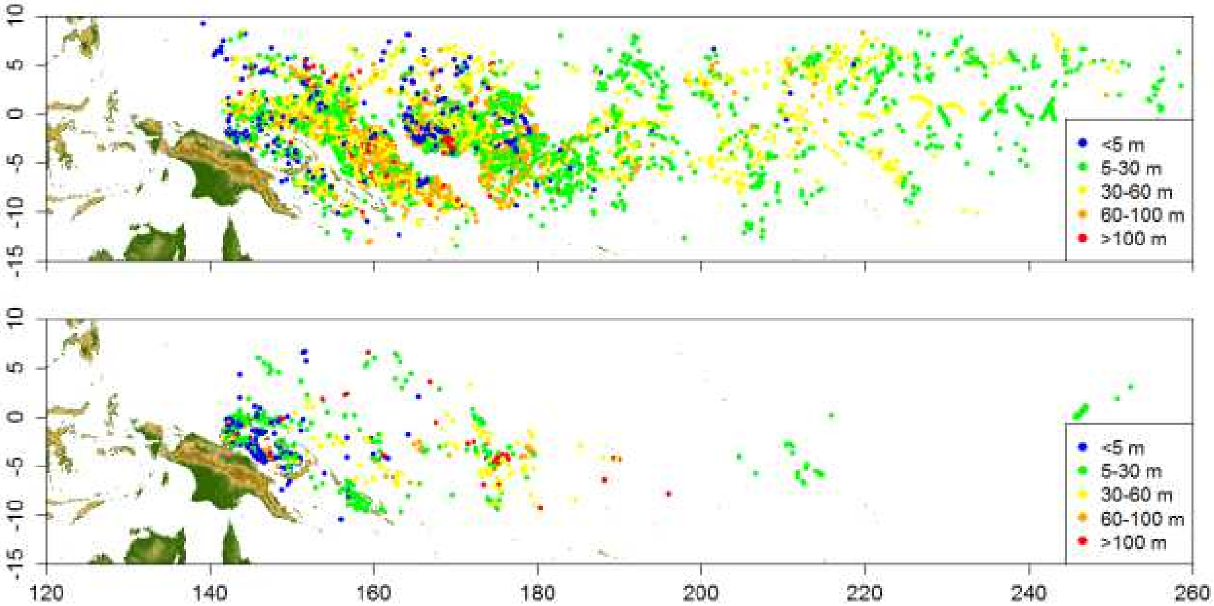

Figure 5.- Distribution of dFADs and aFADs color coded by the maximum depth of the FAD, as recorded by the observers in GEN-5 forms (depths over 200 m were considered artifact and not included).

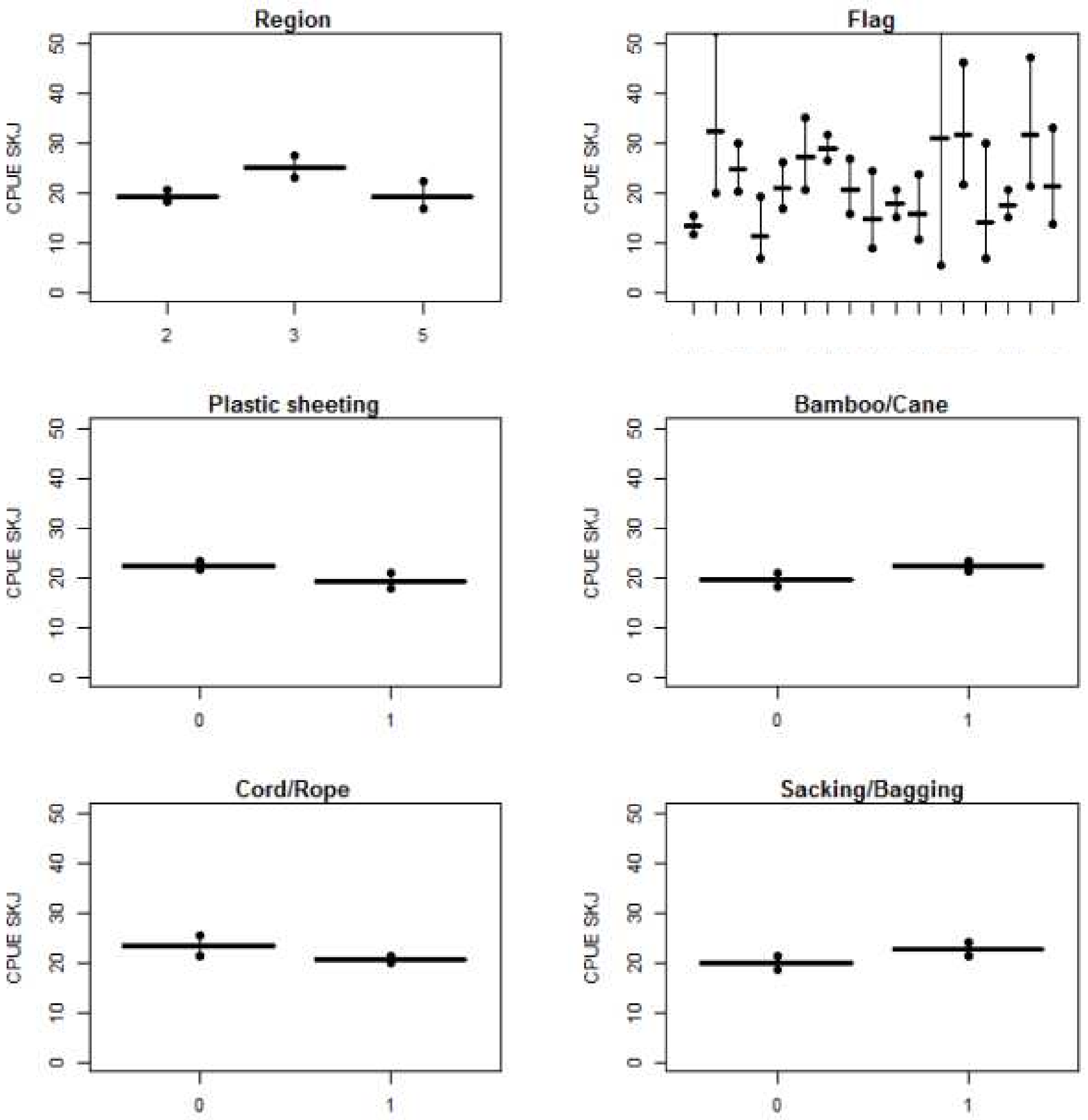

Figure 6.- Factors affecting the catch per set of skipjack in sets covered by GEN-05 forms (note: for practical purposes, the effect of all the FAD design materials is not shown, but are in the same range as the ones shown).

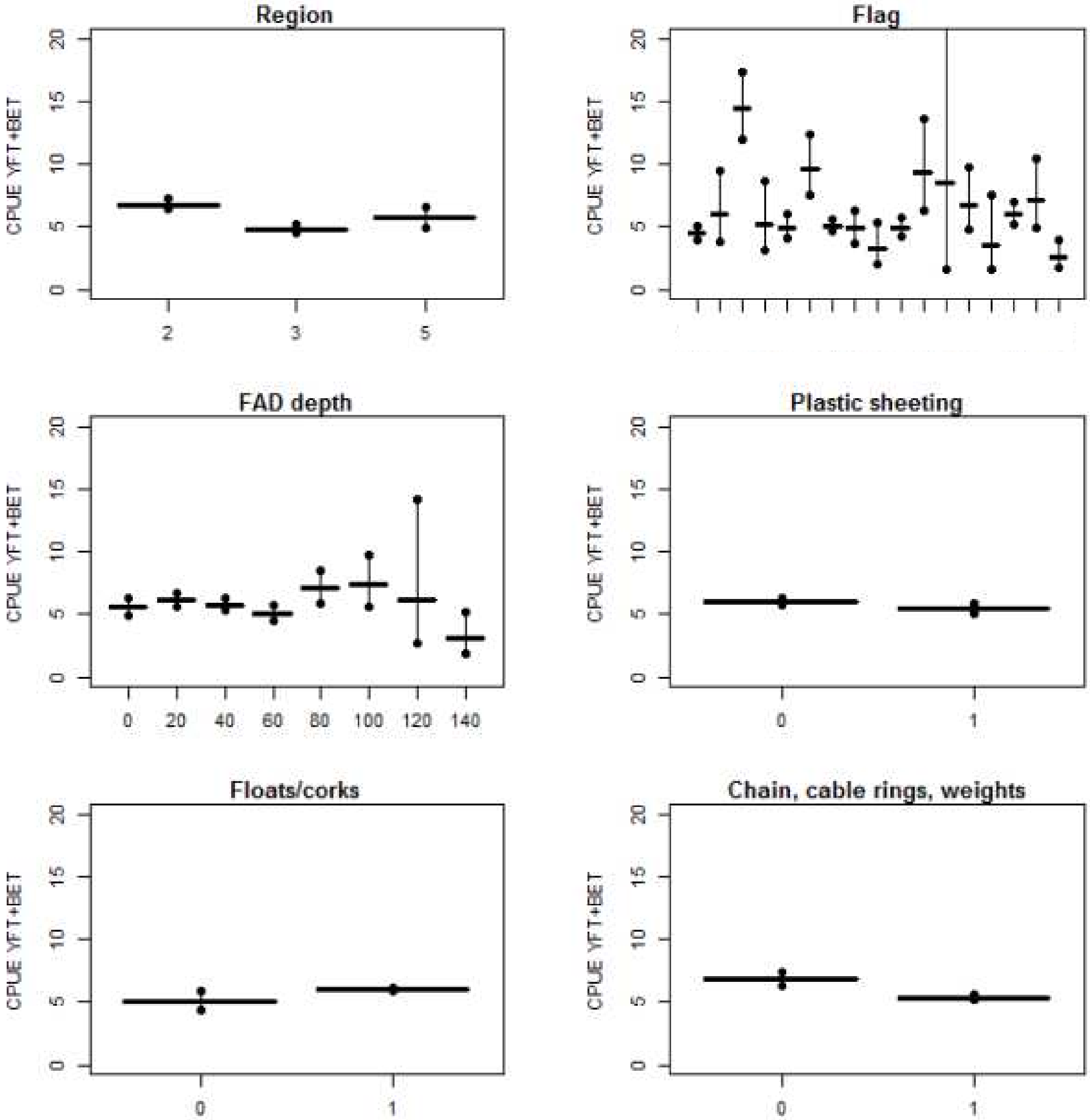

Figure 7.- Effect of different factors over the catch of bigeye plus yellowfin in dFAD sets covered by GEN-05 forms.

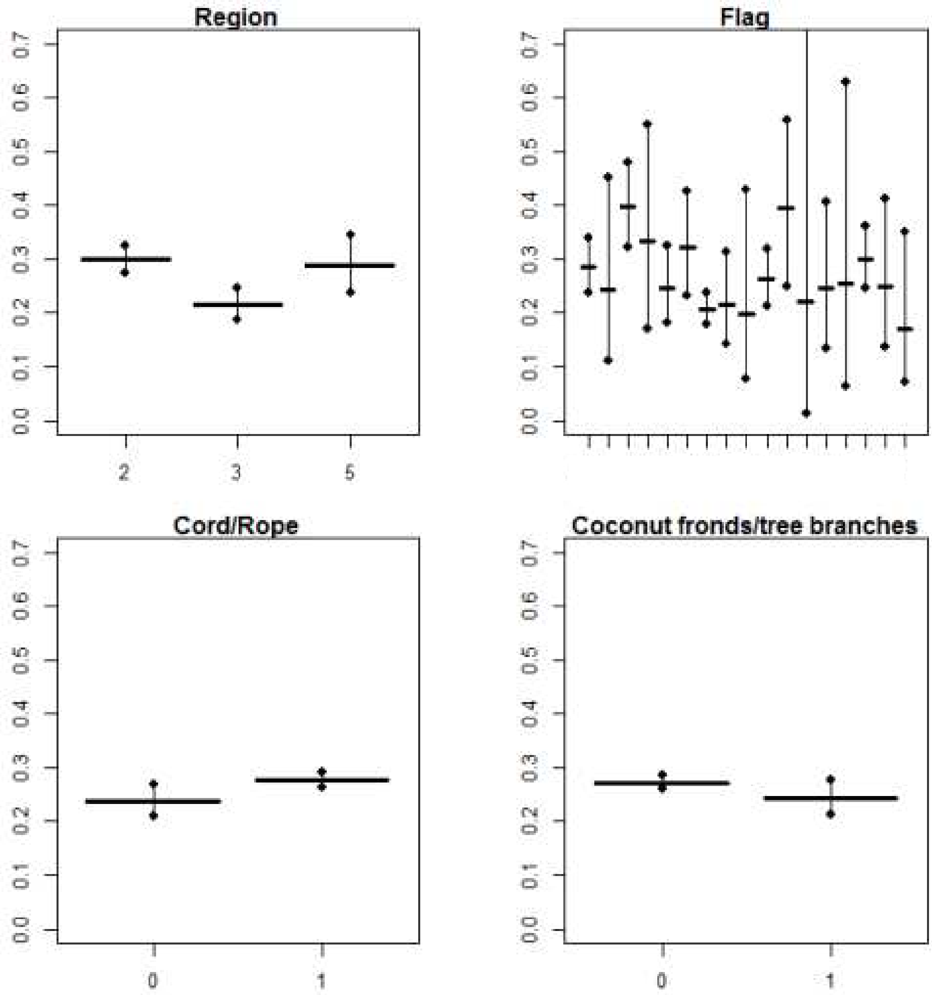

Figure 8.- Effect of different factors over the percentage of bigeye plus yellowfin in sets covered by GEN-05 forms.

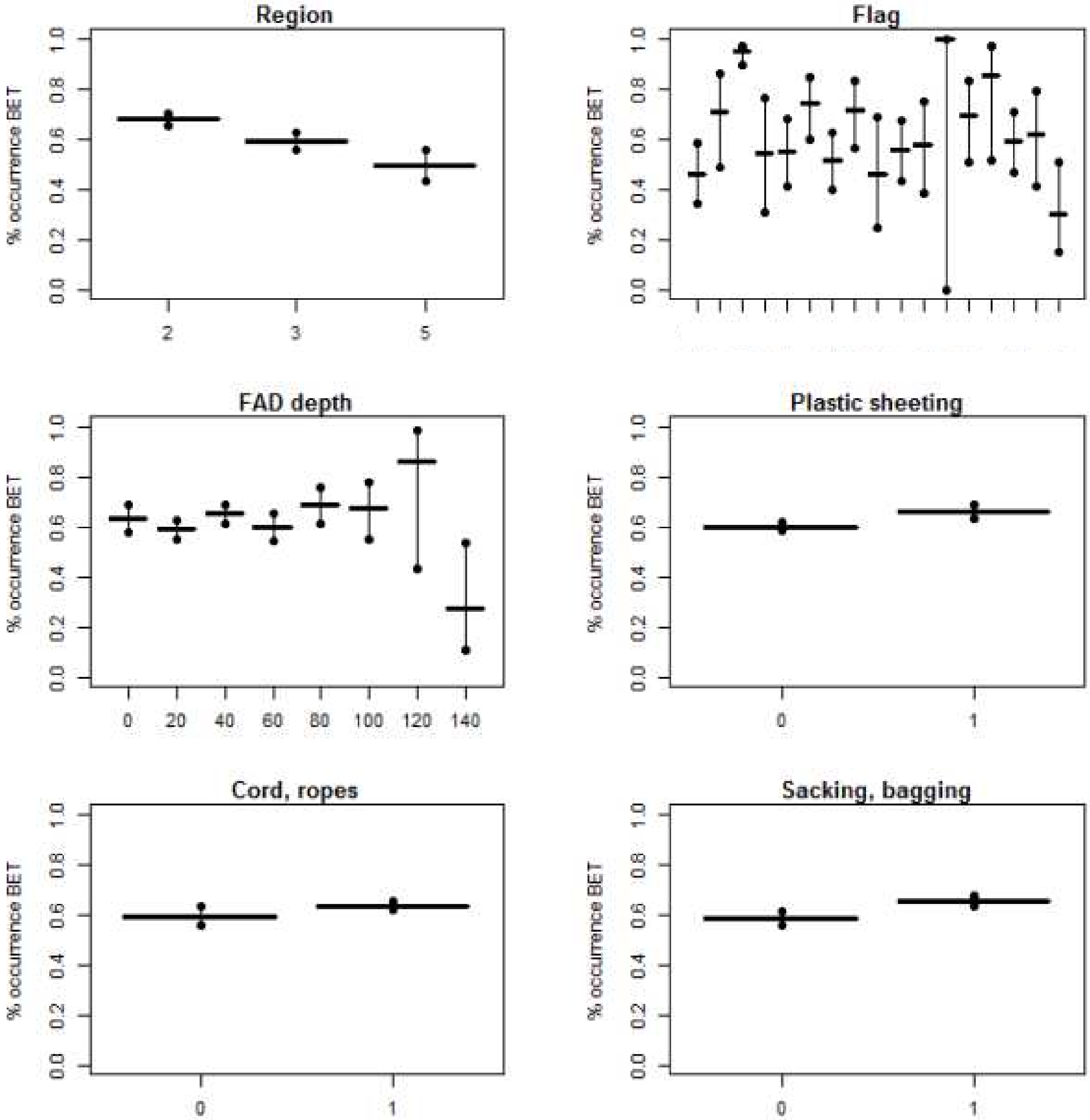

Figure 9.- Factors affecting the presence of bigeye catches reported in dFAD sets covered by GEN-05 forms (note: for practical purposes, the effect of all the FAD design materials is not shown, but are in the same range as the ones shown).

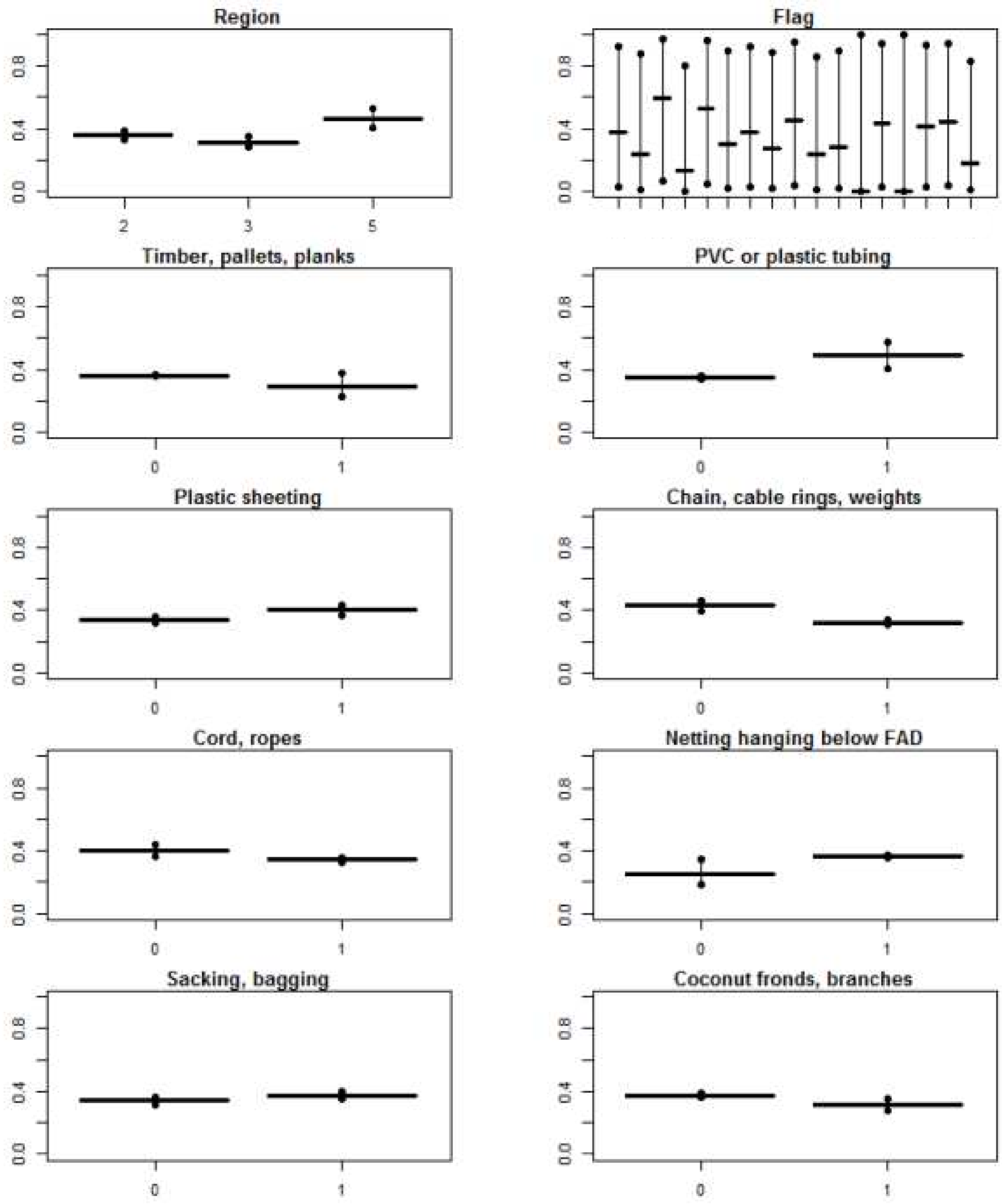

Figure 10.- Factors affecting the presence of silky sharks in dFAD sets covered by GEN-05 forms.

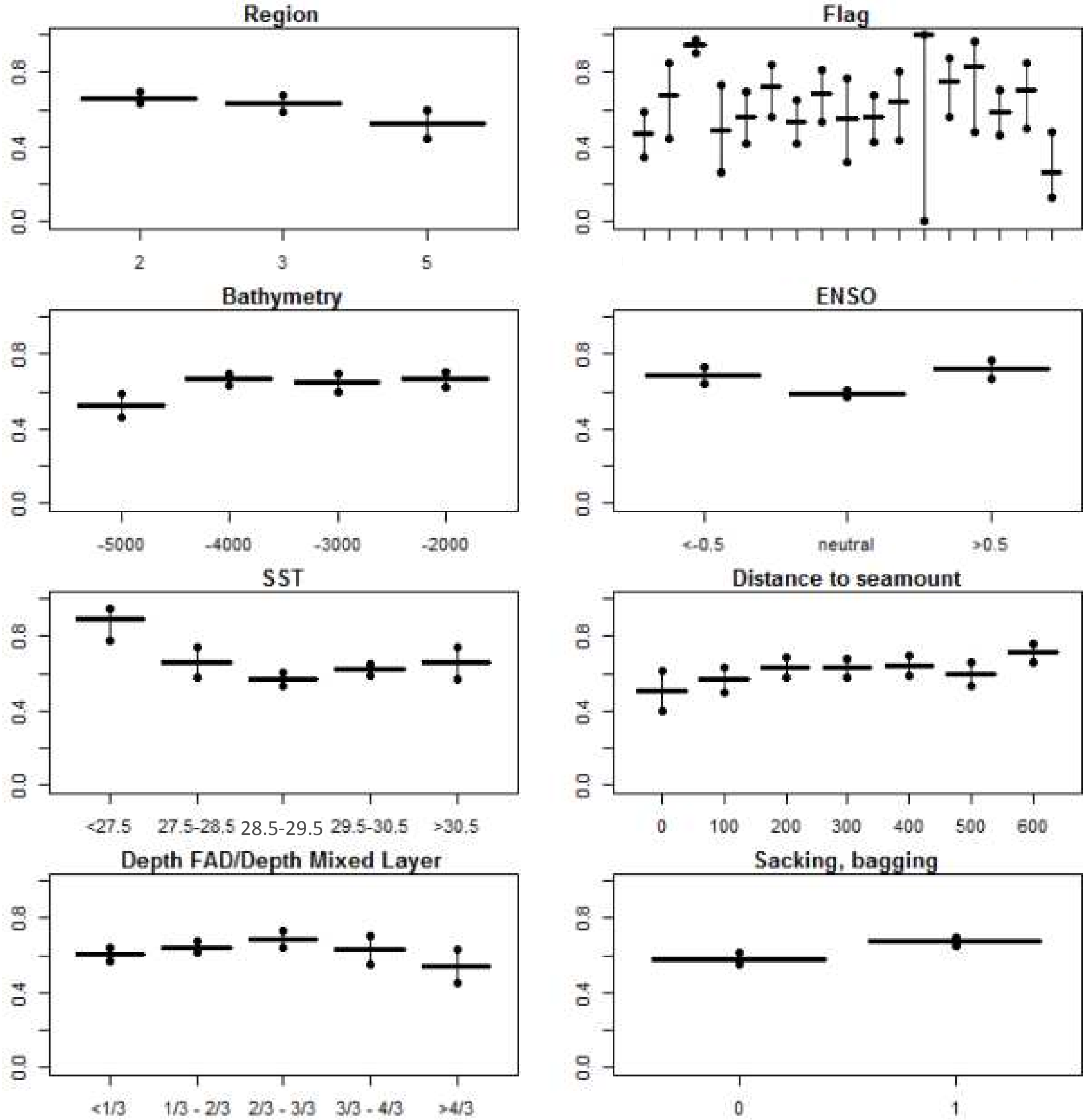

Figure 11.- Effect of different factors, including environmental variables, over the presence of bigeye in dFAD sets.

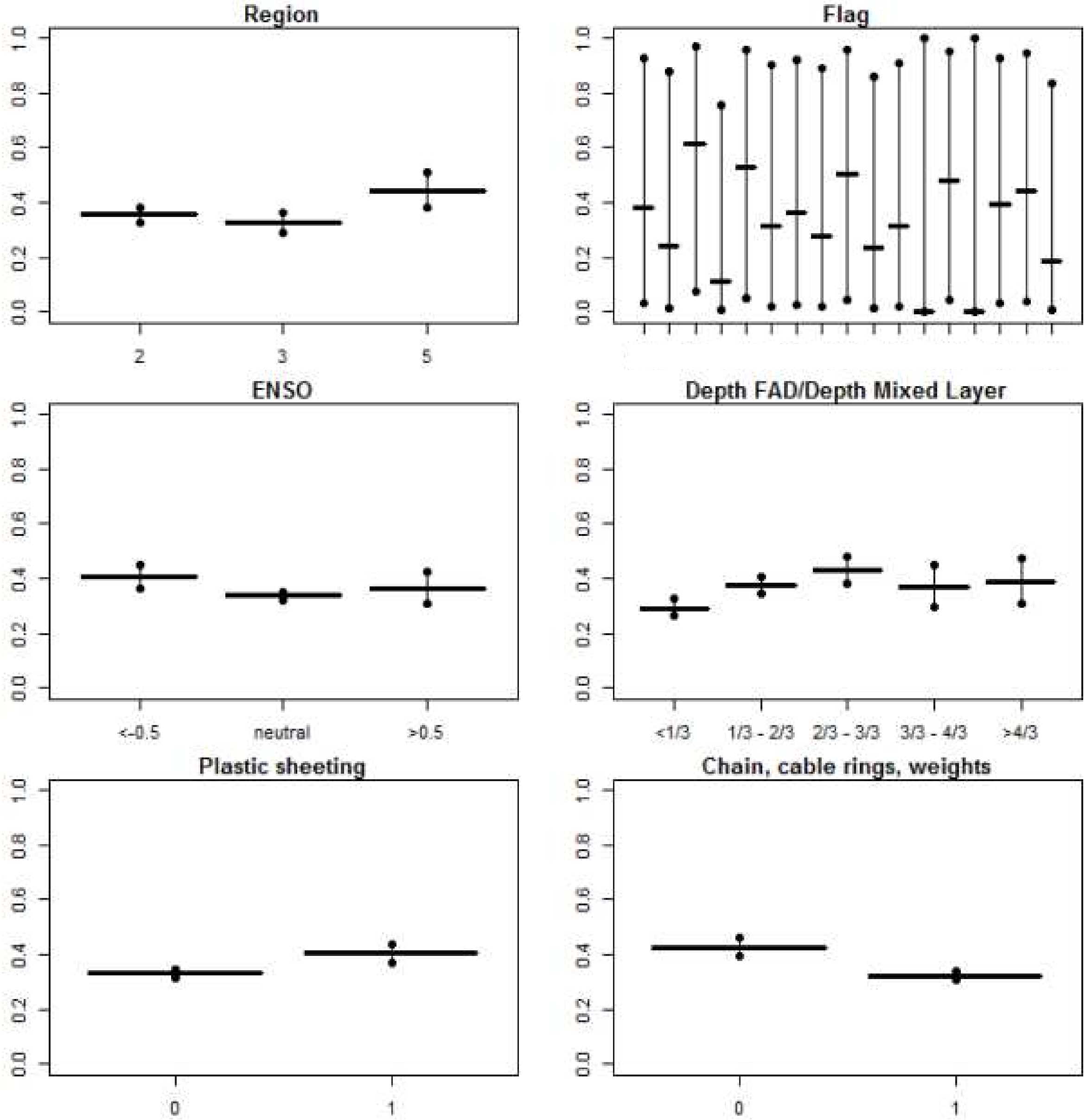

Figure 12.- Effect of different factors, including environmental variables, over the presence of silky sharks in dFAD sets.

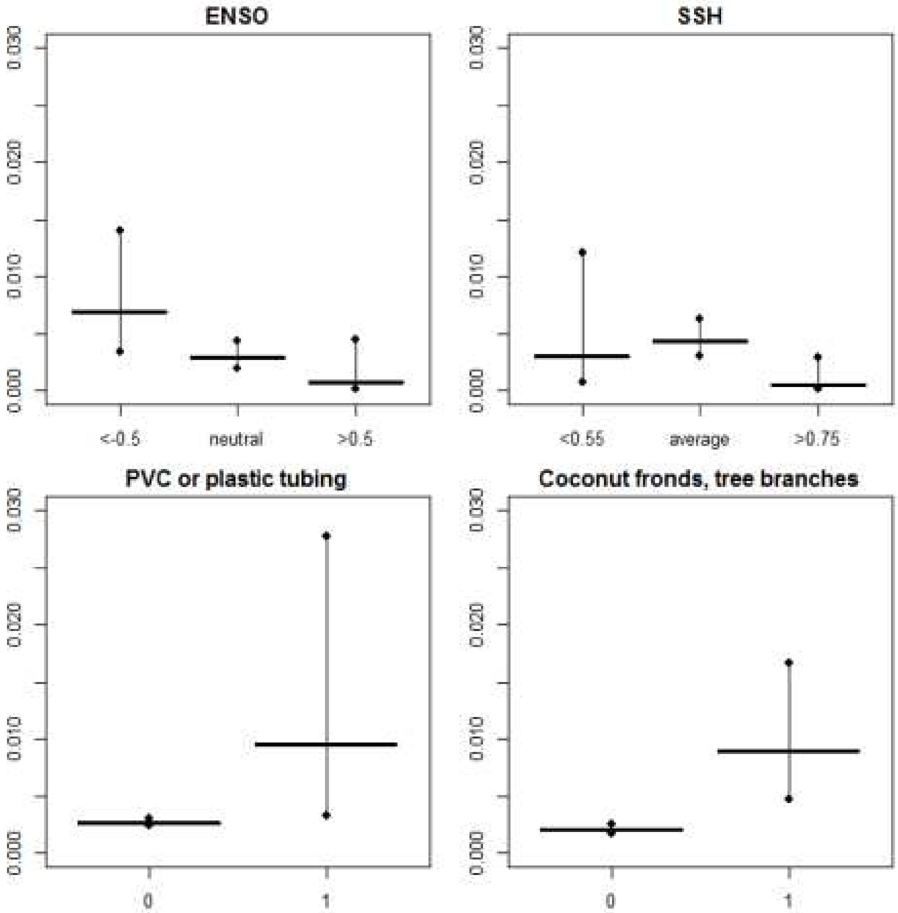

Figure 13.- Effect of different factors, including environmental variables, over the presence of oceanic whitetip sharks in dFAD sets.

APPENDIX A

FAD/PAYAO and FLOATING OBJECTS INFORMATION RECORD

Form GEN-5

REVISED DEC 2009

OBSERVER NAME	VESSEL NAME	OBSERVER TRIP ID NUMBER	PAGE OF

Date (from PS-2)	Time	Set No.	Object number	Origin of FAD	Deployment date	latitude dd°mm.mmm'	N S	and longitude ddd°mm.mmm'	E W	SSI trapped	FAD as found	Comments / sketch / change description
										YES / NO		
FAD Materials Main materials			FAD attachments		Max est. depth	FAD length	FAD width	Buoy number	FAD / Payao No. and or markings		FAD as left	
					M	M	M					

Date (from PS-2)	Time	Set No.	Object number	Origin of FAD	Deployment date	latitude dd°mm.mmm'	N S	and longitude ddd°mm.mmm'	E W	SSI trapped	FAD as found	Comments / sketch / change description
										YES / NO		
FAD Materials Main materials			FAD attachments		Max est. depth	FAD length	FAD width	Buoy number	FAD / Payao No. and or markings		FAD as left	
					M	M	M					

Date (from PS-2)	Time	Set No.	Object number	Origin of FAD	Deployment date	latitude dd°mm.mmm'	N S	and longitude ddd°mm.mmm'	E W	SSI trapped	FAD as found	Comments / sketch / change description
										YES / NO		
FAD Materials Main materials			FAD attachments		Max est. depth	FAD length	FAD width	Buoy number	FAD / Payao No. and or markings		FAD as left	
					M	M	M					

Date (from PS-2)	Time	Set No.	Object number	Origin of FAD	Deployment date	latitude dd°mm.mmm'	N S	and longitude ddd°mm.mmm'	E W	SSI trapped	FAD as found	Comments / sketch / change description
										YES / NO		
FAD Materials Main materials			FAD attachments		Max est. depth	FAD length	FAD width	Buoy number	FAD / Payao No. and or markings		FAD as left	
					M	M	M					

How Detected (FAD)

1 Seen from Vessel (no other method)
2 Seen from Helicopter
3 Marked with Radio beacon
4 Bird Radar
6 Info. from other vessel
7 Anchored (GPS)
8 Marked with Satellite beacon
9 Navigation Radar
10 Lights
11 Flock of Birds sighted from vessel
12 Other (please specify)
13 Vessel deploying FAD (not detected)

Floating Object
'as Found' or 'as Left'

1 Man made object (Drifting FAD)
2 Man made object (Non FAD)
3 Tree or log (natural, free floating)
4 Tree or logs (converted into FAD)
5 Debris (flotsam bunched together)
6 Dead Animal (specify; i.e whale, horse, etc.)
7 Anchored Raft Fad or Payou
8 Anchored Tree or Logs
9 Other (please specify)
10 Man made object (Drifting FAD)- changed

Fad Materials
Main Materials

1 Logs, Trees or debris tied together
2 Timber/ planks/ pallets/ spools.
3 PVC or Plastic tubing
4 Plastic drums
5 Plastic Sheeting
6 Metal drums (i.e 44gal)
7 Philippines design drum FAD
8 Bamboo / Cane
9 Floats / Corks
10 Unknown (describe)

Fad Materials
FAD attachments

11 Chain, cable rings, weights
12 Cord / rope.
13 Netting hanging underneath FAD
14 Bait containers
15 Sacking / bagging
16 Coconut fronds/ tree Branches
17 Other (*describe*)

Note that 'Main materials' and 'FAD attachments' are guideline lists only. Codes 1-17 can all be used to describe either or both main and attachment materials

Origin of Fad

1 Your vessel deployed this trip
2 Your vessel deployed previous trip
3 Other vessel's (owner consent)
4 Other vessel's (no owner consent)
5 Other vessel's (consent unknown)
6 Drifting and found by your vessel
7 Deployed by FAD auxillary vessel
8 Origin unknown
9 Other origin

(please specify in comments section)

APPENDIX B

SPC/FFA REGIONAL PURSE-SEINE OBSERVER DAILY LOG — **FORM PS - 2**

REVISED DEC [illegible]

OBSERVER NAME	VESSEL NAME	OBSERVER TRIP ID NUMBER	PAGE OF

SHIP'S TIME	LATITUDE (dd°mm.mmm')	N S	LONGITUDE (ddd°mm.mmm')	E W	EEZ CODE	ACTIVITY CODE	WIND (kts)	WIND (°)	SEA C-S-M-R-V	HOW DETECT	SCHOOL ASSOC		COMMENTS (and **Set No.** - from PS-3)

FLOATING OBJECT AND SCHOOL SIGHTINGS	Anchored floating objects (with **NO** school)	Anchored floating objects (with school)	Free floating objects (no anchor) (with **NO** school)	Free floating objects (no anchor) (with school)	Free schools	DID YOU OBSERVE ANY EVENTS TO RECORD ON FORM GEN-3 TODAY ?
Example: Tally 𝍸 I — Total 6	Tally — No.	Tally — No.	Tally — No.	Tally — No.	Tally — No.	YES NO (circle one) — Journal pg #

START OF DAY

SHIP's DATE	SHIP's TIME
UTC DATE	UTC TIME

ALL MUST BE RECORDED

ACTIVITY and HELICOPTER CODES

1 Set
2 Searching
3 Transit
4 No fishing - Breakdown
5 No fishing - Bad weather
6 In port - please specify
7 Net cleaning set
8 Investigate free school
9 Investigate floating object
10D Deploy - raft, FAD or payao
10R Retrieve - raft, FAD or payao
11 No fishing - Drifting at day's end
12 No fishing - Drifting with floating object
13 No fishing - Other reason (specify)
14 Drifting -With fish aggregating lights
15R Retrieve radio buoy
15D Deploy radio buoy
16 Transhipping or bunkering
17 Servicing FAD or floating object

H1 Helicopter takes off to search
H2 Helicopter returned from search

If FAD involved be sure to fill out a GEN-6 Form - FAD and Floating Object Information Record

Changing buoys ? - use first line for 15R and next for 15D

HOW DETECTED

1 Seen from vessel
2 Seen from helicopter
3 Marked with beacon
4 Bird radar
5 Sonar / depth sounder
6 Info. from other vessel
7 Anchored FAD / payao (recorded)

"Seen from helicopter" Use when vessel gets to the school of tuna that helicopter either: 1. reported on, or 2. dropped buoy on

SCHOOL ASSOCIATION (tuna)

1 Unassociated
2 Feeding on Baitfish
} Free schools
3 Drifting log, debris or dead animal
4 Drifting raft, FAD or payao
5 Anchored raft, FAD or payao
6 Live whale
7 Live whale shark
8 Other (please specify)
9 No tuna associated

APPENDIX C

SPC/FFA REGIONAL PURSE SEINE OBSERVER SET DETAILS

FORM PS - 3

REVISED July 2012

OBSERVER NAME	VESSEL NAME	PAGE OF (SET No.)

OBSERVER TRIP I.D. NUMBER	START OF SET DATE AND TIME — OBSERVER: (see PS-2) DD MM YY hh mm	START OF SET DATE AND TIME — VESSEL LOG: DD MM YY hh mm

SET SEQUENCE TIMES

EVENT:	START OF SET (SKIFF OFF)	BEGIN PURSING (WINCH ON)	END PURSING (RINGS UP)	BEGIN BRAILING	END BRAILING	END OF SET (NEXT ACTIVITY START)
TIME:						

SET CATCH DETAILS

brail capacity (mT Type 1 brail (see PS-1 form) x sum of all brails (see PS-4 form)) = Total catch mT

+ type 2 brail (mT x)

less bycatch (see below) mT

= Total tuna catch mT =>

OBSERVER's BREAKDOWN of TOTAL TUNA CAUGHT - *circle YES or NO for each species*

N.B.: these calculations include all the tuna in this catch, whether retained or discarded

SKIP-JACK		YELLOWFIN SMALL (< 75 cm)		YELLOWFIN LARGE (> 75 cm)			BIGEYE SMALL (< 75 cm)		BIGEYE LARGE (> 75 cm)		
YES NO	(%)	YES NO	(%)	YES NO	(%)	NUMBER	YES NO	(%)	YES NO	(%)	NUMBER

BY-CATCH (ALL NON-TARGET SPECIES)

SPECIES CODE	FATE CODE	OBSERVER (mT)	OBSERVER No.	VESSEL LOG (mT)	VESSEL LOG No.	COMMENTS
Total weight of bycatch:		mT		mT		

Comments

TARGET TUNA

		SKJ	YFT	BET
A. **OBSERVER** estimates of total of each species caught (mT)				
Observer	FATE			
	a. (mT)			
Vessel	FATE			
	(mT)			
Observer	FATE			
	b. (mT)			
Vessel	FATE			
	(mT)			
Observer	FATE			
	c. (mT)			
Vessel	FATE			
	(mT)			
B. **OBSERVER totals (mT)** discards + RCC (a+b+c)				
Tuna kept onboard for later unload — if not RWW	FATE			
	OBS (mT)			
	VES (mT)			
Tuna kept onboard for later unload	FATE	RWW	RWW	RWW
	OBS (mT)			
	VES (mT)			
Due to gear break / bycatch mitigation		ESC	ESC	ESC
estimates	OBS (mT)			
	VES (mT)			

TAGS - How many Tags were recovered ? ______ *Record species and tag numbers. Fill tag recovery forms!*

FATE CODES

RWW	Retained - whole weight	DFR	Discarded trunk - fins retained (shark only)	DPA	Discarded SSI (species of special interest) - alive DPA
RHG	Retained - headed and gutted (billfish only)	DTS	Discarded - too small (tuna only)	DPD	Discarded SSI (species of special interest) - dead DPD
RGG	Retained - gilled and gutted (kept for sale)	DGD	Discarded - gear damage (tuna only)	DPU	Discarded SSI (species of special interest) - unknown condition DPU
RPT	Retained - partial (e.g. fillet, loin)	DVF	Discarded - vessel fully loaded	DPQ	Discarded - poor quality
RCC	Retained - crew consumption (onboard)	DUS	Discarded - unwanted species	DOR	Discarded - other reasons (specify)
ROR	Retained - other reason (specify)	DSD	Discarded - shark damage	ESC	= Escaped
RFR	Retained trunk - fins retained (shark only)	DWD	Discarded - whale damage		

APPENDIX D

SPC/FFA REGIONAL OBSERVER SPECIES OF SPECIAL INTEREST	FORM GEN - 2

REVISED DEC 2009

OBSERVER NAME	VESSEL NAME	OBSERVER TRIP ID NUMBER	PAGE OF

The species was: *Tick to indicate* → ↓ LANDED ON DECK ☐ INTERACTED WITH VESSEL'S GEAR ONLY ☐ SIGHTED ONLY ☐

TIME OF LANDING (see PS-2, PL-2, LL-4) OR TIME OF INTERACTION / SIGHTING		SHIP'S DATE AND TIME DD	MM	YY	hh	mm	LATITUDE (dd°mm.mmm')	N S	LONGITUDE (ddd°mm.mmm')	E W

SPECIES CODE	SPECIES DESCRIPTION

SPECIES LANDED ON DECK:

LANDED:	CONDITION CODE	CONDITION DESCRIPTION

DESCRIBE ONBOARD HANDLING	LENGTH (cm)	LENGTH CODE	SEX (M-F-I-U)

DISCARDED	CONDITION CODE	CONDITION DESCRIPTION

TAGS	*RETRIEVED*			*PLACED*		
	TAG NUMBER	TYPE	ORGANISATION	TAG NUMBER	TYPE	ORGANISATION

INTERACTIONS WITH VESSEL OR VESSEL GEAR:

VESSEL ACTIVITY DURING INTERACTION → SETTING ☐ HAULING ☐ SEARCHING ☐ TRANSITING ☐ OTHER (specify) ☐ ....

CONDITION	No.	CODE	DESCRIPTION		No.	CODE	DESCRIPTION
START OF INTERACTION:				*END OF INTERACTION:*			

DESCRIBE THE INTERACTION

SPECIES SIGHTED

VESSEL ACTIVITY WHEN SIGHTED → SETTING ☐ HAULING ☐ SEARCHING ☐ TRANSITING ☐ OTHER (specify) ☐ ....

NUMBER SIGHTED	NUMBER OF ADULTS	NUMBER OF JUVENILES	ESTIMATE THE OVERALL LENGTH(s) (From the head to the tail)

DISTANCE FROM VESSEL	SPECIES BEHAVIOUR WHEN SIGHTED
m	

SPECIES OF SPECIAL INTEREST

TTL	LOGGERHEAD TURTLE	FAW	FALSE KILLER WHALE	DBO	BOTTLENOSE DOLPHIN
LTB	LEATHERBACK TURTLE	SHW	SHORT-FINNED PILOT WHALE	DCO	COMMON DOLPHIN
TUG	GREEN TURTLE	KPW	PYGMY KILLER WHALE	DRR	RISSO'S DOLPHIN
LKV	OLIVE RIDLEY TURTLE	MEW	MELON HEAD WHALE	DSI	SPINNER DOLPHIN
TTH	HAWKSBILL TURTLE	HUW	HUMPBACK WHALE	DSP	SPOTTED DOLPHIN
KEZ	EASTERN PACIFIC GREEN TURTLE (BLACK TURTLE)	SIW	SEI WHALE	DST	STRIPED DOLPHIN
		MYS	BALEEN WHALES	RTD	ROUGH-TOOTHED DOLPHIN
FBT	FLATBACK TURTLE	ODN	TOOTHED WHALES		
		MAM	ALL MARINE MAMMALS	DLP	ALL DOLPHINS
TTX	ALL TURTLES	BRW	BRYDE'S WHALES		
		RHN	WHALE SHARK	BIZ	ALL BIRDS