EASTERN PACIFIC REGIONAL SEA TURTLE PROGRAM

Final, DRAFT Report - June 2006

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Team members on the deck of the Siempre Olayita

Document Citation:

Hall, M. A., Vogel, N., and M. Orozco. 2006. Draft Report of Year Two of the Eastern Pacific Regional Sea Turtle Program. Final project report, June 2006, to the Western Pacific Regional Fishery Management Council. 72 pgs.

A Technical Report of the Western Pacific Regional Fishery Management Council pursuant to NOAA Award No. NA05NMF441092.

EXECUTIVE SUMMARY

The Eastern Pacific Regional Program to reduce sea turtle mortality in artisanal longline mahi-mahi and tuna fisheries of Latin America started after a round of workshops with longline fishers from Ecuador in the second quarter of 2004. The project initially began as a small test of the use of circle hooks, limited to a dozen vessels from the Ecuadorian fleet. The response of the fishing community, the fisheries agencies from the countries from the region, and international and national conservation organizations resulted in the development of a multi-year regional program, extending from Peru to Mexico. The first year of the program was supported by the Western Pacific Regional Fishery Management Council (WPRFMC), the Undersecretariat of Fisheries Resources from Ecuador (SRP), the World Wildlife Fund (WWF), the National Oceanographic and Atmospheric Administration (NOAA, USA), the Inter-American Tropical Tuna Commission (IATTC), The Ocean Conservancy (TOC), and other organizations. The implementation strategy proposed was very well received, and other countries requested similar activities.

In the second year, the program expanded its activities considerably in Ecuador, and started in several other Latin American countries from the Pacific coast including: Panama, Costa Rica, Peru, Guatemala and El Salvador. The second year objectives were to increase sample size, and expand coverage to the whole eastern Pacific region, and to gather additional information and data towards identifying conclusive sea turtle bycatch mitigation strategies for Latin American artisanal longline mahi-mahi and tuna fisheries. The funding sources for the second year included those mentioned above, plus the welcomed addition of the Overseas Fishery Cooperation Foundation from the Fishery Agency of Japan, which contributed resources and very valuable expertise.

The program has finished its second field season (June 2005-2006), continuing with the tests of circle hooks, fishers workshops, and the data collection based on observer programs. The emphasis for this year was on the management of this expansion, and the development of unified and consistent data forms and databases. All these databases will have to be brought together to perform the statistical analyses needed to study the impacts of the circle hooks on hooking rates of target and non-target species, on the location of hooks in the hooked individuals, and on entanglement rates for all the region's longline fisheries.

The final report for year two builds off the results from year one (Largacha et al, 2005). This report is part of an ongoing project that describes the activities, but presents only a limited number of analyses, since the bulk of them will be

performed on the complete database, after a strict set of quality control procedures are implemented in all participating nations. The integration of results from the whole region will add to the robustness of the conclusions, and it will show the broad range of the program, that today constitutes one of the largest conservation and quite possibly the largest fishery mitigation program in the world.

THE IMPLEMENTATION STRATEGY

We have continued using the basic ideas and procedures developed during the first year of work:

- Workshops with fishers to introduce the problem and the program proposed to facilitate the testing of alternative hooks, and to request volunteer participation.
- Hook exchanges following an experimental design: replacing half of the J hooks in a line by circle hooks (of an adequate size for each fishery).
- An observer program to monitor the tests.
- Distribution of instruments to release hooked and entangled turtles, and training of fishers in their use.
- Workshops with fishers to analyze results, problems, and possible improvements.
- Bring together all stakeholders with a common ground.
- Develop a regional network of closely connected programs.

As more and more people, fishers and organizations have joined our program, it became necessary to produce a harmonious growth, that will not compromise the previous achievements, and that will continue building up on the trust that the program is generating from the different sectors involved. It also became necessary to ensure consistency among the programs in the scientific processes used to collect and manage the data. Three activities were dedicated to these goals, and given a very high priority:

- Frequent travel through the region by the program coordinator (M. Hall).
- Development of a common form and common database programs, and training of the local participants.
- A technical workshop, involving all participants.

To make sure that the growing number of participants would not have a negative impact on the excellent interactions among sectors, by deviating from a "philosophy and approach" that have been successful in building a strong coalition in

the region, a simplified list of principles and guidelines was prepared, and it is included as an Appendix in this report. These concepts are not a scientific product, but without them, progress would probably be much more difficult. It is of critical importance that the different sectors and participants know and understand the need to maintain clear and consistent principles in their involvement.

NEW INFORMATION ON THE STATUS OF SEA TURTLE POPULATIONS

The objective of the program is to reduce fishery interactions with leatherback (*Dermochelys coriacea*), loggerhead (*Caretta caretta*), olive ridley (*Lepidochelys olivacea*), and green (or black) (*Chelonia mydas agassizii*) sea turtle populations that occur in the region. Fisheries are one of the possible causes for depressed population trends, but there are many other factors than could also have significant roles (climate and oceanography, predation, egg and/or turtle exploitation). As current data are often not available in the published literature, it was decided to include a section containing the most recent data available for eastern Pacific leatherbacks and north Pacific loggerheads from their main nesting beaches.

In general, the numbers of loggerhead turtles nesting in Japan have increased after the lowest nesting values observed in 1999 – 2000. For the Australian nesting populations of loggerheads, recent published data is not available, however, personal communications from Australian scientists indicate that the numbers there are also higher than in previous years. The leatherback populations nesting in Costa Rica, and in Mexico show considerable improvements in the 2005 – 2006 season compared to 2004-2005, the worst on record. It is still very far from a situation that could lead to optimism, but at least it is "a bit less bleak than last year."

DEVELOPMENT OF THE REGIONAL PROGRAM

A way to measure the growth of the program is through the increase in the observer program. By early 2004, data from only a handful of observer trips were available for the region. By June of this year, data from 500 trips were available, covering close to 2,800 sets, and over a 1,000,000 hooks. Almost 5,400 observer days at sea have produced this database. This list includes 66 bottom longline trips, some of the first data available on these fisheries. The geographical extent of the observer program now covers from 30 S. to 15 N., and from 70 W. to 95 W.

A regional technical workshop was organized in Puntarenas, Costa Rica. The workshop brought together practically all program participants, and a few special guests, invited to spend six days building a joint knowledge and experience base for the program. An extensive discussion on the data collection system and forms, was followed by discussions of results in all regions, similarities and differences, sea turtle ecology and behavior, and reviews of current status of the turtle populations, and of the longline fisheries of the eastern Pacific. At the end, several sessions addressed future plans for improvements on the data collection system and on the databases, experimental work aimed at reducing hooking rates and entanglements, improvements in equipment and handling to release sea turtles, observer roles and training, and discussion of communication materials for the fishing community

Database management

During the past year, major developments took place in the creation, and organization of the regional database. The forms used for data collection throughout the region were also subject of a detailed review, and improvements were introduced in most of them. The observer manual was rewritten, to reflect the changes. Input from many observers, and participants was the basis for the modifications. The new manual and forms are included as an Appendix (in Spanish only).

RESULTS OF EXPERIMENTAL WORK

Tuna, billfishes and shark fisheries (TBS)

Even though the database is undergoing a major revision to improve quality and consistency, it was possible to make some preliminary comparisons of the results. In the fisheries targeting tunas, sharks, and billfishes (TBS), the circle hooks of size 16/0, with 10 degrees of offset are proving to be very successful at reducing sea turtle hooking rates, while maintaining the target catch rates. The circle hooks used are made out of stainless steel and are very durable, and this tilts the economics in their direction. Reductions of over 60%, and up to 80%, were observed in trials using C16/0 hooks compared to traditional J hooks. These results are paving the way for a full replacement of J hooks by circle hooks in the TBS fisheries, by gaining acceptance in the fishing community, and promoting the adoption of the new hooks without the need of cumbersome, expensive, and frequently ineffective enforcement systems.

Mahi-mahi Fisheries

The results of the use of circle hooks in the mahi-mahi fishery has been less consistent than the results of the tuna fishery. We started testing circle hooks sizes 14/0 and 15/0 off South America, and the hooking rates of sea turtles showed a reduction in magnitude, although less than in the other fisheries. However catch rates of the target species declined considerably. In mahi-mahi fisheries off Central America, some vessels were already using circle hooks, and in those cases, we proposed an increase in the size of the hooks if they were interested in testing this option. The results were quite positive.

The addition of wire appendages to hooks

In trying to reduce gut hooking of species of recreational value, fishers and researchers from New Zealand (P.Barnes; Willis and Millar, 2001) added wire appendages to their hooks, to make them wider, and thus harder to swallow.

Circle hook with wire appendage attached.

C. Bergmann (NOAA, Pascagoula) thought that the concept could be valuable for sea turtles in fisheries which the use of large circle hooks is not a viable solution (such as the mahi-mahi fishery). Therefore, it was decided to run an experiment adding wires to circle hooks to compare the control J hooks, used in the mahi-mahi fishery, with C13/0 with wires, and with C16/0 without wires, in a two-leg experiment ran from Peru and Ecuador. The reasoning for the comparisons was that the C13/0 plus wire is approximately as wide as the C16/0 without wire. The results were very encouraging and will be presented in a peer review publication by T. Mituhasi, M. Hall, C. Bergmann, M. Parrales, J. Calderon, and M. McCracken.

Overall, the reductions in sea turtle hooking rates ranged from 53% to 80% for the 13/0 hooks with the wire appendages, compared to reductions of 53% to 100% for the 16/0 circle hooks. Also, the incidence of lower survival hookings (i.e.

swallow deep) were much lower with both circle hooks (25% for the 13/0 and 12% for the 16/0) compared to the J hooks (76%).

Furthermore, the target catch rates for the two legs combined were quite similar (27.8/1000 J hooks, 30/1000 C13/0 hooks with wire, and 23.9/1000 16/0 hooks). In the Peruvian leg, where smaller mahi-mahi were caught, J hooks outperformed the circle hooks, but in the Ecuadorian leg it was the other way around. The wire appendages promise to be an additional, simple and economic way to further reduce hooking rates, and the proportions hooked with low survival possibilities.

FUTURE ACTIVITIES

For the next period (year three, 2006-2007), we have plans for several experiments to reduce entanglements of sea turtles. These include replacement of floats with others less likely to attract turtles, replacement of line materials, additions of tubing to stiffen the line close to the floats, and tests of vertical lines. Also, experiments with several types of hooks with wire appendages will continue. The other activities will continue as before, but plans and resources will expand the use of circle hooks and dehookers.

Final REPORT: 2005-2006

THE PROBLEM

The incidental mortality of sea turtles due to longline fishery interactions is one of many factors that affect populations. Leatherback (*Dermochelys coriacea*) and loggerhead (*Caretta caretta*) sea turtles are the species in the most critical population status, and actions are needed to mitigate longline fishery impacts. The problem was described in the Report for the First Year of the Ecuadorian program (Largacha et al., 2005)[1]. Some additional data on the status of the sea turtle populations that have been produced after that report include:

Loggerhead sea turtles

After steep declines in the 90s, the loggerhead sea turtle nesting counts in Japan appear to be stable or increasing, including Yakushima Islands which account for over 30% of loggerhead nesting activity in Japan (Kamezaki et al. 2003). A summary of total loggerhead nesting activity in the Indian and Pacific Oceans is seen in Figure 2.

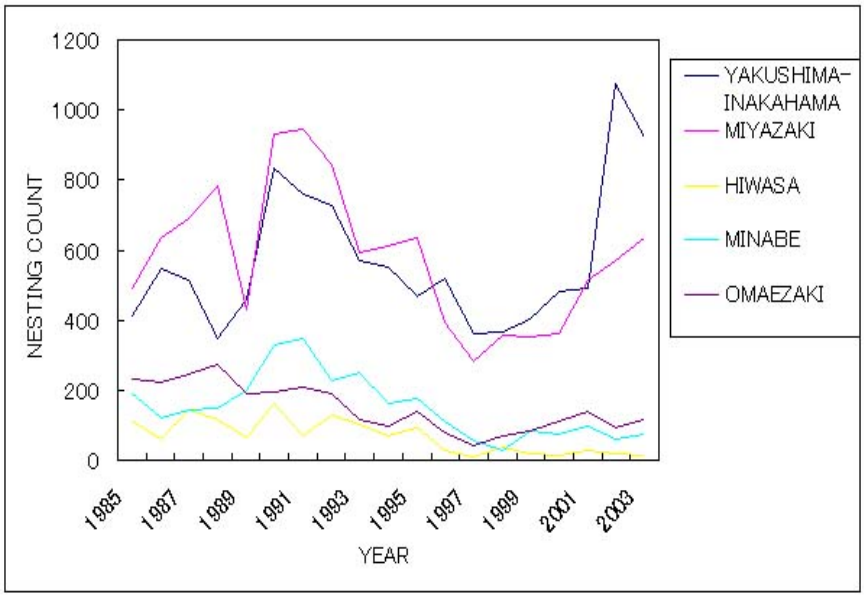

Figure 1. Loggerhead nesting trends at five locations in Japan (data source from the website of the Sea Turtle Association of Japan).

[1] http://www.wpcouncil.org/protected.htm
Largacha et al. (2005) Working with the Ecuadorian Fishing Community to Reduce the Mortality of Sea Turtles in Longline Fisheries. Final year one report to the Western Pacific Regional Fishery Management Council. (2MB pdf)

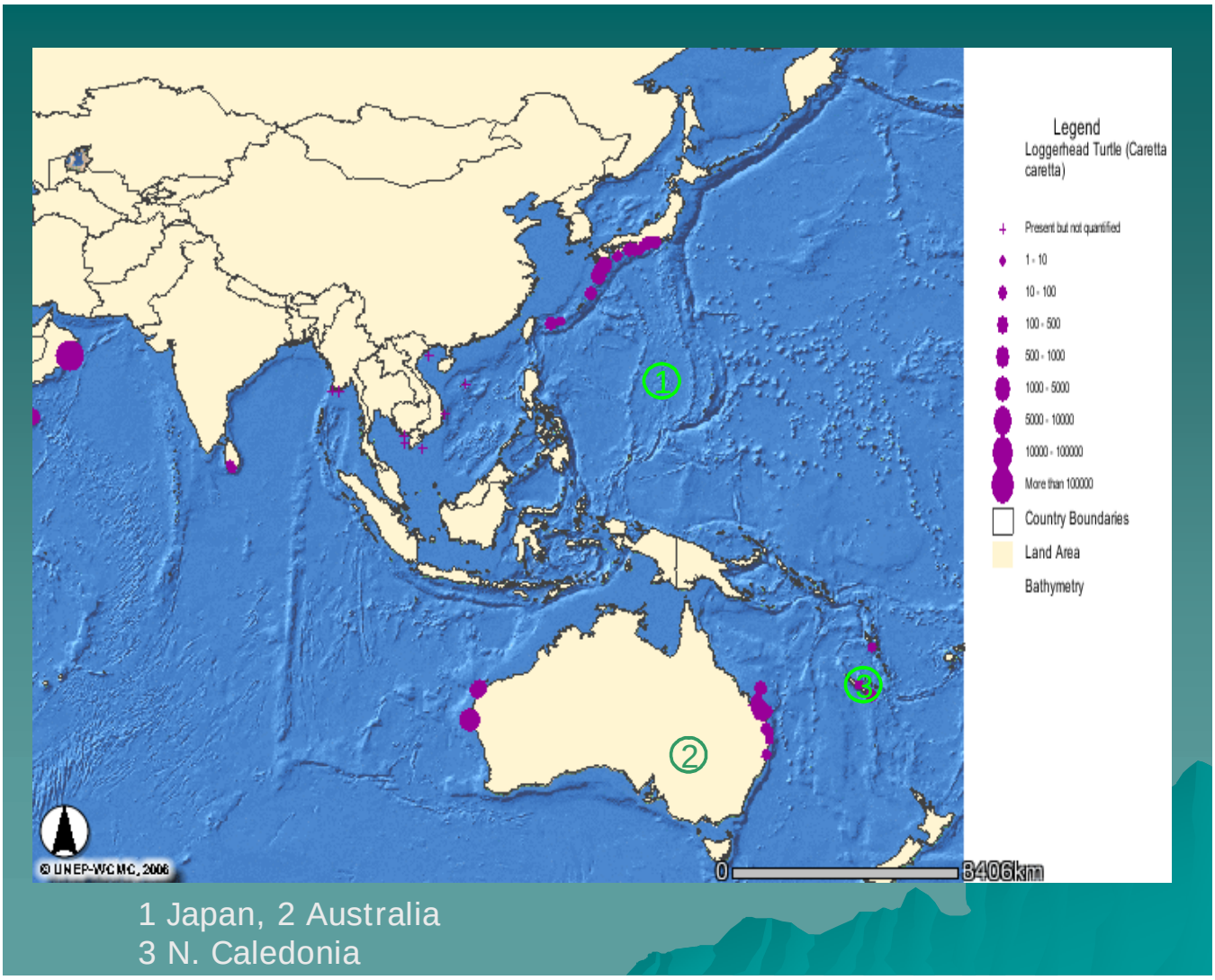

Figure 2. A recent map from the UNEP-WCMC program provides a quite complete description of the major nesting areas of loggerhead sea turtle in the Pacific and Indian Oceans (from UNEP/WCMC 2006).

Although recent published data are not available for the Australian loggerhead nesting populations that were declining until the year 2000, personal communications from Australian scientists indicate that the numbers there are also higher than in previous years. It will be very interesting to see if these populations mirror the positive changes observed for the Japanese beaches.

Eastern Pacific Leatherback sea turtles

The eastern Pacific leatherback turtle index nesting beaches in Mexico showed some increase over the last season, however, nesting values are still quite low to warrant excitement (Figures 3 and 4). Although data for the 2005 – 2006 season was not complete because nesting was still under way, in comparing the leatherback counts for the last two seasons, most beaches show relatively higher numbers than previous years (Figure 4).

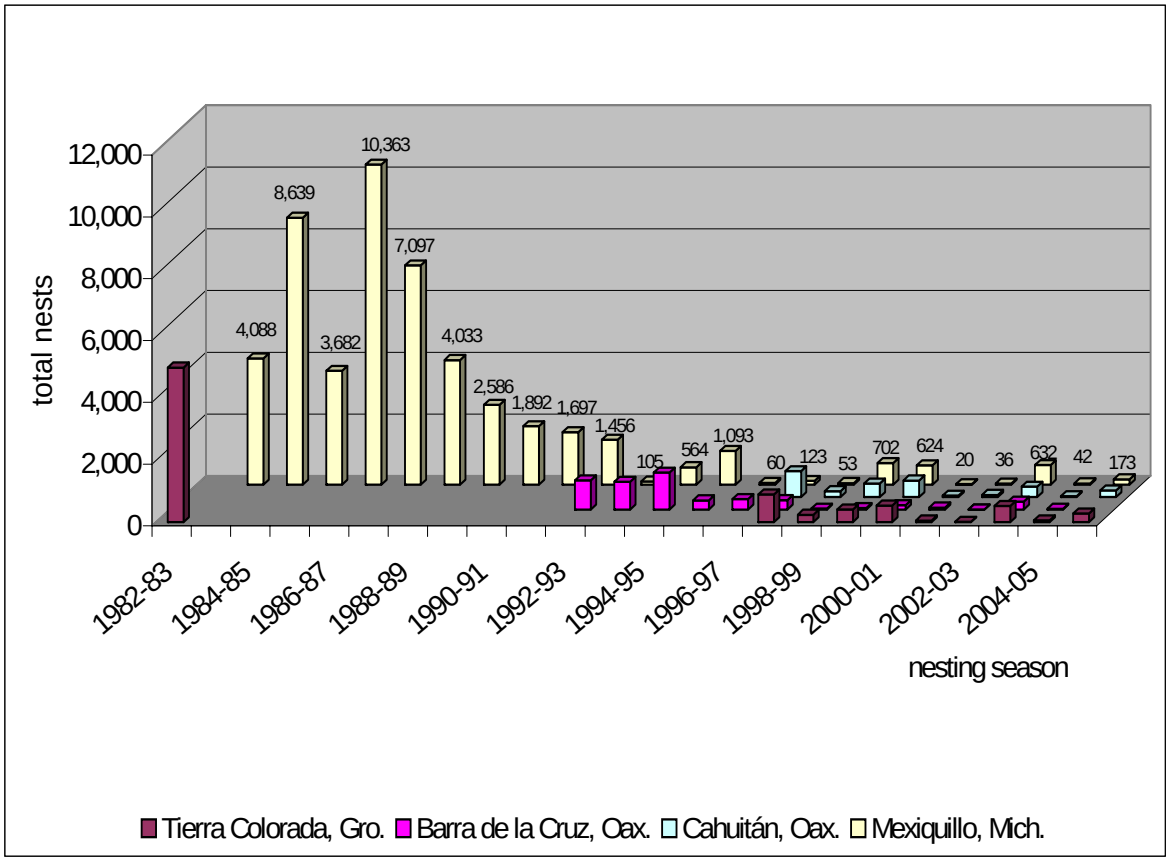

Figure 3. Overall nesting trends for eastern Pacific leatherback turtles (Sarti et al., *in press*)

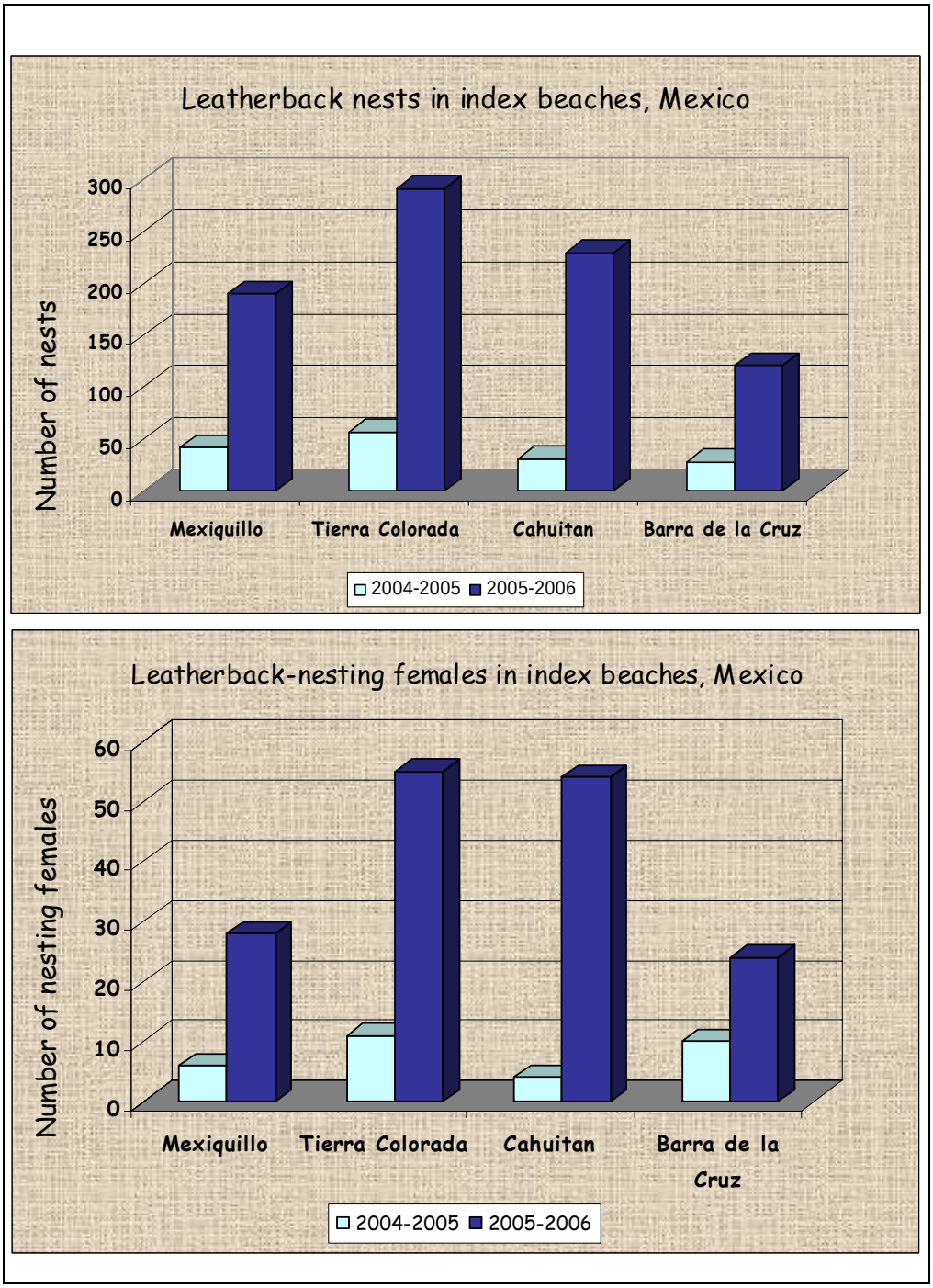

Figure 4. East Pacific leatherback nesting data for the 2005 – 2006 season in Mexico (note: nesting still under way) (Sarti et al., pers. comm.)

In Costa Rica, after the lowest number of record in 2004-05, a slight increase in number of nesting females was observed during the 2005-06 nesting season (Figure 5), but still quite low to be optimistic (Spotila et al. unpub.)

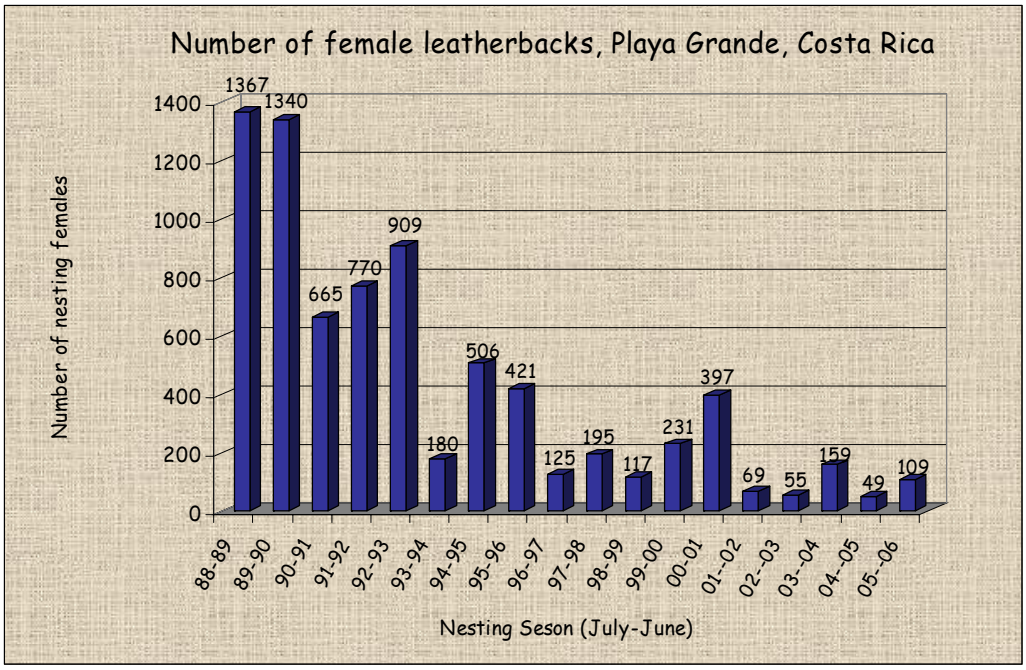

Figure 5. Nesting trends of leatherback turtles in Costa Rica (Spotila et al. unpub.)

The improvements shown in figures 1, 4 and 5 do not mean that the danger for the populations has lessened, but at least they are an encouraging sign, showing that some of the negative factors (or impacts) are being addressed, or that some new or higher positive factors are at play. In any case, the higher numbers at least "buy us some time" to complete the program.

OBSERVER PROGRAM

The observer program has grown very rapidly, and the number of observed trips has gone past 500, with over 1,000,000 hooks observed. The following Table 1 shows the distribution of observer trips by surface or bottom, by fishery (Mahi-mahi, Tuna-Billfish-Shark TBS, Shark, or grouper), by season and by port. There are also observer data for Colombia and El Salvador that have not been included in the database yet. Additionally, the program has produced the first significant data set on bottom longlining in the world.

Table 1. Summary of observer program in operation at Manta, Ecuador; Balboa, Panama; Puntarenas, Costa Rica; Paita, Peru North; Pucusana, Peru Center; Ilo, Peru (south); San Jose, Guatemala; Santa Tecla, El Salvador.

				Observer effort			
Type	**Fishery**	**Year**	**Port**	**Nr.Trips**	**Nr. Set**	**Nr Hooks**	**Nr Days**
Surface	TBS	2004	Manta	75	304	33,382	1,105
Surface	TBS	2005	Manta	65	401	50,418	901
Surface	TBS	2005	Balboa	8	88	118,366	129
Surface	TBS	2005	Puntarenas	15	188	69,553	316
Surface	TBS	2006	Manta	5	32	4,601	88
Surface	TBS	2006	Puntarenas	1	23	16,397	46
Surface	TBS	2005	Painta	4	31	8,347	80
Surface	TBS	2005	Puntarenas	12	144	78,765	242
Surface	TBS	2005	Ilo	24	178	43,501	374
Surface	TBS	2005	Pucusana	6	55	65,341	109
Surface	TBS	2006	Puntarenas	1	7	2,789	15
				216	**1,451**	**491,460**	**3,405**
Surface	Mahi-Mahi	2004-2005	Manta	18	126	32,200	264
Surface	Mahi-Mahi	2004-2005	Paita	3	26	6,757	38
Surface	Mahi-Mahi	2004-2005	Balboa	1	11	8,950	13
Surface	Mahi-Mahi	2004-2005	Puntarenas	2	18	7,191	31
Surface	Mahi-Mahi	2004-2005	Ilo	7	33	3,651	48
Surface	Mahi-Mahi	2004-2005	Pucusana	2	16	5,624	23
Surface	Mahi-Mahi	2004-2005	San Jose	14	30	7,821	42
Surface	Mahi-Mahi	2005-2006	Manta	28	127	50,686	350
Surface	Mahi-Mahi	2005-2006	Paita	6	48	12,972	127
Surface	Mahi-Mahi	2005-2006	Balboa	14	149	160,995	190
Surface	Mahi-Mahi	2005-2006	Puntarenas	20	191	104,968	314
Surface	Mahi-Mahi	2005-2006	San Jose	101	301	114,864	316
				216	**1,076**	**516,679**	**1,756**
Bottom	Grouper	2005	Balboa	**2**	**30**	**17,441**	**29**
Bottom	Shark	2005	Balboa	1	14	8,467	14
Bottom	Shark	2005	San Jose	49	116	21,574	112
Bottom	Shark	2006	San Jose	16	62	11,919	47
				66	**192**	**41,960**	**173**
		GRAND TOTAL		**500**	**2,749**	**1,067,540**	**5,363**

Characteristics of the observer program

Boats participating in the experiments agree to carry an observer for a number of trips. The observers are trained by the staff of the program, and their at sea pay and food costs while on board are covered by the program. At the end of a trip the observer is debriefed by a program coordinator, after which the data are entered into the database. Observer training includes the use of dehookers, dipnets, and other devices to dehook or disentangle turtles.

Data collection

The data collection forms used in the experiments are standardized throughout the region. A recent meeting of the program participants produced a list of proposals for data collection changes that are currently being implemented. Preliminary versions of the Forms, and of the Manual are included in the Appendix.

Database activities

As the program evolved, it became evident that an organized and standardized database system was needed, and Nick Vogel from IATTC was asked to develop this. The programs were developed in MS ACCESS, and were distributed to all the national programs. Training on data entry, error checking, data analyses and other related subjects was begun in the region. The first training session covered participants from Peru, Ecuador, and Colombia. Another session will cover Guatemala, El Salvador, Nicaragua, Costa Rica, and Panama.

Spatial coverage of the observer program

The addition of new countries to the program has increased the spatial coverage throughout the region. The following maps shows sets of the mahi-mahi, and the tuna billfish, and shark fisheries, for all years combined (Figure 6). The individual years have important differences, so a longer time series is required to describe the fishing areas.

Observed effort (sets)

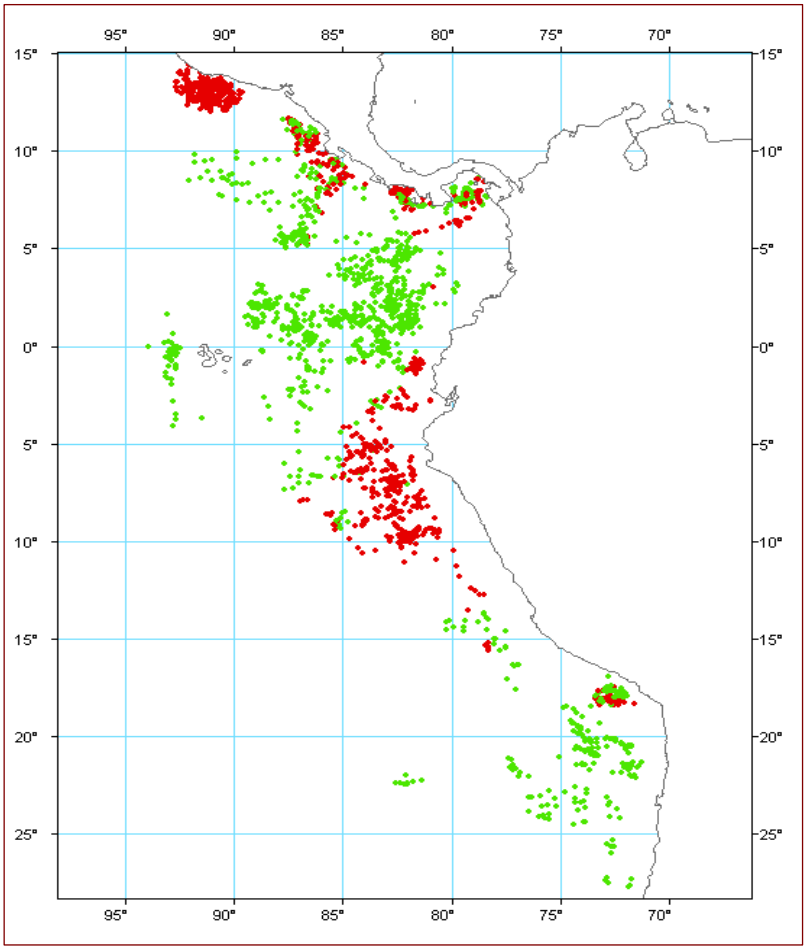

Figure 6. Spatial coverage of the observer program to date (2004-2006) for tuna and mahi-mahi fisheries.

However, the fisheries take place in very different habitats and regions of the eastern Pacific, and it is important to gather data representative of all oceanographic variability. If the distribution of sets is compared with the map below, showing the main characteristics of the region, we can see that the coastal habitats, defined as being within 300 miles of the shoreline, are well-represented in the data, but some long-distance fleets operating from the area are yet to be sampled.

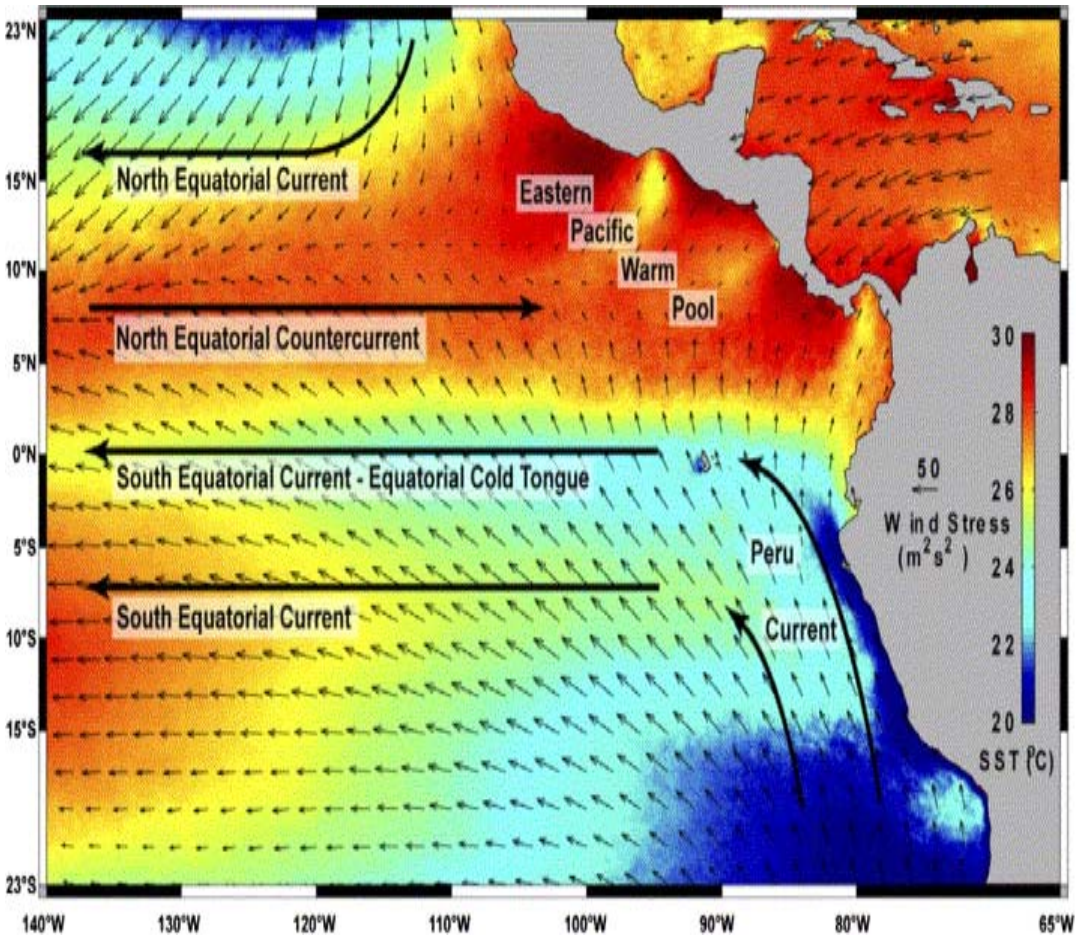

Figure 7. Oceanic data of currents and sea surface temperature (from Pennington et al., 2006).

WORKSHOPS AND MEETINGS

Workshops

Workshops have continued to be a significant part of the program. The list of participants by country, is enclosed in the map showing the distribution of the ports or caletas where workshops were organized (Figure 8). Many of the locations were visited in repeated occasions, so the total number of workshops for the total duration of the program has continued its steady increase, as the example for Ecuador shows. (Figure 9).

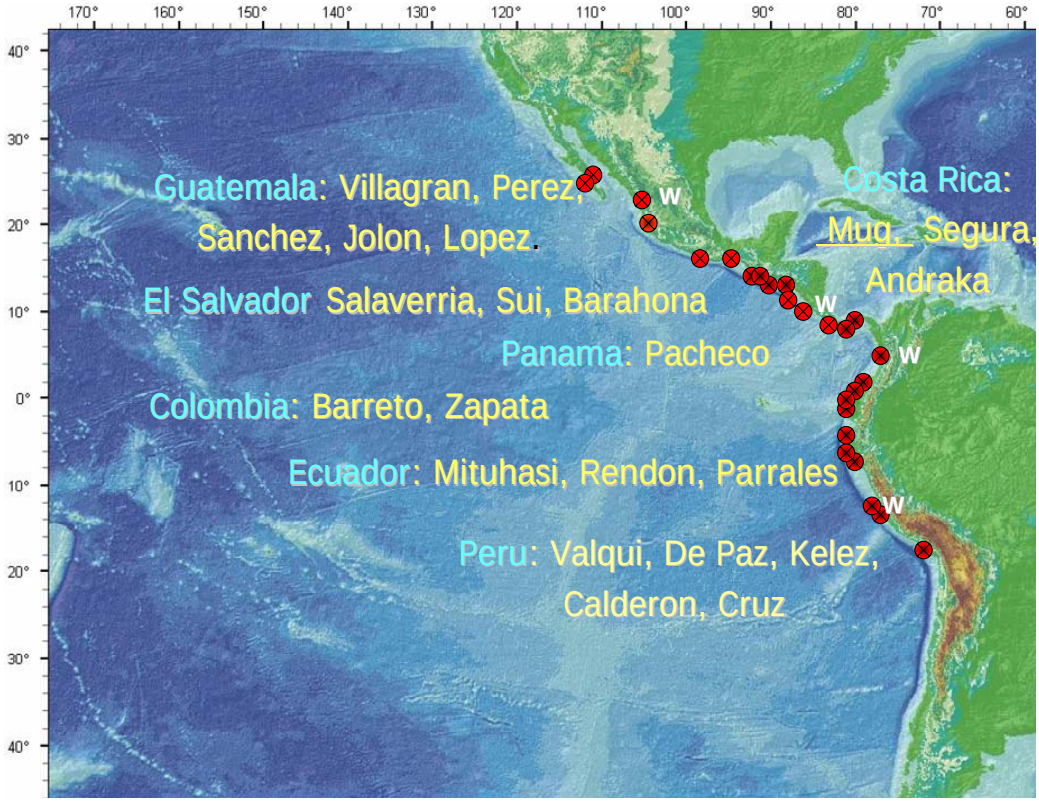

Figure 8. Country location of fisher workshops (2004-2006).

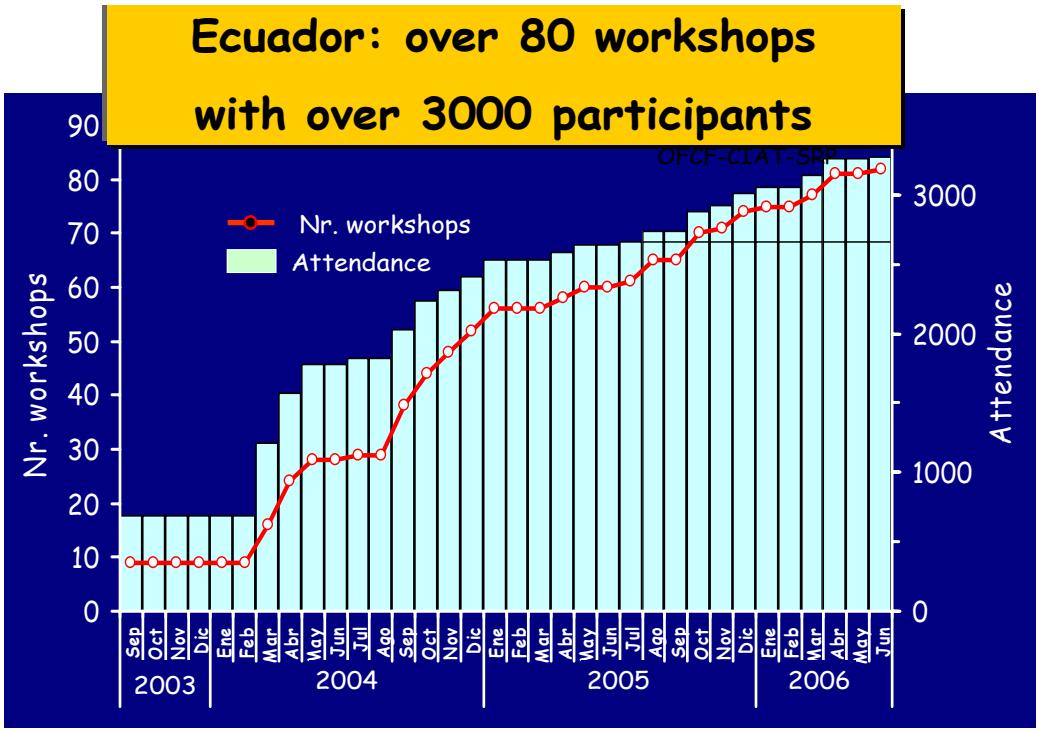

Figure 9. Number of workshops and participants in attendance.

The First Regional Workshop of the Eastern Pacific Program to Reduce Sea Turtle Mortality – Puntarenas, Costa Rica, June 11 – 18, 2006

With the data collection program growing rapidly, and the number of observer trips exceeding 500, it was decided to assemble the entire team to compare results, discuss future steps (expansion of programs, experiments, analyses, etc.), and to achieve the best possible standardization of the data. The meeting convened in Puntarenas, Costa Rica, June 11 – 18, 2006 with about 50 international participants.

The main objectives were to share and discuss the results achieved to date, improve the quality and consistency of the generated databases, improve the training of scientists and observers, improve the techniques used to handle hooked and entangled turtles, review bycatch rates for turtles, for target species, and for other bycatch species, review all information available from previous mitigation experiments, and to plan future steps on the analyses, publication, and experimentation of the data collected. The Workshop was sponsored by The Overseas Fishery Cooperation Foundation of Japan, WWF, IATTC, NOAA, WPRFMC, and JIMAR . The following were the major topics reviewed:

1 – Description of characteristics of longline fisheries of participating countries (Peru, Ecuador, Colombia, Panama, Costa Rica, Nicaragua, El Salvador, Guatemala, Mexico) and a comparison with other important world fisheries with invited participants (US Atlantic, US Hawaii, Brazil (3 regions), Uruguay (Pacific), and Spain.
2 – Status of the sea turtle stocks.
3 – Recent experiments with circle hooks or baits (US Atlantic, US Pacific, Brazil – TAMAR, Spain – Mediterranean), wired hooks (eastern Pacific).
4 – Sea turtle handling: instruments, techniques, procedures
5 – Sea turtle hooking rates in the different countries and fisheries.
6 – Locations of hooks by type
7 – Fish catch rates in the different countries and fisheries.
8 – Bottom longlining data
7 – Other bycatches in the fisheries
8 – Communication materials
9 - Entanglements
10 – Other topics
    Hook characteristics
    Selectivity of circle hooks
    Applied physiological research
    Post-hooking mortality
    Statistical characterization of fisheries
11 – Research areas of interest
    ACCESS databases and forms

List of attendees

Organization, Country	Names
OFCF, Japan	Takahisa Mituahi
IATTC	Martín Hall, Cleridy Lennert, Nick Vogel
NOAA, USA	Christofer Boggs, Yonat Swimmer (Hawaii) John Watson (Pascagoula)
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Industry, El Salvador	Rafael Baires
PROBIOMA, Guatemala	Mario Jolón, Regina Sánchez
Defenders of Wildlife, Mexico	Juan Carlos Cantú
Consultant, Mexico	Pedro Ulloa
TAMAR, Brazil	Gilberto Sales, Fernando Fiedler, Nilamon Leite
C.R.E.M.A. España	Mari Luz Parga
Dir. Nac. Recursos Acuaticos, Uruguay	Andres Domingo
Centro Cetaceos, Spain	Ricardo Sagarminaga
Parque Ostional, Costa Rica	Carlos Mario Orrego
Observers	Gilberto Solares, Guatemala
	José Rodolfo López, Ecuador
	Carlos Javier Lucas, Ecuador
	Raul Alfredo Carrión, Peru
	Daniel Navarro, Panama
	Ricardo Carit, Costa Rica

We thank our sponsors

ANALYSIS OF HOOKING RATES

Spatial distributions

Most of the sets sampled had no sea turtle bycatch, as shown in Figure 10. However, in both types of fisheries there are very large positive values of interactions (Figure 11). These values were plotted in the following figures, and showed some aggregations of high values occur presumably in regions of high density of turtles.

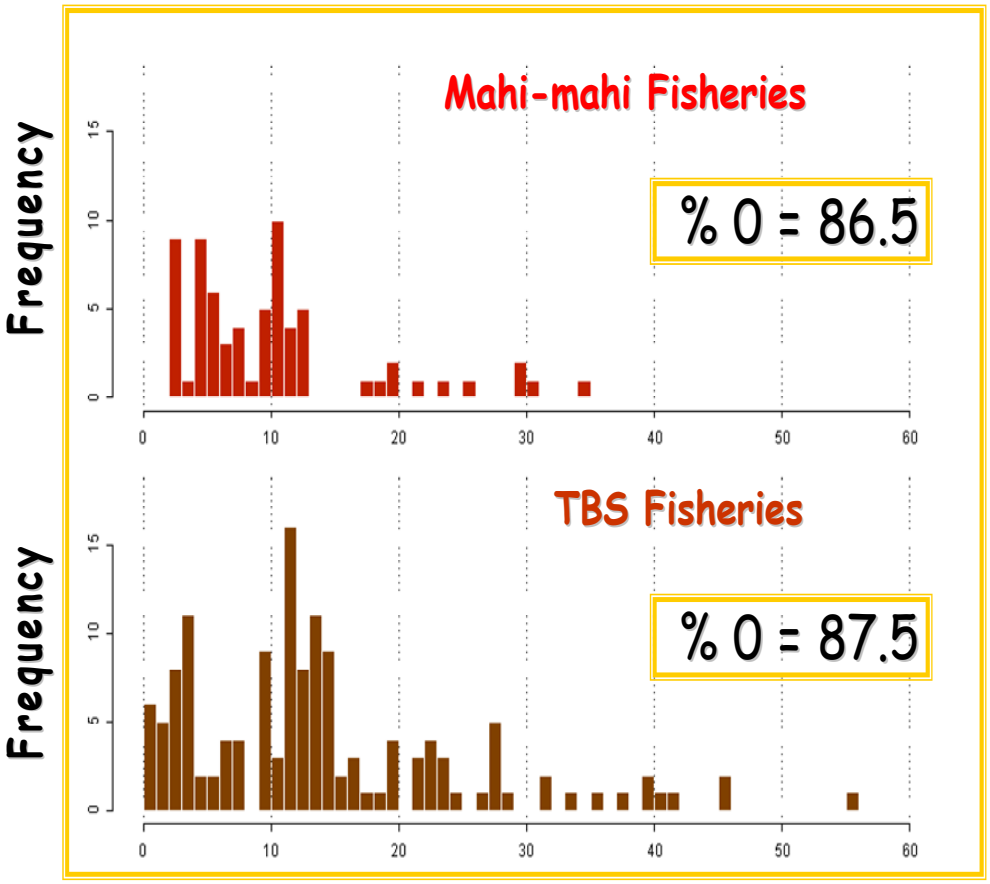


Figure 10. Frequency of turtle interactions in TBS and mahi-mahi fisheries.

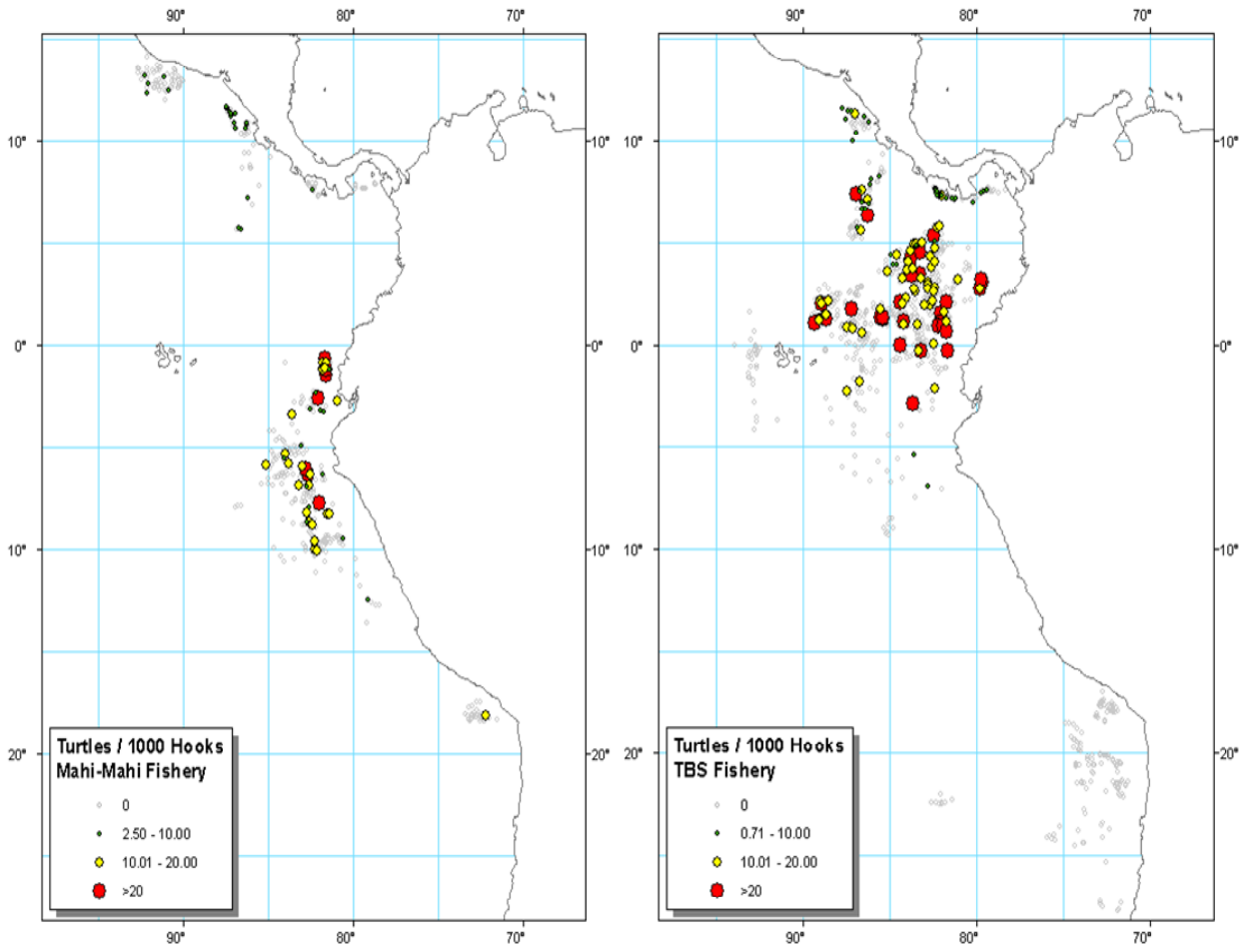


Figure 11. Fishery/turtle interaction locations in the mahi-mahi and TBS fisheries.

The area South of 15 S. shows very low hooking rates, but this area may be of interest because of the presence of loggerhead sea turtles. The areas off Northern Ecuador and Southern Colombia have high hooking rates, mostly of olive ridleys, as shown in Figure 12 (below) , reflecting the large concentrations of turtles in the region. Further to the South, South of 2 S., it appears that black turtles are the most common. The other species are all present, but in much lower numbers.

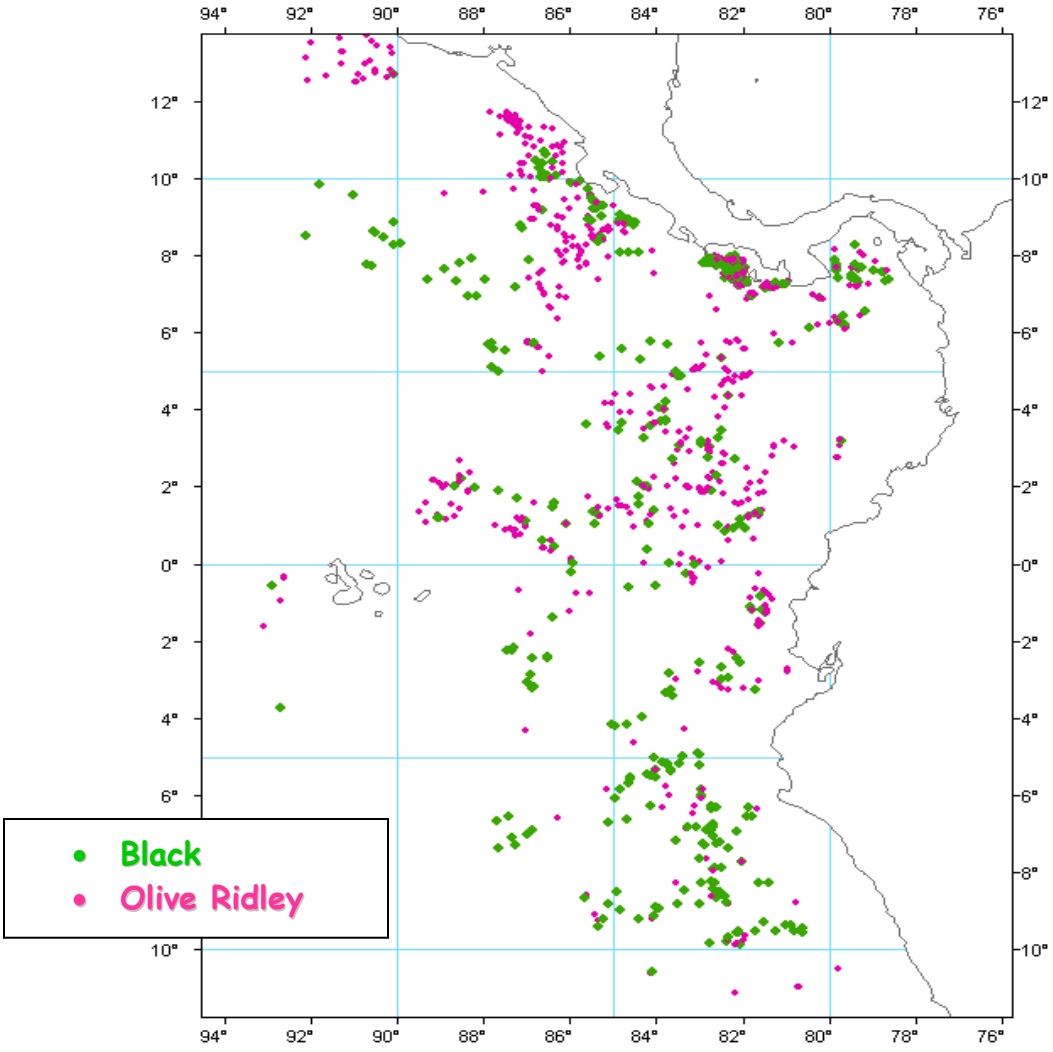


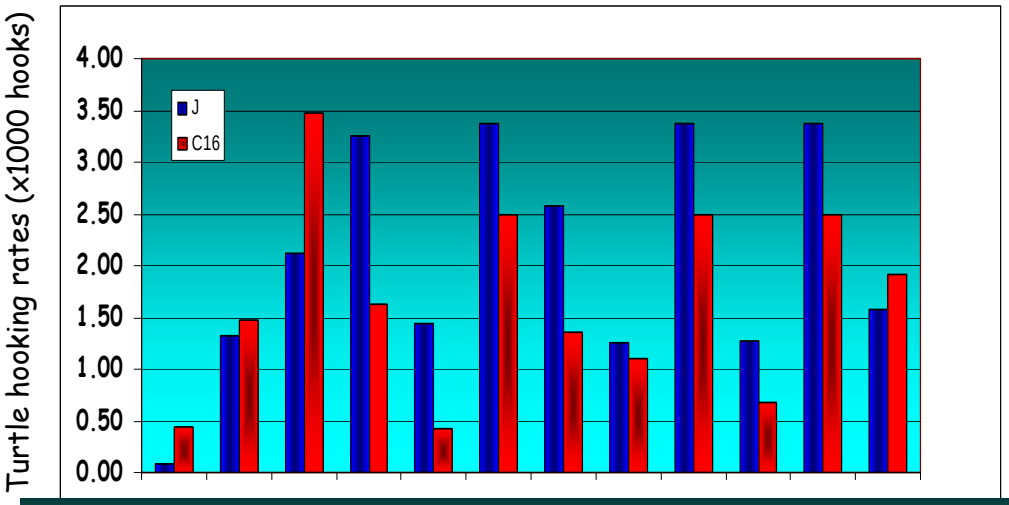
Figure 12. Olive ridley and black turtle interactions in all fisheries combined.

HOOKING RATE RESULTS

As the database is currently being given a thorough review for quality control, and some data has not yet been entered into the database, the following figures should only be considered as preliminary.

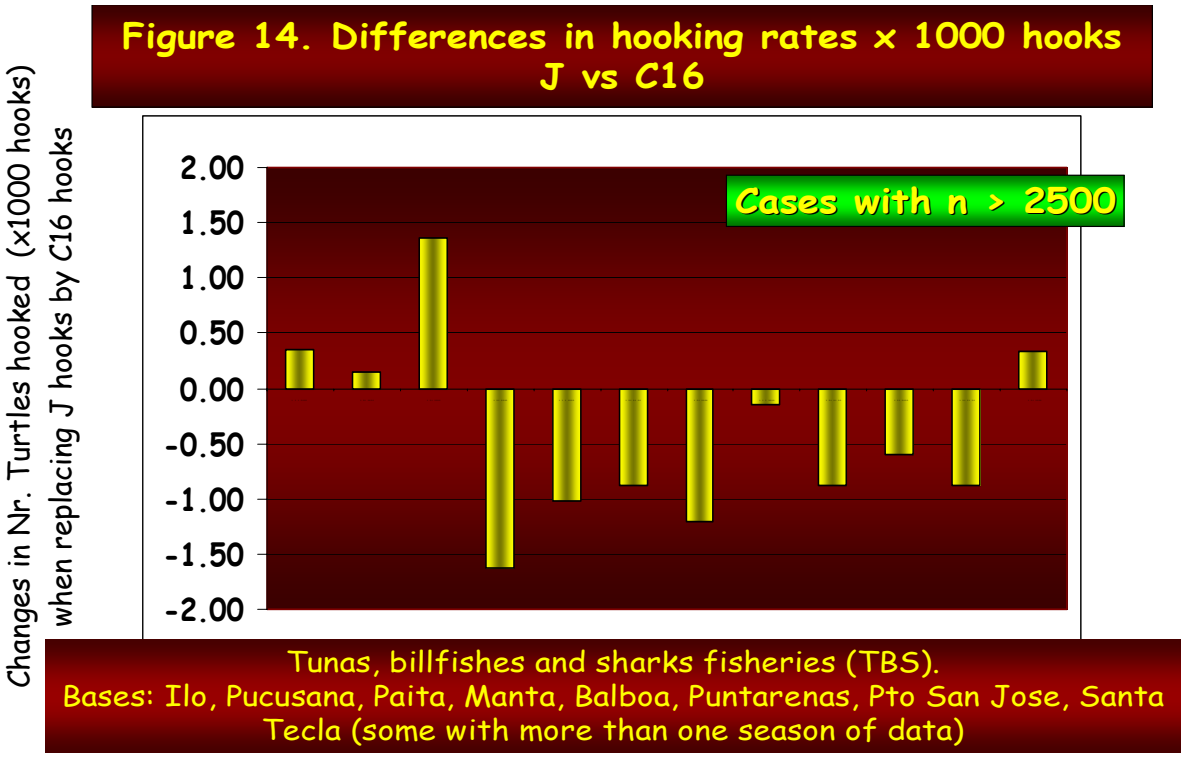
The comparison of hooking rates in J hooks, and in Circle hooks of size 16 (C16/0), shows very positive results (Figure 13). The reductions in hooking rates are considerable in magnitude, and consistent in most locations.

Figure 13. Turtle hooking rates x 1000 hooks J vs C16

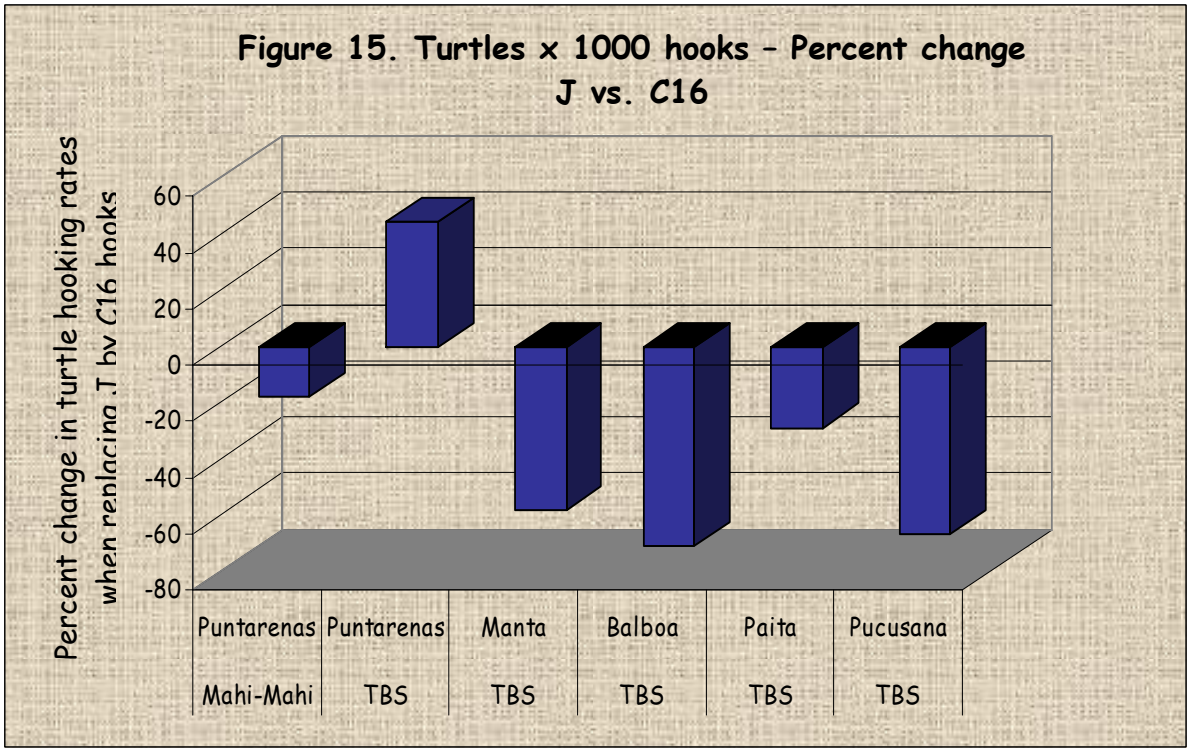


Tunas, billfishes and sharks fisheries (TBS).
Bases: Ilo, Pucusana, Paita, Manta, Balboa, Puntarenas, Pto San Jose, Santa Tecla (some with more than one season of data)

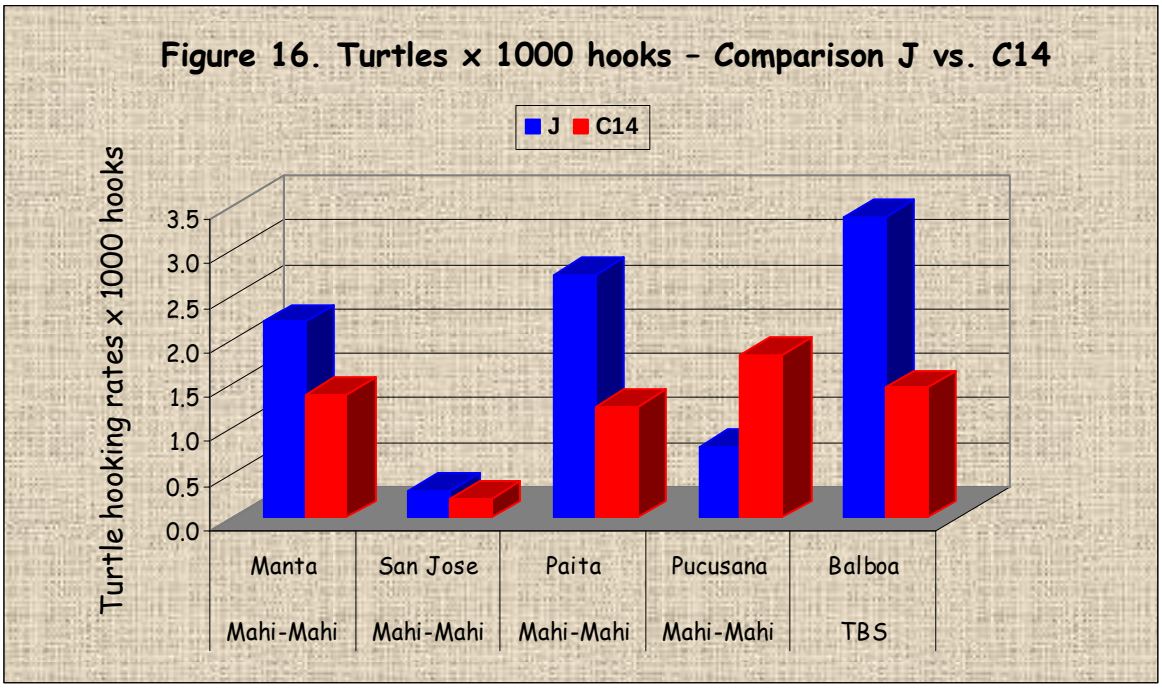
One way to measure the potential impact of the circle hooks is to compute the decrease in hooking rates in numbers of individuals. The figure 14 below shows that most fisheries observed a reduction of 0.5 to 1 turtle per 1000 hooks results from the change of J hooks by C16 circle hooks. This translates into reductions of 500 to 1000 turtles per million hooks, a considerable figure that could help reduce incidental fishery mortality.



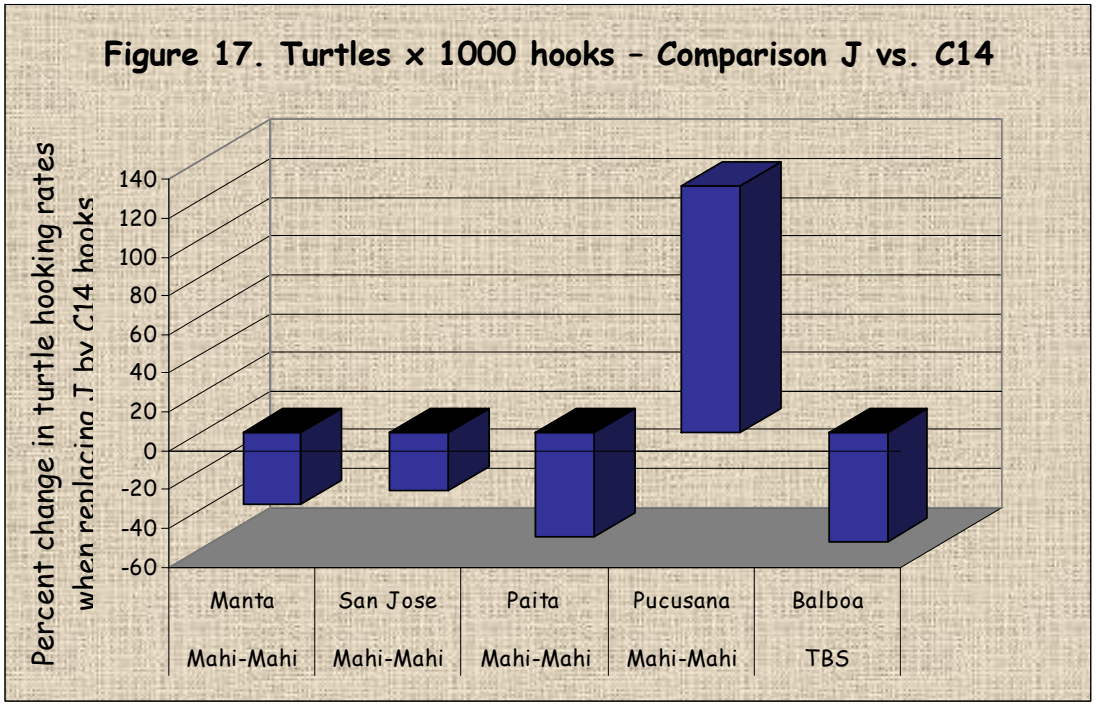
Using only a subset of the data with larger sample sizes, we can see that the percent reduction reaches almost 80% in Panama (Balboa), but in general it is in the 40% to 80% range (Figure 15). More data are needed to determine why the Puntarenas TBS fishery doesn't show the same pattern as the others.



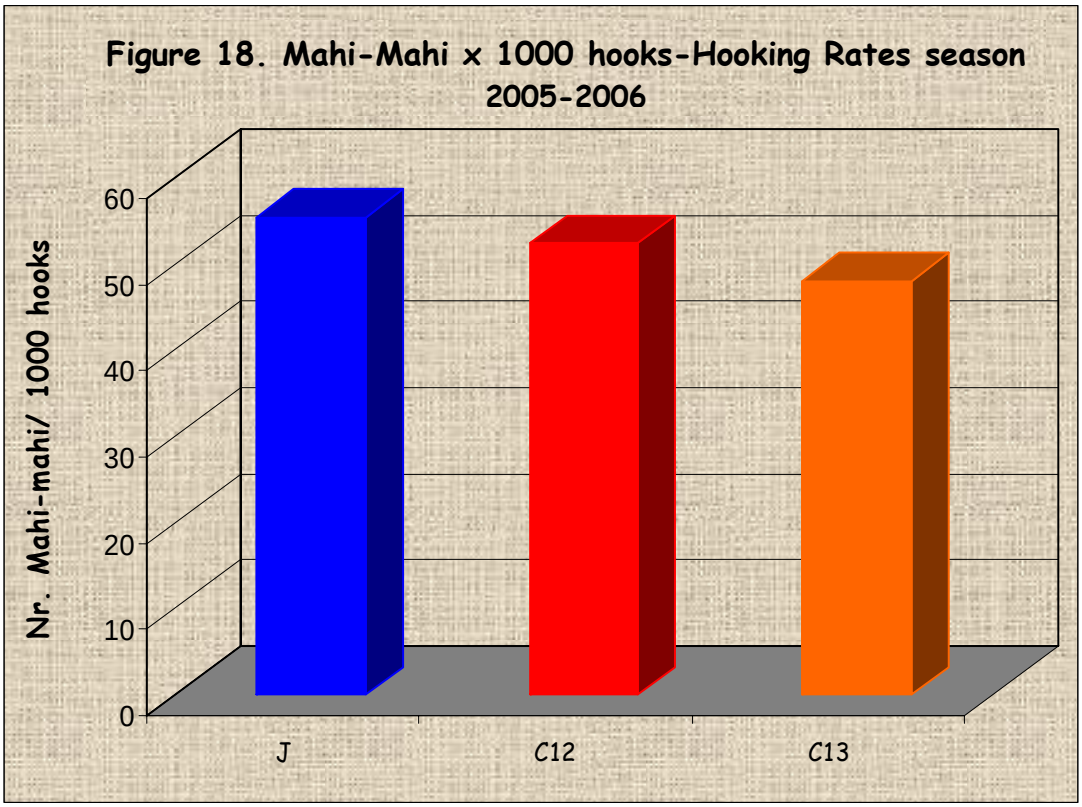
The comparison of J hooks in the mahi-mahi fishery, with Circle hooks size 14/0, is shown in Figure 16, using the cases with more robust sample sizes. Again, most cases show a reduction in hooking rates, but the magnitudes are lower overall than in the case of the 16/0 hooks.



The percent reductions in this case are of lower magnitude, but still consistent among areas, as shown below (Figure 17). To be effective as a mitigation measure, the gains have to be increased, so more tests with other sizes or types of hooks should be performed. The addition of wire appendages to these hooks may provide that additional gain.



In fisheries targeting smaller fish (such as mahi-mahi), the fishers complain that the larger circle hooks put them at a disadvantage. Although studies are needed to assess the impact of fishing on smaller-sized fishes, the issue needs to be considered from the fisheries point of view. Therefore, a limited test using circle hooks sizes C12/0 and C13/0 was performed and the results (Figure 18) showed that C12/0 hooks did not reduce sea turtle hooking rates, but the size C13/0 showed some promise. It was decided to limit the size of the hooks used in the whole regional experiment to sizes larger than C12/0, and to extend the testing of wire appendages on C13/0 to see if it is possible to obtain additional reductions to those observed.



The gains with respect to sea turtle hookings are not clear yet. One hook showed a very good response (a one third reduction), but the other showed an increase of one third (Figure 19). Only data for one season are available. However, this is another case where the addition of a wire appendage, for example, could improve hook performance to reduce turtle bycatch.

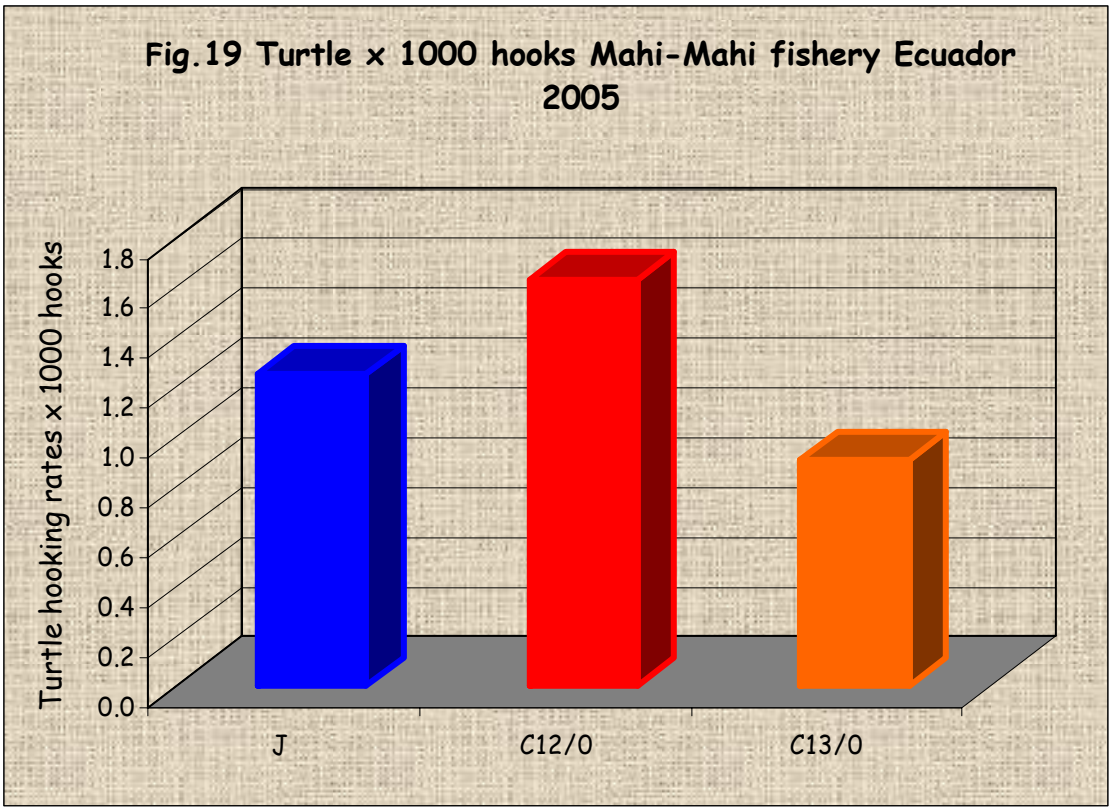


Fig.19 Turtle x 1000 hooks Mahi-Mahi fishery Ecuador 2005
Turtle hooking rates x 1000 hooks
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
J
C12/0
C13/0

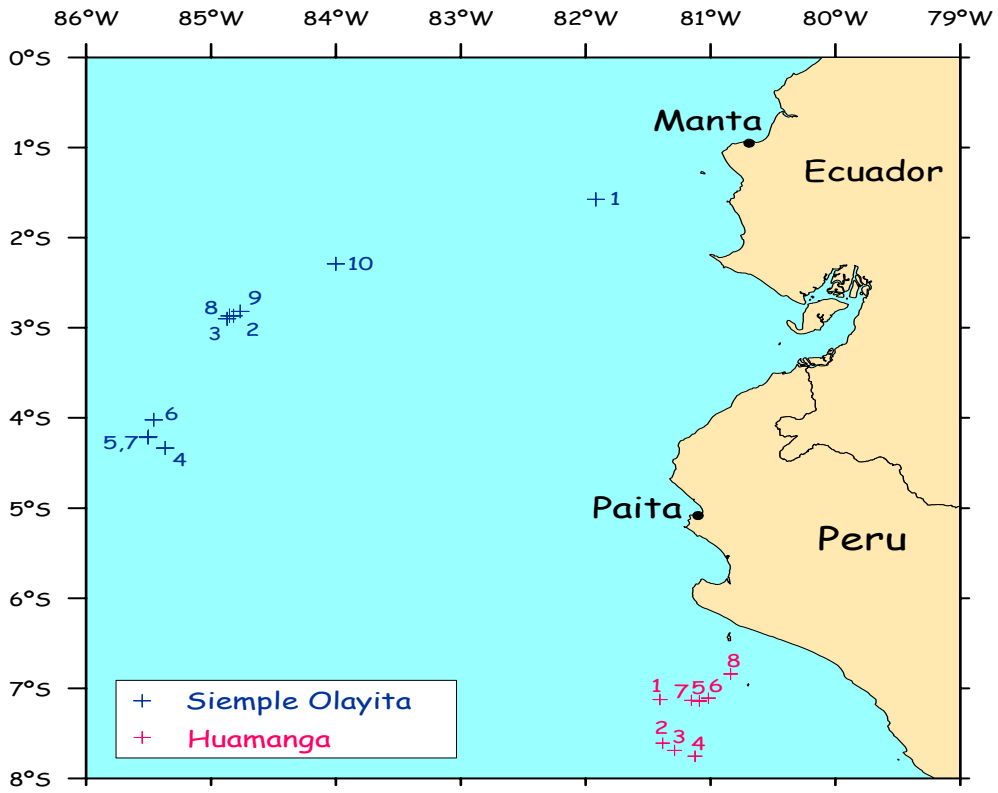
HOOKS WITH WIRE APPENDAGES

In 2001, researchers from New Zealand (Willis and Millar, 2001) tested hooks with a wire appendage to reduce gut hookings of target species in a recreational fishery. They called the type of hook a "Barnes hook", probably a reference to Paul Barnes (Barnes from Fishing Kites Tackle shop in New Zealand, an innovator in fishing gear and techniques). This wire appendage makes the hook wider, and thus harder to swallow.

Charles Bergmann from NOAA, Pascagoula, circulated the reference among a group of researchers thinking that the concept could be useful in fisheries which the use of large circle hooks is not a viable solution (such as the mahi-mahi fishery). In consultation with Bergmann, C. Boggs (NOAA, PIFSC), J. Watson (NOAA, Pascagoula), and T. Mituhasi (OFCF) an experimental design was developed to perform a limited experiment. Two replicates were run, one at Paita, Peru, organized with the Centro de Entrenamiento Pesquero de Paita, and the other at Manta, Ecuador. In both cases fishing vessels were chartered with the objective of making 10 sets, and fishing approximately 20,000 hooks in each trip.

Two treatments were compared to the control J hooks: a small circle hook 13/0 with a wire appendage, and a larger 16/0 circle hook without a wire (Figure 20). The experiment was limited to these options because of the low sample size. Ideally a couple more treatments should have been included. The 13/0 hook with the wire appendage roughly approaches the width of the 16/0 hook, so we can separate the effect of the wire.

Figure 20. Hooks used in the experiment: J hook, 13/0 circle hook with wire, and 16/0 circle hook.



The locations of the experimental sets

The results were very encouraging; Bergmann's assessment was correct. The reductions in sea turtle hooking rates ranged from 53% to 80% for the 13/0 hooks with the wire appendages, compared to reductions of 53% to 100% for the 16/0 circle hooks (Figure 21). Also, the incidence of lower survival hookings (i.e. swallow deep) were much lower with both circle hooks (25% for the 13/0 and 12% for the 16/0) compared to the J hooks (76%). The statistical analyses are being carried out by M. McCracken and the results will be presented in a publication by T. Mituhasi, M. Hall, C. Bergmann, M. Parrales, J. Calderon, and M. McCracken.

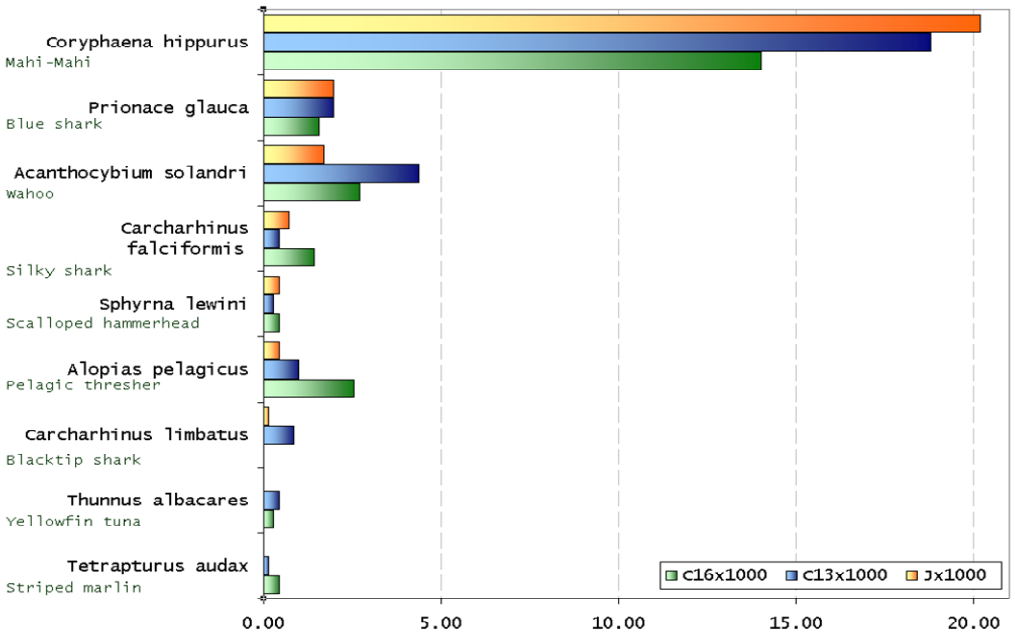
Figure 21. Turtle Hooking rates

	J vs C13W	J vs C16
Peru results	-80%	-100%
Ecuador results	-53%	-53%
Overall results	-63%	-70%

Furthermore, the target catch rates for the two legs combined were quite similar: 27.8/1000 J hooks, 30/1000 C13/0 hooks with wire, and 23.9/1000 16/0 hooks (Figure 22). In the Peruvian leg, where smaller mahi-mahi were caught, J hooks outperformed the circle hooks, but in the Ecuadorian leg it was the other way around.

The wire appendages promise to be an additional, simple and economic way to further reduce hooking rates, and the proportions hooked with low survival possibilities. There is even the possibility of adding them to J hooks, if there is stiff resistance to switch to circle hooks.

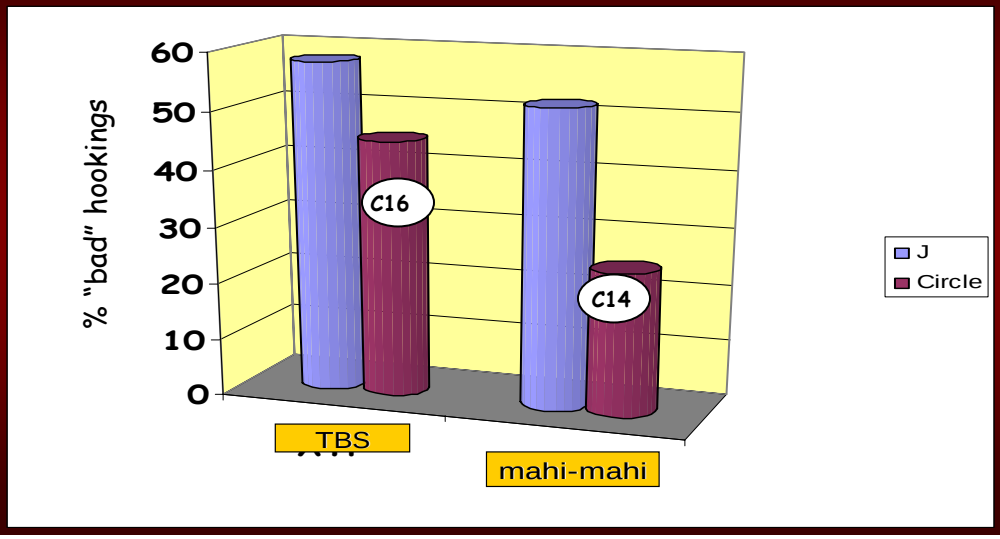
Figure 22. Overall target catch rates by hook type in wire appendage experiments (C/16, C/13 & wire, J).



LOCATION OF HOOKINGS

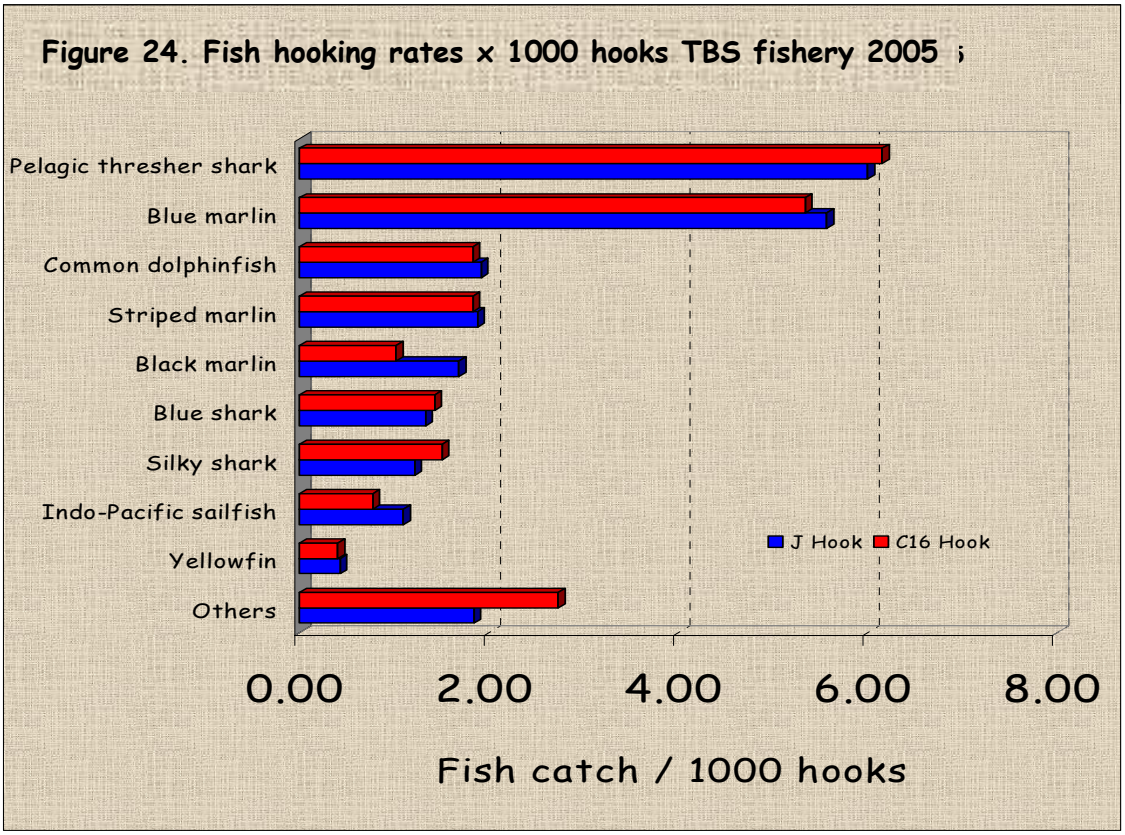
Another advantage of circle hooks is that they tend to produce hookings in the mouth or jaws of the turtles, and therefore, they are easier to remove and, even if not removed they result in higher survival than that of deep hookings. The following figure 23 shows the pooled results from the different experiments using C/16 and C./14 hooks versus J hooks:

Figure 23. % "Bad" hookings



TARGET SPECIES HOOKING RATES

In the TBS fishery, the target CPUE of the C16/0 circle hooks has continued to be very similar to the control J hooks, as illustrated with the Ecuador data below (Figure 24). They are quite balanced for most of the species captured.



In the mahi-mahi fishery, the target catch rates were much lower for circle hooks C14/0 and C15/0 than for the control J hooks (Figure 25).

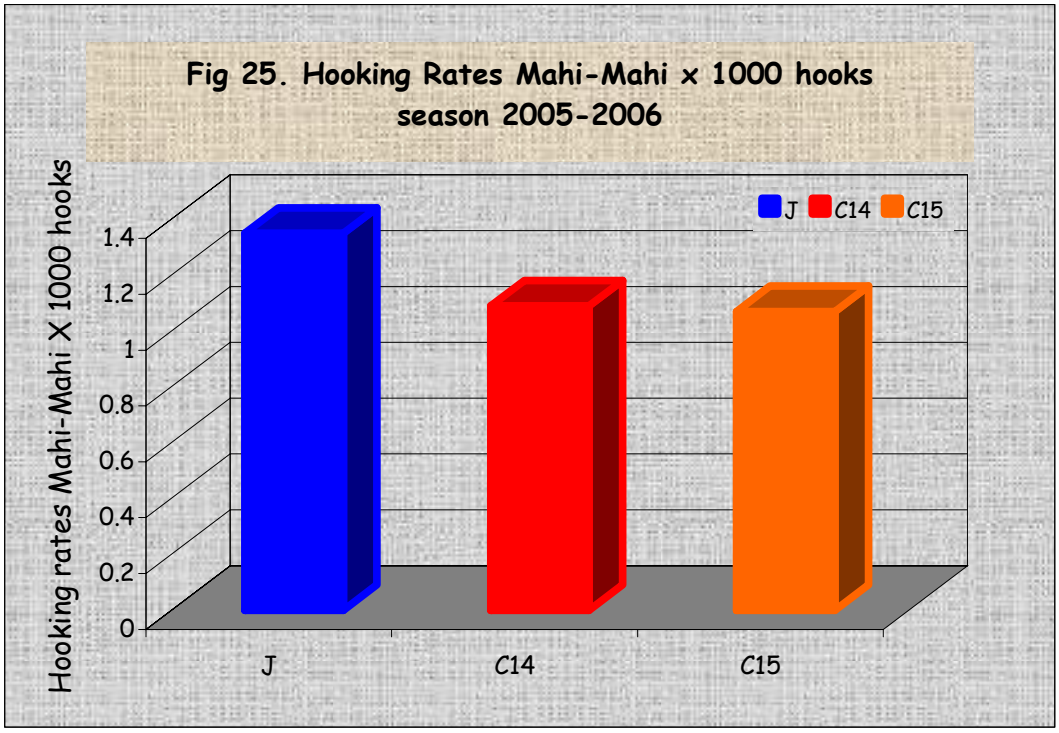
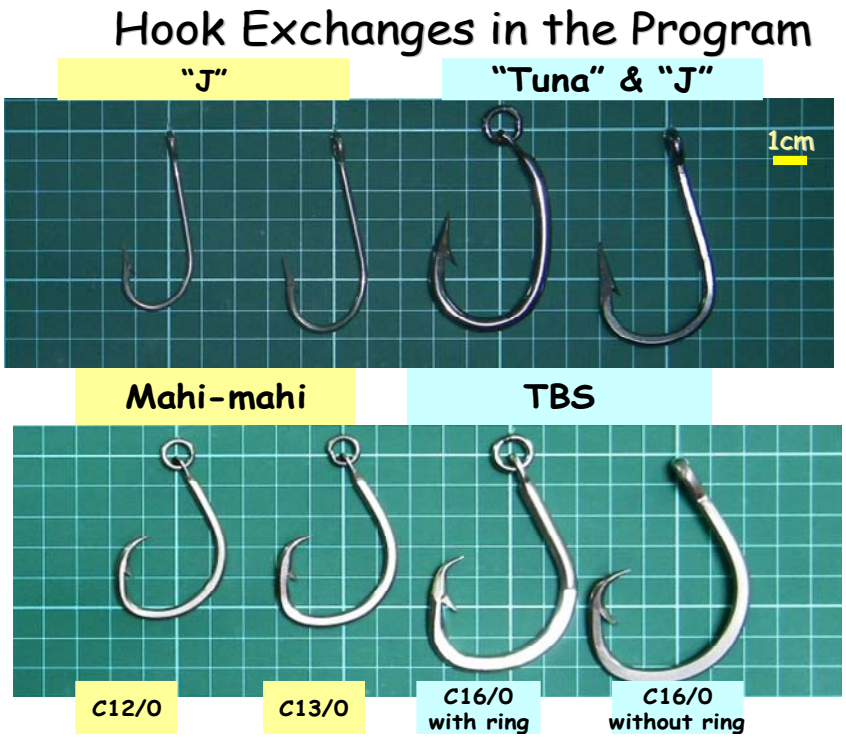


Fig 25. Hooking Rates Mahi-Mahi x 1000 hooks
season 2005-2006
Hooking rates Mahi-Mahi X 1000 hooks
1.4
1.2
1
0.8
0.6
0.4
0.2
0
J
C14
C15
J
C14
C15

HOOK EXCHANGE

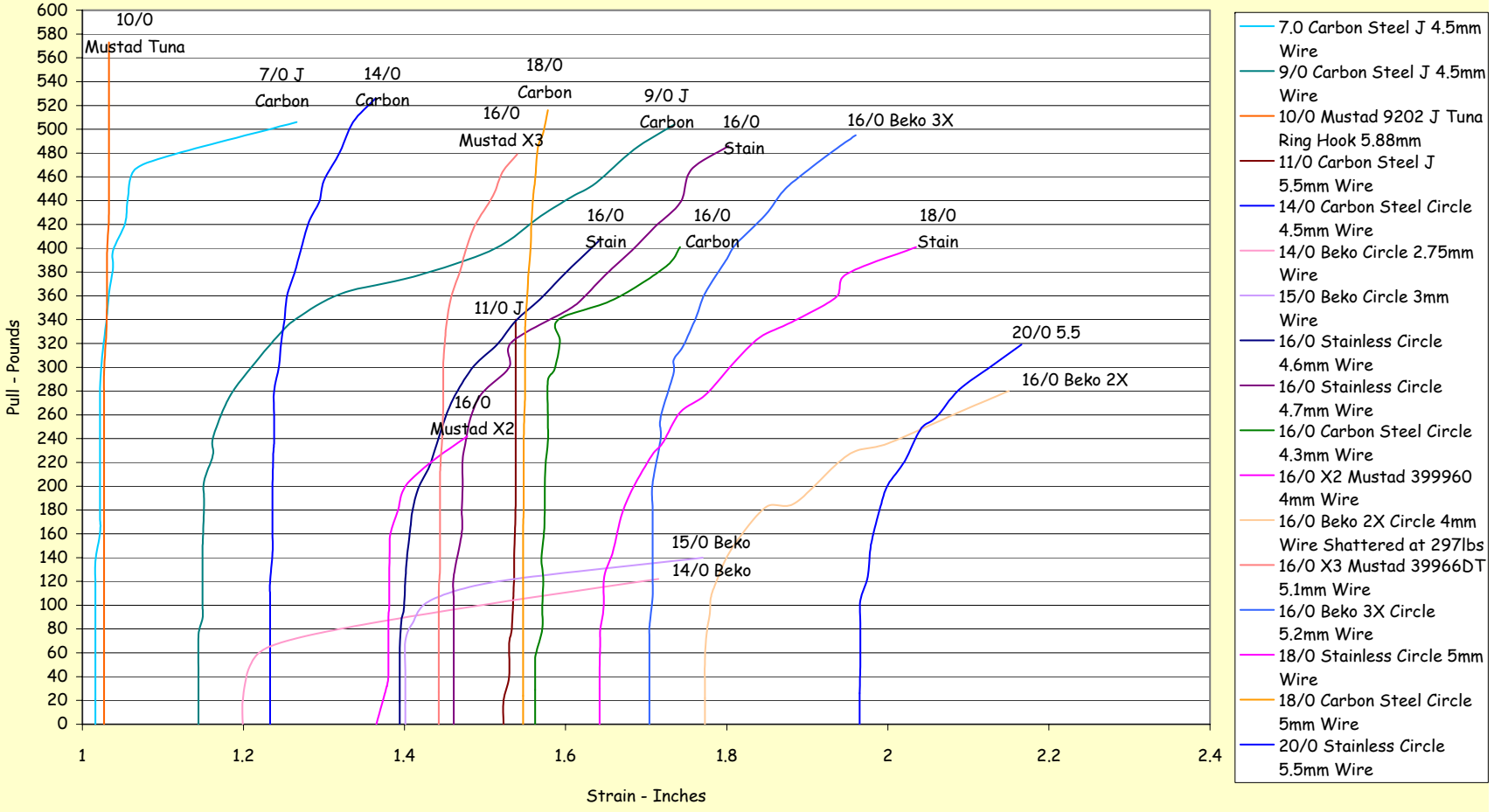
As previously mentioned, the test of hooks types and sizes has continued. In the last season we introduced stainless steel circle hooks made in Japan and in India. The Japanese design is shown below; it has a ring on the eye, which makes them more attractive to the fishers. The initial trips with these hooks have yielded a good performance, and acceptance by the fishers. Overall, the project has exchanged approximately 1,000,000 J hooks with circle hooks (with appropriate fishery dependent size).



The Indian hooks tested have had manufacturing problems (rust and breaks) and the company is trying to solve them. As they were a low cost alternative, there is still interest in their potential. The figure below shows the strength characteristics of all the hooks tested so far.

Hook Pull vs Strain

Note The X axis represents the measurment of the hook between the tip and shank after being pulled to the listed pounds on the Y axis

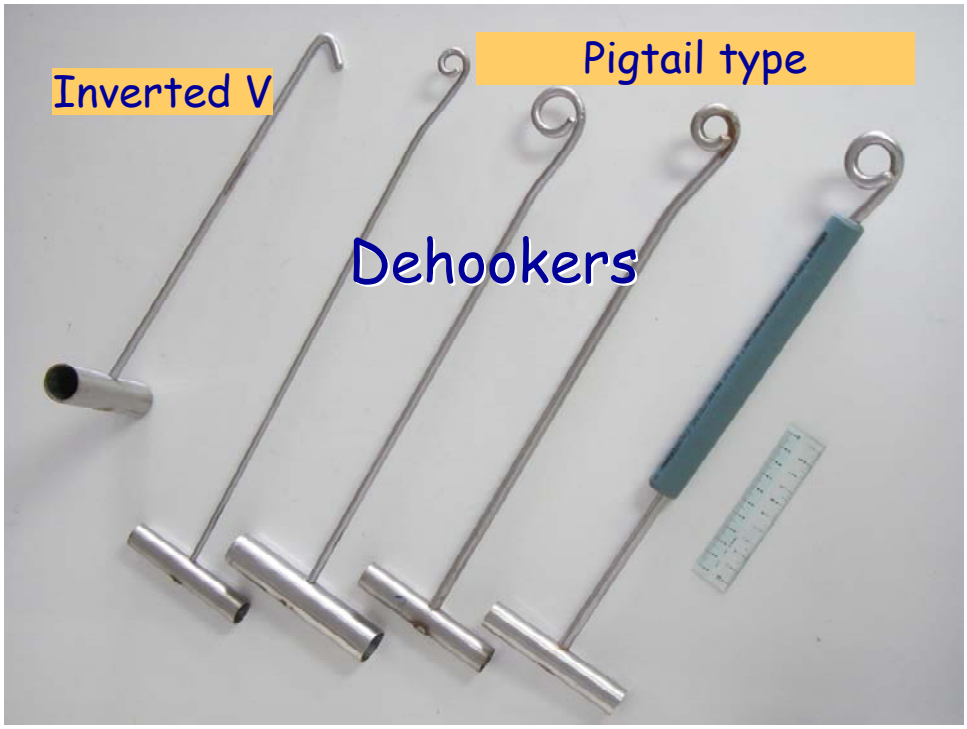


TURTLE HANDLING EQUIPMENT

Using the experience accumulated over the first years of the program by the observers, fishers, and staff, we undertook a revision of the instruments and techniques that were used to handle entangled or hooked sea turtles. The recommendations from NOAA experts had been prepared with some species and sizes in mind, and the conditions in the eastern Pacific were different.

Dehookers

The most useful dehooker has been the "Inverted-V" type; this dehooker is most effective with hooks in the mouth area of the turtle. It will become even more important with the increase in the use of circle hooks that tend to hook turtles in the jaw and commisure area. This will be the first one provided to the boats. The pigtail type dehookers are adequate for some individuals, but too large for others. The PVC sleeve that they had was quite useless for the declared purpose of keeping the turtle's mouth opened. Modifications are needed to make these more useful for the smaller turtles of the eastern Pacific region. These should include smaller "pigtails", thinner wires, and the elimination of the PVC part. The smaller wire diameter should reduce costs, since the thicker one far exceeded the needs.

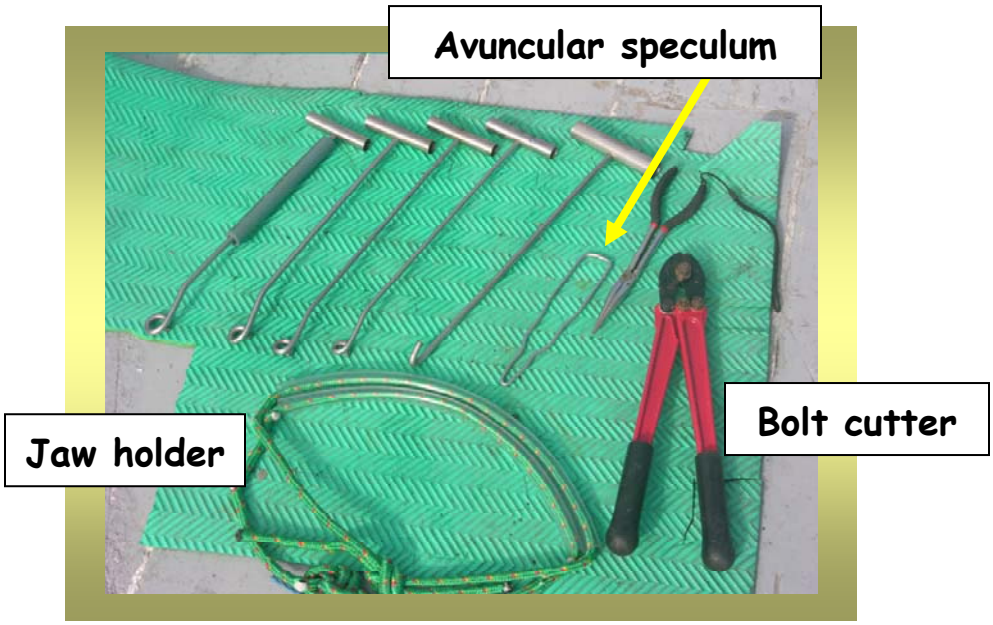


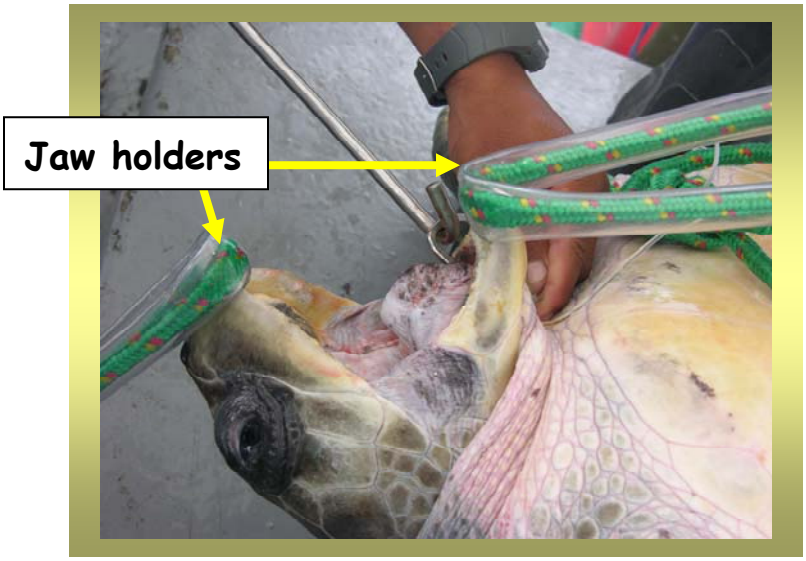
Mouth Openers

The "avuncular speculum" proved very adequate for forcing the turtles to open their mouths in the cases where it was necessary. After the mouth was opened, two pieces of rope encased in a plastic hose were attached to both jaws, and an assistant could keep the mouth open for a prolonged period of time when it was necessary (jaw holders).

Other Instruments

A heavy duty bolt cutter is needed to cut the tip of a hook in some cases. A line cutter with a long handle will also be important for releasing turtles and other entangles species (e.g. mantas).





Dipnets

Dipnets have proved very effective to lift the turtles to the deck unharmed. But the stress on the frame has suggested some modifications, and T. Mituhasi and M. Parrales are developing the new design.

PROGRAM COORDINATION

The coordination of the program, ensuring that the implementation follows the guidelines established in the region, advising the researchers, maintaining the contacts among sectors and countries, requires frequent trips to the region, and activity in all the countries. Over the past year the activities have included:

- ✓ Organization and moderation of technical workshop, Puntarenas, Costa Rica, June 2006
- ✓ Fishers workshops, seminars, presentations to Fisheries and Environmental Agencies, Fishers cooperatives and federations, Fishers schools, and universities, in Peru, Ecuador, Panama, Costa Rica, El Salvador, and Guatemala.

Results of the program have been presented at the following meetings:

- ✓ International Fishers Forum III, Yokohama, Japan July 25 – 29, 2005
- ✓ International Sea Turtle symposium, Crete, Greece April 3-8, 2006
- ✓ Society Conservation Biology, San Jose California June 24-28, 2006
- ✓ IATTC Annual Meeting, Bussan, South Korea June 26-28, 2006

- ✓ Compartiendo experiencias en la Conservación de Tortugas Marinas-IUCN/CONAP, Puerto Quetzal, Guatemala July 20-22, 2006
- ✓ FENAPESCA Federación Nacional Pescadores Artesanales, Guatemala City, Guatemala, July 20, 2006
- ✓ Universidad de San Carlos de Guatemala, Centro de Estudios del Mar y Acuicultura –CEMA, Guatemala City, Guatemala July 24, 2006
- ✓ International Fishers Forum III, Yokohama, Japan
- ✓ International Sea Turtle symposium, Crete, Greece

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Willis, T.J., and R.B. Millar. 2001. Modified Hooks Reduce Incidental Mortality of Snapper (Pagrus auratus: Sparidae) in the New Zealand Commercial Longline Fishery. *ICES Journal of Marine Science* 58 (4): 830-841

APPENDIX A

Developing a model for cooperation among nations, and stakeholders

Developing a model for cooperation among nations, and stakeholders

The traditional approach to the bycatch problems has been an adversarial relationship between conservation groups, and industry and fishers groups. The traditional attitude has been distrust of the other participants, and a sequence of media denounces – denials. Clearly, a different model was needed, to be able to bring together all the resources, talents, specific skills, and motivation from all sides. There are common interests for all sectors; for instance, the conservation of ecosystems is needed for sustainable fisheries. Intelligent fishers, and intelligent environmentalists, can see that the first victims of the destruction or degradation of an ecosystem are the fishers. Food security, sustainable fisheries, and employment are critical in all countries, but especially in those with larger numbers of inhabitants close to the poverty level. In most cases, the differences between the sectors, are more of an issue of how the objectives are formulated and presented to each other, than a basic conceptual divergence.

It was necessary to find the common ground, and a set of guidelines that could create a harmonious team. The common ground was defined in two basic premises:

-- Nobody wants to cause sea turtle mortality, and much less bring a species to extinction.

-- Nobody wants to put fishers out of work.

The first premise affirms the will of the fishers to work to avoid incidental mortality. The second affirms the will of the conservation groups, and others to search for a solution that includes the fishers.

Guidelines:

Solutions must be:

- based on rigorous scientific results
- effective to reduce incidental mortality
- practical in their adoption
- economically viable for the fishers
- specifically adapted to the different fisheries and regions

Working with the fishers to find the solutions is the approach most likely to succeed, and the most likely to lead to a fair outcome, so it is the one chosen.

Continuous communication with the fishing communities, and among the sectors is a critical component of the process.

The broader the spectrum and number of participating institutions, the better for the achievement of our objectives, as far as the basic premises are shared by all.

The regional integration of all the efforts is critical to achieve the goals. A regional and global visions must prevail over the national views.

International cooperation is necessary to achieve the goals of the program.

All activities of the program are executed with full knowledge of the respective national authorities, and they are based on a strict respect for the countries' sovereignty.

Capacity building in the region is a requirement, and an objective of the project. This must include the members of the fishing communities, and their leadership.

The adoption by the fishers of mitigation technology, and techniques, should be voluntary whenever possible, and the best options will be developed working with the fishers.

APPENDIX B

Data collection forms & file manual

Programa de Observadores en Buques de Palangre

Manual de Campo

Última revisión: 3 de agosto de 2006

INDICE

Introducción

A principios del ano 2004 un programa de observadores embarcados en buques palangreros comenzó en Manta, Ecuador. El propósito de este programa es la toma de datos de captura de peces y tortugas por anzuelos J y circular, con el fin de montar estadísticas sobre el efecto del uso de los anzuelos circulares en la reducción de la captura de tortugas en esta pesquería, y el impacto del cambio sobre las capturas de especies objetivo.

Los barcos de palangre que participen en el programa han modificado sus líneas de anzuelos, total o parcialmente, para alternar anzuelos J y anzuelos circulares de distintos tamaños. Observadores notan la captura de peces y tortugas por cada tipo de anzuelo en los tramos de línea experimental. Formularios especializados fueron desarrollados para la toma de estos datos, y el propósito de este manual es explicar la forma correcta de tomar los datos en los formularios.

Labores y responsabilidades

Usted ha sido seleccionado para acompañar a un barco de palangre en un viaje de pesca. Se requiere de usted que siga al pie de la letra las instrucciones en este Manual. Usted es responsable de la precisión de los datos que colecta, y de que los formularios están completos. NO DEBE reportar ninguna información que no haya observado directamente, y si por alguna razón tuviera que hacerlo debe indicar claramente que lo hizo. Si tiene dudas es preferible indicar que las tiene, a reportar como cierto lo que puede ser un error. Durante el viaje registrará información sobre las actividades pesqueras del barco en los formularios siguientes:

F1) Registro de Embarcación
F2) Registro de Aparejos Palangreros
F3) Registro de Lance Palangrero
F4) Registro de Especímenes Individuales
F5) Registro de Tortugas

Debe hacer lo posible por no entorpecer las faenas de pesca al desempeñar sus labores. La información que recolecta es propiedad del programa de investigación, y es altamente confidencial. No haga ni guarde copias de sus formularios y demás datos, ni tampoco divulgue la información a personas ajenas. Lo que sucede en un barco no debe ser comentado en otra embarcación. Mientras esté a bordo del barco, no debe llevar a cabo actividades personales ni de cualquier otro tipo que pudieran interferir con sus labores como observador. Dada la sensible naturaleza de la confiabilidad que se le da a sus datos, es necesario que se conduzca de manera responsable y profesional durante todo el viaje. El uso del alcohol o de estupefacientes conduce a la disminución de la credibilidad del observador y, en caso de detectarse, resultará en su despido inmediato. Su responsabilidad se limita

a observar, y registrar sus observaciones en los formularios adecuados. No debe asesorar acerca de la interpretación de leyes o reglamentos o impedir las prácticas de pesca regulares de la embarcación, aún cuando el capitán u otro tripulante soliciten su opinión. Si se diera este caso, deberá cortésmente recordarles que Ud. no esta calificado para ello, y que no tiene ninguna autoridad ni para aplicar las leyes, ni para hacer excepciones a las mismas, y que para cualquier aclaración, la tripulación deberá consultar con las autoridades competentes del estado de jurisdicción de la embarcación. Aunque Ud. conozca las leyes, y observe alguna violación de las mismas, su única función en el barco es la recolección de datos y otras actividades requeridas por el programa. SE ESPERA que el observador haga un esfuerzo por entrenar a los tripulantes de todos los barcos en los que viaje en los métodos mas adecuados para liberar tortugas enganchadas o enredadas, incluso el uso de instrumentos que lo faciliten.
COMO REGLA GENERAL: SE ESPERA QUE EL OBSERVADOR REPORTE SOLAMENTE LO QUE VE. SI EL OBSERVADOR NO PUDO OBSERVAR ALGO, O TIENE DUDAS DEBE REFLEJAR SUS DUDAS EN SUS DATOS Y NO TRATAR DE "ADIVINAR" LA RESPUESTA.

Antes del viaje

Deberá aprobar con un grado de aptitud un curso de entrenamiento, antes de ser asignado a un barco. Técnicos del programa de investigación le darán instrucción sobre la identificación de peces y tortugas, los formularios de datos, y las medidas de seguridad y el protocolo a seguir a bordo del barco. Asegúrase de que tiene el número de muestreo para el viaje, ya que tendrá que anotarlo en cada registro. Personal de la Sede le proporcionará este número. El Formulario F1 puede ser llenado en su totalidad antes de zarpar.

Durante el viaje

Familiarícese con este *Manual de Campo*, y consúltelo a menudo para asegurarse que está tomando de forma correcta los formularios de datos. Así evitará repetir los mismos errores una y otra vez. Familiarícese con el barco y con la conducta y "reglas" de sus tripulantes. Fíjese en particular en la ubicación de los chalecos salvavidas, los extintores de incendios, y el equipo de primeros auxilios. Establezca relaciones cordiales con los tripulantes del barco. Explíqueles sus tareas, y que es responsable de obtener datos correctos. Esté siempre conciente de su seguridad personal, y no corra riesgos; NINGUN DATO ES MAS VALIOSO QUE LA VIDA DE UN OBSERVADOR. Nunca entre al agua durante las faenas de pesca: bajo ninguna circunstancia. Obtenga el permiso del capitán antes de usar cualquier equipo del barco. En caso de sufrir una lesión, es importante que documente detalladamente las circunstancias, y que pida al capitán levantar un acta para efectos legales y del seguro de gastos médicos.

Después del viaje

Deberá colaborar con quienes revisen sus datos para completar y corregir sus formularios. Esta revisión de datos es su mejor oportunidad para aclarar dudas, presentar problemas o hacer observaciones de interés. Como Ud. entiende los objetivos del programa, esperamos que observaciones sobre temas no cubiertos por los formularios, pero que Ud. crea que pueden ser de utilidad, sean escritos como comentarios en los formularios y presentados directamente a los revisores de datos.

INSTRUCCIONES PARA LA TOMA DE DATOS

Su responsabilidad primordial durante el viaje es observar y registrar los datos con la mayor precisión posible y de la manera que se le ha instruido. Las anotaciones deben ser legibles, escritas en letra de imprenta, y en los espacios indicados. Si no está seguro de algún dato, deje el espacio correspondiente en blanco y haga apuntes explicativos.

Formularios

F1 – Registro de Embarcación

El Registro de Embarcación fue diseñado para anotar datos relacionados al buque. Estos datos normalmente no cambian entre viajes, aunque pueden cambiar en el curso del tiempo. Por este razón no es necesario llenar este registro para cada salida. El observador puede llenar el registro la primera vez que un buque sea muestreado para tomar los datos básicos, y luego para completar datos faltantes o cuando crea que el buque ha cambiado de alguna forma. Se debe verificar que no haya habido cambios.

Campos del formulario

Código El número asignado a este buque. El personal del programa en su sede proporcionará este código antes de zarpar.

Nombre El nombre del barco.

Matricula La identificación oficial del barco.

Armador El nombre del dueño del barco. Puede anotar otra información útil, por ejemplo la dirección de la empresa, números telefónicos, correo electrónico, etc. Preste atención a la forma exacta de escribir el nombre para no crear falsas duplicaciones.

Tipo Bote o fibra. Un bote trabaja de forma independiente, una fibra trabaja con un barco nodriza.

Puerto principal El nombre del puerto desde donde opera el buque normalmente.

Eslora La longitud, en metros, del buque desde la punta de la proa hasta el extremo de la popa.

Manga La anchura, en metros, del buque en el punto más ancho.

Puntal La altura del barco, medido en el medio de su longitud, desde la cubierta hasta la quilla.

Dist. cubierta/agua La distancia, en metros, desde la cubierta hasta la superficie del agua. Es de interés para conocer las longitudes de desenganchadores y chinguillos/salabardos.

Capacidad La cantidad máxima, en toneladas métricas, del cargamento de pescado que puede llevar el buque.

Motor principal Detalles sobre el motor principal, por ejemplo la marca, modelo, año de fabricación, potencia, dentro o fuera de borda, etc.

Número de tripulantes El número de personas que normalmente acompañan el buque en un viaje de pesca.

Capacidad combustible La cantidad máximo de combustible que puede llevar el buque, en galones. Si el barco normalmente lleva contenedores portátiles de combustible, como tambores o pomos, debe incluir esta cantidad en el número total con una explicación de los detalles.

Capacidad agua El volumen máximo de agua que puede llevar el buque, en galones.

Método de conservación de captura Describa el sistema de conservación de la captura, por ejemplo en hielo, con un sistema de amoníaco, etc.

Tipo de combustible Anote el tipo de combustible utilizado, por ejemplo diesel o gasolina.

Equipos de navegación y pesca Describa cualquier equipo de navegación o pesca (GPS, ecosondas, termómetros, etc.) con que el buque está dotado, incluso la marca del equipo, modelo, alcance, etc.

Observaciones Anote cualquier otra nota relacionada a la embarcación que sea relevante, por ejemplo motores secundarios.

F2 - Registro de Aparejos Palangreros

El Registro de Aparejos Palangreros fue diseñado para anotar datos que fácilmente pueden cambiar entre viajes. El formulario es separado en 3 secciones:

- Datos del viaje
- Características del equipo del palangre
- Datos de los anzuelos

Campos del formulario

Datos del viaje

EMBARCACION: El nombre del buque que efectúa el muestreo.

MUESTREO: El número secuencial asignado a este viaje. El personal de la sede proporcionará este código antes de zarpar.

OBSERVADOR: El nombre del observador que toma los datos.

Fecha Salida / Llegada La fecha de la salida y llegada del buque.

Puerto Salida / Llegada El nombre del puerto de la salida y llegada del buque.

Hora Salida / Llegada La hora y minutos de la salida y llegada del buque.

Nombre del Capitán El nombre de la persona que dirige la operación de pesca.

Combustible usada La cantidad de combustible, en galones, consumido durante el viaje.

Nombre del Armador El nombre del dueño y/o empresa propietaria del buque.

Fibras acompañantes Si el buque que realiza las faenas de pesca funciona como base para lanchas pequeñas durante un viaje, indique el número de lanchas pequeñas (fibras) que trabajan con el buque. Si el buque trabaja de forma independiente, deje el espacio en blanco.

Si la embarcación es una fibra / Nombre del Bote Si el buque que realiza la faenas de pesca es una lancha pequeña (fibra) que colabora con un barco más grande durante el viaje, indica el nombre del barco que brinda apoyo. Si el buque trabaja de forma independiente, deje el espacio en blanco.

Características del equipo del palangre

En esta sección puede anotar las características del palangre. Cada elemento del palangre está descrito en un renglón, con las características de cada elemento descritas en las columnas al lado derecho. No debe anotar datos en las celdas sombreadas, ya que no es un dato útil o no tiene sentido tomar datos de esta

combinación de fila y columna. En muchos cuadrados del formulario hay etiquetas de unidades en las celdas que contienen medidas. Asegúrese de que anote el número EN ESAS UNIDADES.

Para la columna de Material y Color, debe usar el código numérico correspondiente. Si un elemento del palangre esta hecho de más de un material, o presenta más de un color, debe anotar todos los códigos correspondientes separados por un guión (-). Por ejemplo si hay flotadores rojos, otros de color café y otros amarillos, en la fila de 'Flotador' y columna de 'Color' debe anotar '4-10-3'.

Puede utilizar la columna de 'Observaciones' para anotar comentarios sobre el equipo del palangre.

Línea madre Anote el diámetro en milímetros, la longitud en millas náuticas, y la distancia entre anzuelos en brazas.

Reinal superior/medio/inferior Anote las características de cada casilla. Si no hay un reinal medio, deje esta fila en blanco. Si hay una batalla presente, anote los detalles en la fila de 'Reinal inferior'. Batalla es la porción terminal del reinal reforzada con metal cuando se pescan tiburones.

Profundidad de los anzuelos Anote la profundidad estimada de los anzuelos en brazas.

Total de anzuelos en la línea Anote el **número total** de anzuelos en la línea entera cuando ésta es completamente armada.

Orinque Anote la longitud y los códigos del material y color.

Boya La boya es un flotador principal en la línea, normalmente en los extremos de la línea. Anote los datos indicados.

Bandera Anote los datos indicados.

Flotador Los flotadores son las pequeños boyas que se utilizan para sostener los anzuelos dentro de la línea. Anote los datos indicados.

Lampo o mechero Anote los datos indicados.

Datos de los anzuelos

Esta sección es utilizada para proporcionar datos del número y características de los distintos anzuelos de la línea madre entera cuando está armada. Si los pescadores cambian la configuración de la línea madre dentro de un viaje, incluya cada tipo de anzuelo y la cantidad máxima usada durante el viaje.

En el formulario hay espacio para hasta 4 anzuelos distintos. Si hay más de 4 anzuelos en la línea, debe elegir los anzuelos más importantes para los propósitos del experimento. Por ejemplo es más importante anotar datos sobre los anzuelos circulares y J usados en los tramos de la línea con anzuelos apareados que un tramo de la línea con pura anzuelo J que no es parte de la línea experimental.

Cada anzuelo que definen en la hoja de Registro de Aparejos Palangreros (F2) llevará una etiqueta 🅐, 🅑, ©, Ð. Se usan estos símbolos bien diferentes para ayudarles a evitar confusiones entre los formularios. El anzuelo al que identificaron como © en un formulario debe seguir llamándose © en todos los otros lugares donde se lo menciona. En el Registro de Lances debe usar la columna con la misma letra para anotar los datos del anzuelo descrito en el Registro de Aparejos Palangreros.

Tipo Indica si es un anzuelo J (anzuelo Japonés para atún, Japanese tuna hook) o C (circular).
Tamaño Indica el tamaño del anzuelo.
Material Anote el código del material del anzuelo. Consulte con la tabla tblAnzMaterial.\
Marca Anote el fabricante u origen del anzuelo, por ejemplo 'Mustad' o 'Corea'.
Viraje Anote los grados de viraje del anzuelo. Si no hay viraje, anote cero.
Argolla Indique con 'Sí' o 'No' la presencia de una argolla (anillo) en el extremo del anzuelo.
Observaciones Anote cualquiera otra nota que crea interesante o relevante sobre el anzuelo. Especialmente importante es el caso cuando encuentra un anzuelo con características que no están cubiertas en las tablas.

F3 - Registro de Lance Palangrero

En el Registro de Lance Palangrero debe anotar datos específicos de cada lance. Sólo debe incluir lances que son parte del experimento, y solo se deben registrar las capturas que suceden en la porción de la línea donde los anzuelos están alternados. Por ejemplo, si un pescador ha cambiado anzuelos en sola una mitad de su línea, y el resto de la línea tiene solo anzuelos J, el observador debe registrar las tortugas y pescados capturados en la sección de la línea donde los anzuelos están alternados. Estos son los lances con anzuelos apareados alternativamente, para investigar la efectividad de cada tipo de anzuelo en la captura de peces y la reducción de captura incidental de tortugas.

Las características de los anzuelos 🅐, 🅑, ©, Ð son definidos en el Registro de Aparejos Palangreros. Asegúrese de que mantenga la misma relación entre los anzuelos definidos en la hoja de Aparejos y la hoja de Lances.

Campos del formulario

EMBARCACION: El nombre del buque que efectúa el muestreo.
MUESTREO: El número secuencial asignado a este viaje. El personal de la sede proporcionará este código antes de zarpar.
No. Lance El número consecutivo del lance, empezando con 1.
Fecha La fecha del lance.

LAT/LON/HORA Hay 4 momentos importantes en cada lance: el inicio y fin del lance, y el inicio y fin de la recogida. Para cada uno de ellos debe anotar la latitud y longitud, en grados y minutos, y la hora. Siempre debe anotar la hora usando el reloj de 24 horas. Por ejemplo 8:30 PM se escribiría 2030.

No. Anz. al Mar Anote el número de anzuelos de cada tipo que son parte del experimento y que se ponen en el agua durante el lance. Si una parte de la línea no tiene anzuelos apareados (alternados J y C), se considera que los anzuelos en éste tramo no son parte del experimento, y **no** se los debe incluir en este numero. No importa que tipo de anzuelos sean los que están sin aparear, no se deben mezclar las capturas en la porción no apareada.

No. Anz. Perdidos Anote el número de anzuelos de cada tipo que son parte del experimento y se perdieron durante el lance.

No. Anz. Cebo Nuevo Anote el número de anzuelos de cada tipo que son parte del experimento que fueron revisados, recebados con un cebo fresco, y devueltos al mar.

Carnada Hay espacio para hasta 4 tipos de carnada:

Tipo - % del total Anote el tipo de carnada y el porcentaje de ese tipo de carnada en la casilla correspondiente.

% de anz. en experim. Anote el porcentaje de todos los anzuelos echados al mar que son parte del experimento. Por ejemplo, digamos que hay 900 anzuelos en la línea armada. En un lance echan 500 al mar, y dejan 400 a bordo. De los 500 al mar, hay un tramo de 100 anzuelos J (no parte del experimento) y 400 apareados con J y anzuelos circulares (parte del experimento). El porcentaje de anzuelos echados al mar que son parte del experimento es 80% (400 de los 500 echados al mar).

Lance - ¿Rueda? Indica con una flechita ☑ si el lance es 'a la rueda'. Cuando hay una concentración de peces en un área reducida, una estrategia de captura es poner en el agua una cantidad mínima de anzuelos en un círculo alrededor de la mancha. Después los pescadores repasan una y otra vez sobre esta línea corta, sacando la captura y recebando los anzuelos. Esta práctica se llama 'a la rueda'.

Lance -¿Patrullado? Indica con una flechita ☑ si durante el lance los pescadores revisaron los anzuelos sin sacar la línea entera desde un extremo, sacando la captura y recebando los anzuelos.

Dirección Recogida Indica con una flechita ☑ si los pescadores regresaron al extremo original de la línea madre para recogerla (Inicio a fin), o si al lanzar toda la línea madre empezaron a recobrarla desde el último extremo (Fin a inicio).

Temp. Agua Anote la temperatura del agua, en grados centígrados o Fahrenheit.

Tipo Pesca Anote el principal objetivo de la pesca, según los pescadores (eg. dorado, tiburón, atún, etc.).

Prof. Arte Indica con una flechita ☑ si el palangre es colocado en la superficie, a medio agua, o a fondo.

Observaciones Anote cualquiera otra nota relacionada al lance que sea relevante.

F4 - Registro de Especímenes Individuales

Se usa el Registro de Especimenes Individuales para anotar la captura de peces. Sólo debe incluir captura que sale en los anzuelos que son parte del experimento. Estos son los anzuelos apareados alternativamente. SE CONSIDERA CAPTURA SOLO LA QUE LLEGA A LA CUBIERTA DEL BARCO; SI EL PEZ SE SUELTA Y

ESCAPA, O SE CAE, NO SE LO INCLUYE. Las características de los anzuelos **A**, **B**, **©**, **Ð** se han definidos en el Registro de Aparejos Palangreros. Asegúrese de mantener la misma relación entre los anzuelos definidos en la hoja de Aparejos y la hoja de Especimenes Individuales.

Campos del formulario

EMBARCACION: El nombre del buque que efectúa el muestreo.

MUESTREO: El número secuencial asignado a este viaje. El personal de la sede proporcionará este código antes de zarpar.

No. Lance El número del lance que corresponda a los lances definidos en el Formulario de Lances.

Hora La hora a la que la captura fue subida a bordo. No es necesario anotar la fecha.

Nombre Anote el nombre científico SIEMPRE QUE PUEDA, nombre común, o código asignado a la captura.

Sexo Anote el sexo de la captura si es posible determinarlo.

Longitud Anote la longitud, en centímetros, de los distintas especias según las diagramas al fondo del formulario. Para tiburones, toma la longitud total desde la punta del hocico hasta el extremo de la cola. Para picudos, toma la longitud postorbital. Para atunes y los demás peces toma la longitud furcal.

Peso Si tiene forma de pesar la captura, anote el peso en kilogramos.

Estado Anote el código del estado de la captura, según la tabla de estado de peces (tblEstPeces).

Lugar Enganche Anote el código correspondiente al lugar de enganche, según la tabla de lugares de enganche de peces (tblEngPeces).

Anzuelo A **B** © **Ð** Anote en cual de los anzuelos previamente definidos salió la captura.

Las características de los anzuelos A, **B**, ©, **Ð** son definidos en el Registro de Aparejos Palangreros. SIEMPRE asegúrese de que mantenga la misma relación entre los anzuelos definidos en la hoja de Aparejos y la hoja de Especímenes.

Destino Anote el código correspondiente al destino de la captura, según la tabla de destinos de peces (tblDestPeces).

Observaciones Anote cualquier otra observación relacionada a la captura que le parezca interesante.

F5 - Registro de Tortugas

Debe usar una hoja de Registro de Tortugas para cada tortuga enganchada o enmallada. Sólo debe incluir las tortugas que salen enganchadas en los anzuelos que son parte del experimento. Estos son los anzuelos apareados alternativamente con el propósito de investigar la efectividad de cada tipo de anzuelo en la captura de peces y la reducción de captura incidental de tortugas. Además SOLO SE DEBEN INCLUIR TORTUGAS QUE LLEGAN A LA CUBIERTA O AL COSTADO DEL BARCO ENGANCHADAS o enmalladas. Si se sueltan o se caen no se cuentan. Si una tortuga se engancha en un tramo de la línea que no es parte del experimento, **NO** debe anotarla en una hoja de Registro de Tortugas.

Campos del formulario

EMBARCACION: El nombre del buque que efectúa el muestreo.

MUESTREO: El número secuencial asignado a este viaje. El personal de la sede proporcionará este código antes de zarpar.

Fecha / Hora La fecha y hora que la tortuga fue liberada.

No. Lance El número del lance que corresponda a los lances definidos en el Formulario de Lances.

Especie Anote el nombre científico, nombre común, o código asignado a la tortuga.

Sexo Anote el sexo de la tortuga si es posible determinarlo.

LCC Anote la longitud del caparazón sobre la curva según la esquema al fondo del formulario.

ACC Anote la anchura del caparazón sobre la curva según la esquema al fondo del formulario.

Cola LTC Anote la longitud de la cola según la esquema al fondo del formulario.

Anzuelo Ⓐ **B** © **Đ** Si la tortuga fue enganchada, Anote en cual de los anzuelos previamente definidos salió la captura. Las características de los anzuelos Ⓐ, **B**, ©, **Đ** son definidos en el Registro de Aparejos Palangreros. Asegúrese de que mantenga la misma relación entre los anzuelos definidos en la hoja de Aparejos y la hoja de Lances.

Color Boya Anote los colores de las boyas. La boya es un flotador principal en la línea, normalmente en los términos de la línea. Si las boyas presentan distintas colores, puede anotar todos los códigos correspondientes separados por un guión (-). Por ejemplo si hay una boya roja, otro de color café y otra amarilla, puede anotar '4-10-3'.

Color Flotador Anote los colores de los flotadores. Los flotadores son los pequeños que se utilizan para sostener los anzuelos dentro de la línea. Si los flotadores presentan distintas colores, puede anotar todos los códigos correspondientes separados por un guión (-).

Posición: Latitud / Longitud Anote la posición del buque en el momento de liberar a la tortuga.

Estado Describa el estado de la tortuga (Enganchada/enmallada viva/muerta, avistada, etc.). Anote el código correspondiente de la tabla tblEstTortuga entre los paréntesis ( ).

Enredo Si la tortuga fue enredada, describa el entallamiento, por ejemplo donde en el palangre se enmalló la tortuga, que parte de la tortuga fue enmallado, etc. Anote el código de la tabla tblEnredo correspondiente al lugar de enredo en el palangre entre los paréntesis ( ). Si la tortuga no fue enredada, deja esta sección en blanco.

Enganche Si la tortuga fue enganchada, describa donde se enganchó la tortuga. Anote el código de la tabla tblEngTortuga correspondiente al lugar de enganche entre los paréntesis ( ). Si la tortuga no fue enganchada, deja esta sección en blanco.

Destino Describa como salió la tortuga del encuentro con el palangre. Anote el código correspondiente de la tabla tblDestTortuga entre los paréntesis ( ). Por lo general, una herida leve es una herida del cual la tortuga sobrevivirá sin problema. Una herida grave es una herida tan seria que a lo mejor la tortuga NO sobrevivirá.

Observaciones Anote cualquiera otra nota relacionada al lance que sea relevante.

Marca Antigua / Nueva Si la tortuga tiene marcas, anote los características de la(s) marca(s). No debe quitar la marca a menos que la marca tenga instrucciones indicando que debe quitarla, o que la tortuga este muerta. Si coloca una marca nueva, anote las características.

Esquema con relación al arte Si la tortuga este enmallada, puede dibujar donde se enredó la tortuga en el palangre, por ejemplo en la línea madre, en un reinal, o cerca de una boya.

Localización del anzuelo y enredo de la tortuga Si la tortuga se enganchó, use los dibujos para indicar la ubicación del anzuelo o donde en el cuerpo de la tortuga se enredó.

Anexos

Tablas de códigos

Carnadas comunes (tblCarnada)

ID	Código	Nombre Comun	Nombre Científico
248	THR	Tiburon zorro	Alopias spp.
506	CAX	Bagres marinos / Congos	Ariidae Fam.
114	BLT	Melva,caballa	Auxis rochei
104	FRZ	Cabolla	Auxis sp
116	FRI	Botellita	Auxis thazard
145	CNT	Pez Puerco (Chancho)	Canthidermis maculatus
602	VEP	Carduma	Centengraulis mysticetus
131	DOX	Perico	Coryphaenidae
1447	CCLX	Lenguado	Cyclopsetta sp
1446	WKX	Corvina	Cynoscion sp
175	GIS	Calamar, pota (m)	Dosidicus gigas
1175	GIS	Calamar, pota (v)	Dosidicus gigas
103	BKJ	Patiseca	Euthynnus lineatus
1444	AGMX	Morena	Gymnothorax sp
1449	ILL	Calamar	Illex sp
111	SKJ	Barrilete	Katsuwonus pelamis
176	SQC	Calamar	Loligo sp
268	RMV	Manta no identificada	Mobula spp.
0	OTRA	Otra carnada	NA - Otra carnada
170	PENI	Pez No Identificado	NA - Pez no Identificado
154	TINI	Tiburón no identificado	NA - Tiburón no identificado
601	OPHI	Anguila	Ophichthus zophochir
276	THX	Sardina gallera	Opisthonema sp
1443	TGAX	Barbuda	Polydactylus sp
245	BSH	Tiburon azul	Prionace glauca
1445	GOAG	Salmonete	Pseudupeneus grandisquamis
117	BIP	Bonito mono	Sarda Orientalis
1448	CHP	Sardina	Sardinops sagax
2230	MAS	Macarela,(sal)	Scomber japonicus
230	MAS	Macarela,(m)(con)	Scomber japonicus
442	BIS	Ojón (m)	Selar crumenophthalmus
1442	BIS	Ojón (v)	Selar crumenophthalmus
107	TUN	Atún	Thunnini
110	YFT	Atun aleta amarilla	Thunnus albacares

Color (tblColor)

ID	Color
0	Otros
1	Celeste
2	Verde
3	Amarillo
4	Rojo
5	Azul
6	Blanco
7	Negro
8	Anaranjado
9	Plomo
10	Café

Destino Peces (tblDestPeces)

ID	Descripción
0	Otro
1	Devuelta al mar
2	Venta comercial
3	Consumido por la tripulación
4	Utilizado para carnada

Destino Tortugas (tblDestTortuga)

ID	Descripción
0	Otro estado
1	Liberada ilesa
2	Liberada con heridas menores
3	Liberada con heridas graves
4	Devuelta al mar muerta
5	Comercio (venta)
6	Consumo

Enganche Peces (tblEngPeces)

ID	Descripción
0	Otro lugar
1	Tragada
2	Mandibula Inf. Sup. comisura
3	Externa
4	No enganchada - enredada

Enganche Tortugas (tblEngTortuga)

ID	Descripción
0	Otro lugar o desconocido
1	Caja craneal
2	Tragada
3	Mandíbula superior
4	Mandíbula inferior
5	Cuello
6	Aleta derecha anterior
7	Aleta derecha posterior
8	Aleta izquierda anterior
9	Aleta izquierda posterior
10	Axila
11	Lengua
12	Cola
13	Caparazón
14	Comisura de la boca

Enredo Tortugas (tblEnredo)

ID	Descripción
0	Otro lugar o desconocido
1	Junto a flotador
2	Reinal
3	Línea madre
4	Reinal y línea madre
5	Orinque de flotador
6	Reinal, línea madre y flotador

Especies comunes (tblEspecie)

ID	Especie	Nombre Comun	Nombre Cientifico
0	NOID	Especie no identificado	No identificado
132	WAH	Peto	Acanthocybium solandri
307	PTH	Zorro pelágico	Alopias pelagicus
248	THR	Zorro no identificado	Alopias spp.
306	BTH	Zorro ojón	Alopias superciliosus
242	ALV	Tiburón zorro pinto	Alopias vulpinus
506	CAX	Bagres marinos	Ariidae Fam.
516	TFD	Toadfishes	Batrachoididae Fam.
514	LEF	Lemguado, rodaballo no ident.	Bothidae Fam.
234	CXS	Jurel	Caranx sexfasciatus
232	TRE	Jureles, pámpanos	Caranx spp.

154	TINI	Tiburón no identificado	Carcharhiniformes
157	FAL	Tiburón sedoso	Carcharhinus falciformis
243	CCE	Tiburón toro	Carcharhinus leucas
151	CCL	Tiburón punta negra	Carcharhinus limbatus
152	OCS	Tiburón punta blanca oceánico	Carcharhinus longimanus
240	RSK	Cazones picudos, tintoreras	Carcharhinus spp.
419	WSH	Jaquetón blanco	Carcharodon carcharias
509	COX	Congrios	Congridae Fam.
183	CFW	Dorado pompano	Coryphaena equiselis
182	DOL	Dorado común	Coryphaena hippurus
131	DOX	Dorado no identificado	Coryphaenidae
270	STT	Raya	Dasyatidae
156	PLS	Raya látigo violeta	Pteroplatytrygon violacea
513	DIO	Tamboril, peces erizo	Diodontidae Fam.
133	RRU	Salmonete, salmón	Elagatis bipinnulata
505	GPX	Mero, cherna, perro	Epinephelus spp.
103	BKJ	Barrilete negro	Euthynnus lineatus
410	TIG	Tintorera tigre	Galeocerdo cuvier
129	PINI	Picudo no identificado	Istiophoridae, Xiphiidae
122	SFA	Pez vela	Istiophorus platypterus
247	SMA	Mako de aleta corta	Isurus oxyrinchus
158	MAK	Tiburón mako, nep	Isurus spp.
111	SKJ	Barrilete	Katsuwonus pelamis
186	KIN	Chopa gris (gallinaza)	Kyphosus analogus
502	LEC	Miramelindo	Lepidocybium flavobrunneum
135	LOB	Berrugate, dormilón	Lobotes surinamensis
510	SNA	Achotillo, Dientón	Lutjanidae Fam.
124	BLM	Marlín aguja negra	Makaira indica
126	BUM	Marlín aguja azul	Makaira nigricans
121	MRNI	Marlín no identificado	Makaira, Tetrapturus
268	RMV	Manta no identificada	Mobula spp.
264	RMT	Manta cornuda	Mobula tarapacana
269	RANI	Raya, nep	Mobulidae, Dasyatidae
136	MOX	Pez sol	Mola mola
507	MUI	Morenas	Muraenidae Fam.
170	PENI	Pez no identificada	NA - pez no identificado
411	CNX	Cazón trompa blanca	Nasolamia velox
245	BSH	Tiburón azul	Prionace glauca
422	PSK	Tiburón cocodrilo	Pseudocarcharias kamoharai
311	SRX	Rayas, pastinacas, mantas	Rajiformes
105	BZX	Bonito	Sarda chiliensis, S. orientalis
117	BIP	Bonito mono	Sarda orientalis

304	SIE	Carite sierra	Scomberomorus sierra
512	LNV	Pampano	Selene brevoortii
137	YTL	Medregal limón	Seriola rivoliana
184	AMX	Medregales no identificado	Seriola spp.
134	JURE	Jurel	Seriola, Caranx spp.
511	BAZ	Barracudas	Sphyraenidae Fam.
310	SPL	Cornuda común	Sphyrna lewini
241	SPK	Cornuda gigante	Sphyrna mokarran
153	SPN	Cornudas no identificadas	Sphyrna spp.
246	SPZ	Cornuda cruz	Sphyrna zygaena
11	DSPC	Manchado costero	Stenella attenuata
500	PUX	Tamboril	Tetradontidae Fam.
127	SSP	Marlín trompa corta	Tetrapturus angustirostris
125	MLS	Marlín rayado	Tetrapturus audax
107	TUN	Atún no identificado	Thunnini
102	ALB	Atún blanco	Thunnus alalunga
110	YFT	Aleta amarilla	Thunnus albacares
106	BET	Patudo, ojo grande	Thunnus obesus
501	CUT	Sierrilla	Trichiuridae Fam.
504	NED	Aguja, marao	Tylosurus spp.
123	SWO	Pez espada	Xiphias gladius

Estado Peces (tblEstPeces)

ID	Descripción
1	Pescado vivo
2	Pescado muerto

Estado Tortugas (tblEstTortuga)

ID	Descripción
0	Otro estado
1	Enredada viva
2	Enredada muerta
3	Enganchada viva
4	Enganchada muerta
5	Avistada

Materiales (tblMaterial)

ID	Descripción
0	Otros
2	Nylon Multifilamento
3	Nylon Monofilamento
4	Polietileno

5	Polipropileno
6	Acero
7	Bronce
8	Material plástico
9	Poliestireno
10	Tela

Tipo de Pesca (tblPesca)

ID	Descripción
1	Atún
2	Dorado, perico
3	Mero
4	Tiburón