Marshall Islands Sea Turtle-Fisheries Interaction Outreach and Education Phase 2

Final Report

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GILLETT, PRESTON AND ASSOCIATES INC.

SUMMARY

Activities were undertaken during Phase 2 of the project *Marshall Islands Sea Turtle-Fisheries Interaction Outreach and Education* during various periods from February, 2006—December, 2007. Instruction was provided to observer trainees of the Marshall Islands Marine Resources Authority and supplies and equipment provided for observer and office use. A training syllabus was produced for the future use of MIMRA, and later follow-up discussions held with Marshall Islands Marine Resources Authority observer program staff. Outreach activities with the Chinese locally-based longline fleet in Majuro included a presentation to several vessel operators on the subject of bycatch mortality mitigation, including the importance of not discharging plastics and other refuse into the sea. Mortality mitigation information in the Chinese language was also distributed to vessel agents and operators. The project's goals of heightening awareness of sea turtle bycatch and encouraging observers to accurately record details of interactions were met. The goal of reducing turtle mortality subsequent to interactions was hindered by high post-hooking turtle mortality prior to landing onboard. A summary of available turtle interaction data gathered by observers from 2005—2007 is presented. A total of 33 interactions were recorded during the period, with the number interactions and rate of interaction highest on observed trips in 2007. Olive ridley turtles comprised the majority (58 percent) of all recorded interactions. All turtles involved in interactions except one leatherback were likely juveniles. The question of whether turtle bycatch awareness and bycatch mitigation training can be successfully integrated into other observer training activities remains unanswered due to timing and logistic problems during the project. It was determined that the practicality and advisability of MIMRA staff undertaking future training of their observers in turtle bycatch awareness is low. It is preferable to continue outreach activities and dispensing information to the domestic-based longline fleet. Information on recorded sea turtle interactions with that fleet should also be shared with the locally-based vessel operators and their agents.

ACRONYMS AND ABBREVIATIONS

EEZ	Exclusive Economic Zone
FSM	Federated States of Micronesia
JIMAR	Joint Institute of Marine and Atmospheric Research
MIFV	Marshall Islands Fishing Venture
MIMRA	Marshall Islands Marine Resources Authority
mt	metric ton
PIRO	Pacific Islands Regional Office
PI	Principal Investigator
RMI	Republic of the Marshall Islands
SCL	Straight Carapace Length
SPC	Secretariat of the Pacific Community
SPREP	Secretariat of the Pacific Regional Environment Programme
WCPO	Western and Central Pacific Ocean
WUTMI	Women United Together in the Marshall Islands

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INTRODUCTION

This report contains a summary of activities undertaken during phase 2 of the project, "Marshall Islands Sea Turtle-Fisheries Interaction Outreach Education". Under phase 1 of the project, activities took place during July and August, 2004. The bulk of activities under phase 2 described in this report took place during the period November, 2005 to March, 2006. Additional follow-up and contacts occurred during other NOAA Fisheries Service-sponsored sea turtle-related activities undertaken in the Marshall Islands during 2007. The project was undertaken with the cooperation and assistance of the Marshall Islands Marine Resources Authority (MIMRA)[1], and was funded by NOAA Fisheries Service Pacific Islands Regional Office (PIRO), via the University of Hawaii's Joint Institute for Atmospheric and Marine Research (JIMAR).

As the second phase of an ongoing project, activities were designed to update, expand and reinforce earlier work in sea turtle bycatch mortality mitigation in the Marshall Islands. The entire project builds on an earlier investigation, *Defining parameters for Sea Turtle Research in the Marshall Islands* that took place in 2003-2004, also funded by NOAA Fisheries Service Pacific Islands Regional Office[2].

The objectives of phase 2 of the project were consistent with those of phase 1 and centered on capacity-building among marine resource conservation and management personnel at MIMRA. A second target audience was comprised of longline tuna fishing vessel owners and/or operators based in the Republic of the Marshall Islands (RMI). The project's objectives were to:

- expand the outreach efforts for fishermen in sea turtle-fishery interaction mitigation by improving the capabilities of MIMRA local staff and observers in recognizing, handling and reporting interactions between sea turtles and commercial tuna fisheries in the Marshall Islands,
- sensitize commercial tuna longline fishing operators in the Marshall Islands to the importance of sea turtle survival during the course of their operations,
- collect data on sea turtle interactions with the domestic-based tuna longline fishing fleet,
- provide appropriate instructions to industry and MIMRA on how to handle specific sea turtle interaction situations, and
- integrate the topic of sea turtle-fishery interactions into MIMRA's ongoing management program.

The Principal Investigator (PI) retained to conduct the project was Mike A. McCoy of Kailua-Kona, Hawaii, an associate of the marine resources consulting firm Gillett, Preston and Associates headquartered in Port Vila, Vanuatu. The PI was hired under a personal services contract with the University of Hawaii's Joint Institute for Marine and

[1] Post Office Box 860, Majuro, Republic of the Marshall Islands 96960.

[2] See NOAA Pacific Islands Region Administrative Report AR-PIR-08-04: McCoy, M.A. (2004) Defining parameters for sea turtle research in the Marshall Islands.

Atmospheric Research. Funds provided were those necessary for PI fees and expenses, and included equipment and supplies acquisition by the PI for MIMRA and project use.

In addition to completing the scope of work noted above, the overall project included assistance of the PI in planning and executing a related conservation and management project. That undertaking, also funded by PIRO, is operated by a local non-governmental organization, Women United Together in the Marshall Islands (WUTMI)[3].

This report is intended for the use of the Pacific Islands Regional Office, NOAA Fisheries in Honolulu, Hawaii and is presented in four sections. Background to the project, including a description of the domestic tuna longline fleet based in the Marshall Islands, is presented in the first section of the report. This is followed by a section describing the execution of the work plan, including project highlights, and a description of key elements in project implementation. The third section provides some indicative results of the project's efforts at heightening the awareness of sea turtle interactions and a summary of available interaction records from MIMRA observer reports. The final section, conclusions drawn from the project, is intended to be useful in planning similar projects and possible follow-up activities in the Marshall Islands and other Pacific Island countries.

The PI expresses his gratitude to the Executive Director of MIMRA, Glen Joseph and his staff. The MIMRA Port Sampling and Observer Coordinator, Manasseh Avicks, was the PI's counterpart during the project and provided valuable assistance and helpful insights during training and provided industry liaison in Majuro. A senior observer, Mr. Dike Poznanski, appointed MIMRA Deputy Observer Coordinator during the intermediate stages of the project, assisted the PI in day-to-day matters and with liaison with the domestic-based longline fleet. The map of terrestrial tag returns was produced by Ms. Sarah Klain, former Peace Corps volunteer working with the Palau Marine Resources Turtle Project. Mr. Ray Clarke and Ms. Karen Frutchey at the Pacific Islands Regional Office, NOAA Fisheries are also thanked for their assistance and support during the course of the project.

[3] PI participation reported upon separately to the Pacific Islands Regional Office in four separate reports: January 3, 2006, April 24, 2006, January 23, 2007 and May 3, 2007.

1. PROJECT BACKGROUND

The project reported upon here involved MIMRA as the host agency and was undertaken from the perspectives of the fishing industry and domestic government-driven fisheries management. The project was intended to support the MIMRA observer program by providing tools and instruction that would enable observers to demonstrate viable mitigation techniques to vessel operators, captains and crews in the Majuro-based longline fishery.

After completion of the first phase of the project in 2004, it was clear that a second phase was required due to:

- the need to reinforce ideas on and attitudes towards sea turtle conservation and management in the Marshall Islands that were first introduced during phase 1,
- the development of improved release techniques by NOAA Fisheries and additions to available training and awareness materials,
- the apparently high turnover of observers on MIMRA's staff, and the hiring of an RMI national as assistant observer coordinator to assist the expatriate observer coordinator provided under funding from the Secretariat of the Pacific Community (SPC),
- the increase in the number of longline vessels based in Majuro and the likelihood that the additional operators/captains had not been exposed to efforts at bycatch mortality reduction from the first phase,
- the need to determine the desirability and practicality by which such awareness training might be devolved to local or regional organizations currently engaged in observer training,

The project's activities in the Marshall Islands are part of a greater effort by PIRO to heighten awareness of the subject of bycatch mitigation and introduce mortality reduction techniques to several other countries in the Western and Central Pacific Ocean (WCPO). Similar NOAA PIRO-supported projects have been or will be undertaken in Indonesia as well as Pacific Island countries with significant or nascent onboard observer programs, including Federated States of Micronesia, Papua New Guinea, Cook Islands, Fiji, and Palau.

1.1 Phase 1 Summary

Phase 1 of the project was undertaken in late August and early September, 2004. After preliminary meetings with MIMRA staff and others to introduce the project, major activities included:

- Production of observer materials, including species identification handouts, interaction and release instructions, prototype training syllabus and MS PowerPoint presentation;

- A two-day observer workshop to introduce subjects of sea turtle biology, release techniques and equipment, record keeping, and other relevant subjects;
- Presentation of the project's goals and an introduction to the subject of sea turtle conservation to various non-governmental organizations in the Marshall Islands;
- A separate workshop focusing on sea turtle conservation for senior MIMRA staff involved in fishery development work at the community level and senior officers of the Marshall Islands Sea Patrol;
- Contacts with the domestic-based tuna longline industry in Majuro and a workshop with vessel agents focusing on sea turtle bycatch release techniques and relevant aspects of sea turtle biology making them vulnerable to commercial fishing operations.

The first phase of the project resulted in a positive reception from the MIMRA observer program and the domestic-based foreign longline fishing industry in Majuro. Observers were instructed in detail on how to identify turtles involved in fishery interactions. Several such interactions were documented with disposable cameras provided by the project. Publicity in the local newspaper of the first phase's activities spurred greater awareness of turtle conservation in Majuro without adversely affecting public perceptions of the longline industry's activities in Marshall Islands waters[4]. Heightened awareness of sea turtle conservation and fisheries management needs resulted in several turtle tag returns coming to light that had previously been forgotten or ignored.

1.2 Recent Longline Activity in the Marshall Islands

Longliners licensed to fish in the Marshall Islands Exclusive Economic Zone (EEZ) are comprised of domestic-based foreign-flagged vessels and foreign-based, foreign-flagged vessels. There are no Marshallese citizens employed on the longliners licensed to fish in the Marshall Islands EEZ.

During the period 2005 to mid-2007 approximately 30 to 40 longline vessels operated from the Majuro fish base at any one time. In December, 2007 there were a total of 33 Chinese and six FSM flagged vessels based at Majuro. Four additional Chinese-owned and operated vessels were in port awaiting paperwork that will enable them to fly the Marshall Islands flag[5].

The fish base is a government-owned facility that is leased to the Marshall Islands subsidiary of a Hong Kong-based firm, Luenthai Fishing Venture. The subsidiary, Marshall Islands Fishing Venture (MIFV), contracts with vessels from mainland China to base their vessels in Majuro and provides them fuel, ice, export packing and other services. In 2006 there were four distinct Chinese fleets based at Majuro operating in conjunction with MIFV, each with its own resident fleet manager. Three of the fleets

[4] This was in stark contrast to public outcry and foreign criticism of the activities of longline vessels licensed by MIMRA in 2003 to target sharks.

[5] The Republic of the Marshall Islands operates a domestic and an open (i.e. flag of convenience) registry. The latter has five tuna purse seiners registered, all of which are based in the Marshall Islands. The four longline vessels awaiting registration will be the first tuna longliners entered on this registry.

represent separate Chinese fishing entities, while Luenthai Fishing Venture also owns and operates several of its own vessels from the base.

Japanese longline vessels are those operating from Japan under an umbrella fishing agreement that includes purse seining and pole-and-line fishing. Due to the nature of the fishing agreement between MIMRA and Japan, the number of vessels authorized to fish may not reflect the actual number that operated in the RMI EEZ[6]. An important feature of the agreement with Japan is the lack of a provision calling for observers from MIMRA on licensed vessels operating in the RMI EEZ.

The overall trend for longlining by Japan in the Marshall Islands is steeply downward. From a high of 1,900 mt of target tuna catch reported in 2003, the figure dropped to 593 mt the following year and 185 mt in 2006.

Table 1 shows the number of foreign longline vessels licensed to fish in the Marshall Islands EEZ from 2002 to 2006. Vessels from China represent the largest segment of active longline vessels in the Marshall Islands. Vessels flagged in the Federated States of Micronesia (FSM) are actually those owned and/or controlled by the Chinese firm that operates the Majuro fish base.

Table 1 Number of Foreign Longline Vessels Licensed to Fish in the Marshall Islands EEZ by Year and Flag, 2002-2006

Year	CHINA	FSM	JAPAN	KOREA	TAIWAN	BELIZE	TOTAL
2002	29	2	30	1	10	1	73
2003	32	4	24	1	10	2	73
2004	39	4	17	1	3	8	72
2005	42	6	25	2	5	8	88
2006	36	9	29	0	5	0	79

Source: MIMRA (2007)

The fleets that were the target of turtle bycatch work were the Majuro-based Chinese, Belize and FSM flagged vessels.

1.2.1 Catch and Effort

The compilation and raising of catch and effort data for 2006 was not complete at the time of writing this report. Based on unloading data, the 2006 catch for domestic-based longline fleets was approximately 4,390 mt for all species. This included 2,217 mt of bigeye and 1,559 mt of yellowfin. The bigeye catch accounted for approximately 48 percent of the target catch composition in 2006 (MIMRA 2007).

Of importance to gauging the utility and importance of turtle bycatch outreach activities with the domestic fleet is the amount of effort expended by the various fleets in the RMI EEZ. Although comprehensive effort figures are not available, unraised logsheet data indicates that domestic-based longliners (China and FSM flag) accounted for approximately 93 percent of the target tuna catch in 2006. For the same year, Japanese

[6] Vessels pay a nominal registration fee and then an activation fee based on the duration of an active license.

and Taiwanese longliners reported catches of only 6.7 percent and .5 percent of the target tuna catch, respectively. Although these figures may be adjusted on the basis of incomplete reporting, it is clear that focusing outreach activities on the domestic-based longline fleet is justified in terms of its dominant position in the fishery.

Total longline effort by domestic-based vessels from data supplied by MIMRA is shown in Table 2. With only partial information available for 2007, Chinese flagged vessels accounted for 81 percent of longline effort for all years combined.

Table 2 Longline Effort by Marshall Islands Domestic-Based Vessels, 2005-2007

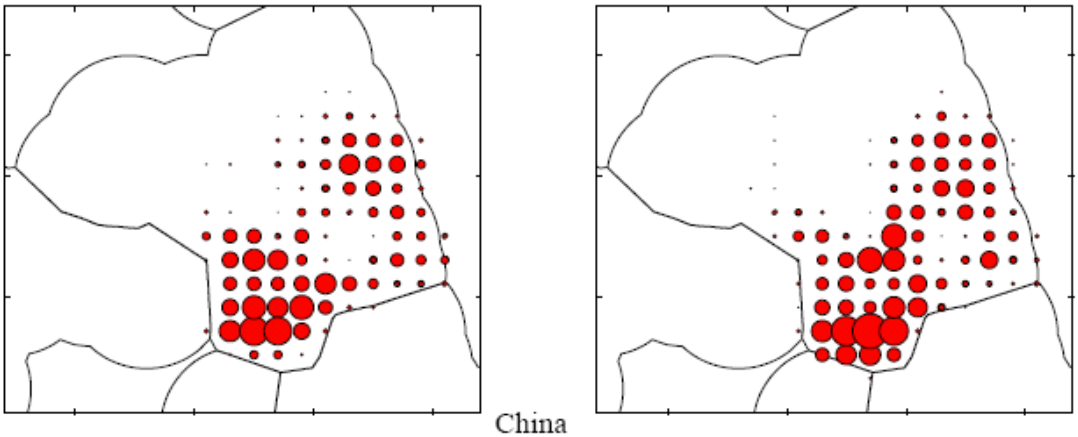
	2005	2006	2007
China	8,062,100	10,397,800	1,642,100[a]
FSM	1,255,800	1,773,700	412,000[b]
Belize	949,200	304,300	0[c]
TOTAL	10,267,100	12,475,800	2,054,100

[a] effort up to March 2007 only
[b] effort up to May 2007 only
[c] re-flagged to FSM in 2007
Source: SPC and MIMRA data

1.2.2 Geographic Distribution of Longline Effort

During 2005 and 2006, Chinese longliners based in Majuro tended to concentrate their activities to the south and northeast of Majuro (Figure 1).

Figure 1 Geographic Distribution of the Longline Catch by China in Marshall Islands EEZ, 2005 (Left) and 2006 (Right)



Source: MIMRA (2007)

1.2.3 Fishing Gear and Technology Employed

Chinese longline vessels have sporadically operated from Majuro since the early 1990s. During the past decade the vessels were characterized by the use of Taiwanese-style "basket gear" (Figure 2) and shallow setting at night, usually in association with certain moon phases.

Figure 2 Longline "Basket Gear" Employed on Chinese Vessels Based in Majuro During 1990s

In recent years, MIFV has been instrumental in increasing the technological sophistication of Chinese vessels based in Majuro. The use of US manufactured hydraulic monofilament longline reels and line shooters (Figure 3 and Figure 4) is now almost universal among vessels in the fleet. According to the Chinese fish base manager, the intention of employing this equipment is to better target bigeye tuna habitat. Added benefits to hydraulic reels and line shooters over the more traditional basket gear are the reduced number of crew required as well as the ability to increase the number of hooks per set. Hooks per set for this fleet have risen from about 700 or so during the 1990s to approximately 1600--2000 in 2006 and 2007.

Figure 3 Hydraulic Monofilament Longline Reel Onboard Chinese Longline Vessel Based in Majuro

Figure 4 Hydraulic Line Shooter Onboard Chinese Longline Vessel Based in Majuro

An occasional shortage of fresh water in Majuro can result in an inability to produce sufficient ice for fleet use in storing the catch. As a result a few more vessels utilizing refrigerated seawater have been introduced in recent years, but the majority of the fleet still relies on ice to preserve the catch. In December, 2007 there were six vessels utilizing refrigerated seawater out of a total 39 longline vessels operating from Majuro.

Another change to fishing practices in the past few years has been in the type(s) of bait employed. Primarily for cost reasons, there has been a shift away from the near exclusive use of squid as bait to more commonly using finfish such as mackerel scad (*Decapterus spp*.). The switch in bait preference coincided with the introduction of hydraulic longline reels and line shooters in the fleet. Squid had been used with the basket gear employing shallow sets during periods before and after the full moon. The switch to mackerel scad and other non-squid bait accompanied the use of hydraulic longline reels and daytime sets intended to deploy the fishing gear deeper in the water column. The use of squid appears to have increased during 2007, perhaps due to a return to the bait's return to price competitiveness[7]. Even though some squid is now used, 2007 observer data indicate that it has not been in conjunction with sets at night; rather, it is used during daytime sets.

Chinese vessels based in Majuro utilize Japanese-style longline hooks exclusively. There have been no attempts by either government or industry to introduce larger circle hooks. Some vessels employ baited shark lines of 20 to 30 meters length on all or most of the floats in a set. The bait used is any damaged bycatch fish, including mahimahi, wahoo, skipjack and occasionally tuna.

1.3 Turtles in the Marshall Islands

Four species of sea turtle are known to occur in the Marshalls: the green, *Chelonia myda*s, hawksbill, *Eretmochelys imbricata*, leatherback *Dermochelys coriacea,* and olive ridley, *Lepidochelys olivacea*[8]. Discussions with Marshallese make it clear that by far the most common turtle in the Marshall Islands is and always has been the green sea turtle. Also known but not nearly as common is the hawksbill. Both are known to nest in the Marshall Islands, but nesting by hawksbills is rare (McCoy 2004).

Neither leatherback nor olive ridley turtles are well known by inhabitants of the Marshall Islands; however, their presence in the marine environment has been confirmed by observed bycatch reported to MIMRA[9].

Several turtle tag returns from metal flipper tags placed on turtles at nesting sites in the Marshall Islands, and one such return from a turtle tagged in Australia recovered in the Marshall Islands are intriguing. Figure 5 depicts known passive tag returns to date. All turtles tagged and recovered were green turtles. Release and recovery locations are

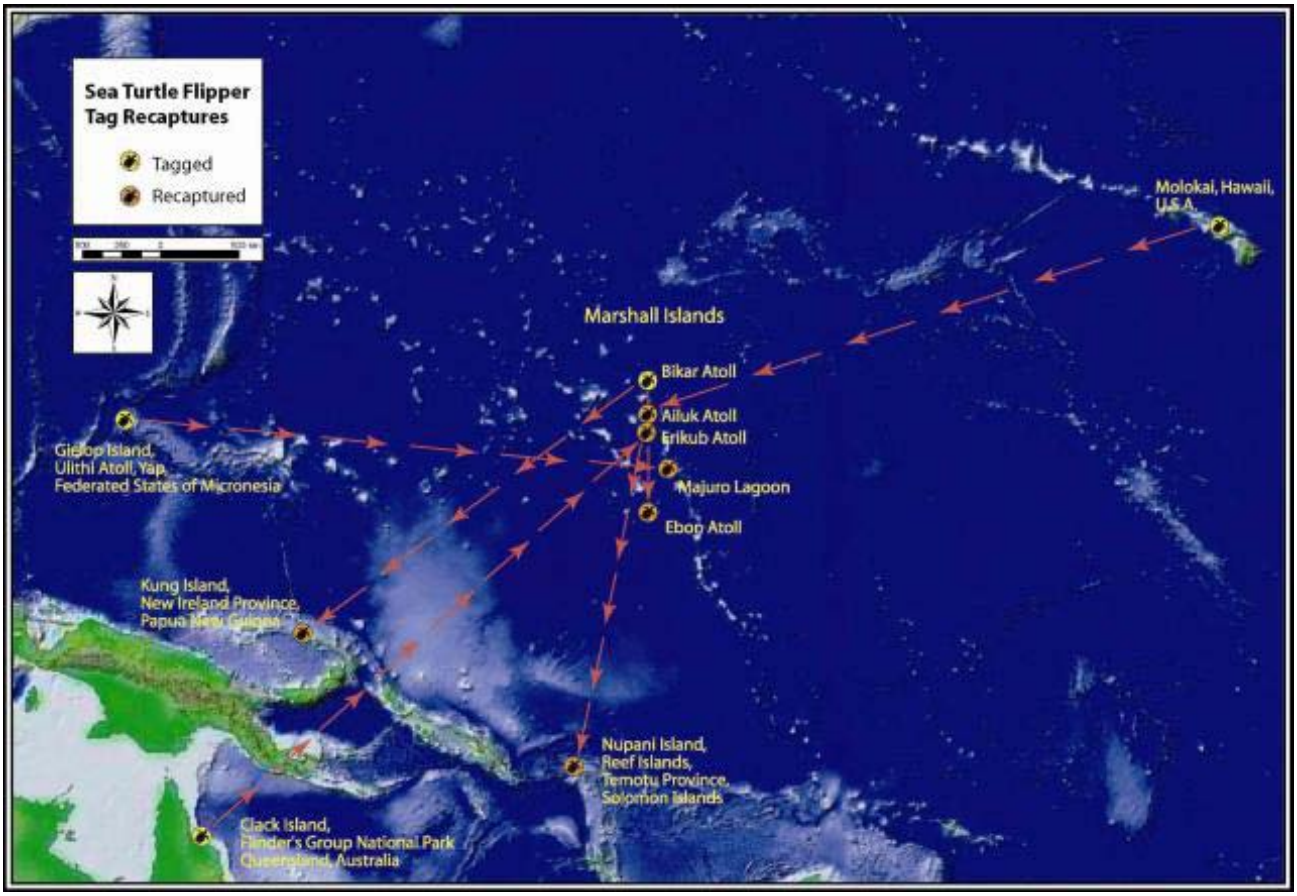
[7] Squid catches in the South American fishery were depressed for several years, resulting in increased prices that made it less competitive with finfish bait such as bigeye scad, saury, mackerel scad and other species.

[8] There is one anecdotal report, uncorroborated, from a dive master of the presence of a loggerhead turtle, *Caretta caretta,* at Bikini.

[9] The first confirmed reports of leatherback and olive ridley turtles in the waters of the Marshall Islands were from SPC fishery observers onboard Majuro-based Chinese longliners in 1997. Olive ridley turtles were first reported from adjacent Micronesian waters by Falanruw and McCoy (1975).

connected with red arrows to indicate tagging and recover locations, but do not necessarily indicate exact migratory routes.

Figure 5 Marshall Islands Green Turtle Tag Recoveries



Source Data: SPREP and Mike A. McCoy

1.4 Summary of the MIMRA Observer Program

The observer program at MIMRA has been in operation in its present form since late 2003. Initially, MIMRA had what was called an “observer program” by the staff for several years prior to 2003. The activities, however, were limited to monitoring transshipments in Majuro and did not include placement of observers onboard fishing vessels to collect catch and other data at sea.

In late 2003, SPC provided MIMRA an observer coordinator to re-organize and run the observer program at MIMRA. The MIMRA program has become one of the better operated programs in the Pacific Island countries, and includes transshipment monitoring and sampling as well as at-sea observers.

The first full year in which MIMRA observers were placed onboard fishing vessels was 2004. MIMRA employed a total of 10 observers who took a total of 45 trips; 24 on

longliners based in Majuro, and 21 on purse seine vessels. Observers recorded a total of 1006 sea days in 2004, with 301 days or 30 percent spent on longliners. The first phase of this project provided training in sea turtle bycatch mortality mitigation and some equipment to the new observers. The bulk of activities were, however, aimed at heightening awareness in MIMRA and the industry to the need to address sea turtle interactions in a manner that would provide the animals with the greatest chance of survival.

MIMRA subsequently continued to attempt to recruit additional observers and conduct training programs in association with FFA and SPC in efforts aimed at increasing overall observer coverage. During 2005 MIMRA employed a total of 15 observers, five more than 2004, and the number of sea days spent on all gear types increased from 1006 to 1539. A large number of observers in 2005 were new, however, as attrition among the first group was relatively high; a situation not unexpected when commencing an observer program and hiring mostly untrained, inexperienced personnel.

As in 2004, a significant number of observer trips were taken on purse seine vessels. In 2005, observers spent about 76 percent of total sea days on purse seiners. In contrast to the relatively large observer coverage of purse seiners, 24 percent (399 sea days) were spent on domestic-based longliners. No observers were placed on foreign-based longliners. The 25 longline trips on which observers were placed in 2005 averaged 16 days in length.

In 2006, more observers were recruited to fill vacancies and increase the overall observer number to 20. The total number of sea days on all gear types increased to 2,223. 1,063 days (48 percent) were spent on longliners during a total of 73 trips (MIMRA 2007).

During observer training conducted in Majuro in 2006 by FFA and SPC, the FFA trainer remarked that he saw a marked improvement in the quality of trainees as evidenced by their comprehension of the subject matter and their resultant test scores. He attributed the improvement to rigorous screening of applicants by the observer coordinator and a better understanding by applicants of the requirements of the job.

MIMRA attempts to retain an overall regular schedule of observer placement. In practice, observers are placed onboard domestic-based longline vessels on an opportunistic basis. Monthly observer coverage in 2006 was thus uneven, with largest number of sea days occurring during March—May, and the least during December, January, February.

Chinese vessels based in Majuro operate 12 months per year. Factors determining the level of observer coverage include other demands placed on observer program personnel, such as port sampling of longline and purse seine transhipment, and observer placement on purse seine vessels under the FSM Arrangement and US Tuna Treaty. The low level of observer coverage during December, January, and February might also be attributed to a combination of these factors as well as a reluctance of observers to be at sea during the holiday period.

A total of 53 longline trips were taken by observers on Majuro-based vessels during 2007, a 27 percent decline from 2006. The total number of sea days in 2007 was not yet available when information for this report was being compiled[10].

[10] MIMRA had not received reports from observers for three completed trips

2 WORK PLAN EXECUTION

2.1 Project Summary, Chronological Narrative

Discussions with MIMRA officials finalizing the timing for the project took place in late 2005 while the PI was present in Majuro on a related project. At that meeting the work plan and other aspects of the project were reviewed and it was agreed to commence phase 2 activities in February, 2006. Activities were scheduled to coincide with a training course for new MIMRA onboard fishery observers planned for Majuro at around that time. The MIMRA Observer Coordinator felt this timing would provide an opportunity for optimum participation[11].

Activities of the PI for operation of phase 2 in Majuro commenced in December, 2005 and continued through February, 2006. Supplies for training and observer use were ordered and sent to Majuro. Liaison with PIRO and MIMRA on subjects related to the project continued during the period.

The PI had earlier suggested that PIRO undertake translation of the NOAA turtle release and handling guidelines into Chinese for distribution to Taiwanese and Chinese longline vessels that offload in Majuro. The PIRO international turtle project coordinator, Karen Frutchey, arranged for the translation, printing, and laminating of the guidelines in both simplified and traditional Chinese characters. Copies of the guidelines were produced and made available in time for their use and distribution during the course of the project.

The PI arrived in Majuro on February 21 and began preparations for project activities, including necessary meetings to introduce the project and arrange schedules. A training program for new MIMRA observers was about to begin, so a meeting was held with the FFA Observer Coordinator who was conducting the training to agree on a tentative schedule that would include the turtle bycatch instructions. A meeting was also held with the MIMRA Observer Coordinator the following day, and with the MIMRA Executive Director on February 23. Each of these two latter meetings introduced the activities to be undertaken during phase 2, arrange venues for training, and agree on other logistical and project support matters.

Preparation for observer training continued over the next several days, including revision of an earlier PowerPoint presentation and expansion of an earlier syllabus prepared during phase 1. Supplies that had been sent ahead during prior months were retrieved from storage at MIMRA and organized for distribution to trainees.

Printing, binding, and laminating other training material was accomplished over a period of several days due to local power outages on Majuro, and a national holiday that limited office access.

During this and later periods in Majuro, the PI was also involved from time to time in research and information gathering relevant to the WUTMI outer islands turtle project for the PIRO international turtle project coordinator. A meeting was held with a local businessman interested in raising hatchling turtles for conservation purposes (the practice was discouraged and several pertinent articles on the subject provided). Several

[11] The observer training course was led by the Observer Coordinator at the Forum Fisheries Agency and an observer trainer from the Secretariat of the Pacific Commission. It was the second such course held for MIMRA trainees since late 2003.

people familiar with turtle nesting in the outer islands were interviewed for information on possible atoll sites for a future satellite tagging project, and availability and costs of potential vessels for charter was also undertaken.

A one-day training course in handling and recording sea turtle interactions with longline and purse seine fisheries was held for new observers on February 27 at the Maritime and Fisheries Training School. The training syllabus produced in 2004 was revised to include later information relevant to turtles in the Marshall Islands and to reflect the fact that recipients of such training would be new observer trainees and not just experienced observers as before. The new syllabus was printed and photocopied at MIMRA and subsequently distributed to the new observer trainees prior to the ending of their course.

The presence in Majuro of representatives from regional organizations engaged in work in RMI provided an opportunity to explain the project's activities and goals. Meetings were held with the Asian Development Bank's country representative on February 28 and with the SPC Inshore Fisheries Advisor on February 29.

During the period March 2-4, preparations were undertaken for two additional meetings/workshops. The first was a meeting and presentation to Chinese longline vessel operators and available fishing vessel captains at the fish base on Saturday, March 4.

The second meeting was a refresher course for experienced observes and new MIMRA staff in charge of oceanic fisheries and nearshore resources. Scheduling delays due to unavailability of some participants meant this course did not occur until the morning of March 6. The course was completed in one day and the PI departed Majuro that evening.

Subsequent to the activities described above, there were additional opportunities in 2007 to discuss ongoing observer activities and turtle bycatch-related subjects with the MIMRA staff. Such discussions were held during trips taken to Majuro in late January and early May, 2007 for related PIRO-sponsored activities.

A final trip under the project was undertaken during the first week of December, 2007. The purpose of the trip was to obtain as much data as possible from MIMRA records and raw observer data that had not yet been processed by SPC. Raw observer data in the form of logbooks, data sheets and diaries were consulted and information relevant to turtle interactions and longline effort was extracted. It had been the intention to gather data from earlier years, however, most data had been sent to SPC and were not available at MIMRA[12].

2.2 Observer Training in Sea Turtle Bycatch Mortality Mitigation

Observer training in sea turtle bycatch mortality mitigation was held in conjunction with an ongoing observer training course for new observers conducted in Majuro by SPC and FFA. Prior to conducting the mortality mitigation training with the new observers, the PI observed several hours of the ongoing observer training course that was being held at

[12] The reason for the availability of only 2007 data was explained by MIMRA personnel as being linked to the installation of the SPC "Tufman" system. That system enables electronic transmission of data sheets directly from MIMRA to SPC. The system was not in place prior to 2007, and hence data sheets had to be physically sent to SPC where, presumably, they remain.

the Marshall Islands Maritime and Fisheries School. A total of 20 trainees were attending the course and the FFA Observer Coordinator remarked that overall it was the best group they had trained in the Marshall Islands to date.

As with similar projects conducted elsewhere, the turtle bycatch training included subjects intended to familiarize trainees with various aspects of sea turtle biology and life history. The course presented by the PI centered on PowerPoint slides that made use of actual photos from fishing operations wherever possible to emphasize the appropriateness of the subject matter. Appendix 1 lists the 46 separate talking points addressed during the training that were accompanied by appropriately illustrative slides and discussion.

During the training sessions each participant was provided with a 3-ring zipper binder. It was explained that reference materials to be provided during the training were to be placed in the binder and taken onboard during observer trips. When subjects were covered during the session requiring references to hand-outs, the hand-outs were distributed at the time of discussion. Participants then placed the hand-out in their zipper binder before moving on to the next subject. The handouts included laminated placards from NOAA Fisheries showing turtle release instructions, a similar laminated placard produced by SPC showing turtle release instructions on one side and profiles of five turtle species in five languages with corresponding national flags on the reverse side. An additional laminated placard contained specific instructions for vessel captains in handling sea turtles, with Taiwanese language instructions on the reverse side.

Trainees were given instruction in the proper method of taking photographs and identifying turtles landed onboard. It was also emphasized that photos should be taken of turtles interacting with fishing gear in the water when for whatever reason they are not landed. MIMRA was provided with a sufficient number of one-use disposable cameras to cover four trips for up to 20 trainees.

A portion of the training included hands-on practice of two techniques important to mortality mitigation. The first consisted of de-hooking turtles that have ingested hooks where appropriate. This was practiced by participants utilizing a short-handled bite-block de-hooker and a three-sided narrow cardboard box to simulate the mouth and throat of a sea turtle. The second technique was the method of cutting free entangled sea turtles utilizing a line cutter mounted on the end of an expandable painter’s pole. Figure 6 shows two trainees practicing de-hooking, with the cutter pole in the corner of the wall in the background.

Figure 6 Practice in the Use of De-hookers by Observer Trainees in Majuro

A 34-page syllabus, *Sea Turtle-Tuna Fishery Interaction in the Marshall Islands, A Guide for Fishery Observers,* was prepared for use by participants and distributed during the training. This syllabus was a revised version of one produced for the first training in 2004. The contents of the syllabus tracked the PowerPoint presentation and contained many of the same illustrations. Trainees were instructed to keep the syllabus with them in the binder while onboard, and to refer to it when questions arose. Additional aids, such as the SPC index card-sized sea turtle identification cards, had already been distributed to participants by the SPC/FFA trainers prior to the turtle bycatch sessions[13].

A separate one-day course covering much the same material presented to new trainees was held at the end of the project for experienced observers and some of the MIMRA staff. In attendance were five experienced observers, the assistant observer coordinator, and senior MIMRA staff including the heads of the divisions of oceanic fisheries, coastal fisheries, policy and planning, and community affairs.

[13] The binders also proved useful to participants in storing information provided by the SPC/FFA trainers in loose leaf form during the 2-week period of their course.

Electronic copies of the PowerPoint presentation and the syllabus were given to the MIMRA observer coordinator for reference and possible future use in later training programs.

2.3 Project Results and Highlights

The work plan for phase 2 of the project is contained in the Scope of Work document shown in Appendix 2. In that document, the tasks given the PI relevant to MIMRA and the domestic-based longline fishing industry were to:

- meet with MIMRA local staff and commercial fishing interests based in Majuro to review observer data and progress of the observer program in introducing mitigation techniques,
- explore the effectiveness of the Phase 1 outreach efforts for Majuro-based fishing vessel operators and determine what, if any, adjustments need to be made to the program
- introduce and train new observers hired since Phase 1 in use of the latest release tools and techniques
- ensure that MIMRA's Observer Coordinator in the Marshall Islands is fully conversant with the methods, tools, and techniques required, and be capable of continuing further such training of observers in the future

Over the course of both phases of the project, MIMRA was provided with basic equipment and supplies to enhance their observer program as well as to equip a portion of their observers with the necessary longline turtle mortality mitigation tools[14]. A list of the equipment provided is in Appendix 4.

Continued cooperation from MIMRA on sea turtle activities and turtle bycatch-related activities contributed to the success in delivering the project's message of the importance of mitigating sea turtle bycatch mortality. During the course of the project MIMRA appointed a new staff person to be in charge of turtle conservation and management activities outside of the observer program.

The PI was encouraged that MIMRA has also placed further emphasis on the observer program and supported its expansion. A reorganization of MIMRA physical facilities has provided a larger space for the observer program in the office, providing adequate storage for equipment and supplies provided by the project.

The positive attitude of the domestic-based longline industry also contributed to the project's success in heightening awareness of the need to address sea turtle interactions. MIFV facilitated a meeting with captains and agents at the fish base by requiring all agents and those captains in port to attend. The company also provided an interpreter for the presentation.

[14] It was never the intention, nor could the project budget have enabled, equipping all 20-25 MIMRA observers with such equipment. Rather, MIMRA was asked for an estimate of the number of observers who might be at sea at any one time on domestic based longline vessels, and the equipment quantities were based on those numbers. Additional quantities of some of the equipment were provided with the understanding that it would assist the observer program in general.

2.3.1 Effectiveness of Observer Training

One way to gauge the effectiveness of observer training in the instillation of positive attitudes towards sea turtle interactions is through a perusal of daily work diaries and reports submitted by observers. These documents can be useful in providing an indication of an observer's approach to sea turtle interactions onboard fishing vessels. Not all observers write detailed entries into their diaries, and the relatively small number of turtle interactions compared with other necessary observer activities does not provide all observers with an opportunity to express themselves on turtle-related activities.

It is clear, however, that some observers were conscientious in their application of the lessons learned during the training, even though their education level may have prevented more detailed (or coherent) explanations of their activities. Some excerpts from observer daily work diaries:

> (1) anyway while haul around 20:42 hrs one poor green turtle caught but death. One of the crew ask me to give him the turtle he wanted to eat it. The turtle length is 49CL. Observer send the turtle back to the sea.
>
> (2) It very easy to remove the hook from the mouth because of not inserted too deep inside. Been used hands to remove the hook and not fishing tools. After removal of hook, took it to the stbd side of vessel and applied all procedures of handling onboard plus more identify of what exact species is this. No problem caused seriously damaged to the green turtle because nothing make it weak on board. It moving onboard strongly healthy as I'm working with it. I've been worked with the species of special interest to find whether it female or male, but specifically not. so I put indeterminate (I) because I'm not sure with the exact sex. Finally discarded overboard by facing the head down and body toward the water and released it. As soon as reached the water, the green turtle quickly swim deep down and move strongly happy.
>
> (3) Landed on deck with strong healthy and no problem caused to her. Hooked in the mouth but been released the hook. And she's looked great and strong healthy. Removed the hook from the mouth which is very simple, because the hook not insert through inside but edge of the mouth. Hooked at the right side of the mouth and not totally inside. Released after 38 minutes on deck. As soon as the green turtle reached water, swam healthy and strong fast in the water no problem so occurred during time of landing and applied procedures.
>
> (4) When it first landed on deck, it was pronounced seriously dead. The body totally not moving and breathing as I worked with. Used plier to remove the hook from the throat of it. Been inserted deep inside, but it dead. Removed it to the other side of the vessel and treated by placing towel at back of it and flush it with lot of salt water from the hose. so end one hour and fifty minutes long of applying handling procedures. Is completely pronounced seriously dead of no moving and breathing. but white foams keep coming out from it mouth with eyes closed.
>
> (5) At 1919 hook nbr 11 one olive ridley turtle was caught and it takes about 20-25 minutes to pull it up. But few minutes later it comes up 52 cm and it flapping and moving around. They wait about 15 or 20 min to take off the hook one of the crew take off the hook, but it still moving and flipper flapping. It was hook closely to front of the lower jaw and the crew release it and it was not swimming around,

but diving quickly. After watching the turtle diving back again and continue on monitoring.

(6) March 8 2007: at 2005, at position 07 deg 23.730N 176 deg 53 E I saw a small turtle about 13 cm. it was not moving when I saw it, kind a late to pick it up because we were hauling. At 2225 the vessel caught one olive ridley turtle. It was 44 cm carapace length. it was already death when came onboard so they discarded it after I sampled it, no tag was recovered with it.

2.3.2 Effectiveness of Outreach Activities

Outreach activities centered on contacts with the domestic-based longline company, MIFV. Discussions were held opportunistically with the company's resident manager to plan presentations to his staff and available captains, and to discuss their cooperation with observers. Plastic laminated Chinese language placards adapted from the English version used in protected species workshops in Hawaii were distributed. As is the case with companies utilizing Chinese and Taiwanese vessels in other locations, the initial response on the subject of sea turtles was that Chinese never intentionally harm turtles due for cultural reasons. It was necessary, however, to explain that improper handling of turtles during and after interactions with the fishing gear could also be deadly and this project intended to instruct captains in the currently accepted best practices to be employed in such interactions.

It was also explained to MIFV that MIMRA understood that due to ongoing fishing activities it was impractical to reach all captains to impart this information during the short period the PI was available in Majuro. As a result MIMRA would be training observers who could later use interaction situations to impart the required information.

The presentation to the assembled captains and their local agent/representatives at the fish base was titled, *Sea Turtle-Longline Interactions in the Marshall Islands: How the Fishing Industry Can Help*. In addition to demonstrating de-hooking, line cutting, reviving comatose turtles, and the use of bolt cutters in freeing turtles hooked externally, the PowerPoint presentation emphasized the following points:

- Different species of sea turtles they might encounter, along with Chinese names
- Important aspects of sea turtle biology and life history, including migratory habits, late maturity, nesting sites in the Marshall Islands
- Tracking turtles with satellite transmitters and known tracks through the Marshall Islands
- Decline of Pacific leatherback populations
- What to do in interaction situations; introduction of placards in Chinese describing techniques to use
- Importance of retaining all trash, especially plastic bags that might be mistaken for jellyfish and ingested by sea turtles
- What observers are to do in interaction situations, including measuring, photography, recording of data, releasing in proper manner

For the period the PI was in Majuro, MIFV management cooperated fully with the project and facilitated access to available personnel as required. It is difficult, however, to gauge the effectiveness of these activities as they might translate to actions taken by captains at sea in turtle interaction situations. Anecdotal information from observers indicates full cooperation is extended to their efforts at release of turtles caught incidentally to longline operations.

3 REVIEW OF OBSERVER DATA ON SEA TURTLE—LONGLINE INTERACTIONS

3.1 Observer Coverage of Longline Fishing Effort

The observer coverage of longline fishing effort is shown in Table 3. Information for 2007 was obtained by consulting raw data held at MIMRA and adding that to data previously processed by SPC. At the time of compiling this information for 2007, three observer reports and data had not been received by MIMRA from observers who had recently completed their trips. Complete data for 2006 was not available at MIMRA as hard copies had been sent to SPC but not all had been entered into the observer database[15].

Table 3 Observed Longline Trips and Fishing Effort, 2005-2007

Year	Observed Longline Trips	Effort (hooks)
2005	31	602,267
2006[a]	57	932,666
2007[b]	53	844,748
TOTAL	141	2,379,681

[a] data for some observer trips (<10) not yet entered at SPC

[b] does not include 3 trips for which reports have not yet been received by MIMRA

Source: SPC and MIMRA data

Data collected by MIMRA observers from Majuro-based longline trips are recorded in the standard SPC observer logbooks. Commencing in 2007, the information contained on the original forms is sent via the electronic "tufman" system[16] to SPC where it is then entered into the SPC database.

Information on interactions is contained on the Gen-2 form, *Species of Special Interest* (Appendix 3). Condition codes describe the condition of individual animals when landed on deck. Condition codes used are given in Table 4.

[15] P. Williams, SPC, personal communication

[16] The tufman system enables personnel in a national fisheries management office such as MIMRA to efficiently scan and electronically transmit the various observer forms directly to SPC. The data are also available for query on the computer operating with the system in the national office.

Table 4 Condition Codes

SPECIES LANDED ON DECK:			
USE THESE CONDITION CODES	**A0** - Alive. But you are unable to further categorise its condition.		
	A1 - Alive and healty.		
	A2- Alive, but injured or distressed.		
	A3 - Alive, but unlikely to live.	**D** - Dead	**U** - Condition unknown.
	A4 - Entangled, okay.	**D1** - Entangled, dead	**U1** - Entangled, unknown condition.
	A5 - Entangled, injured.	**D2** - Hooked, externally, dead.	**U2** - Hooked, externally, condition unknown
	A6 - Hooked, externally, injured.	**D3** - Hooked, internally, dead.	**U3** - Hooked, internally, condition unknown.
	A7- Hooked, internally, injured.	**D4** - Hooked, unknown, dead.	**U4** - Hooked, unknown, condition unknown.
	A8 - Hooked, unknown, injured.		
Condition description	Write a description of the condition of the species when landed / discarded. This may help to further assess the condition of the landed / discard species.		

Source: SPC Observer Gen-2 Form

A separate short narrative condition description is required on the Gen-2 form, but is not usually entered into the database. A third source of information about the interaction is the observer's daily diary. The completeness of these documents relating to sea turtle interactions are highly variable, depending on the time available for entering information into the diary on a particular trip, and the inclination of the observer to record specific details of the interaction other than what is required on the Gen-2 form. In general, MIMRA observers complete the Gen-2 form, including submission of the form noting when no such interactions took place. Some observers are not as conscientious with their daily diaries as it relates to interactions with species of special interest.

Turtle species are identified with the standard FAO 3-letter taxonomic codes: LKV (LEO) = olive ridley, TUG = green, TTH = hawksbill, LTB = leatherback. A generic code, TTX, is used when the observer is unable to identify the turtle. The use of the species code LKV for olive ridley has appeared in the data since a recent species identification book produced by SPC specifically for observer use contained LKV as the code for that species. LEO, a prior designation by FAO for that species, is contained in identification information published by SPC and others in prior years.

Fate codes applicable to all species including target species are to be entered by observers on the Gen-2 form. For sea turtles, the most commonly used codes are:

- DPA Discarded—species of special interest Alive
- DPD Discarded—species of special interest Dead
- DDL Discarded—too difficult to land
- DSO Discarded—struck off before landing
- DPU Discarded—in an unknown condition

3.2 Observed Turtle Interactions

Numbers of Interactions

Turtle interactions with longline vessels based in Majuro during 2005, 2006, and 2007 are shown in Tables 5, 6 and 7. The 2005 data include one turtle interaction (shown in ***bold italics*** in Table 5) observed during a trip that lasted almost two months onboard a foreign-based Japanese longliner. This was the only such trip on a foreign-based longliner undertaken by a MIMRA observer during the period 2005-2007.

Time of landing in the three tables indicates either the time at which the turtle was brought onboard, or the time at which it was struck off the line in the water. All such landings occurred between approximately 1700 and 0230 the following day based on the local time onboard the vessel. Line hauls typically commenced around 1600 (4 PM) and ended when the last of the gear was brought onboard, usually in the hours following midnight.

Table 5 Sea Turtle Interactions from Majuro-based Longline Trips Recorded by MIMRA Observers, 2005

Date	Time of Landing	Turtle Species	Fate	Condition (Landing)	Condition (Release)
13.01.2005	1855	LEO	DPD	D	D
14.01.2005	1856	LEO	DPD	A3	D
21.01.2005	2237	TUG	DPD	A3	D
28.06.2005	2109	TTX	DPA	A1	A1
10.11.2005	***1705***	***LEO***	***DPD***	***A3***	***U***
03.12.2005	1713	TTH	DPD	D	D

Source: SPC and MIMRA data

Table 6 Sea Turtle Interactions from Majuro-based Longline Trips Recorded by MIMRA Observers, 2006

Date of Interaction	Time of Landing	Turtle Species	Fate	Condition (Landing)	Condition (Release)
19.02.2006	1950	TUG	DPD	D	D
23.03.2006	2318	TTH	DPD	D	D
25.03.2006	0056	LEO	DUS	A1	D
31.05.2006	1903	LEO	DPD	D	D
10.07.2006	1704	LEO	DPD	D	U
15.07.2006	2003	TTH	DPD	D	D
20.07.2006	1735	LTB	DPA	A1	A2

Source: SPC and MIMRA data

Table 7 Sea Turtle Interactions from Majuro-based Longline Trips Recorded by MIMRA Observers, 2007

Date of Interaction	Time of Landing	Turtle Species (LKV=LEO)	Fate	Condition (Landing)	Condition (Release)
11.03.2007	1715	LKV	DPD	D	D
08.03.2007	2225	LEO	DUS	D	D
23.03.2007	2205	TUG	DPQ	D	D
25.03.2007	1900	TTH	DFR	A3	D
26.03.2007	2328	TTX	DPD	D	U
29.03.2007	0144	LKV	DPD	D	D
01.04.2007	0231	LKV	DPD	D	D
02.04.2007	2150	LKV	DUS	D	D
03.04.2007	1748	LEO	ROR	A2	U
04.04.2007	0119	LKV	DPD	D	D
10.04.2007	2118	LTB	DPD	A2	A2
11.04.2007	0016	LKV	DUS	D	D
11.04.2007	0026	LKV	DUS	D	D
12.04.2007	0015	LKV	DUS	D	D
04.07.2007	1919	LEO	DPA	A1	A2
21.09.2007	1818	TUG	DPA	A2	A2
24.09.2007	1652	TUG	DPD	D	D
07.10.2007	2042	TUG	DPD	D	D
09.10.2007	2200	LKV	DPD	D	D
11.10.2007	1921	LKV	DPD	D	D

Source: SPC and MIMRA data

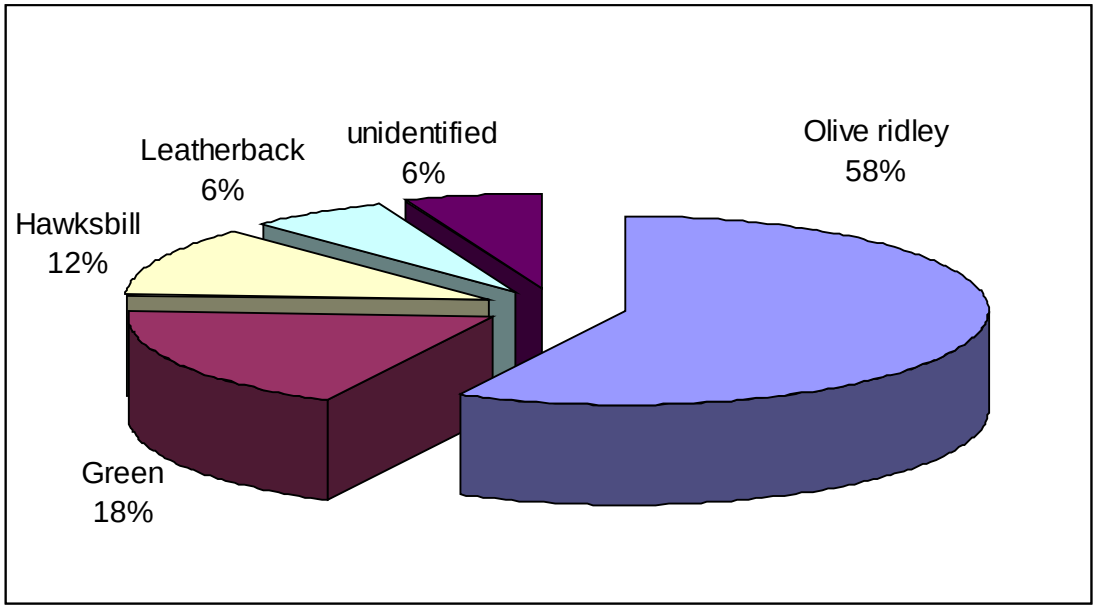
Species Involved in Interactions

Figure 7 depicts the distribution of species among the 33 interactions recorded by observers shown in the 3 tables above. A total of 19 interactions or approximately 58 percent involved olive ridleys. The remainder is comprised of 6 greens (18 percent), 4 hawksbills (12 percent), 2 leatherbacks (6 percent), and 2 unidentified (6 percent)[17].

Only two leatherbacks were recorded by observers during the 2005-2007 period. One was captured in 2007 and struck off the line in the water. It was estimated by the observer to have been “two and a half meters long”. A second leatherback (apparently a sub-adult as shown on deck in the cover photo to this report) was captured in 2006 and released in A2 condition. No record of this turtle’s measurement could be found at MIMRA. If it exists, the information is likely to be on the Gen-2 form sent to SPC prior to the introduction of the Tufman electronic data transfer system.

[17]The two unidentified turtles were recorded in 2005, even though all observers should have had adequate training and species identification materials to enable species identifications by then. Inspection of interaction records indicates that both incidents where the turtle species was not identified were recorded by the same observer.

Figure 7 Observed Turtle Interactions with Domestic-based Longline by Species, 2005-2007



Source: MIMRA observer data (note: may not include all interactions as some data not available for 2006 and 2007 at time of data compilation for this report)

Rates of Interaction with Tuna Longlines

The observed rates of interaction per thousand hooks for all turtle species during the three year period 2005-2007 are shown in Table 8. Of note is the increase in the interaction rate for 2007. The possible reasons for this increase are discussed in the following section.

Table 8 Sea Turtle-Longline Interaction Rates on Observed Longline Trips, 2005-2007

Year	Effort (hooks)	Recorded Turtle Interactions	Rate of Interaction Per '000 hooks
2005	602,267	6	0.010
2006[a]	932,666	7	0.008
2007[b]	844,748	20	0.023
TOTAL	2,379,681	33	0.014

[a] data for some observer trips (<10) not yet entered at SPC

[b] does not include 3 completed trips for which reports have not yet been received by MIMRA

Source: SPC and MIMRA data

Size of Turtles Involved in Interactions

Data consulted at MIMRA for 17 olive ridley and green turtles measured by observers onboard in 2007 showed the turtles to all be sub-adults. The straight carapace length

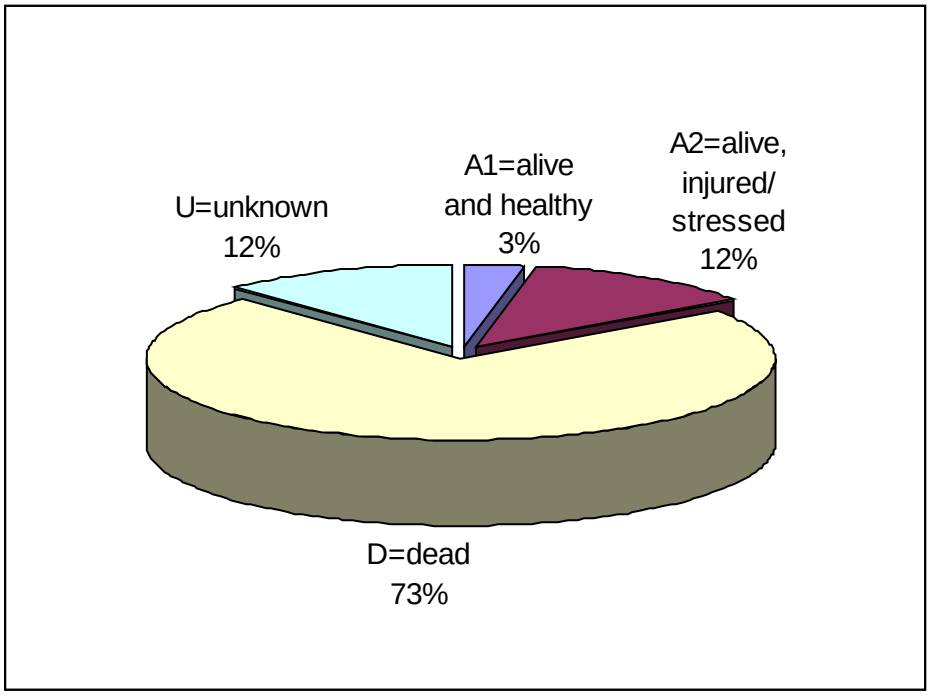
(SCL) measurements for olive ridleys (n = 12) averaged 46.4 cm within a range of 37 to 54 cm. Greens (n = 5) had an average SCL of 46.8, and ranged from 41 to 52 cm.

Turtle Mortality Attributed to Interaction with Tuna Longlines

The mortality rates for recorded interactions over the three-year period are high, with only five turtles (15 percent) out of the 33 identified as alive upon release. Four of the five were described in A2 condition, alive or injured or distressed, with only one described as alive and healthy. Of note are the two leatherbacks that were released alive; one adult struck off in the water, and one sub-adult returned to the sea after fishing operations.

From the data in Tables 5, 6, and 7 it can be seen that of the 24 turtles recorded as dead upon release, 20 were landed in that condition. The circumstances that might have contributed to mortality in each case, e.g. ingestion of hooks, drowning, cannot be determined from available data. Figure 8 shows the condition upon release for the 33 turtle interactions recorded by observers in 2005-2007.

Figure 8 Condition of Turtles Upon Release, 2005-2007



Source: MIMRA observer data (note: may not include all interactions as some data not available for 2006 and 2007 at time of data compilation for this report)

As is generally the case in deeper sets using the equipment and gear configurations employed by the Majuro-based vessels, most turtles observed captured were on the shallower hooks in a set, i.e. those closest to the floats. Of note was one olive ridley captured on the eleventh hook in a 26-hook set. The turtle was alive when brought aboard, hooked towards the front of the lower jaw. The hook was removed, and the turtle was returned to the sea in A2 condition according to the observer. The fact that the turtle

was brought onboard early in the haul, at 1919 local time may have contributed to its survival.

The relatively small number of turtles described as alive and healthy when released had an impact on opportunities for flipper tagging by observers. MIMRA has been provided with flipper tags and applicators for the use of observers, however no such tags were affixed during the three year period.

Turtle Interactions and Shark Lines

It is interesting to note that available 2007 observer information showed that turtles were not caught on shallow shark lines attached to floats that were baited with pieces of damaged bycatch or tuna flesh. When utilized, shark lines are usually 20 to 30 meters in length and attached to most or all floats in a set. Standard Japanese tuna hooks are used on shark lines and no different from the other hooks in a set.

There were 11 instances in 2007 where turtles were captured on mainline hooks and bait set for the target catch when shark lines were also employed on the same set. There are several possible explanations for the lack of turtle interaction with shark lines. Turtles may have a food preference for baitfish or squid rather than chunks of fish flesh. Prior hooking of sharks on the shark lines or presence of sharks in the area of the shark lines may act as a deterrent to turtles approaching the bait.

3.3 Discussion

It was not the purpose of the project or this report to provide an exhaustive analysis of turtle bycatch data from MIMRA's observer program, nor reach any definitive conclusions regarding sea turtle interaction with longline fishing activities in the Marshall Islands. Such an undertaking would require much more time than was available to examine the data held at MIMRA. It would also require consulting data and information on longline activities where turtle interactions were not observed, as well as past observer data that is no longer held or easily accessed at MIMRA.

It is nevertheless useful to identify certain aspects of the available observer data that can assist in directing further investigations and perhaps shed some light on interactions between sea turtles and longline fishing in the Marshall Islands. Two such aspects are the apparent high sea turtle mortality in interactions as compared with that recorded during 1990-2000 in the WCPO, and the observed increase of such mortality within the Marshall Islands over the past 3 years.

3.3.1 Sea Turtle Mortality Levels from Interactions with Longline in RMI

OFP (2001) reviewed available sea turtle bycatch data in WCPO tuna fisheries. Observer longline data from 1990—2000 that covered 2,143 observed sets in the western tropical Pacific from 10° North to 10° South indicated 83 turtles were captured, of which 58 percent were released healthy, 8 percent injured/stressed, 6 percent barely alive, and 27 percent dead. Taking the injured/stressed and barely alive categories together with known mortalities, 41 percent of turtles captured incidentally during the

period could be considered mortalities or possible/likely mortalities. Using the same criteria for the RMI observer data, 85 percent of recorded interactions from 2005—2007 could be considered mortalities or possible/likely mortalities.

It is not possible to determine here why the turtle bycatch mortality is higher in RMI than previously reported in the western tropical Pacific by OFP in their 2001 publication. There are several possibilities, although any conclusions drawn would be highly speculative. Some of the reasons for the reported higher mortality in 2005—2007 might be:

- Larger sizes of turtles were captured in locations where observers were most prevalent during the previous decade. Larger (and stronger) turtles may have been able to better withstand injury and stress;
- Observers have now had more training in turtle bycatch and may be better able to discern various levels of injury and stress.
- Some of the turtles released and noted as "healthy" during the 1990-2000 period might have been struck off the line and not brought onboard.
- A large number of turtles could have been caught on shallow sets during the 1990-2000 period, and this could have resulted in their being able to drag the branch lines to the surface, thereby avoiding drowning.

3.3.2 Increase in the Interaction Rate in 2007

As shown in Table 8, interactions were recorded by observers as occurring at a higher rate in 2007 than the two earlier years: over double the rate in 2005 and nearly 3 times the rate for observed interactions in data available for 2006. From available information, it was not possible during the course of this project to determine the reasons for the increase in interactions. There are several possibilities that might be considered as contributing to the apparent increase in the interaction rate:

- A lack of consistency in spatial and temporal coverage of the longline fishery during the 3-year period
- observers became more diligent in their record-keeping in 2007
- changes in fishing gear configuration, bait used, or to other technological parameters

A more thorough analysis of observer and vessel logbook data could shed light on the first bullet point. This would have to await more complete data entry by SPC than is available at the present. A detailed examination of observer-generated data and re-checking with SPC summaries would also be useful prior to any such analysis. For example, during the examination for this report of hard-copy data recorded by observers for 2007 the PI found that one interaction record entered at SPC and shown on an SPC summary as the capture of a hawksbill (TTH) was actually a pelagic thresher shark (PTH).

The second bullet point would be more difficult to quantify. Again, searches through observer diaries, photographs, and daily notes may turn up interactions that were not recorded on the Gen-2 form or omitted from the LL-4 form by some observers.

Changes in fishing gear configuration or the use of different fishing technology may be easier to quantify but need to be carefully examined. A perusal of the observer data made available by MIMRA during visits to Majuro during 2007 indicated that at least some vessels are apparently using the hydraulic reels and line shooters to employ more hooks in a set rather than to target deeper depths. Several observer log sheets indicated a relatively high proportion of shallow water bycatch such as wahoo, mahimahi, and barracuda. According to SPC, a sampling of sets using setting parameters recorded by observers onboard Chinese vessels setting 25 or more hooks between floats indicated the fishing gear was employed much shallower than one would expect for that number of hooks between floats.[18] It is not known if this pattern is consistent across the fleet. For some vessels, the implications are that either the proper use of the equipment to deploy hooks deeper is not understood by some captains, or is being used to increase bycatch such as sharks by setting more hooks in shallow sets.

4. CONCLUSIONS

It is important to reiterate that project activities were designed to (1) heighten awareness of sea turtle bycatch, (2) reduce mortality where possible, and (3) encourage observers to accurately record details of interactions.

The results described in this report indicate that the project was successful in items (1) and (3). Success can be also considered for item (2), however the number of turtles assisted was reduced by the high mortality experienced prior to landing onboard.

Phase 1 of the Marshall Islands project followed the practice of similar projects in other Pacific Island countries in that turtle bycatch mortality mitigation training was undertaken with experienced observers. These observers already know well their primary tasks onboard, and have extensive experience at sea.

Phase 2 of this project for the first time combined the turtle bycatch training with an SPC/FFA course for aspiring observers. The objectives in doing this were two-fold. First, it was deemed important to determine if the content of this aspect of observer training was appropriate for presenting to new trainees, given their lack of experience and familiarity with all observer tasks. The second objective was to provide relevant MIMRA staff with an opportunity to take over such training in the future by participating in a team-teaching approach.

Integration of Turtle Bycatch Awareness with other Observer Training

In other Pacific Island countries where the PI has undertaken similar observer training activities[19], the target audience has been experienced observers and not new trainees. Combining the turtle bycatch training with the SPC/FFA training exercise aimed at new participants was undertaken to see if integration of such information was (1) appropriate

[18] Peter Williams, personal communication.
[19] Papua New Guinea, Federated States of Micronesia, New Caledonia, and Palau.

for first-time trainees and (2) practical for SPC/FFA to integrate into their ongoing training.

The results with trainees who became observers, as shown in Section 2.3.1, above tend to confirm that undertaking the turtle bycatch awareness training during regular observer training was successful in this instance. Lessons were not lost on several of the trainees who eventually became observers.

Whether or not an entire day (or longer) is appropriately integrated into regular SPC/FFA training is not known. Both individuals conducting the observer course at the time in Majuro, one from SPC (a port sampler and observer trainer) and the FFA observer coordinator expressed a desire to observe the turtle bycatch training activities undertaken by the PI. There were, however, logistic and health problems that prevented this from occurring. After the dates for the training were set, scheduling conflicts resulted in the SPC trainer departing prior to the PI's arrival in Majuro. Then, during the days when the PI was carrying out his instruction in Majuro, the FFA trainer was taken ill and had to remain in his hotel room. Thus there was no opportunity for the professional observer trainers to either observe or participate in the training as undertaken by the PI.

Practicality of MIMRA Undertaking Turtle Bycatch Training of Observers

It was intended that the MIMRA observer coordinator and his assistant would participate in the training exercise and be in a position to present it at later periods during refresher training. The provision of an updated syllabus containing this information was also intended to support future training at a local level. Unfortunately, however, only the assistant was able to attend, as other pressing business at MIMRA required the observer coordinator to be elsewhere.

It is the opinion of the PI (strengthened by subsequent discussions with the FFA trainer) that in the case of RMI, good observer coordinators or their assistants do not necessarily possess the attitudes or personalities that would contribute to making them good trainers. Even if they did have a predisposition to undertaking such activity, their existing workload in running an observer program does not allow them the luxury of focusing on organizing and undertaking formal training activities.

In hindsight, this should have been self-evident. Neither FFA nor SPC have had the transfer of training functions to local observer coordinators as one of their program goals. Their trainers have become very proficient in their work, and return time after time to the same countries to conduct primary training as well as refresher courses.

There will be a continuing need to provide intensive turtle bycatch awareness and mortality reduction observer training in the future. Since it is not likely that MIMRA staff members will take this up on their own, it is important that the regional organizations engaged in observer training continue to be involved.

The use of expertise external to the Marshall Islands is one key in gaining acceptance of the concepts and practices presented[20]. In such cases, the local observer coordinators can act in a supporting role, ensuring that observers are following instructions,

[20] This is also the case in countries more developed than the Marshall Islands. In New Caledonia, for example, in spite of having a relatively well-trained and highly educated fishery staff, the government fisheries department opted for outside assistance to enhance acceptance of concepts and practices by the equally well-trained and educated domestic fishing industry.

Even though it is not likely that the observer coordinator and his assistant will undertake training of observers in a formal classroom setting, this does not mean that they will not impart their knowledge and experience by other means. Opportunities exist for one-on-one information exchange during pre-boarding briefings and post-trip de-briefings. These activities can be used to provide detailed instruction in handling interactions, placing of metal flipper tags on turtles, and accurate recording of interaction data.

Continuation of Outreach to the Domestic-based Longline Fleet

The composition of the fleet, both in vessels and captains, changes somewhat from year to year. Contacts in the company administration, both the fish base manager and agents for the several fleets operating there also change periodically. It would thus be preferable to continue industry outreach activities. Activities should include introductions and demonstrations of accepted bycatch mortality equipment (line cutters, de-hookers, and dip nets).

It is highly unlikely that in the current regulatory environment in the Marshall Islands will include conditions placed on vessels to provide their own equipment, as is the case in the US. The *gratis* provision of the necessary bycatch mortality mitigation equipment can signal to the industry that the government is serious about reducing turtle mortality, and encourage compliance through this means.

If such equipment is provided to vessels, it should be done along with a requirement that captains are instructed in the use of such tools in bycatch mortality mitigation. This could be accomplished individually onboard while vessels are in port, or in a class situation. Personnel used to carry out this instruction do not necessarily have to be those engaged in the MIMRA observer program. Suitable personnel may include those in MIMRA used to speaking in public and to groups, such as those engaged in coastal and community affairs and extension work in the management of local fisheries.

A continuing emphasis on bycatch mortality mitigation will also serve to keep the subject of sea turtle interaction in front of the industry. An important aspect of ongoing contact with the industry is the sharing of the results of interaction investigations such as those contained in this report. Should more stringent management measures such as gear modification be required in the future to minimize or alleviate interactions, an ongoing dialog with the industry on the subject of sea turtle bycatch would help to explain the need for such measures.

References

Falanruw, M. and M.A. McCoy (1975) Occurrence of ridley sea turtles in the western Caroline Islands. Micronesica, vol. 11, No. 1, University of Guam.

McCoy, M.A. (2004) Defining parameters for sea turtle research in the Marshall Islands. Administrative Report AR-PIR-08-04, Pacific Islands Regional Office, NOAA Fisheries, Honolulu, 92 pages.

MIMRA (2007) Republic of the Marshall Islands, Annual Report Part 1, information on fisheries, research and statistics. WCPFC-FC3-AR Part 1 WP16. Third Meeting of the Scientific Committee, Western and Central Pacific Fisheries Commission, 13-24 August, 2007, Honolulu, Hawaii, 24 pages.

OFP (2001) A review of turtle bycatch in Western and Central Pacific Ocean tuna fisheries. Report prepared for the Secretariat of the Pacific Regional Environment Programme, Noumea. 36 pages.

Appendix 1 Observer Training Talking Points

	Fisheries Observers Guide to Sea Turtles and Longline Interaction in the Marshall Islands
1.	Welcome to this aspect of your training as a MIMRA fisheries observer. In this session you will learn: •How to identify the turtle species you may encounter as an observer; •Some important aspects of sea turtle biology and life history; •What to do if a turtle is caught by the vessel on which you are an observer; •How to use certain tools that you will carry on board to deal with sea turtle interactions in tuna fisheries; •Why it is important to use these tools and follow instructions; Your role in educating captains and fishermen in handling sea turtles caught incidentally to fishing operations.
2.	Some Useful Terminology Carapace The shell of a turtle Carnivorous Uses other animals for food. This includes sponges and corals (which are living animals and not plants) as food CCL Curved Carapace Length: the curved length of the shell measured lengthwise Comatose Unconscious but alive EEZ Exclusive Economic Zone Herbivorous Uses plants for food Marine turtles = sea turtles. Either term can be used. Omnivorous Uses both plants and animals for food Plastron The underside shell of a turtle SCL Straight Carapace Length: the length of the carapace as measured lengthwise by calipers
3.	You should be familiar with the common English names and three-letter species codes for the species of sea turtles known to be found in the RMI EEZ. It would be helpful if you also know the scientific name of each species of sea turtle. The species codes are listed at the bottom of the Gen-2 form in the Observer Logbook
4.	Why should we be concerned about or interested in fishery interactions with sea turtles? Reason #1: The number of sea turtles is declining in many places in the WCPO An example is the status of leatherback turtles in the Pacific. On a world scale, the breeding populations of leatherback turtles in the western Pacific region are of primary importance. Although there is no nesting in RMI, there are an estimated 2,000 females that nest at an identified 27 sites throughout Melanesia.
5.	Reason #2: Sea turtles are important as a food source and in the culture of many inhabitants of the Pacific Islands, including Marshall Islands
6.	Reason #3: Turtles are a shared resource. Individual turtles undertake migrations from RMI to other jurisdictions in the WCPO. Like tuna, we need to gather as much information as possible to assist in management of the resource.

7.	Reason #4: General heightened awareness of the decline in sea turtle stocks is placing increased pressure on the fishing industry to minimize impacts on sea turtles. Observers are well-placed to provide information and guidance to the industry on best practices.
8.	The use of turtle excluder devices (TEDs) in trawl fisheries are being encouraged eliminate turtles from the catch
9.	New techniques and fishing gear are being developed to lessen interaction between turtles and longline fishing operations
10.	Sea Turtle Species Identification
11.	Brief summary of sea turtle biology: General information on sea turtle life cycles applicable to all species of turtles found in the RMI EEZ
12.	Summary: Two important aspects of sea turtle life history are: (1) delayed maturity and (2) non-annual breeding. This means that there must be a high number of turtles survive every year to enable the species to continue.
13.	An important tool in solving the mysteries of turtle life history is the use of DNA analysis
14.	Known Turtle Migrations from Tag Returns in RMI
15.	Some facts about green turtles
16.	Green turtle nesting in RMI
17.	Green turtle nesting sites in the Western and Central Pacific Ocean, Asia and Eastern Indian Ocean
18.	Some facts about hawksbill turtles
19.	HAWKSBILL TURTLE SURVIVAL STATUS: “CRITICALLY ENDANGERED”
20.	Some facts about olive ridley turtles
21.	Some facts about leatherback turtles
22.	Leatherback nesting in the Pacific and SE Asia
23.	Leatherback migration: Migratory routes of some leatherbacks in the Pacificare becoming known because of the use of satellite tags for tracking
24.	Status of leatherback turtles
25.	Entanglement of turtles in fishing gear
26.	Sea Turtles and Longline Fishing in the WCPO
27.	Vulnerability of turtles to longline depth
28.	Longlining and turtle mortality
29.	Locations of sea turtle interaction with longline fisheries north of 10° South latitude, based on observer reports from SPC
30.	Existing records of turtle-longline interaction
31.	Turtles and Longline Hooks
32.	Instructions for handling turtles that are caught by longline
33.	Some turtles may appear dead, but are actually comatose (unconscious). Follow the instructions on the SPC placard to try and revive comatose sea turtles
34.	Threats to sea turtle survival other than commercial fishing
35.	Measuring turtles caught incidentally to fishing operations
36.	Tagging Sea Turtles During Longline Operations
37.	Why it is important to tag sea turtles whenever possible

38.	Tags and Tagging Equipment
39.	Instructions for tagging turtles onboard
40.	Recording tagging data; Why it is important to accurately record all interactions with turtles
41.	Use of satellite transmitters to track turtles
42.	Cooperation and support of the fishing industry to obtain information
43.	Photographs are an important part of collecting data. Instructions for photographing turtles onboard fishing vessels
44.	Photograph any tumors or strange markings on turtles
45.	Observers are the key participant and an important part of collecting the necessary data. The information collected will be vital in contributing to better management of the country's resources.
46.	Thank you. The people of the Pacific Islands greatly appreciate your assistance in helping to save sea turtles by minimizing the chances for sea turtles to be hurt or killed during interactions with tuna fisheries.

Appendix 2 Scope of Work

The consultant will follow up and expand on Phase 1 of the Marshall Islands Sea Turtle-Fisheries Interaction Outreach Education Project that was undertaken at the Marshall Islands Marine Resources Authority (MIMRA) in 2004. The consultant shall (1) explore the effectiveness of the Phase 1 outreach efforts for Majuro-based fishing vessel operators and crew in the Western and Central Pacific Ocean in sea turtle-fishery interaction mitigation, (2) introduce and train new observers that have been hired since Phase 1 in use of the latest release tools and techniques. The consultant shall also ensure that MIMRA's Observer Coordinator in the Marshall Islands is fully conversant with the methods, tools, and techniques required, and be capable of continuing further such training of observers in the future. The Consultant shall also provide support to the local non-governmental organization, Women United Together in the Marshall Islands (WUTMI) in developing and instituting a program to disseminate information and collect relevant turtle data in Majuro, Kwajalein, and selected outer atolls of the Marshall Islands.

In order to carry out the above, the Consultant shall (1) meet with Marshall Islands Marine Resources Authority (MIMRA) local staff and commercial fishing interests based in Majuro to review observer data and progress of the observer program in introducing mitigation techniques, (2) evaluate the success of program implementation aboard commercial fishing vessels based in Majuro and determine what, if any, adjustments need to be made to the program, and (3) introduce and train observers in the use of de-hooking devices.

Appendix 3 SPC Observer Form Gen-2

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

REVISED DEC. 2004

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 ☐

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

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* TAG NUMBER	TYPE	ORGANISATION	*PLACED* TAG NUMBER	TYPE	ORGANISATION

INTERACTIONS WITH VESSEL OR VESSEL GEAR:

VESSEL'S ACTIVITY DURING INTERACTION → SETTING ☐ HAULING ☐ TRANSITING ☐ OTHER (specify) ☐

START OF INTERACTION:	CONDITION CODE	CONDITION DESCRIPTION	*END OF INTERACTION:*	CONDITION CODE	CONDITION DESCRIPTION

DESCRIBE THE INTERACTION

SPECIES SIGHTED

VESSEL'S ACTIVITY WHEN SIGHTED → SETTING ☐ HAULING ☐ TRANSITING ☐ OTHER (specify) ☐

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

DISTANCE FROM VESSEL	SPECIES BEHAVIOUR WHEN SIGHTED
NM	

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
LEO	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
				RTD	ROUGH-TOOTHED DOLPHIN
FBT	FLATBACK TURTLE	ODN	TOOTHED WHALES		
		MAM	ALL MARINE MAMMALS	DLP	ALL DOLPHINS
TTX	ALL TURTLES				
		RHN	WHALE SHARK	BRZ	ALL BIRDS

Appendix 4 Equipment Provided MIMRA Observer Program, 2004-2006

ITEM	Phase 1	Phase 2	TOTAL
1. Long-handled de-hookers	0	4	4
2. Short-handled de-hookers	5	4	9
3. 34-inch de-hookers	2	2	2
4. Line cutters and extension poles	6	4	10
5. Dip nets	4	0	4
6. Bolt cutters	4	0	4
7. Portable GPS units, Garmin GPS-72	3	8	11
8. Hand-bearing compass	2	0	2
9. Disposable cameras	24	6	30
10. Digital cameras	3	4	7
11. Turtle tag applicators	2	6	8
12. Zipper binders	14	15	29
13. DVD player	1	0	1
14. Training videos, DVDs	3	0	3
15. Portable external speakers for presentations		1 set	1
16. Navigation charts	4 sets	0	4
17. Laser printer	1	0	1
18. Fax machine		0	1
19. 3-hole punch	1	1	2
20. Paper cutter	1	0	1
21. Photo albums	6	0	6
22. Plastic Laminator and supplies	1	1	2