

Pacific Islands Marine Turtle Management Plan

*Implementing the U.S. Recovery Plans
for Pacific Sea Turtle Populations*



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Executive Summary

The purpose of this Pacific Islands Marine Turtle Management Plan (or Plan) is to provide a regional approach to implementing the Recovery Plans for U.S. Pacific Sea Turtle Populations, and provide a framework to help prioritize activities in order to maximize efforts to recover marine turtles occurring in the Pacific Islands Region (PIR). This Plan identifies conservation and management priorities for the PIR, and as practicable focuses efforts to implement Priority 1 actions of the U.S. Recovery Plans unless other national or international considerations dictate otherwise. Programmatic objectives to guide recovery efforts are outlined including a process to prioritize the selection of projects or activities given limitations in resources or other considerations. The National Marine Fisheries Service (NMFS) Pacific Islands Regional Office (PIRO) Protected Resource Division (PRD) has primary responsibility for implementing the Endangered Species Act (ESA) to protect and recover marine turtles within the PIR. Other PIRO divisions, other NMFS offices and agencies, and non-NMFS organizations are also important partners in recovery and management efforts within the PIR.

Recovery of threatened and endangered species is a long-term challenge requiring sustained, cooperative effort of government, academia, non-governmental organizations, businesses, local communities, and private land owners. Partnerships are essential in the recovery of listed species and necessary to address priority actions identified in the U.S. Recovery Plans for Pacific Sea Turtle Populations. This Plan helps integrate research and management efforts. It also attempts to strengthen the coordination between NMFS partners. As such, this Plan is a tool for partners: federal agencies and organizations, state, territory or other regional partners that are stakeholders in the recovery of ESA listed marine turtle species in the PIR. This Plan will be reviewed periodically to ensure that priorities and needs have not changed significantly and remain relevant for use in directing activities and projects to implement the U.S. Recovery Plans and fulfill PIRO's ESA mandates and responsibilities.

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1.0 Introduction

The National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) jointly administer the Endangered Species Act (ESA)¹ and share responsibility for conservation, management, and recovery of listed marine turtle species. In the Pacific Islands Region (PIR) NMFS Pacific Islands Regional Office (PIRO) is responsible for marine turtles in the marine environment, with scientific and applied research conducted by NMFS Pacific Islands Fisheries Science Center (PIFSC). PIRO and PIFSC work collaboratively to support the conservation and management of marine turtles and their habitats in the PIR and the Western Central Pacific Ocean (WCPO).

Five species of marine turtle occur in the PIR and are listed under the ESA as either endangered: leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*), and loggerhead (*Caretta caretta*)², or threatened: green (*Chelonia mydas*) and olive ridley (*Lepidochelys olivacea*). Given that marine turtles are highly migratory, a coordinated multilateral conservation and management approach among nations and other parties throughout the WCPO is required for recovery.

The PIR marine jurisdiction includes approximately 1.5 million square miles extending west past the Pacific dateline and south of the equator, representing the largest NMFS jurisdictional area in the United States. The PIR is comprised of exclusive economic zones (EEZs) adjacent to the state of Hawaii, Territory of American Samoa, Territory of Guam, the Commonwealth of the Northern Mariana Islands (CNMI), and the U.S. Pacific Remote Island Areas (PRIAs): Jarvis, Johnston, Wake, Howland and Baker Islands, Kingman Reef, and Palmyra and Midway Atolls (Figure 1). American Samoa, Guam, and CNMI will be referred to as U.S. territories in this document. The Republic of the Marshall Islands (RMI), Federated States of Micronesia (FSM) and Republic of Palau (ROP) are nations with Compacts of Free Association³ with the U.S., and given their proximity to the PIR are highly relevant to Regional marine turtle recovery efforts.

¹ The purpose of the ESA of 1973, as amended (16 U.S.C. 1531 et seq.) is to provide a means by which to conserve ecosystems upon which endangered and threatened species depend, to provide a program for conservation of endangered and threatened species, and to take appropriate steps to recover species; such as through implementation of Recovery Plans.

² In September 2011, the Services (NMFS and USFWS) determined that the loggerhead turtle (*Caretta caretta*) is composed of nine distinct population segments (DPS) that constitute “species” that may be listed as threatened or endangered under the ESA (76 FR 58868: September 22, 2011; Conant et al. 2009). In the Pacific, there exist two loggerhead turtle DPS populations: North Pacific and South Pacific, both are classified as endangered (76 FR 58868; September 22, 2011).

³ Nations with Compacts of Free Association were formerly governed by the U.S. as part of the United Nations Trust Territory of the Pacific Islands, considered “Freely Associated States,” but have since become sovereign States. However, they are still eligible to receive funds from U.S. Federal agencies and continue to maintain close ties with the United States.



Figure 1. Map of U.S. jurisdiction in the Pacific Islands Region: Filled EEZs are U.S. possessions and open EEZs are Nations with Compacts of Free Association with the U.S..

To fulfill ESA mandates to support the recovery of listed species, PIRO conducts section 7 consultations, facilitates and supports section 6 agreements, responds to petitions under section 4 regarding listings and critical habitat designations, evaluates applications for section 10 permits, and implements the Recovery Plans for U.S. Pacific Sea Turtle Populations (NMFS and USFWS 1998a-e). Additional considerations include working to implement mandates of the Magnuson-Stevens Fishery Conservation and Management Act⁴ (MSA, reauthorized in 2006), and other international binding and non-binding instruments designed to facilitate international marine turtle conservation. These include: Regional Fishery Management Organizations⁵ (RFMOs), the Secretariat of the Pacific Regional Environmental Program (SPREP), Community of the Pacific's Oceanic Fisheries Programme, the Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC), and the Indian Ocean Southeast Asia Marine Turtle Memorandum of Understanding (IOSEA MoU).

PIRO is comprised of multiple divisions that carry out actions for recovery, conservation, and management of marine turtle species in the Pacific Ocean. These include, the Protected Resources Division (PRD), International Fisheries Division (IFD), Sustainable Fisheries Division (SFD), Observer Program (OP), and Habitat Conservation Division (HCD). NOAA's Office of Law Enforcement (OLE) protects marine turtles and their habitats by enforcing more than 35 federal statutes and international treaties governing the high seas and international trade. The PRD has primary responsibility for implementing the ESA to protect and recover listed species and as such is the primary

⁴ The MSA as amended through 1996 and reauthorized in 2006 (MSRA) is the primary law governing marine fisheries management in US federal waters focusing on rebuilding overfished fisheries, protecting essential fish habitat and reducing/mitigating fishery bycatch.

⁵ The primary international RFMO for highly migratory species (HMS) in the PIR is the [Western and Central Pacific Fisheries Commission \(WCPFC\)](#). Some fisheries also operate to the east of 150° west and therefore enter the area of the [Inter-American Tropical Tuna Commission \(IATTC\)](#).

driver of this management plan. However, there are many other important partners that PIRO works with to further marine turtle recovery. These include: state and territory governments of Hawaii, American Samoa, Guam, CNMI, the USFWS, various non-profit organizations, and the Western Pacific Fisheries Management Council (WPFMC); particularly in the context of mitigating impacts of federally-managed commercial fisheries (Appendix A). Additionally, because research activities are guided in-part by management needs, PIRO works with NMFS science centers as appropriate to ensure management activities and decisions are based on the best available scientific information. Within PIFSC, PIRO collaborates with the Marine Turtle Research Program (MTRP), Marine Turtle Assessment Program (MTAP), Fish Biology and Stock Assessment Division (FBSAD)/Fisheries Interaction and Conservation Program (FICP), and Ecosystem and Oceanography Division (EOD).

1.1 Purpose and Scope of the Plan

The purpose of this Pacific Islands Marine Turtle Management Plan (Plan) is to implement Priority 1 actions of the Recovery Plans for U.S. Pacific Sea Turtle Populations and identify regional priorities that will guide efforts to maximize conservation and management of marine turtles of the PIR. Regional priorities are based on the existing U.S. Recovery Plans and published scientific literature in consideration of regional capacities. Although NMFS is mandated and seeks to implement recovery actions for all species within its marine jurisdiction and address as many existing threats as practicable, program activities in any given year are limited by fiscal, staff, and other resource considerations. Considering these limitations, priority program actions by various divisions within PIRO are outlined. This Plan is intended to facilitate integration of research and management activities and strengthen coordination between partners, and will be reviewed biennially.

1.2 Coordination

Within NMFS, the Pacific Islands Regional Office (PIRO) and Science Center (PIFSC), the Southwest Regional Office (SWRO) and Science Center (SWFSC), and the Headquarters Office of Protected Resources (F/PR) are actively engaged in Pacific marine turtle conservation, management and recovery activities. NMFS works collaboratively with partners such as the Department of the Interior (USFWS, USGS, NPS), WPFMC, states and territories, universities, non-governmental organizations (NGOs), and international agencies to support and implement projects to address research, conservation and management needs and recovery priorities throughout the PIR and WCPO (see Appendix D). Coordination with these partners assists with the development of projects and regional priorities. NMFS also convenes annual planning meetings that bring marine turtle coordinators and program leads together to discuss projects and funding priorities for the upcoming fiscal year. It is during these meetings that representatives identify how to best coordinate recovery, research and management activities amongst various partners.

2.0 Prioritization Overview

The process to prioritize projects and activities is summarized in this section. It includes the use of U.S. Recovery Plans and species-specific information (as supported by scientific published literature) while considering regional authorities, criteria, and action plans to guide the application of PIRO resources.

The five Recovery Plans for U.S. Pacific Sea Turtle Populations (NMFS and USFWS 1998a-e) provide the foundation of regional recovery efforts. Recovery Plans identify threats and recovery actions in four categories (nesting environment, marine environment, captive care, and international cooperation) and rank necessary tasks or actions as Priority 1, 2, or 3. Priority 1 actions are defined as those required to prevent extinction, or to prevent species from declining irreversibly in the foreseeable future. Priority 2 actions are defined as those actions that must be taken to prevent significant decline in species population/habitat quality or some other significant negative impact short of extinction. Priority 3 actions are all other actions necessary to provide for full recovery of the species. As practicable, this Plan aims to focus efforts on Priority 1 actions of the U.S. Recovery Plans unless regional or other national or international considerations dictate otherwise.

Although Recovery Plans provide a basis for regional priorities, many of their actions address threats and impacts on a broad scale at the species level. However, in some instances regional information exists that can further direct and focus recovery efforts for the different nesting aggregations⁶ (or assemblages) occurring within the PIR (Moritz 1994; Seminoff 2004; Hamann et al. 2010; Wallace et al. 2010; Wallace et al. 2011). For example, green and hawksbill turtles that nest and use coastal habitats of the U.S. territories and PRIAs are embedded within a complex structure of WCPO populations (FAO 1990; NMFS 1998; Bowen et al. 1995; Dutton et al. 1999; Dutton 2005; Moritz et al. 2002; Dethmers et al. 2006; Craig et al. 2004; Cruse and Kolinski et al. in prep; Snover 2007). In contrast, studies of hawksbill and green turtles in Hawaii suggest they may not typically intermingle with other WCPO aggregations (Balazs and Chaloupka 2004; Chaloupka et al. 2008; Dutton et al. 2008a, 2008b; Parker et al. 2009; Seitz et al. 2012). Such aggregations will likely have specific research, conservation and management needs. These delineations can be useful for the purposes of this Plan.

Additionally, some recovery efforts may require activities in international locations. As noted within Recovery Plans, some tasks do not necessarily apply to areas within U.S. jurisdiction, but must be addressed to restore U.S. populations. However, NMFS has varying levels of authority and responsibility to implement management and recovery actions. In order to facilitate species recovery, NMFS periodically coordinates with USFWS and international partners to identify and support projects on nesting beaches or internationally. For example, nesting beach work may be supported following consultation with USFWS and a determination that USFWS does not have the resources

⁶ The use of “nesting aggregation” to describe the separation in Pacific nesting assemblages is solely for the purposes of this management document. It does not imply a designation of subpopulations or distinct population segments (DPS) as defined by joint NOAA/USFWS policy (62 FR 4722; Feb.6, 1996) which is a separate statutory process under the ESA.

to carry out the project but agrees the activity is of high priority, and supports NMFS doing so. Furthermore, while PIRO has primary responsibility for management activities, there are circumstances in which research activities may be supported that NMFS science centers are unable to implement directly, but which are needed to directly inform management actions. In such instances, support for research activities is carried out in consultation and with technical guidance provided by relevant NMFS science centers or other recognized experts.

Regional criteria and existing action plans are used when appropriate to prioritize projects and activities for funding or implementation. Existing research or management action plans provide the opportunity to align PIRO objectives with those of other regional partners. Such action plans include: NMFS Priorities for Implementing the Leatherback Turtle Recovery Plan in the Western Pacific (2011 in review; developed jointly by SWFSC, PIRO, SWR and PIFSC, and adapted from the 2008 Bellagio Steering Committee); PIFSC Research Plans for Hawaiian Green Turtles (Kubis and Balazs 2007) and Pacific Green (excluding Hawaii) and Hawksbill turtles (Snover 2008); and NMFS and USFWS Five Year Action Plan for Research and Management of Hawksbills in Hawaii (in review); SPREP Marine Turtle Action Plan (MTAP 2007); IOSEA MoU Conservation and Management Action Plan (IOSEA CMP 2009); the Coral Triangle Marine Turtle Action Strategy, and other Regional Action Plans.

The following regional criteria are applied, as applicable, to help prioritize projects and activities for funding or implementation:

- Species listing status (threatened vs. endangered);
- Recent (~30 year) nesting trend and projected future trajectory (as supported by scientific literature) for each aggregation;
- Extent to which an aggregation occurs within PIR jurisdiction and/or is affected by regional federally-managed activities; and
- Extent to which an activity addresses U.S. Recovery Plan Priority 1 tasks.

Greater priority is generally given to projects or activities that are implemented in the marine environment (i.e., NMFS jurisdiction), are related to Reasonable and Prudent Measures⁷ or Conservation Recommendations⁸ provided by NMFS in a Biological Opinion, address multiple species, implement activities outlined in existing action plans (such as those described above), and/or provide a high conservation value to the species for low cost or expenditure of resources.

⁷ RPMs are non-discretionary measures included in Biological Opinions as NMFS recommendations of ways to minimize or eliminate adverse impacts to affected species.

⁸ Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation Recommendations are discretionary agency activities to reduce or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or develop information.

3.0 Regional Management Priorities

3.1 ESA Mandates

The ESA aims to protect and recover imperiled species and ecosystems upon which they depend. Fulfilling ESA mandates at times requires immediate attention to completing certain activities that have statutory deadlines which makes these activities high priority for PIRO. ESA sections most relevant to PIRO and marine turtle species occurring in the PIR include: section 4 (listing determinations and designations, and recovery planning and implementation); section 6 (cooperation with states); section 7 (federal agency actions and consultations); section 10 (permits). See Appendix C for an overview of PIR-specific discussion of these ESA sections.

3.2 Multi-Species Management

Within the U.S. Recovery Plans, a Priority 1 Action all species have in common is to reduce and/or eliminate incidental mortalities in commercial and artisanal fisheries. NMFS works to support and develop domestic marine commerce through fishery research and management. Sustainable management of U.S. Western Pacific fisheries and minimization of protected species bycatch is a top priority for PIRO. Additionally, anthropogenic induced climate change, marine debris, pollution, and growing marine commerce are emerging threats that may also impact all five species that forage in or migrate through or within NMFS marine jurisdiction. Efforts to address, manage or mitigate these over-arching regional impacts to the five species of the PIR in the marine environment are discussed in this section.

Western Pacific Fisheries

Interactions and incidental mortality in fisheries is a significant threat to continued recovery of Pacific marine turtle species (NMFS and USFWS 2007a-e; FAO 2004, 2010; Lewison et al. 2004, 2006, 2009; Alfaro-Shigueto et al. 2011; Gilman et al. 2009; Peckham et al. 2007; Stewart et al. 2010; Wallace et al. 2010b, 2011). NMFS is responsible for identifying and reducing sources of marine turtle bycatch and mortality in U.S.-commercial fisheries active in the WCPO. U.S. commercial longline fisheries are managed under the Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific Region (Pelagic FEP).⁹ In addition to commercial longline fisheries, U.S. purse seine vessels operate within the WCPO under the jurisdiction of the U.S. as authorized by the South Pacific Tuna Act of 1988 (SPTA) and High Seas Fishing Compliance Act of 1995, targeting skipjack and yellowfin tuna (NMFS 2006). A generalized summary of information of ‘observed’ interactions¹⁰ in Western Pacific U.S.-commercial fisheries active in the WCPO used to assist in determining priorities for PIRO management or conservation activities is provided in Appendix B.

⁹ The Hawaii and American Samoa-based longline fisheries are managed by Federal regulations pertaining to the Pelagics FEP, as well as other Federal fisheries regulations that apply to the Western Pacific. For the complete set of these Federal regulations, see [50 CFR Part 665](#), and for summaries see [Hawaii Longline Fishing Regulations](#), [American Samoa Pelagic Longline Fishery Regulations](#), and [Measures to Reduce and Mitigate Interactions](#) between marine turtles and Western Pacific pelagic fisheries.

¹⁰ An interaction with fishing gear can mean entanglement or hooking, but does not necessarily imply mortality.

Actions to mitigate and reduce fisheries bycatch in commercial fisheries benefit multiple species and directly address a domestic source of marine turtle mortality. PIRO's work encompasses a range of management activities and PRD provides a supporting role to SFD and IFD that lead, respectively, NOAA's efforts to manage Western Pacific commercial fisheries and U.S. engagement in international fisheries agreements. Under this Plan, PIRO will continue efforts to fulfill MSA, SPTA, and RFMO objectives pertaining to bycatch reduction in WCPO fisheries potentially affecting all five marine turtle species through the following three activities:

1. Fisheries Management – PIRO SFD is responsible for implementing approved fishery management actions governing U.S. domestic fisheries in the PIR. SFD supports the region's fisheries through the development, evaluation, and implementation of fishery policy and legislation. Amendments to existing fisheries ecosystem plans include gear modifications and other measures to reduce incidental interactions with sea turtles. SFD will continue to consult with PRD under section 7 of the ESA to ensure that federally authorized fisheries do not jeopardize the continued existence of ESA-listed species, including marine turtles. SFD will also continue to provide mandatory annual protected species workshops for owners and operators of registered vessels with federal longline permits in the PIR. Conservation Recommendations provided in Biological Opinions (NMFS 2004, 2005, 2008, 2010) and codified via regulations (50 CFR 665.812) include [NOAA's Sea Turtle Handling Guidelines](#) to increase post-hooking survivorship and promotes gear technology research. Through close collaboration with PIFSC FICP, this Plan encourages continued work to reduce the likelihood of marine turtle interactions and reduce post-hooking mortality, including reviewing and refining (if appropriate) estimates of post-release survivorship of turtles bycaught in longline fisheries. Since 2004, the Hawaii-based longline fisheries have operated under a number of [regulatory measures](#) designed to reduce the number and severity of marine turtle bycatch which have significantly reduced bycatch by up to 90% (Gilman et al. 2007).

The WPFMC is a quasi-federal agency established to develop regional fisheries management plans to conserve marine resources while maintaining opportunities for domestic, commercial, and non-commercial (i.e., recreational and subsistence) fishing at sustainable levels. The WPFMC develops fishery management plans based on input from the public, advisory committees, and best-available science provided by the PIFSC and others including the [Pelagic Fisheries Research Program](#). Plan amendments are transmitted to the [Secretary of Commerce](#) for approval. Management measures approved by the Secretary are implemented by NMFS and enforced by NOAA OLE and the U.S. Coast Guard 14th District. PIRO SFD and WPFMC coordinate efforts to develop and amend fishery management plans, draft and implement federal fishery regulations, and monitor federal fisheries. The WPFMC contributes to marine turtle recovery efforts through their protected species program that focuses on species of greatest concern due to interactions with federally-managed fisheries (Appendix A).

2. Fisheries Observer Program – PIRO’s Observer Program (OP) provides observer coverage aboard Western Pacific federally-managed fisheries (Pelagic FEP). Currently [2012], observers are placed aboard Hawaii-based pelagic longline vessels targeting swordfish (100% coverage) and tunas (~20% coverage) and American Samoa longline vessels targeting albacore tuna (~20% coverage). See section 4.3 of this Plan for detailed information pertaining to OP observer coverage and activities. Fishery observers document incidental interactions with protected species, including marine turtles. When possible, observers retain carcasses of dead turtles and bring them back to Honolulu to be necropsied by the PIFSC MTRP with genetic samples forwarded to the SWFSC genetics laboratory for analysis to determine population origins and stock structure. If turtles are caught alive, observers collect genetic tissue samples when possible and handle turtles according to NOAA’s approved Sea Turtle Handling Guidelines (to dehook, disentangle, or revive any comatose turtles). Since 1995, observers have collected over 379 samples from leatherbacks, loggerheads, greens, and olive ridleys, contributing significantly to our understanding of stock structure and relative fishery impacts to these species. The program also has an extensive outreach program to support, train or build capacity of other national observer programs throughout the WCPO.

3. International Fisheries Management – PIRO’s International Fisheries Division (IFD) provides policy advice and technical and administrative support for international fisheries agreements and related issues in the WCPO. International cooperation in fisheries management is driven by the highly migratory nature of many target and non-target species, including marine turtles. IFD maintains involvement in RFMO commercial fishery management activities. To date, the IFD and partners have been integral in the adoption of a binding Western and Central Pacific Commission Conservation and Management Measure¹¹ to further progress RFMO conservation and management efforts. Conservation Recommendations in various section 7 Biological Opinions encourage NMFS to provide technical and financial assistance necessary to export advances in knowledge of techniques and gear modifications that reduce interactions with marine turtles and/or dramatically reduce the immediate and/or delayed mortality rates of captured turtles with other nations engaged in similar fishing practices to reduce fishery impacts to marine turtle populations worldwide (NMFS 2004, 2005, 2008, 2010). To accomplish this, PIFSC FBSAD/FICP and WPFMC will continue to collaborate with PIRO to support management efforts to promote and transfer fishery mitigation technology and handling measures, and support in-country capacity building of observer programs for international longline and

¹¹ In 2008, the WCPFC implemented Sea Turtle Conservation Measures (CMM 2008-03) requiring vessels fishing for tuna and tuna-like species to reduce frequency and severity of interactions in accordance with [FAO guidelines](#). The WCPFC requires shallow-set longline fisheries to use either: large circle hooks, whole finfish bait, or other mitigation measures proven to reduce the interaction with or increase survivorship of marine turtles. RFMOs also require members and cooperating non-members to safely handle and release marine turtles they encounter and provide bycatch data to respective Secretariats.

purse seine fisheries – as well as support in-country conservation and management efforts. Furthermore, NMFS headquarters Office of Protected Resources (F/PR), Office of International Affairs (F/IA), and the U.S. State Department Office of Marine Conservation will continue to engage in international marine turtle conservation and management efforts, and collaborate with PIR-based agencies regarding international engagement aimed at supporting domestic regulations, bilateral and multilateral agreements (such as that of RFMOs), and promoting activities outlined in the U.S. Recovery Plans.

Climate Change

As highly migratory, wide-ranging organisms that are biologically tied to temperature regimes, marine turtles are vulnerable to effects of global climate change in aspects of their physiology and behavior (Hays et al. 2003; Hawkes et al. 2009; Robinson et al. 2008; VanHoutan 2011). Impacts to marine turtle populations resulting from anthropogenic climate change may occur at different rates or at different levels between species, yet current and potential future impacts are highly uncertain and unlikely to show up at the population level for several decades to centuries (Limpus 2006; Parmesan and Yohe 2003). Overall, little scientific data exists regarding impacts of anthropogenic climate change on marine turtles, either globally or specific to the PIR, and science has just begun to predict how climate change may impact populations or how they will adapt to environmental changes in various habitats. PIRO will continue to monitor new information, collaborate with regional climate change research organizations, encourage regional climate models to help more accurately predict possible species and habitat responses to projected climate change, and will incorporate mitigation measures into management efforts where possible.

Marine Debris and Pollution

Marine debris is defined by NOAA as any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment. Manmade materials like plastics, micro plastics, and derelict fishing gear (e.g., ghost nets) that may impact turtles via ingestion or entanglement can reduce food intake and digestive capacity, cause distress and/or drowning, expose turtles to contaminants, and in some cases cause direct mortality (Arthur et al. 2009; Balazs 1985; Bjorndal et al. 1994; Bugoni et al. 2001; Doyle et al. 2011; Keller et al. 2004; Parker et al. 2011; Wabnitz and Wallace 2010). Marine turtles have pelagic stages; including when they leave the nesting habitat as hatchlings and enter a period known as the “lost years” that can last for years or decades (Lutz and Musick 1997; Zug 2002). While the impact of marine debris to Pacific turtles during pelagic life stages is currently unquantified, it is quite likely that impacts may be severe given the increase of plastics and other debris and pollution entering the marine environment over the past 20-30 years (Arthur et al. 2009; Doyle et al. 2011; Stewart et al. 2011; NMFS and USFWS 2007a-e; Hutchison and Simmonds 1992; Law et al. 2010; Mrosovsky et al. 2009; Wabnitz and Nichols 2010). This Plan works to encourage the NMFS [Marine Debris Program](#) to address and reduce marine debris impacts throughout the PIR, and promotes collaborative efforts to remove debris and derelict gear impacting pelagic and reef habitats of which turtles depend (Donohue et al. 2001; Pichel et al. 2007). PIRO will

continue to monitor new information on the effects of marine debris and pollution on marine turtle populations and will incorporate mitigation measures into management efforts where possible.

Marine Commerce, Vessels, and Exploration

There exists an escalating use of the marine environment by a variety of commercial and government interests that may pose a range of complex risks to marine resources, including to marine turtles during their pelagic life stages. Impacts associated with marine exploration, military operations, and transiting vessels can range from vessel strikes or disturbance (Hazel et al 2007), discharge, contaminant and oil (Balazs 1985; Vargo et al. 1986; Veermat et al 1997; Hall et al. 1983; Hutchison and Simmonds 1992; Lutcavage et al. 1995), lighting (Witherington & Bjorndal 1990), shipping, and anthropogenic noise from seismic surveys (Gausland 2003, OHara & Wilcox 1990; McCauley et al. 2000), ship and aircraft noise (NMFS 2010), high energy sonar (Pilcher and Siow 2010), drilling, and explosives detonations (O’Keeffe & Young 1984; Navy 2001, 2007). Although some information exists pertaining to sensory capabilities of turtles (Southwood et al. 2008; Swimmer and Brill 2006; Wang et al. 2007, 2010), limited information exists to assess the influences of various natural and anthropogenic stresses to turtles in the marine environment (NRC 2010). PIRO will continue to use the best available scientific and commercial information to evaluate the impacts of federal actions via section 7 consultations, and encourage additional sensory and demographic research to inform management decisions (NMFS 2010). Recent efforts to increase information through [Marine Spatial Planning](#)¹² initiatives may prove valuable to regional management activities and PIRO will continue to monitor new information to incorporate into management efforts where possible.

3.3 Species-Specific Management

To compliment efforts to address over-arching marine impacts and fulfill ESA mandates, additional recovery actions are needed to address various other threats to Pacific marine turtle populations to further promote recovery. These threats include: directed take and harvest; predation (of eggs or turtles); terrestrial/near shore habitat destruction, modification, or degradation; disease and contaminants; and interactions in commercial, artisanal, and recreational fisheries (NMFS and USFWS 2007a-e). Relative impacts from each of these threats may vary between species and nesting aggregations, and may affect various life stages in different habitats throughout a species life cycle (Hamann et al. 2010; Wallace et al. 2010; Wallace et al. 2011). Therefore, priority recovery actions to address these impacts are described for each species separately in this Section. In some cases, different nesting aggregations are referred to within an individual species because enough information exists at a regional level that suggests different management and conservation needs. For each species or aggregation, a brief description of geography,

¹² In June 2010, the President signed an Executive Order creating a National Ocean Policy and National Ocean Council which adopted a “Framework for Effective Coastal and Marine Spatial Planning” (CMSP) to facilitate analysis of current and anticipated uses of the ocean to reduce user conflicts and reduce environmental impacts. The framework directs CMSP be implemented at the large marine ecosystem level associated with each U.S. EEZ region to develop regional ecosystem-based marine spatial plans.

recent population trend, and primary threats is provided, followed by a table outlining primary regional management and research needs to progress recovery efforts and implement the species-specific Recovery Plans.

Leatherback Turtle (*Dermochelys coriacea*)

Leatherback turtles are endangered throughout their global range. In the Pacific, leatherbacks traverse the entire ocean basin when migrating from foraging to nesting habitats (Benson et al. 2011). There are three demographic populations in the Pacific identified through genetic studies that are relative to recovery management: 1) a Western Pacific population that nests in Papua Barat, Indonesia, Papua New Guinea (PNG), Solomon Islands and Vanuatu, 2) an Eastern Pacific population that nests in Mexico and Costa Rica, and 3) a Malaysian population (Dutton et al. 1999, 2007; Benson et al. 2011; NMFS and USFWS 2007b).

The Western Pacific leatherback meta-population harbors the last remaining nesting aggregation of significant size in the Pacific with approximately 2700–4500 breeding females (Dutton et al. 2007). Turtles nesting in Indonesia migrate through waters of Malaysia, Philippines, and Japan, across the Pacific past Hawaii to foraging grounds in temperate waters off North America (Benson et al. 2007a,b,c; Benson et al. 2011). The Western Pacific austral summer nesting population exhibits strong site fidelity to the central California foraging area (Benson et al. 2011) which puts them at high risk of interaction with longline fisheries, including Hawaii-based fisheries, during migrations. Primary impacts to Western Pacific leatherback population in addition to U.S. commercial longline fisheries include: fishery interactions with international fleets within the Sulu Sulawesi and South China Seas and north Pacific Ocean, direct harvest of eggs and turtles, nest predation by feral animals, coastal development and village sprawl, coastal fishery impacts, beach erosion, low hatch success, marine debris entanglement and ingestion, and climate change (Benson et al. 2011; Bellagio Steering Committee 2008; NMFS and USFWS 2007b; Starbird and Suarez 1994; Suarez and Starbird 1996).

The largest nesting site for the Western Pacific population is at Jamursba-Medi, Papua Barat, Indonesia with an estimated mean of 2,733 nests annually in 1999-2006, making up approximately 38 percent of the total estimated nesting for the Western Pacific population during this time period (Dutton et al. 2007). Anecdotal reports from the early 1980s suggest that nesting at Jamursba-Medi has declined during the decade preceding initiation of nest counts in 1993 (Hitipeuw et al. 2007). Besides Jamursba-Medi, there exist 27 other leatherback nesting sites in the Western Pacific region (6 in Papua, 10 in PNG, 8 in the Solomon Islands, and 3 in Vanuatu) (Dutton et al. 2007). Approximately 62% of known leatherback nesting between 1999 and 2006 occurred at these 27 sites. However, of the total Western Pacific nesting population, 70% occurs in Papua Barat, Indonesia (Dutton et al. 2007). Monitoring activities have not been sufficiently long-term to determine a reliable trend at these sites, but anecdotal information and published research suggest a decline in nesting activity over the past 50 years (Bellagio Sea Turtle Conservation Initiative 2008; NMFS and USFWS 2007b; Hirth et al., 1993; Hitipeuw et al. 2007; Starbird and Suarez 1994).

The SWFSC, SWR, PIRO and PIFSC have jointly developed an internal plan “Priorities for Implementing the Leatherback Turtle Recovery Plan in the Western Pacific” that contains detailed information on research and conservation progress to date and helps guide a coordinated regional approach to implement priority actions [based in-part on the 2008 Bellagio Sea Turtle Conservation Initiative]. This internal working document outlines specific next steps to continue to progress recovery efforts and research needs to support management actions, which are reflected in Table 1. In addition to a comprehensive plan to unite regions and nations in research and conservation, the 2008 Bellagio Sea Turtle Conservation Initiative developed options for sustainable financing for continued leatherback turtle conservation and monitoring programs.

The Eastern Pacific leatherback turtle aggregation nests in Mexico and Costa Rica. This nesting aggregation used to host the world’s largest leatherback nesting population, which has now been reduced to less than 250 females nesting annually (NMFS and USFWS 2007b; Sarti et al. 2007; Spotila 2000). This nesting aggregation has a foraging strategy that is limited to the southeastern Pacific (Donoso and Dutton 2010; Shillinger et al. 2008, 2010). Anthropogenic and environmental impacts to this population persist (NMFS and USFWS 2007b). East Pacific leatherback interactions to date [2012] have occurred only in the Hawaii-based deep-set longline fishery where genetic analysis indicates that 8% (n = 1 of 12) of leatherback interactions are with individuals from this nesting aggregation (NMFS 2008). Because U.S. Western Pacific commercial fisheries have a greater impact on Western Pacific leatherbacks, recovery actions for East Pacific leatherbacks are considered lower priority with respect to this management Plan for PIRO than activities specific to Western Pacific leatherbacks.

In addition to fishery management objectives described in Section 3.2, NMFS and partners (such as the WPFMC) have been involved in leatherback turtle research and conservation activities in the Western Pacific since 2000 to address priority actions outlined in the U.S. Pacific Leatherback Turtle Recovery Plan. Despite that some efforts to monitor and conserve leatherbacks have been hampered by naturally occurring phenomena (tide inundation of nests and large earthquakes) and a myriad of land ownership, beach access, and local village politics. NMFS and partners continue to build international partnerships for leatherback conservation throughout the region, and have made tremendous progress toward understanding population structure and locally-based threats (Dutton and Squire 2008). Progress has been achieved by enhancing the capacity of international colleagues (Bellagio Steering Committee 2008), implementing studies on the Economics of Leatherback Conservation (Kinch 2006; Gjertsen et al. 2008; Gjertsen and Niesten 2010), supporting nesting beach conservation and mitigation measures to increase and understand hatching success (Pilcher 2011; Tapilatu and Tiwari 2007; Wurlianty and Hitipeuw 2009), implementing and encouraging PIT tagging (Hitipeuw et al. 2007; Pilcher and Chaloupka in prep), undertaking research to assess migrations and habitat use (Benson et al. 2011), and utilizing innovative molecular techniques (genetics and stable isotopes) to assess stock structure and connectivity (Seminoff et al. 2009; Dutton et al. 2007). Table 1 outlines regional priority needs to maintain or progress initiatives for Western Pacific leatherback turtle aggregation-specific recovery activities not addressed by Sections 3.1 and 3.2.

Table 1. Regional priority needs and U.S. Recovery Plan (RP) priority for Western Pacific leatherback turtles. Relevant projects that address needs are listed (see Appendix D for summary description of projects). Appendix D provides project status (ongoing or completed), but does not necessarily mean that additional efforts to support management needs are not warranted.		
Management needs	RP Priority	Relevant Projects
Understand, quantify and work to reduce and/or mitigate the impact of fishery bycatch and incidental mortality. <ul style="list-style-type: none"> - Assess fishery impacts to migrating and foraging leatherbacks in the Sulu Sulawesi, South China, Bismark and Coral Seas. 	1	1-8; 45
Reduce mortality and bolster survivorship. Implement suitable, science-based and culturally appropriate management measures to reduce nesting beach impacts (from predation, harvest, erosion/inundation, elevated sand temperatures, and any other factors impacting nests). <ul style="list-style-type: none"> - Implement mitigation measures to protect nests, nesting turtles and nesting sites to protect & increase hatchling production. - Implement and expand local community incentive programs to build capacity for community participation/awareness/buy-in of conservation needs to reduce harvest pressure. - Increase education/outreach and community awareness. 	1	40-47
Increase international collaborations to encourage national authorities to become actively engaged and supportive in conservation and management efforts. Increase locally-based in-country enforcement.	1	86
Increase and enhance capacity-building for locally-based project management.	1	40,46,47
Encourage internationally-based stranding programs to track threats.	2	
Facilitate development of locally-based research, conservation and management plans, to include standardized data collection protocols.	1	86
Research needs to inform management decisions	RP Priority	Relevant Projects
Determine annual abundance of nesting activity in the W. Pac. <ul style="list-style-type: none"> - Improve assessments and demographic understanding of the Papua Barat, Birds Head nesting population. - Continue (or establish) long-term nesting beach monitoring at key index sites in the region. - Quantify factors impacting hatchling production and obtain better estimates of the number of hatchlings produced - Increase our understanding of nesting activity during austral summer months (April – August) 	1	40-49
Define/characterize cumulative fishery impacts to Pacific leatherback aggregations in the N. Pacific and Asian regions.	1	1-8, 45, 48, 65
Increase our understanding of in-water populations and habitat use of the W. Pac. nesting aggregation (abundance, distribution, trends, habitats, and threats).	1	40-48; 66, 75-83

Loggerhead turtle (*Caretta caretta*)

Loggerhead turtles are circumglobal, inhabiting continental shelves, bays, estuaries, and lagoons in temperate, subtropical, and tropical waters. In September 2011, the Services (NMFS and USFWS) determined that the loggerhead turtle (*Caretta caretta*) is composed of nine distinct population segments (DPSs) that constitute “species” that may be listed as threatened or endangered under the ESA (Conant et al. 2009; 76 FR 58868: Sept. 22, 2011). These loggerhead DPS populations include: North Pacific Ocean, South Pacific Ocean, North Indian Ocean, Southeast Indo-Pacific Ocean, Southwest Indian Ocean, Northwest Atlantic Ocean, Northeast Atlantic Ocean, South Atlantic Ocean, and Mediterranean Sea. In the Pacific, the two loggerhead turtle DPS populations, North Pacific and South Pacific, have been listed as endangered (76 FR 58868: Sept. 22, 2011).

The North Pacific loggerhead DPS primarily nests in Japan (Kamezaki et al., 2003), although low level nesting may occur outside of Japan in areas surrounding the South China Sea (Chan et al. 2007; Conant et al. 2009). Based on tag-recapture studies, the East China Sea has been identified as the major habitat for post-nesting adult females (Iwamoto et al. 1985; Kamezaki et al. 1997, 2003; Kobayashi et al. 2008, 2011). Satellite tracking of juvenile loggerheads indicates the Kuroshio Extension Bifurcation Region in the central North Pacific Ocean to be an important pelagic foraging area for juvenile loggerheads (Polovina et al. 2006; Howell et al. 2010). Other important juvenile turtle foraging areas have been identified off the coast of Baja California Sur, Mexico (Peckham et al 2007).

Sources of mortality for North Pacific loggerheads in addition to U.S. commercial fisheries include: human encroachment and egg harvest/predation on nesting beaches; nesting beach alteration (armament and habitat degradation) in Japan, incidental take in coastal fisheries in Mexico and Japan, incidental capture in high seas fisheries across the North Pacific, and climate change (Conant et al. 2009; Gardner and Nichols 2001; Gilman et al. 2009; Dutton and Squires, 2008; Peckham et al. 2007, 2008; Kudo et al. 2003, Ishihara 2007; Koch et al. 2006; Matsuzawa et al. 2002; Van Houtan and Halley 2011; Wallace et al. 2010b). Partially due to recent major reductions in the number of loggerheads caught in U.S.-based commercial fisheries as a result of gear modifications and pelagic habitat research (Gilman et al. 2006, 2007; Howell et al. 2008), interactions and mortality with coastal and artisanal fisheries in Mexico and the Asian region likely represent the most serious threats to North Pacific loggerheads (Gilman et al. 2009; Peckham et al. 2007, 2008; Ishihara et al 2007; Ishihara 2009; Conant et al. 2009). Furthermore, climate change and variability appears to be a growing threat to this species (Matsuzawa et al. 2002; Matsuzawa 2006; Van Houtan and Halley 2011). Emerging research suggest loggerhead nesting trends may be strongly correlated to ocean conditions (Van Houtan and Halley 2011). In Japan, many nesting beaches are lined with concrete armoring, thereby causing turtles to nest below the high tide line where most eggs are washed away unless the eggs are moved to higher ground (Matsuzawa 2006). Additional threats to nesting and nest success include light pollution, poorly managed ecotourism operations, and increasing numbers of beachfront hotels and roadways (Kudo et al. 2003). Overall, coastal development and coastal armoring on nesting beaches in

Japan are significant threats to the persistence of this population (Conant et al. 2009; 76 FR 58868; September 22, 2011). Efforts to recover this species must undoubtedly consider and integrate a Tri-national approach between Japan, U.S., and Mexico (and potentially other Asian countries) as appropriate.

In the South Pacific, loggerhead turtles nest primarily in Queensland, Australia, and, to a lesser extent, New Caledonia and Vanuatu (NMFS and USFWS 1998a). During the late 1970s, an estimated 3,500 loggerheads nested in eastern Australia annually, but since that time there has been a substantial decline of over 86% with less than 500 females nesting annually by 2000 (Limpus and Limpus 2003; NMFS and USFWS 2007a). In 2005, a pilot study in New Caledonia identified approximately 60-70 loggerheads nesting on four beaches (Limpus et al. 2006), but based on anecdotal information, nesting activity in New Caledonia may have declined by two orders of magnitude since the 1970s (Limpus 2009). An unknown portion of South Pacific loggerheads forage off Chile and Peru, and preliminary genetic information from Eastern Pacific foraging areas confirms that haplotype frequencies among immature turtles in these areas closely match those found at nesting beaches in eastern Australia (Alfaro-Shigueto et al. 2004; Conant et al. 2009). Large immature and adult loggerheads generally remain in the western South Pacific, inhabiting neritic and oceanic foraging sites (Limpus 2009).

For this nesting aggregation, the greatest threat to juveniles and adults is bycatch in non-U.S. commercial fisheries (trawl, gillnet, longline) (Limpus 2009; Alfaro-Shigueto et al. 2011). At Australian nesting beaches, impacts to loggerhead turtles include adult female take in legitimate aboriginal harvest and low level nest predation by foxes or other vertebrates (Limpus 2009). In New Caledonia, Limpus et al. (2006) documented a number of detrimental anthropogenic and environmental impacts including human harvest, nest predation by dogs, boat strikes, beach development and erosion, sedimentation, lighting impacts and vehicles. Loggerhead turtles are documented as bycatch in pelagic longline fisheries of the WCPFC monitored by the Secretariat of the Pacific Community (Oceanic Fisheries Program 2001 in Limpus 2009). As with the North Pacific DPS, recovery efforts for this species must incorporate a pan-Pacific approach throughout the Southern Hemisphere.

To date, NMFS management efforts relevant to loggerhead turtles pertain to overarching Western Pacific fishery management objectives described in Sections 3.1 and 3.2 as well as supporting efforts to bolster hatchling production (Matsuzawa 2010), understand and mitigate international fishery impacts (Ishihara 2009; Gilman 2009; Peckham 2008), and better understand pelagic ecology and migration (Howell et al. 2008; Polovina et al. 2006; Kobayashi et al. 2011). Table 2 outlines loggerhead-specific recovery activities not addressed by previous sections of this document.

Table 2. Regional priority needs and U.S. Recovery Plan (RP) priority for North Pacific loggerhead turtles. Relevant projects that address needs are listed (see Appendix D for summary description of projects). Appendix D provides project status (ongoing or completed), but does not necessarily mean that additional efforts are not warranted.		
Management needs	RP Priority	Relevant Projects
Understand, quantify and work to reduce and/or mitigate the impact of commercial, artisanal or recreational fisheries. - Reduce/mitigate impacts in coastal fisheries in Japan, Mexico, and other Asian countries as relevant.	1	1-9; 35, 37-39; 84
Maintain stranding program in Baja California Mexico. Encourage stranding programs in Japan.	2	35, 39
Maintain international collaborations to encourage nesting beach monitoring and beach management measures to mitigate impacts from low hatch success due to erosion, predation, or other environmental or anthropogenic impacts. - Encourage efforts to bolster hatchling production. - Encourage efforts to restore nesting beach habitats. - Encourage efforts to reduce tourism impacts.	1	36
Engage Asian and Mexican stakeholders (their communities and policy makers) in outreach and awareness raising initiatives to address/reduce fishery, direct harvest, and development impacts.	1	35, 36, 39
Research needs to inform management decisions		
Define/characterize cumulative fishery impacts in the North and Eastern Pacific and Asian regions	1	3,6,9,14,37, 65, 68-74
Continue international collaborations to facilitate/encourage long-term monitoring of index sites to obtain total estimates of nesting activity, including any other data/information regarding the status, trends, and threats.	1	36-39;
Continue to increase our understanding of pelagic and near shore habitat use, habitat quality, distribution, abundance, and relative threats (including anthropogenic induced climate change and climate variability on populations).	1	35, 66, 68-74; 80-83

Green Turtle (*Chelonia mydas*)

Green turtles in the Pacific are listed as threatened throughout their range, except for the endangered population nesting on the Pacific coast of Mexico. For management purposes, green turtles occurring in the PIR have been separated into three aggregations [however, not DPSs] based on differences in their nesting and foraging habitats which translate to different management and conservation priorities: Hawaiian green turtles, WCPO green turtles, and East Pacific green turtles.

For purposes of this Plan, green turtles nesting and foraging within the Hawaiian Archipelago are considered a discreet management unit separate from other Pacific stocks (Dutton et al. 2008). The primary nesting location at French Frigate Shoals (FFS) in the Northwestern Hawaiian Islands (NWHI) supports over 90% of documented green turtle nesting in Hawaii (Balazs 1976, 1980). Minor nesting also occurs at other atolls and islands in the NWHI¹³ and on Kauai, Oahu, Molokai, Lanai, and Maui (Parker and Balazs 2011). The Hawaiian green turtle population was subjected to extensive human exploitation from turtle and egg harvesting at foraging and nesting grounds from the mid-1800's until early 1960 (Balazs 1975; Chaloupka and Balazs 2007; Van Houtan in prep), and nesting habitat destruction as a result of development and WWII impacts (Balazs 1975, 1976; Niethammer et al. 1997; Balazs and Chaloupka 2004a). Since enactment of state and federal ESA protections in 1974 and 1978, respectively, the nesting population at FFS has exhibited high annual variability in nesting female abundance with an upward, 5.7% annual growth rate, nesting trend over the past thirty years (Balazs and Chaloupka 2004b; Chaloupka et al. 2008).

Green turtles in Hawaii are afflicted by fibropapillomatosis (FP), a debilitating tumor-forming disease. While the disease appears to have regressed over time (Chaloupka et al. 2009) it persists in the population and its occurrence shows spatial variability (Van Houtan et al. 2010). The PIFSC MTRP conducts health assessments focusing on FP to determine causes and impacts to individuals and the population. Van Houtan et al. (2010) theorize a connection between FP and the State's land use, waste-water management practices and invasive macroalgae suggesting a tight correlation exists between invasive algae and proliferation of FP. Research is currently ongoing, but pending additional scientific information results may lead to future management action.

The Interim Recovery Plan for Hawaiian Sea Turtles (Balazs et al. 1992) and the Research Plan for the Hawaiian Green Turtle (Kubis and Balazs 2007) outline risks to the survival and continued recovery of green turtles in Hawaii. These include: habitat degradation, disease [FP], incidental mortality from fishery interactions, human harassment, and illegal harvesting (Balazs 1992). Additional impediments to recovery may include climate change and associated sea level rise, predation, marine debris entanglement, and invasive algae (Baker et al. 2006; Kubis and Balazs 2007; Van Houtan et al. 2010; Arthur et al. 2008a, 2008b). Additional management considerations described in the 2008 Papahānaumokuākea Marine National Monument Management

¹³ Nesting occurs at Laysan, Lisianski, Pearl and Hermes, and Midway. Four infertile nests were laid at Kure in 2009. No information exists about nesting activity at Nihoa and Necker.

Plan include protection of nesting, basking, foraging, and migratory habitats within the NWHI monument.

Additional scientific information on green sea turtles found in Hawaii is needed to inform management decisions (Table 3). Evaluating demographic parameters (reproductive rates, nesting frequency, maturity, recruitment, growth and size distributions, survival) as well as abundance estimates and population assessment would be of value (NRC 2010).

Green turtles occurring throughout the WCPO are a complex matrix of shared aggregations from different nesting beach origins. Genetic sampling and analysis to assess regional stock structure is ongoing. The majority of WCPO green turtles originate from areas outside U.S. jurisdiction but may migrate through or forage within the PIR or may interact with Western Pacific fisheries managed by PIRO. Preliminary results suggest that green turtle aggregations foraging within the Marianas Archipelago, for example, are generally made up of turtles from regional Pacific Island rookeries, although further analysis may reveal contributions from distant rookeries (Dutton pers. comm. unpublished). Therefore, for management purposes this aggregation includes green turtles occurring in the U.S. Pacific Flag Areas (U.S. territories and PRIAs), and internationally from states with Compacts of Free Association (ROP, FSM, RMI), as well as other Pacific nations that are members of SPREP¹⁴, IOSEA¹⁵ and Asian region.

Green turtles are thought to have nested in nearly all countries and territories of the Pacific Islands region (Micronesia, Melanesia, and Polynesia), likely creating substantial sub-population structure as has been found around Australia (Dethmers et al. 2006). Green turtle aggregations occurring within PIRO's management jurisdiction are also linked to the IOSEA and SPREP regions as confirmed via satellite telemetry and/or genetic analysis (Cruce and Kolinski et al. in prep; Cheng et al. 2008; Dethmers et al. 2010; Dutton et al. unpublished; Guam DAWR unpublished; Kuen 2011; Norman et al. 1994; PIRO/RMI unpublished; Moritz et al. 2002; Palau BMR 2008; SPREP 2010; Maison et al. 2010).

Threats in Asia and the PIR impact WCPO green turtles as they straddle these regions. These includedirected harvest fueled by ongoing trade in turtles in China and Vietnam (Pilcher et al 2007; Chan et al. 2009; TRAFFIC Southeast Asia-Indochina 2004) and fishery bycatch in commercial and artisanal near shore fisheries (Lewison and Crowder 2006, 2009; Gilman et al. 2009; Pilcher et al. 2008; Peckham et al. 2007; Stewart et al. 2010; Wallace et al. 2010b; Alfaro-Shigueto et al. 2011). Efforts to increase our understanding of important habitats, anthropogenic impacts, and mixed stock foraging

¹⁴ SPREP membership includes: 21 Pacific island member countries and territories (American Samoa, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Guam, Kiribati, Marshall Islands, Nauru, New Caledonia, Niue, Northern Marianas, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu and Wallis & Futuna) and four developed countries (Australia, France, New Zealand and United States of America).

¹⁵ As of January 1, 2012, there are 33 member countries of the IOSEA. IOSEA countries relevant to this plan only include: Australia, Bangladesh, Cambodia, India, Indonesia, Malaysia, Myanmar, Papua New Guinea, Philippines, Sri Lanka, Thailand, and Viet Nam.

structure of species continue to be high priority for WCPO marine turtle management actions (Table 4).

SPREP's 2008-2012 Marine Turtle Action Plan (MTAP) provides an opportunity to coordinate NMFS goals with regional recovery and management. The goal of the SPREP MTAP is to conserve marine turtles and their habitats, in keeping with the traditions of the people of the Pacific Islands region (SPREP MTAP 2007). According to SPREP, unsustainable harvest, feral animal predation of nests, incidental capture in commercial fishing, degradation of habitat (e.g. coastal development and natural disaster), pollution and marine debris, boat strikes and climate change are the main threats to marine turtles in the region. Limited financial and personnel (including capacity) resources available for implementing educational programs and other management and conservation actions in the region, and a general lack of data on demographics and trends are identified as primary challenges impeding effective conservation for green turtles in the WCPO.

Eastern Pacific green turtles nest on the west coast of Mexico and elsewhere in Central America, including Revillagigados Islands, Mexico and Galapagos Islands, Ecuador, with an estimated 3,319 – 3,479 Eastern Pacific females nesting annually in the past few years (NMFS & USFWS 2007d). At the primary nesting sites in Michoacan, Mexico and the Galapagos Islands, nesting activity has increased steadily since the 1970s with both sites reported to host between 1,000 and 2,000 nesting females annually (NMFS & USFWS 2007d). In addition, previously unknown nesting areas have recently been discovered in El Salvador (J. Seminoff, pers. comm.), further boosting estimates of the Eastern Pacific population. While East Pacific green turtles occasionally interact with U.S. based commercial fisheries (NMFS 2005) and have been observed, captured, and sampled at Palmyra Atoll, their nesting and nearshore foraging habitats fall largely within the area of responsibility for the NMFS Southwest Region (SWR). Therefore, PIRO management efforts for this aggregation will focus primarily on maintaining fisheries bycatch mitigation efforts described in Sections 3.1 and 3.2.

Table 3. Regional priority needs and U.S. Recovery Plan (RP) priority for Hawaii green turtles. Relevant projects that address management or research needs are listed (see Appendix D for summary description of projects). Appendix D provides project status (ongoing or completed), but does not necessarily mean that additional efforts are not warranted.		
Management needs	RP Priority	Relevant Projects
Assist the state of Hawaii in implementation of their ESA Section 6 program (which includes turtles).	1	8-11, 15,16,
Maintain and expand outreach and education initiatives to promote co-existence to reduce harassment, public disturbance, and fishery impacts of turtles in near shore MHI habitats.	1	15-18
Support and encourage efforts to reduce boat strikes.	1	16
Monitor disease [FP] and other ecosystem research. Implement mitigation and management measure as appropriate, and convene meetings or workshop to disseminate information to policy makers and State management officers.	1	16
Maintain stranding program	2	11
Encourage efforts (i.e., NOAA marine debris program) to restore habitats and remove derelict gear from coral reefs of the PIR	1	53, 83
Implement any management actions in NMFS jurisdiction resulting from future Green Turtle Status Review(s).	1	
As per management recommendations in Papahānaumokuākea Marine National Monument Management Plan (2008) protect nesting, basking, foraging, and migratory habitats within the NWHI monument: <ul style="list-style-type: none"> - Prevent introduction of mammalian predators, - Reduce artificial lighting near nesting beaches, - Prohibit undesirable habitat alteration, - Control human access and minimize disturbance, - Minimize and manage vessel hazards to habitats and to foraging and migrating turtles, - Mitigate climate change & associated sea level rise impacts at nesting habitats. 	1, 2	14, 15
Research needs to inform management decisions	RP Priority	Relevant Projects
Increase understanding of in-water population abundance, distribution, habitat use, and reef ecology: <ul style="list-style-type: none"> - Ensure in-water index sites are representative of the population and habitats with systematic surveys adequate to assess population distribution, trends, and abundance. - Ensure in-water habitat studies include relevant near shore index sites (to include productive reef habitats). - Assess body condition and health (including assessments of contaminants and parasite loads). - Increase understanding of foraging ecology and ecosystem relationships between turtles and other marine organisms (sharks, reef fish, invertebrates, and algae). - Continue to assess impacts of invasive marine algae to turtles. 	1	54-59, 66 80-83

Analyze stranding data to assess geospatial hotspots of impacts, such as from FP, boat strikes, harvest, and near shore fishery-induced strandings.	1	11
Assess/quantify impact of barbless circle hooks currently assumed to reduce interactions, impacts, or mortality to protected species.	1	10
Expand survey efforts at FFS, throughout NWHI, and MHI to identify habitats and determine nesting, basking, and relative threats.	1	54
As per research recommendations in Papahānaumokuākea Marine National Monument Management Plan (2008): <ul style="list-style-type: none"> - Maintain current nesting monitoring at East Island - Periodically assess distribution of nesting activity throughout NWHI - Study nest-site temperature regimes to assess climate impacts - Identify and map areas of high turtle foraging activity and high-use corridors used by turtles migrating between their breeding sites and foraging areas 	1	53,54,57, 59, 64

Table 4. Regional priority needs and U.S. Recovery Plan (RP) priority for WCPO green turtles occurring in the PIR. Relevant projects that address needs are listed (see Appendix D for summary description of projects). Appendix D provides project status (ongoing or completed), but does not necessarily mean that additional efforts are not warranted.		
Management needs	RP Priority	Relevant Projects
Understand, quantify, and work to reduce and/or mitigate impacts of commercial, artisanal and recreational fisheries throughout the Pacific Islands and IOSEA regions with shared WCPO aggregations	1	1-10, 34 63-67; 80-82
Continue to build capacity to ensure long-term implementation of PIR marine turtle programs. <ul style="list-style-type: none"> - Establish NMFS Sect 6 agreement with Guam and Am.Samoa and maintain CNMI's agreement. - Facilitate and encourage CNMI, Guam, and Am.Samoa to draft locally-relevant Sea Turtle Research & Management Plans. 		63, 64, 80-82
Maintain & encourage stranding programs in U.S. Flag Areas	2	23-28
Strengthen coordination with Marine National Monument Program to effectively contribute to Monument management planning so that sea turtles are effectively represented.	NA	29
Continue to address and reduce unsustainable harvest of WCPO aggregations (of eggs & turtles): <ul style="list-style-type: none"> - Strengthen (culturally relevant) E/O to address and reduce harvest. - Encourage CITES compliance with international partners to reduce direct harvest and trade of turtles. Includes coordination with F/PR, F/IA, USFWS, SPREP and IOSEA. - Empower SPREP and SPREP member nations to strengthen enforcement and in-country legislation (where relevant) to ensure regulations are based on sound biological information. - Empower SPREP and SPREP member nations (leaders) to better understand and address local impacts to turtles and their habitats. 	1	19, 23-33

Encourage efforts to reduce feral animal predation (nests and turtles), degradation of habitats (coastal development), pollution/debris, and boat strikes in SPREP member nations.	1	23-33, 53, 83
Encourage establishment of index site monitoring in SPREP member countries.	1	19, 23-30
Develop joint research and conservation plan uniting management actions of the PIR with IOSEA region for shared WCPO aggregations.	1	34
Research needs to inform management decisions	RP Priority	Relevant Projects
Publish results of collaborative satellite tracking studies of tags deployed in FSM, RMI and Mariana's (Guam and CNMI).	1	
Acquire estimates of total green turtle nesting throughout Oceania, including any other data/info regarding status, trends, threats, and genetic stock structure of population(s) to help inform management actions.	1	23-37; 66, 63-64; 80-83
Maintain (encourage) population assessment and threat identification programs at nesting and in-water index sites in U.S. Flag Areas and Freely Associated States	1	23-32
Undertake annual rapid assessments (or establish annual field season) at Rose Atoll	1	
Increase understanding of in-water populations, habitats, threats and connectivity. <ul style="list-style-type: none"> - Assess mixed stock foraging dynamics via genetics and satellite telemetry to further elucidate international connections 	1	23-29; 63-64, 66, 80-83

Hawksbill turtle (*Eretmochelys imbricata*)

Hawksbill turtles are endangered throughout their global range. For PIRO PRD management purposes, hawksbill turtles in the PIR have been separated into two aggregations based on differences in their nesting and foraging habitats which translate to different management and conservation priorities: Hawaiian hawksbills and WCPO hawksbills.

The Hawaiian archipelago supports a small population of hawksbill turtles, with five to fifteen individuals nesting each year on the Big Island of Hawaii, and 1-2 nesting females annually on Maui. Additional low-level nesting also occurs annually on Molokai. Preliminary genetic research suggests that the population in Hawaii may be genetically distinct from other Pacific hawksbills (Dutton et al. 2008b). Between 1989 and 2010, hawksbill nesting has been documented at fourteen sites on the Island of Hawaii, five on Maui, and at least one on Molokai with over 100 individual nesting females tagged (Sietz et al. in prep). Primary threats to hawksbill turtle recovery in Hawaii include habitat alteration and degradation, coastal development, beach erosion, non-native predators and vegetation, marine debris, boat strikes, and recreational fisheries interactions (Katahira et al. 1994; NMFS & USFWS 2011 in review). Satellite tracking of post-nesting females suggests animals stay within the waters of the MHI (Parker et al. 2009), however, there still remains a significant lack of information regarding hawksbill turtle foraging habitat use around the MHI including habitat use by post hatchling and juvenile hawksbills. Priority activities identified by state and federal agencies, academia, and non-governmental organizations are summarized in the NMFS and USFWS (2011 in review) Five Year Action Plan for Research and Management of Endangered Hawksbill Sea Turtles in Hawaii (Table 5).

WCPO hawksbill turtles nest in small numbers in several archipelagos, including Samoa, Fiji, the Marianas, Micronesia, the Marshall Islands, Palau, the Solomon Islands, Tonga, and Vanuatu (NMFS & USFWS 2007e). The largest WCPO hawksbill rookeries are in Fiji and the Solomon Islands, where harvest of adults and eggs still appears to be occurring at unsustainable levels (Limpus and Miller 2008; Broderick and Pita 2004). Total number of nesting females for the WCPO hawksbill population has been estimated at 940 – 1,200 females annually with an overall downward trend (NMFS & USFWS 2007b). Baseline nesting demography, population status, trends, and genetic stock structure information for hawksbill turtles is lacking throughout the species' range in the WCPO. Major causes of continued decline include commercial exploitation driven by the continuing demand for hawksbill shell (bekko) (TRAFFIC Southeast Asia-Indochina 2004), directed harvest of eggs, poaching of adult and immature turtles (Chan et al. 2009; Limpus and Miller 2008), and destruction and degradation of nesting habitats and coral reefs that provide foraging and resting areas (NMFS and USFWS 2007e). Efforts to increase our understanding of important habitats, anthropogenic impacts, and mixed stock foraging structure continue to be high priority for WCPO hawksbill turtle management actions (Table 5).

Table 5. Regional priority needs and U.S. Recovery Plan (RP) priority for hawksbill turtles. Relevant PIR projects that address needs are listed (see Appendix D for summary description of projects). Appendix D provides project status (ongoing or completed), but does not necessarily mean that additional efforts are not warranted.		
Management needs	RP Priority	Relevant Projects
Maintain nesting beach monitoring activities in Hawaii and mitigate threats and impacts at nesting beaches (invasive plants, predators, lighting, beach use conflicts, etc.).	1	20,21
Assess, reduce and/or mitigate near shore fishery impacts in Hawaii.	1	9, 10, 15-16
Continue to pursue and facilitate projects to better understand habitats throughout the PIR and WCPO	1	22-29, 62
Increase public awareness among island communities about the presence and status of Hawaii hawksbill population, the cultural significance, and actions the public can take to promote conservation and recovery of the species.	1	22
Maintain PIR stranding programs	2	11, 22-29
Maintain NOAA's marine debris program to restore habitats and remove derelict gear from coral reefs (turtle habitats) of the PIR.	1	53, 83
Continue to address and reduce harvest of WCPO hawksbill turtles <ul style="list-style-type: none"> - Encourage CITES compliance with international partners to reduce direct harvest and trade of WCPO turtles. Includes coordination with F/PR, F/IA, FWS, IOSEA, SPREP and CITES. 	1	32, 34
Develop joint research and conservation plan uniting management actions of the PIR with IOSEA region for shared WCPO aggregations.	1	
Research to inform management decisions	RP Priority	Relevant Projects
Increase our understanding of in-water populations, distribution and abundance <ul style="list-style-type: none"> - Continue to assess/monitor the Hawaii population through ID of turtles in foraging habitats; capture-mark-recapture; and stranding program - Undertake spatial GIS analysis of stranding data 	1	22-30, 62-64, 85
Continue to collect information on population dynamics of hawksbills in Hawaii <ul style="list-style-type: none"> - Continue to identify and assess threats at all major nesting beaches - Facilitate peer review publication of existing data. - Model population characteristics - Increase understanding of foraging ecology, growth rates, and ecological relationships necessary to support recovery. 	1	21,22 80-82

Olive ridley turtle (*Lepidochelys olivacea*)

Olive ridley turtles occur in the U.S. EEZ waters and interact with Hawaii-based longline fisheries. The largest olive ridley *arribadas* occur in India, Mexico, and Costa Rica (NMFS and FWS 1998c; NMFS and FWS 2007c). Olive ridleys foraging in the western Pacific likely originate from aggregations in India, other western Pacific beaches, Mexico and Costa Rica (NMFS and FWS 2007c; NMFS 2008). The eastern Pacific population has increased dramatically in the past decade to over 1 million nesting turtles, since closure of the directed fishery in 1990 (Marquez-M. et al. 2005). Eguchi et al. (2007) survey results between 1992 and 2006 were consistent with the dramatic increases of olive ridley nesting populations that have been reported over the past decade for beaches in the Eastern Tropical Pacific. Prior to that closure, large-scale commercial harvest of eggs and directed commercial take of juveniles and adults for leather were the primary sources of mortality. Today, coastal development and habitat degradation, illegal harvest of eggs, and incidental take in pelagic longline, coastal gillnet, and trawl fisheries are the primary sources of mortality (Dutton and Squire 2008; NMFS and FWS 2007c).

Primary PIRO management and recovery activities for olive ridley turtles focus almost entirely on fishery management objectives achieved through fishery management measures of Western Pacific fisheries as described in Section 3.2. A number of projects have been implemented that may benefit Pacific olive ridley populations. These include: projects # 1-9, 49-51, 65, 80 – 84 (See Appendix B). PIRO PRD encourages any programs working with other marine turtle species to collect information opportunistically, when possible, on olive ridleys during the course of project activities (including the collection of genetic DNA samples). Mitigation or elimination of impacts from other (non-fishery) federal actions (i.e., military or development) are achieved through section 7 consultations as described in Sections 3.1 and 3.2 of this document.

4.0 PIRO Division-Specific Management Activities

The following section describes management actions and programs supported and implemented by PIRO's four divisions to progress or address regional, multi-species, or species-specific priority needs for marine turtle recovery under the ESA or other mandates.

4.1 Protected Resources Division

PIRO PRD has the primary authority to implement the ESA to recover listed species occurring within NMFS jurisdiction of the PIR. PRD implements or supports recovery projects and priority tasks of the five Recovery Plans for U.S. Pacific Sea Turtle Populations (NMFS & USFWS 1998a-e). PRD staff conduct analyses of human impacts on protected species, recommend mitigation measures to minimize or eliminate negative impacts, support conservation and recovery projects and build local capacity for species conservation through training, education, and technical assistance. PRD implements the sections of the ESA as previously described (Section 3.1; Appendix C), works with other federal, state and U.S. territory partners to fulfill recovery obligations of the ESA, and assists in efforts to comply with or implement recommendations consistent with that of binding and non-binding instruments designed to facilitate international conservation such as that of RFMOs, MSA, IAC, IOSEA, SPREP, and others.

PRD drafts adaptive annual implementation plans based on available resources and capacities but with the goal of achieving the following objectives in order to implement and guide recovery activities of PIRO's Marine Turtle Management Program (MTMP). These eight programmatic objectives are not ranked in order of priority, and to the extent possible are implemented by the MTMP concurrently.

1) Maintain regional efforts to reduce and mitigate bycatch in fisheries.

Interactions in commercial, artisanal and recreational fisheries are a well documented threat to Pacific marine turtles (NMFS and USFWS 2007a-e; NRC 1990; FAO 2004, 2010), and are the top priority for recovery as stated in the U.S. Recovery Plans. Additionally, there is a growing understanding that small-scale artisanal and coastal fisheries are a significant threat to marine turtles (Gilman et al. 2009; Lewison and Crowder 2007; Lewison et al. 2004, 2006, 2009; Pilcher 2009; Peckham et al. 2007, 2008; Stewart et al. 2010; Wallace et al. 2010; Alfaro-Shigueto et al. 2011). Through the management actions described in sections 3 of this document, PRD will contribute to efforts to understand, assess, and reduce fishery impacts that may impact shared marine turtle species of the WCPO. Such efforts will likely occur in close coordination with SFD, IFD, and PIFSC FICP.

FY12-16 Actions/Projects:

A. Western Pacific U.S.-commercial fisheries

- Conduct consultations with SFD under section 7 of the ESA to ensure that federally authorized fisheries do not jeopardize the continued existence or recovery of ESA-listed species.

- Provide technical support as needed to the OP, SFD and IFD to promote bycatch reduction technology and mitigation.
 - Assist SFD evaluate if regulatory measures are adequately reducing sea turtle mortality or fishery interactions.
 - Support efforts to increase and improve data collection to improve longline fisheries management (such as through gear research or gathering of information to better estimate post-release/interaction survivorship of marine turtles bycaught in longline fisheries).
 - Assist SFD to address WPFMC proposals that impact marine turtles.
- B. Non-U.S. managed fisheries
- Support the international exchange of responsible and sustainable longline fishery gear technologies and bycatch handling techniques proven beneficial to marine turtle conservation, including promotion of capacity and expertise in regional observer programs and compliance with RFMO conservation measures.
 - Continue to facilitate efforts to develop and implement measures to reduce and mitigate fishery bycatch and incidental mortality in international coastal artisanal and set-net, and other gear type fisheries impacting WCPO shared aggregations.
- C. Participate in fishery-based international meetings and symposia as applicable.

2) Continue to monitor, mitigate and reduce [non-fishery] anthropogenic impacts to turtles in the marine environment.

Section 3 of this Plan outlines a number of regional threats in the marine environment that must be addressed to aid in recovery. Often, fulfilling ESA mandates requires immediate attention to certain activities in order to comply with statutory deadlines. These activities become high priority to the MTMP. Other marine threats are emerging and additional information or research is needed to inform management decisions.

FY12-16 Actions/Projects:

- A. Consultations under section 7 of the ESA on federal actions as needed.
- B. Implement ESA section 4.
 - Assist with upcoming Green Turtle Global Status Review and implement any resulting management actions.
 - Participate in PIR-relevant critical habitat designation determinations or Recovery Plans.
- C. Assist with implementation of section 10 of the ESA as needed (e.g., review research permits).
- D. Climate Change
 - Monitor and assess climate change issues as they may relate to marine turtle recovery needs or management obligations.
- E. Marine Debris

- Monitor and assess marine debris issues as they may relate to recovery needs or management obligations.
 - Continue to promote efforts (encourage program development) to remove derelict fishing gear or debris from near shore and marine environments potentially impacting turtles or their habitats throughout the PIR.
- F. Marine Commerce and Exploration
- Monitor and assess Marine Spatial Planning activities and initiatives as they apply to marine turtle issues.
- G. Attend meetings or symposia as applicable

3) Continue and further recovery and management activities within the Hawaii Archipelago.

Green and hawksbill turtles occur within the near shore habitats of the Hawaiian Archipelago. On July 31, 2012, NOAA and USFWS announced they will work together to conduct a global status review of green turtles (77 FR 45571). This status review may identify additional or continuing conservation and management needs. Pending the determinations of the status review, the following activities will be employed that will benefit both green and hawksbill turtles occurring within the Hawaiian Archipelago. Furthermore, given that an informed public is integral to the protection and recovery of protected species, education and outreach is a high priority in MTMP's management efforts as well as a Priority 1 activity in the Recovery Plans. The MTMP will therefore work to maintain and expand public outreach and awareness programs to reduce and address anthropogenic impacts to turtles in Hawaii. This includes partnering with various community-based programs and providing accurate, understandable, and science-based information to local residents, tourists, and communities.

FY12-16 Actions/Projects

- A. Maintain the state of Hawaii's section 6 cooperative agreement.
- B. Continue to facilitate hawksbill turtle recovery and conservation efforts to mitigate threats and impacts at nesting and foraging habitats as per NMFS and USFWS Five Year Action Plan for Research and Management of Hawksbills in Hawaii (2011 in review).
 - Co-convene annual Hawaii Hawksbill Turtle Stakeholder meetings to progress recovery actions and hawksbill plan implementation.
- C. Facilitate implementation of management measures outlined in the 2008 Papahānaumokuākea Marine National Monument Management Plan.
- D. Continue to monitor ecosystem research and emerging scientific information to inform management or mitigations measures as appropriate.
 - Strengthen management coordination with PIRO HCD and SFD.
- E. Continue to Implement MTMP's Hawaiian Green Sea Turtle Outreach Plan (the result of a March 2010 multi-agency workshop) to address threats to the population stemming from human disturbance, boat strikes, nearshore fishery interactions, misleading information/perceptions, and illegal harvest.

- Continue to work with the state and other partners to build fisherman awareness via PRD's *Fishing Around Sea Turtles* program to raise capacity to reduce and mitigate near shore fishery impacts, promote realistic gear mitigation measures, disseminate factual information (via FAQs), dispel public misperceptions, and build long-term capacity for fishing around turtles in Hawaii into the future.
 - Collaborate with the State Division of Boating and Ocean Recreation (DOBOR) to reduce boat strikes.
 - Develop and disseminate signage, educational materials, and Fact Sheets (FAQs) about relevant topics to inform and raise public awareness.
 - Maintain existing community-based outreach/education programs and help to establish new programs where human/turtle disturbance is problematic.
 - Promote NOAA's responsible viewing guidelines.
- F. Participate in community outreach events and volunteer training opportunities to disseminate factual information, promote the program, and be available to the public to answer questions and address concerns
- G. Convene meetings and seminars as needed to inform and empower key decision makers of Hawaii governance and relevant federal and state management programs to reduce, address or mitigate anthropogenic impacts to turtles.

4) Continue to build capacity that can support recovery and help marine turtle programs [outside Hawaii] to promote sustainable management of WCPO shared stocks

PRD's MTMP works to empower programs throughout the PIR to establish long-term marine turtle research, conservation, management and recovery programs. Building technical capacity of programs to implement standardized monitoring, conservation, and management activities for marine turtle resources is high priority. This includes maintaining established partnerships and collaborations to sustain regional momentum and build upon successes achieved to date. Given that PIR marine turtles belong to a complex matrix of shared resources of both SPREP and IOSEA regions, PRD works to maximize conservation and management efforts for internationally-shared WCPO nesting aggregations.

FY12-16 Actions/Projects:

- A. Coordinate Marine Turtle Recovery Implementation with federal, state, territory, and other local partners throughout the PIR:
- Continue to provide Section 6 technical assistance to conservation and management partners in CNMI, Guam, and American Samoa.
 - Continue to provide technical support to PIR turtle programs in CNMI, Guam, Am. Samoa, and PRIAs.
 - Evaluate continuing programmatic needs and solicit input from local partners to better define PRD's role for capacity building in recovery and management efforts.

- Continue to encourage regional coordination and locally-based partners (e.g., University, Navy, etc.) to undertake or assist in monitoring activities.
 - Promote education and outreach to reduce illegal harvest and increase community involvement and buy-in for the protection and conservation of marine turtles in the U.S. territories.
 - Collaborate with PIRO Monument Program, PIFSC, and FWS staff to promote opportunities and integrate marine turtle research, management, and recovery efforts into the Pacific Remote Islands Marine National Monument Management Plan.
 - Convene workshops or meetings to build technical program capacity or address conservation and recovery needs.
- B. WCPO International Management and Collaborations:
- Continue to encourage cross-regional coordination (between the PIR, SPREP and IOSEA regions) to best coordinate conservation planning and management of shared WCPO aggregations.
 - Contribute to engagement with IOSEA and SPREP secretariats as needed.
 - Promote and continue efforts to monitor, conserve, and recover shared WCPO aggregations. Priority aggregations include: Western Pacific leatherback, North Pacific loggerhead, and WCPO green and hawksbill turtles given their population status, potential interactions with Western Pacific federally-managed activities, and regional connectivity to the PIR.
 - Attend international marine turtle meetings as applicable.

5) Support and encourage stranding programs

Stranding programs are essential to understanding population threats to marine turtle populations and for identifying measures to reduce such impacts. For this reason, stranding programs throughout the PIR and continued analysis of data are encouraged under this Plan even though stranding programs are listed as a Priority 2 activity in the Recovery Plans. In Hawaii, the Sea Turtle Stranding and Salvage Network¹⁶ is housed within PIFSC MTRP. In the U.S. territories, stranding programs are managed by local government offices. Stranding programs will guide management decisions in Hawaii, U.S. territories, and internationally by providing information on the types of threats causing injury and mortalities to local populations.

FY12-16 Actions/Projects:

- A. Track Hawaii stranding activity via quarterly reporting provided by PIFSC MTRP stranding program.

¹⁶ The PIFSC MTRP conducts and manages a sea turtle stranding and salvage network in Hawaii that involves long-term time series datasets, with ancillary objective and benefits involving rescue, rehabilitation, and return of stranded turtles to the wild.

- B. Facilitate efforts to maintain stranding programs in all three U.S. territories to gather baseline information on threats and impacts.
- C. Facilitate efforts to maintain international stranding programs to assess impacts to shared WCPO aggregations of high management concern (i.e., loggerhead and leatherback turtles in particular).

6) Continue to facilitate and support projects to advance stock assessment and management capacity to support conservation and recovery efforts. [Bulk of work supported by Science Centers and other partners but included here to acknowledge need and possible PRD funding support]

Effective management of long-lived, highly migratory sea turtle species requires knowledge of spatial patterns of distribution and regional connectivity. Genetic research is a significant component of characterizing turtle population structure and shared stock dynamics to identify stock origins and help to direct fishery management actions. It is therefore a high priority to PIRO¹⁷ as well as Priority 1 activity in the Recovery Plans. Given that a region-wide understanding of marine turtle foraging habitats and connectivity does not currently exist (NRC 2010), PRD views gathering information about foraging assemblages, genetic samples (and analysis thereof), and marine habitat usage important to inform management decisions and facilitate development of an integrated, international conservation strategy. All projects supported or implemented by PRD with permits to handle turtles and export samples are required to collect genetic samples. PRD staff also work closely with the SWFSC, PIFSC, SPREP, and IOSEA member countries to acquire samples for genetic stock structure analysis.

FY12-16 Actions/Projects:

- A. Continue to contribute and support efforts towards a Pacific Green Sea Turtle Genetic Mitochondrial DNA Stock Analysis to characterize nesting beaches and for foraging habitat mixed stock analysis.
 - Continue to promote genetic sample collection throughout the region.
- B. Continue to promote satellite telemetry and capture-mark-recapture studies to obtain a greater understanding of region-wide connectivity, habitat use, and population demographics. Priority aggregations include: Western Pacific leatherback, North Pacific loggerhead, WCPO green and hawksbill turtles, and Hawaii hawksbill turtles.
- C. Coordinate annual regional funding solicitations.¹⁸

¹⁷ The Conservation Recommendations in the NMFS 2010 Biological Opinion to reduce marine turtle interactions in the American Samoa-based longline fishery encourages the continuation of ecological, habitat use, migration, and genetics studies for stock structure analysis of green, hawksbill, leatherback, and olive ridley turtles occurring in Oceania.

¹⁸ PRD hopes to improve and strengthen coordination with the WPFMC. As of 2012, the WPFMC and PIRO have had separate processes to solicit projects to address management and research needs; however, it would benefit the region if there were one regional solicitation program that would ensure the process avoids duplication of efforts while ensuring consistency with recovery goals, existing programs, and transparency. Resulting projects of high merit would be assigned to the most appropriate funding or

7) Promote coordination with regional stakeholders and partners.

Communication and coordination with regional partners is critical to recovery efforts to optimize use of programmatic funding, ensure there is no duplication of efforts, and that high priority activities are implemented. This includes (but is not limited to) coordination with the PIFSC and WPFMC. The WPFMC contributes to regional recovery efforts through their Protected Species Conservation and Management Program that focuses on species that have interactions with Western Pacific federally-managed fisheries (WPFMC 2010; Appendix A). Projects implemented by WPFMC's sea turtle program, supported via PIRO cooperative grant agreement, become part of regional efforts to maximize recovery. Therefore, the WPFMC's protected species program should be in concert with NMFS to implement projects that are mutually agreed to benefit management and conservation needs for marine turtle species affected by Western Pacific commercial fisheries.

FY12-16 Actions/Projects:

- A. Review and coordinate with WPFMC's activities
 - Review the Council's annual grant proposals, grant reports, and draft products. Council products produced or developed as a result of NOAA funding (such as educational materials, final contract reports, etc.) are reviewed by PIRO to ensure consistency in messaging, and to ensure they contribute to relevant management and conservation mandates (such as section 7 consultations) and regional recovery planning efforts.
 - Participate via membership on the STAC to facilitate better coordination between offices, help guide conservation and management activities, and ensure consistency with regional recovery management needs, priorities, and actions.¹⁹
 - Coordinate regional funding solicitations.
- B. Convene annual PIRO/PIFSC turtle program meetings (updates and planning)
- C. Coordinate with USFWS, State, and Territories

8) Miscellaneous management activities

In addition to the above listed management activities, additional miscellaneous (and often unforeseen) management activities arise that are necessary to support recovery and management efforts including the annual operations of PRD's MTMP. These include,

implementation mechanism (NOAA or WPFMC) based on staff expertise and existing professional relationships.

¹⁹ The WPFMC process includes input from advisory groups and scientific committees, including advice from their Sea Turtle Advisory Committee (STAC). The STAC annually reviews the Council's sea turtle program and provides recommendations for continued support of programmatic activities. Given that much of the Council's projects are conservation and management oriented, PIRO PRD management staff must work with the STAC to ensure consistency with regional recovery management needs, priorities, and actions.

but are not limited to: 1) tracking PIR activities and providing status updates as appropriate (Biennial Reports to Congress, update USFWS Recovery Online Activity Reporting (ROAR) database, etc.); 2) reviewing management needs and working to identify research activities necessary to support management actions; 3) responding to lawsuits, FOIAs, congressional inquiries, etc.; and 4) conducting reviews as situations arise (and as requested) of manuscripts, biological opinions, Environmental Impact Assessments, etc.

4.2 International Fisheries Division

The PIRO IFD provides policy advice and technical and administrative support for regional fisheries objectives and implements international fisheries agreements in the WCPO. International cooperation in fisheries management is necessary due to the highly migratory nature of many of target and non-target species, including marine turtles. IFD coordinates PIRO involvement with many international organizations, as well as Asian and Pacific Island Nations, in coordination with the Office of Marine Conservation of the U.S. State Department. The IFD provides the initial point of contact with international partners – who in turn may work directly with technical and professional staff and experts at PIRO and PIFSC, as well as other NMFS/NOAA offices such as the F/PR.

FY12-16 Activities

- A. Continue to support implementation of sea turtle conservation measures in RFMOs.

4.3 Observer Program

The PIRO Observer Program (OP) provides observer coverage aboard Western Pacific federally-managed fisheries. Fishery observers are trained biologists who collect data on fishing activities onboard commercial fishing vessels in effort to provide data in support of science and management programs. The program collects a variety of information critical to stock assessment and fisheries management, including data pertaining to catch, bycatch, fishing effort, biological characteristics, interactions with protected resources, and socio-economic information. This information is used by NMFS to develop management measures such as bycatch reduction strategies and protected species regulations.

FY12-16 Actions/Projects

- A. Maintain fisheries observer coverage levels at scientifically defensible level for FY12-16.

Currently, observers are placed aboard Hawaii-based pelagic longline vessels targeting swordfish (shallow set, 100% coverage) and tunas (deep set, 20% coverage), and American Samoa-based longline vessels targeting albacore tuna (20% coverage). Observers record target fish catch, document incidental interactions with non-target fish

and protected species, collect fishing effort data by tallying fish that are kept and discarded, and process specimens for life history information.

- B. Continue to build capacity in regional observer programs.

The OP is also engaged in working with existing and emerging observer programs in the Pacific and Pacific Rim Countries, particularly regarding bycatch issues in longline fisheries. The program has: developed training modules for identification of species of special interest (protected species); developed protocol for handling of turtles and marine mammals; built on previous debriefing protocol and techniques; established minimum standards for observers; established a code of conduct and health/ safety objectives and standards for observers; and developed data handling protocols and designed databases, to name a few accomplishments. The OP also has a close working relationship with the Pacific Islands Forum Fishery Agency (FFA) and WCPFC observer coordinators and together collaborate on a number of in-country training and observer program development initiatives.

4.4 Sustainable Fisheries Division

PIRO SFD is responsible for implementing fishery management actions governing domestic fisheries in the Western Pacific. SFD consults with PRD under section 7 of the ESA to ensure that federally authorized fisheries do not jeopardize the continued existence of ESA-listed species. SFD administers mandatory annual protected species workshops for owners and operators of vessels with federal longline permits. Training includes protected species identification, handling and release techniques, mitigation, and regulatory requirements. SFD routinely collaborates with other divisions at PIRO to review and provide guidance on protected species handling and release topics. Observer trainees are also instructed by SFD in marine turtle dehooking, handling, and release techniques.

FY12-16 Activities

- A. Continue administration of classroom and on-line protected species workshops for longline fishing fleets based in American Samoa, CNMI, Hawaii and Guam.
- B. Continue support of a protected species workshop coordinator.
- C. Continue sea-turtle handling, resuscitation and release training of PIRO Observer Program trainees.
- D. Continue collaboration with PRD and PIROP to review, update and provide guidance on reducing and mitigating interactions between sea turtles and pelagic fisheries in the Western Pacific.
- E. Attend relevant sea turtle and fishery management conferences and meetings.

5.0 Plan Assessment

Annual NMFS planning meetings assist with the development of projects and regional priorities. It is during these meetings that representatives identify how to best coordinate recovery, research and management activities amongst the various partners for the coming fiscal year. This Plan, however, will be reviewed biennially to ensure that priorities and needs have not changed significantly and are relevant to the continued direction of activities and projects to implement the Recovery Plans for U.S. Pacific Sea Turtle Populations and fulfill NOAA/NMFS ESA mandates and responsibilities.

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Appendix A. WPFMC Protected Species Program

The Western Pacific Regional Fishery Management Council (WPFMC) is a quasi-federal organization that is responsible for developing fisheries management plans and works to conserve marine resources while maintaining opportunities for domestic commercial and non-commercial (i.e. recreational and subsistence) fishing at sustainable levels as mandated by the MSA. The WPFMC contributes to regional marine turtle recovery efforts through a protected species program that focuses on species that have interactions with Western Pacific federally-managed fisheries. The WPFMC process includes input from advisory groups and scientific committees, including advice from their Sea Turtle Advisory Committee (STAC). The STAC annually reviews the Council's sea turtle program and provides recommendations for continued support of programmatic activities. Projects implemented by WPFMC's sea turtle program that are supported via PIRO cooperative grant agreement are part of regional efforts to maximize recovery efforts. WPFMC goals and objectives should therefore be in concert with NMFS recovery obligations and work to implement projects that are mutually agreed to benefit management and conservation needs.

The goals of the WPFMC Protected Species Conservation and Management Program are consistent with the following guiding principles (WPRFMC 2010):

1. Support quality research and obtain the most complete scientific information available to assess and manage fisheries;
2. Promote an ecosystem approach in fisheries management, including reducing waste in fisheries and minimizing impacts on marine habitat and impacts on protected species;
3. Conduct education and outreach to foster good stewardship principles and broad and direct public participation in the Council's decision making process;
4. Recognize the importance of island cultures and traditional fishing practices in managing fishery resources and foster opportunities for participation;
5. Promote environmentally responsible fishing and the utilization of sustainable fisheries that provide long term economic growth and stability;
6. Promote regional cooperation to manage domestic and international fisheries; and
7. Encourage development of technologies and methods to achieve the most effective level of monitoring control and surveillance and to ensure safety at sea

Key goals of the WPFMC Protected Species Conservation and Management Program for FY2010-2014 are designed to:

- Improve information baselines and programs through which economic and social information is collected related to protected species interacting with fisheries managed within the jurisdiction;
- Continue to partner with industry, government agencies and non-governmental organizations to develop new technologies and methods to conserve protected species and improve habitat and ecosystem conservation and management;

- Increase both education and public participation opportunities to promote good stewardship and informed management of marine resources;
- Continue to promote environmentally responsible domestic commercial, recreational and subsistence fishing under sound conservation principles;
- Work with Regional Fisheries Management Organizations to develop and adopt new technologies to reduce bycatch of protected species; and
- Promote the development and application of creative fisheries monitoring and enforcement solutions that ensure cost-effective enforcement, and where possible, voluntary compliance with fisheries management measures and controls.

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Appendix B. Overview of Western Pacific Fishery Interactions with Sea Turtles

Information described below is a generalized summary of ‘observed’ interactions²⁰ in western Pacific U.S.-managed fisheries used to inform this Plan and assist in determining priorities for management or conservation activities. Where fishery-specific observer data are lacking, the allowable levels of incidental take from relevant NMFS Biological Opinions are provided. International (non U.S.) fisheries are also a concern, although the information provided in this appendix is only from western Pacific U.S.-managed fisheries. Currently [2012], observers are placed aboard Hawaii-based pelagic longline vessels targeting swordfish (100% coverage) and tunas (~20% coverage) and American Samoa longline vessels targeting albacore tuna (~20% coverage). As of January 1, 2010 the purse seine fishery under a WCPFC conservation and management measure required 100% observer coverage.

Leatherbacks: There are three demographic leatherback turtle populations in the Pacific that have been identified through genetic studies (Dutton et al. 1999, 2007; Benson et al. 2011): 1) a Western Pacific population that nests in Papua Indonesia, Papua New Guinea (PNG), Solomon Islands and Vanuatu, 2) an Eastern Pacific population that nests in Mexico and Costa Rica, and 3) a Malaysian population. Genetic analysis indicates that 100% (n = 18) of leatherback interactions with the Hawaii-based shallow-set longline fishery are with individuals from the Western Pacific leatherback population, the majority of which (93%) are adults (>120 cm SCL) (NMFS 2008; NMFS 2011 in prep). In the Hawaii-based deep-set longline fishery, 92% (n = 11 of 12) of observed leatherback interactions are with the Western Pacific leatherback population and 8% (n = 1 of 12) are with the Eastern Pacific leatherback aggregation (NMFS 2005; 2008). In 2011, there were two documented interactions with leatherback turtles in the American Samoa-based longline fishery. While stock origin information at the time of this Plan’s completion was unavailable, future section 7 consultations will address these interactions. NMFS estimates that 11 leatherback turtles per year may be incidentally taken as a result of the U.S. WCPO purse seine fishery (NMFS 2006).

Loggerheads: Of Hawaii-based longline fisheries, 100% of interactions have been with the North Pacific loggerhead turtle DPS that nests primarily in Japan (NMFS 2008; 76 FR 58868: September 22, 2011). Furthermore, the majority of interactions (96%) have been with juveniles (typically 50 – 80 cm carapace length) (NMFS 2008; NMFS 2011 in prep). NMFS estimates that 11 loggerhead turtles per year may be incidentally taken as a result of the U.S. purse seine fishery (NMFS 2006). Based on the historic fishing distribution of this fleet operating in the WCPO (Action Area is approximately 15 deg. N. to 15 deg. S. and 125 deg. E. to 140 deg. W), interactions may occur with the North Pacific, South Pacific, and Indian Ocean loggerhead DPS populations (as described by Conant et al. 2009; 76 FR 58868: September 22, 2011).

Greens: Green turtles occurring in the PIR are divided into three aggregations as described in the Introduction. Green turtles nesting and foraging within the Hawaiian Archipelago are considered a management unit separate from other Pacific stocks (Dutton et al. 2008). WCPO green turtles are a complex matrix of shared stocks, many with documented linkages to habitats within the U.S. EEZ (NMFS 2010). Green turtles that originate from areas outside U.S. PIR jurisdiction may migrate through or forage within the PIR or may interact with western Pacific

²⁰ An interaction with fishing gear can mean entanglement or hooking, but does not necessarily imply mortality.

fisheries managed by NMFS. Eastern Pacific green turtles nest on the western coast of Mexico and elsewhere in Central America, as well as in the Revillagigados Islands (Mexico) and Galapagos Islands (Ecuador) (NMFS and USFWS 2007). As described in the Pelagic and Hawaii FEPs for the Western Pacific Region, green turtles may interact with Hawaii-based longline fisheries, the American Samoa-based longline fishery, the Hawaii bottomfish fishery, and Hawaii troll and handline fisheries. In the Hawaii-based shallow-set longline fishery, 50% (n = 2) of green turtles caught are from the Hawaii aggregation, and 50% (n = 2) from the East Pacific (NMFS 2008). In the Hawaii-based deep-set longline fishery 47% (n = 7) of observed green turtles caught are from the Hawaii aggregation, and 53% (n = 8) from the East Pacific (NMFS 2008). In the American Samoa-based longline fishery, 100% (n = 13) of observed green turtles caught between April 2006 and August 2010 were from the WCPO aggregation (NMFS 2010). In the Hawaii bottomfish and troll/handline fisheries, a total of 6 green turtle interactions with the Hawaii nesting aggregation is anticipated (NMFS 2008, 2009). NMFS also estimates that 14 green turtles per year may be incidentally taken as a result of the U.S. WCPO purse seine fishery (NMFS 2006).

Olive Ridleys: Olive ridley turtles foraging in the western Pacific originate from nesting areas in India and other western Pacific beaches. Eastern Pacific aggregations originate from nesting areas in Mexico and Costa Rica (NMFS and USFWS 2007). Olive ridley turtles interact with deep-set and shallow-set Hawaii-based longline fisheries. Overall, 70% of olive ridleys (n = 54) caught incidentally in these fisheries originate from the eastern Pacific, and 30% (n = 24) from the western Pacific (NMFS 2008). NMFS estimates that 11 olive ridley turtles per year may be incidentally taken as a result of the U.S. WCPO purse seine fishery (NMFS 2006).

Hawksbills: Currently, no hawksbills have been recorded as incidental catch in U.S. commercial fisheries, although one incidental take is authorized every three years in Western Pacific longline fisheries (NMFS 2008, 2010), and 14 incidental takes in the U.S. WCPO purse seine fishery (NMFS 2006).

Appendix C. Overview of ESA Sections Relevant to this Plan

Sections of the Endangered Species Act (ESA) most relevant to PIRO marine turtle species occurring in the PIR include:

Section 4 - Listings and Designations

[Section 4](#) of the ESA directs federal agencies to make listing determinations, and develop and implement recovery plans for threatened and endangered species. PIRO PRD may lead or assist in development of listing determinations, critical habitat designations, or development of Recovery Plans. PIRO PRD also contributes, including providing updates to biennial reports to Congress and assists in global marine turtle status reviews.

Section 6 – Cooperation with States

[Section 6](#) of the ESA provides a mechanism for cooperation with state and territory governments to establish and fund conservation programs for listed species via section 6 cooperative agreements. Once an agreement is in place, the state or territory becomes eligible to receive federal funding via a competitive process to support the development of conservation and monitoring programs for listed species. ESA section 6 agreements are in place between NMFS and the state of Hawaii and with CNMI, with efforts ongoing to establish agreements with Guam and American Samoa. PIRO PRD's goal is to establish section 6 agreements with all territory governments in the region and build capacity in appropriate agencies for marine turtle research, monitoring and management activities.

Section 7 – Federal Agency Actions and Consultations

[Section 7](#) of the ESA requires federal agencies to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in destruction or adverse modification of critical habitat of such species. In formal consultations, NMFS issues a Biological Opinion on whether a federal action is likely to jeopardize listed species or adversely modify critical habitat. Where appropriate, Biological Opinions provide an exemption for the "take"²¹ of listed species while specifying the extent of take allowed via an Incidental Take Statement (ITS). Reasonable and Prudent Measures necessary to minimize impacts from the federal action, and Terms and Conditions with which the action agency must comply are also included. PIRO PRD works through section 7 to reduce or mitigate impacts from federally funded activities pertaining to coastal/marine development, vessels, military development, and fisheries management actions potentially affecting all five marine turtle species occurring in the PIR.

Section 10 – Permits

[Section 10](#) of the ESA allows NOAA Fisheries Service to issue permits for direct and incidental take. Direct take for scientific research purposes may be allowed under 10(a)(1)(A). Non-federal entities planning to conduct otherwise lawful activities that may incidentally "take" a threatened or endangered species may apply for an Incidental Take Permit under Section 10(a)(1)(B). The latter must be accompanied by a conservation plan, often referred to as a Habitat Conservation Plan (HCP). NMFS marine turtle permits are issued from one central location in the NMFS Permit Office at Headquarters. PIRO PRD may assist in development of and participate in review of permit applications relevant to the PIR.

²¹ The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

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Appendix D. Research, Conservation, and Management Projects

The following projects are those implemented or supported by regional partners (PIRO, PIFSC, SWFSC, SWR, USFWS, or WPFMC) to address regional recovery needs, ESA and other mandates as set forth in this Plan and the PIFSC Marine Turtle Research Plan (2009). Projects not listed or ranked in any specific order.

Project ID	Project name/objective	Implementation Agency (lead funding)	Collaborating partners	Timeline	Status	Grant/Contract recipient	Nesting Aggregation(s)	Project/Activity details/Notes
Conservation and Management Centric Projects (by primary management offices: PIRO, SWR, WPFMC)								
1	Protected species workshops & coordinator [federally mandated]	PIRO SFD	PIFSC, PIRO	FY04-14	Ongoing	NA	PIR & WCPO turtles	Annual protected species workshops for owners and operators of Western Pacific registered vessels with federal longline permits. Training includes protected species ID, handling and release techniques, and regulatory requirements.
2	Fishery Observer Program [federally mandated]	PIRO Observer Prog	PIFSC, PIRO	1994 – FY14	Ongoing	NA	PIR & WCPO turtles	Provide observer coverage aboard Western Pacific federally managed fisheries
3	Fishery Observer Program - training & capacity building	PIRO Observer Prog	PIFSC, PIRO	FY04 –14	Ongoing	NA	PIR & WCPO turtles	Provide observer training and capacity building to international LL fleets.
4	International Transfer of Bycatch Mitigation Technology	PIRO IFD		FY04 –09	Completed (some published)		PIR & WCPO turtles	Augment fishery management efforts to implement recommendations of the WCPFC to develop in-country Observer Programs and provide training in proper handling methods in: Marshall Islands, FSM, PNG, Palau, Indonesia, Vietnam, New Caledonia, Cook Islands, Fiji, and Solomon Islands.

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5	International Transfer of Bycatch Mitigation Technology	PIRO IFD/PRD/ Observer Prog; PIFSC FICP		FY08 –10	completed		PIR & WCPO turtles	Train observers in Indonesia and Vietnam in proper handling methods and dehooking techniques in coordination with circle hook gear experiments
6	WCPFC Engagement	PIRO IFD; State Dpt.	PIFSC	FY04 –14	ongoing	NA	PIR & WCPO turtles	Continue working within the context of WCPFC to modify, and improve international seabird, sea turtle, shark, and other bycatch mitigation requirements.
7	International Transfer of Bycatch Mitigation Technology & Gear Research	PIFSC FICP		FY04 –14	Ongoing (published)		PIR & WCPO turtles	Develop and export better procedures and protocols for handling turtles caught in longline fisheries. To varying degrees, have cooperated in LL fishery studies of Japan, Korea, Indonesia, Philippines, Costa Rica, Vietnam, Ecuador, Guatemala, Brazil, Chinese-Taipei, Peru, Uruguay, Panama, Brazil, Italy and Spain. Experiments tested alternate hooks or bait. Promoted turtle handling methods. Conducted workshops in Costa Rica, Brazil and Ecuador from 2005 to 2009.
8	Turtle Sensory Research & Gear Experiments to Reduce & Mitigate Fishery Interactions	PIFSC FICP			Ongoing (published)		PIR & WCPO turtles	Examine sensory systems (auditory, visual, chemosensory) of marine turtles to identify cues that may reduce fishery interaction rates. Mitigate fishery interactions and impacts by testing and aiding the adoption of large circle hooks.
9	Coastal Gillnet Research & Mitigation	PIFSC FICP	PIRO PRD	FY04 – 14	ongoing (published)		PIR & WCPO turtles	Develop and test strategies (net illumination and shark shapes) aimed at reducing sea turtle interactions with coastal gillnet fisheries.

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10	Barbless circle hook program	PIFSC FMSD	DLNR, PIRO/PRD	FY04 –14	ongoing	NA	PIR green and hawksbill turtles	Promote use of barbless hooks to reduce potential impacts of shoreline recreational fisheries on green and hawksbill turtles
11	Hawaii Stranding Program	PIFSC MTRP/MTAP	DLNR, USGS, PIRO/PRD	<FY14	ongoing (published)	Contracts (vets)	Hawaii green & hawksbill turtles	Rehabilitate and release stranded and rescued marine turtles (mostly greens)
12	Satellite Telemetry Activities	PIFSC MTRP/MTAP	SPREP, PIRO	FY04 –14	ongoing (published)		PIR and WCPO turtles	Deploy satellite transmitters and provide E/O to colleagues from SPREP countries and within the PIR to build capacity to enable satellite tracking of marine turtles.
13	Pacific Sea Turtle Genetic Mitochondrial DNA Stock Analysis	SWFSC	PIFSC, PIRO, SPREP, University of Canberra	FY04–14	Ongoing (published)		PIR and WCPO turtles	Continue to collaborate with regional partners and programs to facilitate and encourage the acquisition genetic samples and CITIES permits for the export of genetic samples necessary for stock structure analysis.
14	ESA section 7 consultations	PIRO PRD	PIFSC, USFWS, DLNR, Navy	FY10 –14	ongoing	NA	PIR green & hawksbill turtles	Implement requirements of the ESA to ensure that federal actions they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in destruction or adverse modification of critical habitat.
15	State of Hawaii Protected Species Program	PIRO PRD (ESA section 6)	PIRO PRD, PIFSC MTRP, USFWS	FY09 –14	ongoing	Hawaii DLNR	Hawaii green & hawksbill turtles	Coordinate and assist the State to mitigate and reduce impacts to turtles from near shore recreational fisheries
16	Public Education/Outreach & Awareness	PIRO PRD	PIFSC MTRP, USFWS, DLNR	FY10 –14	ongoing	NA	Hawaii green & hawksbill turtles	Provide public education and outreach to promote NMFS viewing guidelines. Implement Fishing Around Sea Turtles awareness campaign. Disseminate information to policy makers and State officers to raise awareness to affect mngmnt actions.

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17	Basking beach management	PIRO PRD	PIFSC MTRP, USFWS, DLNR	FY07 –14	ongoing	Malama na Honu	Hawaii green & hawksbill turtles	Public education and outreach at Laniakea Beach, Oahu to reduce disturbance and interactions to basking turtles.
18	Reefwatch Waikiki	PIRO PRD		FY09 –10	completed	Univ. Hawaii	Hawaii green & hawksbill turtles	Public education and outreach in Waikiki (the hub of tourism industry) to reduce disturbance and human interactions in HI.
19	GIS Green Turtle Nesting Beach Database	PIRO PRD	SPREP, PIFSC, USFWS	FY09 –10	Completed (Tech Memo)	NA	WCPO & PIR green turtle	Assess the distribution of green turtle nesting activity throughout Oceania (Tech Memo published Sept 2010)
20	Hawaii Hawksbill Turtle Action Plan	PIRO PRD & FWS/PIFWO	PIFSC, HAVO, HWF, DLNR	FY10	completed	NA	Hawaii hawksbill turtle	Draft Action Plan to outline research, conservation and management actions and coordinate regional stakeholders.
21	Hawaii Island Hawksbill Recovery Project	PIRO PRD	PIFSC MTRP, USFWS PIFWO	FY07 –14	Ongoing (Tech Memo)	World Turtle Trust	Hawaii hawksbill turtle	Nesting beach monitoring to assess population distribution and abundance to advance demographic information. Implement beach mngmnt, removal of invasive plants and animals. Public education and awareness to community and local beach user groups.
22	Maui Hawksbill Turtle In-water & E/O	PIFSC MTAP	PIRO PRD, USFWS PIFWO, DLNR	FY10; FY12	Completed; Ongoing...	Hawaii Wildlife Fund	Hawaii hawksbill turtle	Gather in-water information of foraging turtles in Maui to build an ID database of known individuals and provide E/O to the public.
23	CNMI DFW Sea Turtle Project	PIRO PRD	PIFSC MTRP/MTA P, PIFWO	FY04 –14	ongoing	CNMI DLNR	PIR green & hawksbill turtles	Nesting beach monitoring and in water capture-mark-recapture program to assess population distribution and abundance to advance demographic information.
24	CNMI Sea Turtle Biologist	PRIO PRD	PIFSC MTRP/MTA P	FY09 –11	ongoing	T. Summers (contract)	PIR green & hawksbill turtles	Provide contract sea turtle biologist to the CNMI turtle program to provide training and lead research and monitoring activities for nesting and in-water activities, and E/O.

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25	CNMI Sea Turtle E/O	PIRO PRD	CNMI DFW, MINA	FY10	completed	PMRI (contract)	PIR green & hawksbill turtles	Support E/O activities to build local capacity for conservation to reduce unsustainable harvest of turtles and eggs. Coordinate local agencies and community stakeholders in E/O initiatives. Establish volunteer program to assist CNMI turtle monitoring efforts. Develop informational website: www.ihaggan.org.
26	Guam DAWR Sea Turtle Project; Haggan watch	PIRO PRD	PIFSC MTRP/MTA P, PIFWO	FY03-06; FY09-14	ongoing	Guam DAWR	PIR green & hawksbill turtles	Education and awareness activities through community-based monitoring (e.g., Haggan watch) and building local capacity for conservation through coordination of local agencies and community stakeholders.
27	Guam UoG In-Water Research Program	PIRO PRD	PIFSC MTAP, Guam DAWR	TBD	pending	Univ. of Guam	PIR green & hawksbill turtles	Capacity building to assist UoG to acquire requisite NMFS permit & training to establish an in-water monitoring & research program at UoG marine lab (Dr. Jason Biggs).
28	Am.Samoa DMWR Sea Turtle Project	PIRO PRD	PIFSC MTRP/MTA P, PIFWO	FY03-06; FY08-14	ongoing	A.Samoa DMWR	PIR green & hawksbill turtles	Maintain stranding program, collect samples for genetic studies, and monitor hawksbill and green turtle nesting sites in American Samoa to better understand population distribution and abundance to advance demographic information. Operate under joint NMFS/USFWS permit.
29	Sea Turtles of Palmyra Atoll	PIRO PRD	PIFSC MTAP	FY07-12	ongoing	American Museum of Natural History	PIR green & hawksbill turtles	Investigate baseline population dynamics, ecology, and life history of in-water green turtle populations at Palmyra Atoll to assess population distribution, abundance, and regional connectivity to advance demographic information and contribute to effective management of PIR stocks.

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30	Ulithi Marine Turtle Program, Yap	PIRO PRD	PIFSC MTRP/MTA P	FY05 –14	ongoing	Oceanic Society	WCPO Green turtle	Monitor nesting beaches at Ulithi Atoll, Yap, FAM via community-based monitors. Disseminate information, raise awareness, deploy 12 satellite tags, and collect genetic samples. Expand E/O and genetic sampling at 10 island/atoll locations throughout FSM from turtles taken traditionally.
31	Marshall Islands Genetic Sampling, Data Collection and Satellite Tagging Project	PIRO IFD/PRD	SWFSC, PIFSC MTRP	FY05 –08	completed	WUTMI	WCPO Green turtle	Collect genetic samples from turtles taken traditionally in the Marshall Islands and deploy 5 satellite transmitters to increase understanding of genetic stock structure and regional connectivity of green turtles.
32	Marshall Islands E/O & school curriculum development	PIRO PRD	SPREP	FY10	completed [9/2011]	Marshall Islands Marine Resources Authority	WCPO green & hawksbill turtles	Design an E/O program on Majuro and Wotje atolls to increase public awareness, knowledge, and understanding regarding the significance of turtles and the urgent need to protect populations through school curriculum, special activities, and mass media.
33	New Caledonia Aquarium E/O	PIRO IFD	PIRO PRD, PIFSC MTRP	FY08 –11	ongoing	New Caledonia Aquarium	South Pac. Loggerhead; WCPO green turtle	Augment ongoing research to understand the pelagic habitat use of S.P. loggerhead turtles by supporting E/O efforts to raise public awareness of turtles and conservation in New Caledonia
34	Malaysian Trawl Fishery Bycatch Reduction	PIRO PRD	PIFSC FICP	FY10	ongoing	Marine Research Foundation	WCPO green & hawksbill turtle	To promote TEDs use in Malaysian Trawl fisheries that will reduce impacts to green and hawksbill shared PIR stocks (an estimated 1000 to 4000 turtles are captured in Malaysian trawl fisheries annually; Pilcher et al. 2009).

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35	Integrative initiative for loggerhead turtle management: threat assessment, fishery pound net mitigation, and E/O	PIRO PRD	PIFSC FICP; STAJ	FY09 – FY10	Completed (publication pending)	Ocean Foundation	North Pac. Loggerhead	Assess (monitor) loggerhead bycatch mortality through systematic stranding surveys in Baja, Mexico. Conduct gear mitigation trials to reduce bycatch in Japanese pound nets. Augment ongoing bycatch mitigation efforts with public education and awareness activities to build local capacity for conservation in Baja & Japan. Initiative is a result of Kagoshima Symposium and expert working group funded & convened by PIRO PRD Dec 6-8, 2008.
36	Loggerhead turtle Nesting Beach Management in Japan to Conserve Eggs and Pre-Emergent Hatchlings	WPFMC	USFWS MTCA	FY04 –14	ongoing	Sea Turtle Association of Japan	North Pac. Loggerhead	Conduct nesting beach management to mitigate anthropogenic and environmental impacts (beach erosion/inundation) to save doomed nests at several major loggerhead nesting beaches in Japan to bolster recruitment of individuals into the population.
37	Genetic Analysis to Characterize Rookery Stock Structure and Composition of Pound Net Fishery Bycatch in Japan	WPFMC	SWFSC	FY10	ongoing	Sea Turtle Association of Japan	North Pac. Loggerhead	Characterize the genetic stock structure of Japanese loggerhead populations by sequencing samples collected and stored to date. The project builds on work conducted in 2009 to determine fine scale genetic structure among Japanese rookeries, and to characterize the genetic stock composition of loggerhead bycatch in Japanese coastal pound net fisheries.
38	Assessing the State of Japanese Coastal Fisheries and Sea Turtle Bycatch	WPFMC		FY09 –10	ongoing	Sea Turtle Association of Japan	North Pac. Loggerhead; WCPO turtles	Determine types of coastal fisheries that pose the greatest threats to sea turtle populations through interviews with coastal fishermen in Kyushu and Sea of Japan regions. The project

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								will also analyze stranding records for the study area.
39	Evaluate & Mitigate Bycatch Mortality of Loggerhead Turtles in Coastal Fisheries at BCS, Mexico	WPFMC		FY04 –10	Completed (published)	Ocean Foundation/ Universidad Autonoma de BCS	North Pac. Loggerhead	Assess and develop solutions for fishermen in Baja to ensure continuity of their fisheries and achieve major reductions in incidental captures of loggerheads by artisanal fishing
40	Papua Barat, Indonesia - Index nesting beach leatherback turtle monitoring & conservation (Jamursba-medi & Wermon)	SWFSC	USFWS MTCA, ELNA, PIRO IFD	FY04 –14	Ongoing (published)	UNIPA	West Pac. Leatherback	Support and provide technical support for leatherback nesting beach monitoring and conservation/mngmnt at Jamursba-medi and Wermon beaches.
41	Western Pacific leatherback, aerial surveys & satellite telemetry	SWFSC	PIRO IFD	FY04–07	Completed (published)		West Pac. Leatherback	Nesting beach aerial surveys of Papua, PNG & Solomons (2004-07) and satellite telemetry research to ID habitats.
42	Papua Barat, Indonesia - Wermon nesting beach leatherback turtle monitoring & conservation	WPFMC	SWFSC	FY04 –08	Completed (published)	WWF-Indo	West Pac. Leatherback	Nesting beach monitoring and conservation/ management at Wermon via community based monitors.
43	Papua Barat, Indonesia - leatherback turtle non-index beach survey	WPFMC	SWFSC	FY10	Completed	Everlasting Nature of Asia	West Pac. Leatherback	Monitor and determine the extent of nesting and hatching production in the 20km stretch of the Manokwari province of West Papua, Indonesia (Bawey, Atoli, Mubrani, and Wesnemri Villages), and survey the Manokwari East (Sidei-Wibain Region) to determine the extent of leatherback nesting.
44	Socioeconomic Research to Strengthen Conservation of Leatherback Turtles in Bird's Head, Papua Barat, Indonesia	WPFMC	SWFSC, PIRO IFD	FY10	Completed	Natural Equity	West Pac. Leatherback	Conduct interviews and assessment of local communities in Papua Barat, Indonesia to develop a proposal for structuring conservation agreements with 3 villages impacted by leatherback conservation activities. Build

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								local capacity to continue socioeconomic research and community development work. This project built off initial social science work, supported by SWFSC and PIRO IFD, to evaluate cost-effective conservation alternative strategies for leatherback turtles.
45	Sulu Sulawesi Sea leatherback turtle pelagic habitat assessment (pilot study)	PIRO PRD	SWFSC	FY09	completed	Marine Research Foundation	West Pac. Leatherback	Assess and survey the abundance of foraging leatherbacks and potential anthropogenic impacts in the Sulu-Sulawesi sea via fixed-wing aircraft. Assess any potential leatherback nesting beaches off northern shores of Palawan (Philippines) and Borneo (Malaysia) during surveys.
46	Papua New Guinea - Huon Coast Leatherback Turtle Conservation Program	WPFMC	SWFSC, USFWS MTCA	FY04 -14	ongoing	Marine Research Foundation	West Pac. Leatherback	Conduct community-based leatherback turtle nesting beach monitoring and conservation on the Huon Coast. Implement conservation measures to protect nests, and reduce localized harvest through community development incentives. In 2010 the project received additional/partial support by the USFWS MTCA.
47	Solomon Islands - Leatherback turtle nesting beach monitoring and conservation	SWFSC	USFWS MTCA	FY11	ongoing		West Pac. Leatherback	Continue scientific and technical support to nesting beach programs at Sasakola, Litogarhira, and Rendova and Tetepare in the Western Province to further improve data collection, build local capacity, undertake hatching success studies, and address conservation needs.

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48	Papua New Guinea -Trawl Fishery Bycatch Mitigation	PIRO IFD		FY04 – 06	Completed	National Fisheries Authority	WCPO turtles	Introduction and training of TED technology in trawl fisheries of PNG
49	SPREP Assistant Turtle Database Officer: Maintenance of the Turtle Research and Monitoring Database System (TREDS)	WPFMC	TREDS steering committee	FY04 –10	ongoing	SPREP	WCPO turtles	Support the development and dissemination of the TREDS data base to SPREP members. Support SPREP database officer & travel.
50	Workshop on Mitigating Sea Turtle Bycatch in Coastal Net Fisheries	WPFMC	IUCN, SEAFDEC, IOSEA, NMFS-SEFSC	FY09	Completed (published)		WCPO turtles	Summarize current knowledge on bycatch mitigation in coastal net fisheries and stimulate international transfer of best mitigation practices through a Technical Workshop.
51	LL Gear Technology Transfer to Latin American Artisanal Fisheries	WPFMC	WWF-Latin Am., PIFSC FICP, SWFSC	FY04–07	completed	IATTC	Eastern Pac. Green & Olive ridley turtles	Transfer best practice longline technologies (such as circle hooks and safe handling protocol) to Latin American artisanal mahi-mahi and tuna longline fisheries to reduce sea turtle bycatch and mortality. Over 1.5 million J hooks exchanged for Chooks. Project included Ecuador, Costa Rica, El Salvador, Guatemala, Panama, Peru, Mexico, Nicaragua, and Columbia.
52	Circle hook research	WPFMC		FY10	completed		WCPO turtles	Examine the target catch rate using large circle hooks in American Samoa longline albacore fishery
53	Marine Debris Program	NOAA/PIFSC CRED	DLNR, PIRO, NOAA, Sanctuary	FY07 –14	ongoing	NA	PIR turtles	To survey and remove derelict gear from reefs and ecosystems of the PIR.
86	Meetings and Workshops	WPRFMC; NMFS	PIFSC, PIRO, etc...	FY02 – 12	Numerous convened		All	Bellagio 2004, 2008; IFF2-5; WPRFMC sea turtle workshops; etc...

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Research Centric Projects (by research only agencies: SWFSC and PIFSC)								
Project ID	Project name/objective	Implementation Agency (lead funding)	Collaborating partners	Timeline	Status	Grant/Contract recipient	Nesting Aggregation(s)	Project/Activity details/Notes
54	Green turtle nest monitoring and census nesting females	PIFSC-MTRP	FWS		Ongoing (published)		Hawaii green turtle	Nest census and tagging throughout Hawaii Archipelago
55	Stable isotope analysis	PIFSC-MTRP	UH, SWFSC		ongoing		Hawaii green turtle	Conduct stable isotope analysis of green turtle tissues and food items for potential use as a biomarker for nutritional stress
56	ECOPATH/ECOSYM models	PIFSC-MTRP	PIFSC-EOD, University of British Columbia		Completed (published)		Hawaii green turtle	Develop models to assess carrying capacity of green turtle foraging habitat at Kaloko-Honokohau National Historic Park in Kailua-Kona, Hawaii
57	Systematic monitoring of marine turtles in forage pastures	PIFSC-MTRP			Ongoing (published)		Hawaii green and hawksbill turtle	Capture-mark-recapture program to assess turtles in near shore habitats for: age, sex, size, growth, and health/condition
58	Age and growth rates assessments	PIFSC-MTRP	UH		Ongoing (published)		Hawaii green turtle	Determine age and growth rates to gain understanding of potential productivity
59	FFS hatchling success study	PIFSC-MTRP	SWFSC		Completed (published)		Hawaii green turtle	Determination of density dependent impacts on hatchling success of green turtles at FFS
60	Genetic analysis	PIFSC-MTRP	SWFSC		ongoing & some completed (published)		Hawaii green and hawksbill turtle	Conduct genetic analysis to define stock structure and demographic connectivity, and to elucidate ecology, life history and reproductive strategies of foraging

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							populations
61	Diet and fibropapiloma investigations	PIFSC-MTRP	USGS		Ongoing (published)		Hawaii turtles As part of stranding investigation of all species (mostly greens) to determine causes of mortality/injury (see project # 11)
62	Hawksbill turtle nest monitoring and census nesting females	NPS/USFWS, HWF	PIFSC MTAP, PIRO PRD		ongoing		Hawaii hawksbill turtle Hawksbill turtle nest monitoring, tagging, census of nesting females, and hatchling assessment
63	Systematic surveys of marine turtles in near shore habitats	PIFSC CRED	PIFSC-MTAP		Ongoing (published)		PIR and WCPO turtles Hawaii, US Territories & PRIAs
64	Satellite tracking of marine turtles	PIFSC-MTRP	PIRO PRD		ongoing		PIR & WCPO turtles Enable satellite tracking of marine turtles throughout the region to build capacity for education/outreach to colleagues from American Samoa, CNMI, Guam
65	Assess Post-Hooking Mortality	PIFSC-FBSAD			ongoing		PIR & WCPO turtles Determine post-hooking mortality of turtles caught and released in commercial fisheries
66	Climate forcing in turtle populations	PIFSC MTAP			Ongoing (published)		PIR & WCPO turtles Investigate relationship of oceanographic phenomena and their impacts at various scales of space and time to nesting censuses of Cc, Dc, and Cm.
67	Population assessment	SWFSC			Ongoing (published)		East Pac. green Determine growth and population abundance of green turtles in San Diego
68	Loggerhead migration and pelagic foraging habitats	PIFSC-EOD	PIFSC-MTRP		Ongoing and some completed (published)		North Pac. loggerhead Define migration and foraging habitats of juvenile loggerheads in the N.Pac. using satellite tracking and satellite remotely-sensed

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								oceanographic data
69	Loggerhead dive ecology	PIFSC-EOD			Ongoing and some completed (published)		North Pac. loggerhead	Characterize dive patterns of juvenile loggerheads in the North Pacific from tagging data
70	TurtleWatch	PIFSC-EOD			Ongoing (published)		North Pac. loggerhead	Model Loggerhead Turtle Migration Patterns to Mitigate Fishery Interaction
71	SEPODYM spatial ecosystem models	PIFSC-EOD			ongoing		North Pac. loggerhead	Develop a SEPODYM spatial ecosystem models for loggerhead sea turtles and swordfish in the North Pacific
72	Loggerhead aerial surveys	SWFSC	Ocean Foundation, SWR		Completed (publication pending)		North Pac. loggerhead	Conduct aerial surveys off Pacific Coast of Baja California Peninsula to determine at-sea distribution and abundance
73	Loggerhead foraging ecology and trophic studies	SWFSC	Ocean Foundation		ongoing		North Pac. loggerhead	Conduct stable carbon and nitrogen isotope analysis to determine foraging ecology and trophic niche width of loggerhead occurring off Baja California, Mexico
74	Loggerhead migration and pelagic foraging habitats	PIFSC-MTRP/EOD	PIRO IFD		ongoing		South Pac. loggerhead	Characterize the migration and foraging behavior of juvenile loggerheads in the South Pacific using satellite telemetry and satellite remotely-sensed oceanographic data. In coordination w/project #33.
75	U.S. west coast Leatherback aerial surveys	SWFSC			Ongoing (published)		East Pac. Leatherback	Conduct aerial surveys of leatherback turtles on foraging grounds off the U.S. west coast to determine distribution and abundance

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76	Leatherback foraging ecology	SWFSC	PIFSC		Ongoing (published)	East Pac. Leatherback	Conduct Ecosystem - level energetic studies, including examination of caloric content of jellies and turtle-borne video along central California Coast to determine energy budgets
77	ID critical habitats and migratory corridors	SWFSC			Ongoing (published)	E. & W. Pac. Leatherback	Conduct satellite telemetry (with Direct attachment techniques) of leatherbacks to determine migratory corridors and high-seas habitat use
78	Research Training	SWFSC	F/PR	FY10	completed	West Pac. Leatherback	Conduct researcher exchange, with beach monitors from Papua, PNG, and Solomon to undertake a training course in Trinidad
79	Hatch success studies	SWFSC	UNIPA		ongoing	West Pac. Leatherback	Determine hatchling survivorship for leatherbacks nesting in Papua, Indonesia
80	Genetic Analysis	SWFSC (DNA lab)			Ongoing (some published)	PIR and WCPO turtles	Define stock boundaries and population structure of Pacific marine turtle populations (nesting, foraging, and by-caught), and develop/ implement genetic tools for the purpose of defining biologically valid management units
81	Stable Isotope studies	SWFSC			ongoing	PIR and WCPO turtles	Conduct stable nitrogen and carbon isotope analysis to determine foraging stock structure and trophic ecology of Pacific turtle populations
82	ID habitat use	SWFSC/ PIFSC	PIFSC/ SWFSC		Ongoing some	PIR and WCPO turtles	Identify critical marine turtle habitat use, and

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					completed (published)			migratory corridors in the Pacific Ocean (via satellite telemetry and/or ship-based line transect surveys)
83	NMFS Ghostnet project	SWFSC			ongoing		PIR and WCPO turtles	Characterize regions of marine debris accumulation
84	Fishery management	SWFSC	Pro Delphinus		Ongoing, some completed (published)		PIR and WCPO turtles	Support efforts & training to build capacity for fishery monitoring and management (e.g., observer programs, real-time info access, dehooking techniques) in Peru and Chile
85	Hawksbill nesting beach monitoring	SWFSC			Ongoing (published)		East Pac. Hawksbill	Support efforts to determine annual nesting abundance in the eastern Pacific in El Salvador, Costa Rica, Nicaragua, and Ecuador

References

- Alfaro-Shigueto J, P.H. Dutton, J. Mangel, and D. Vega. 2004. First confirmed occurrence of loggerhead turtles in Peru. *Marine Turtle Newsletter* 103:7-11.
- Alfaro-Shigueto, J., Mangel, J.C., Bernedo, F., Dutton, P.H., Seminoff, J.A. and B.J. Godley. 2011. Small-scale fisheries of Peru: a major sink for marine turtles in the Pacific. *Journal of Applied Ecology*. doi: 10.1111/j.1365-2664.2011.02040.x
- Arther, C., J. Baker and H. Bamford (eds). 2009. Proceedings of the International Research Workshop on the Occurrence, Effects and Fate of Microplastic Marine Debris. Sept 9-11, 2008. NOAA Technical Memorandum NOS-OR&R-30.
- Arthur KE, Balazs GH (2008) A comparison of immature green turtle (*Chelonia mydas*) diets among seven sites in the Main Hawaiian Islands. *Pac Sci* 62: 205–217.
- Arthur KE, Limpus C, Balazs GH, Capper A, Udy J, Shaw G, Keuper-Bennett U, Bennett P. 2008. The exposure of green turtles (*Chelonia mydas*) to tumour promoting compounds produced by the cyanobacterium *Lyngbya majuscula* and their potential role in the aetiology of fibropapillomatosis. *Harmful Algae*, 7: 114–125.
- Baker JD, Littnan CL. and DW Johnston. 2006. Potential effects of sea level rise on the terrestrial habitats of endangered and endemic megafauna in the Northwestern Hawaiian Islands. *Endang Species Res*, 4:1-10.
- Balazs, G.H. 1975. Green turtle uncertain future: Protection vial if remnant population is to survive. *Defenders*; v. 50(6): 521-523.
- Balazs, G.H. 1976. Green turtle migrations in the Hawaiian Archipelago. *Biological Conservation* 9: 125–140.
- Balazs, G. H. 1980. Synopsis of biological data on the green turtle in the Hawaiian Islands. U.S. Dep. Commer., NOAA Tech. Memo. NOAA-TM-NMFS-SWFC-7.
- Balazs, G. H. 1985. Impact of ocean debris on marine turtles: Entanglement and Ingestion. In R. S. Shomura and H. O. Yoshida (editors), *Proceedings of the Workshop on the Fate and Impact of Marine Debris*, 27-29 November 1984. Honolulu Hawaii. U. S. Department of Commerce, NOAA Tech. Memo. NMFS-SWFC-54, pp. 387-429
- Balazs, GH, HF Hirth, PY Kawamoto, ET Nitta, LH Ogren, RC Wass, and JA Wetherall. 1992. Interim Recovery Plan for Hawaiian Sea Turtles. Administrative Report H-92-01 Southwest Fisheries Science Center, Honolulu Laboratory, Honolulu, HI.
- Balazs, G.H. 1996. Behavioral changes within the recovering Hawaiian green turtle population. In: *Proceedings of the 15th Annual Symposium on sea turtle biology and conservation*. NOAA Tech Memo NMFS-SEFSC 387:16-20.
- Balazs, G. H. ,Keuper-Bennett, U.,Bennett, P.,Rice, M. C., Russell, D. J. 2003. Evidence for near shore nocturnal foraging by green turtles at Honokowai, Maui, Hawaii Islands. In: 22nd Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-503, p. 32-34.
- Balazs, G.H. and M. Chaloupka. 2004a. Thirty-year recovery trend in the once depleted Hawaiian green sea turtle stock. *Biological Conservation*, 117:491-498.
- Balazs, G.H., Chaloupka, M. 2004b. Spatial and temporal variability in somatic growth of green sea turtles resident within the Hawaiian Archipelago. *Marine Biology* 145: 1043-1059.
- Bellagio Steering Committee. 2008. Sea Turtle Conservation Initiative: Strategic Planning for Long-term Financing of Pacific Leatherback Conservation and Recovery: Proceedings of the Bellagio Sea Turtle Conservation Initiative, Terengganu, Malaysia; July 2007. The WorldFish Center, Penang, Malaysia. 79 p.
- Benson, S., Dutton, P. Hitipeuw, C. Samber, B., Arbessy, J, and Parker, D. 2007a. Post-Nesting Migrations of Leatherback Turtles (*Dermodochelys coriacea*) from Jamursba-Medi, Birds Head Peninsula, Indonesia. *Chelonian Conservation and Biology*. 6(1):150-154.

- Benson, S.R., K.A. Forney, J.T. Harvey, J.V. Carretta, and P. H. Dutton. 2007b. Abundance, distribution, and habitat of leatherback turtles (*Dermochelys coriacea*) off California, 1990–2003. *Fishery Bulletin* 105:337–347.
- Benson, S.R., K.M. Kisokau, L. Ambio, V. Rei, P.H. Dutton and D. Parker. 2007c. Beach use, interesting movement, and migration of leatherback turtles, *Dermochelys coriacea*, nesting on the north coast of Papua New Guinea. *Chelonian Conservation and Biology* 6:7–14.
- Benson, S.R., Eguchi, T., Foley, D.G., Forney, K.A., Bailey, H., Hitipeuw, C., Samber, B.P., Tapilatu, R.F., Rei, V., Ramohia, P. Pita, J., and P.H. Dutton. 2011. Large-scale movements and high-use areas of western Pacific leatherback turtles, *Dermochelys coriacea*. *Ecophere: Vol 2(7):1-27*.
- Bowen BW, Abreu-Grobois FA, Balazs GH, Kamezaki N, Limpus CJ, Ferl RJ (1995) Trans-Pacific migrations of the loggerhead sea turtle demonstrated with mitochondrial DNA markers. *Proceedings of the National Academy of Sciences of the USA*, 92:3731– 3734.
- Broderick, D., Moritz, C., Miller, J. D., Guinea, M., Prince, R. I. T. and Limpus, C. J. 1994. Genetics studies of the hawksbill turtle (*Eretmochelys imbricata*): evidence for multiple stocks in Australian waters. *Pacific Conservation Biology* 1, 123–131.
- Broderick, A.C., R. Frauenstein, F. Glen, G.C. Hayes, A.L. Jackson, T. Pelembe, G.D. Ruxton, and B.J. Godley. 2006. Are green turtles globally endangered? *Global Ecol. Biogeogr.* 15:21-26.
- Bugoni, L., L. Krause, and M. V. Petry. 2001. Marine debris and human impacts on sea turtles in southern Brazil. *Marine Pollution Bulletin.* 42:1330–1334.
- Bjorndal, K.A. 1982. *The Biology and Conservation of Sea Turtles*. Smithsonian Institution Press, Washington, D.C. revised 1995.
- Bjorndal, K.A., Bloten, A.B., and C.J. Lagueux. 1994. Ingestion of marine debris by juvenile sea turtles in coastal Florida habitats. *Marine Pollution Bulletin*, 28(3): 154-158.
- Brewer, C. 2002. Outreach and partnership programs for conservation education where endangered species conservation and research occur. *Conservation Biology* 16(1):4-6.
- Chan, E.H., Pilcher, N and K Hiew. 2009. Report of the workshop on regional cooperation to address direct capture of sea turtles. 1-3 June 2009 Kuala Terengganu, Malaysia.
- Cheng I-J, Dutton PH, Chen C-L, Chen H-C, Chen W-H, Shea J-W (2008) Comparison of the genetics and nesting ecology of two green turtle rookeries. *Journal of Zoology* 276(4): 375-384.
- Chaloupka, M., Bjornda, K. A., Balazs, G. H. Bolten, A.B., Ehrhart, L.M., Limpus, C.J., Suganuma, H., Troëng, S., Yamaguchi, M. 2007. Encouraging outlook for recovery of a once severely exploited marine megaherbivore. *Global Ecology and Biogeography*. DOI: 10.1111/j.1466-8238.2007.00367.x
- Chaloupka, M. and G.H. Balazs. 2007. Using Bayesian state-space modelling to assess the recovery and harvest potential of the Hawaiian green sea turtle stock. *Ecological Modelling*. Vol. 205: 93–109.
- Chaloupka, M. Work, T.M. Balazs, G.H. Murakawa, S.K. Morris, R. 2008. Cause-specific temporal and spatial trends in green sea turtle strandings in the Hawaiian Archipelago (1982–2003). *Mar Biol.* DOI 10.1007/s00227-008-0981-4
- Chaloupka M, Balazs GH, Work TM (2009) Rise and fall over 26 years of a marine epizootic in Hawaiian green sea turtles. *J Wildl Dis* 45: 1138–1142.
- Conant, T., Dutton, P.H., Eguchi, T., Epperly, S.P. Fayh, C.C. Godfrey, M.H., MacPherson, S.L., Possardt, E.E., Schroeder, B.A., Seminoff, J.A., Snover, M.L., Upite, C.M. and B.E. Witherington. 2009. Loggerhead sea turtle (*Caretta caretta*) 2009 status review under the U.S. Endangered Species Act. Report of the Loggerhead Biological Review Team to the National Marine Fisheries Service, August 2009. 222 pgs.

- Craig, P., Parker, D., Brainard, R., Rice, M. and G. Balazs. 2004. Migrations of green turtles in the central South Pacific. *Biological Conservation*, 116: 433–438.
- Cruce, J., Kolinski, S.P., Parker, D.M., Frutchey, K.P., Balazs, G.H., Clarke, R. 2011 in prep. Identifying Migration-Based Connectivity via Satellite Telemetry for Post-Nesting Green Turtles from Gielop Island, Federated States of Micronesia.
- Delgado S.G., Nichols W.J. 2005. Saving sea turtles from the ground up: awakening sea turtle conservation in northwestern Mexico. *Maritime Studies* 4: 89-104.
- Dethmers, KEM., D. Broderick, C. Moritz, NN. Fitzsimmons, CJ. Limpus, S. Lavery, S. Whiting, M. Guinea, RIT. Prince, and R. Kennett. 2006. The genetic structure of Australasian green turtles (*Chelonia mydas*): exploring the geographical scale of genetic exchange. *Molecular Ecology*. 15(13): 3931-3946.
- Dethmers KEM, Jensen M, FitzSimmons NN, Broderick D, Limpus CJ, Moritz C (2010) Migration of green turtles (*Chelonia mydas*) from Australasian feeding grounds inferred from genetic analyses. *Marine and Freshwater Research* 61:1376–1387.
- Doyle, M., W. Watson, N. Bowlin, and S. Sheavly. 2011. Plastic particles in coastal pelagic ecosystems of the Northeast Pacific Ocean. *Marine Environmental Research*. 71(1): 41-52.
- Donohue, M. J, R. C. Boland, C. M. Sramek, and G. A. Antonelis. 2001. Derelict Fishing Gear in the Northwestern Hawaiian Islands: Diving Surveys and Debris Removal in 1999 Confirmed Threat to Coral Reef Ecosystems. *Marine Pollution Bulletin*, Vol. 42, No. 12, pp. 1301-1312
- Donoso, M. and P.H. Dutton. 2010. Sea turtle bycatch in the Chilean pelagic longline fishery in the southeastern Pacific: Opportunities for conservation. *Biological Conservation* 143: 2672–2684.
- Dutton, P. H., B. W. Bowen, D. W. Owens, A. Barragan, and S. Davis. 1999. Global phylogeography of the leatherback turtle (*Dermochelys coriacea*). *Journal of Zoology* 248:397–409.
- Dutton, P.H. 2003. Molecular ecology of the eastern Pacific green turtle. In: Seminoff J (compiler) *Proceedings of the Twenty Second Annual Symposium on Sea Turtle Biology and Conservation*. NOAA Tech Memo NMFS-SEFSC-503, National Technical Information Service, Springfield, VA, p 69.
- Dutton, P.H. August 9, 2005. Summary of Genetic Analysis of sea turtle samples from HLL fishery observers. NOAA-NMFS-SWFSC La Jolla Laboratory, internal agency report to PIRO.
- Dutton, P.H., C. Hitipeuw, M. Zein, S.R. Benson, G. Petro, J. Pita, V. Rei, L. Ambio, and J. Bakarbesy. 2007. Status and genetic structure of nesting populations of leatherback turtles (*Dermochelys coriacea*) in the western Pacific. *Chelonian Conservation and Biology*. 6(1):47-53.
- Dutton, P.H., Balazs, G.H., LeRoux, R.A., Murakawa, S.K., Zarate, P., and L. S. Martínez. 2008a. Composition of Hawaiian green turtle foraging aggregations: mtDNA evidence for a distinct regional population. *Endang Species Res*. Vol. 5: 37–44.
- Dutton, Peter and Robin Leroux. 2008b. Progress Summary of Genetic Analysis of Hawksbill Samples from the Hawaiian Islands. Unpublished report prepared for the 2008 Hawksbill Recovery Group Meeting. Marine Turtle Molecular Ecology Laboratory NOAA-Fisheries Southwest Fisheries Science Center-La Jolla.
- Dutton, P. H. and D. Squires. 2008c. Reconciling biodiversity with fishing: a holistic strategy for Pacific sea turtle recovery. *Ocean Development and International Law* 39:200–222.
- Eckert, K.L., K.A. Bjorndal, F.A. Abreu-Grobois, and M. Donnelly (eds.) 1999. Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publication No. 4.

- Eguchi T, Gerrodette T, Pitman RL, Seminoff JA and PH Dutton. 2007. At-sea density and abundance estimates of the olive ridley turtle *Lepidochelys olivacea* in the eastern tropical Pacific. *Endang Species Res.* Vol. 3: 191–203.
- FAO (Food and Agriculture Organization of the United Nations). 1990. *Sea Turtles of the World. An annotated and illustrated catalogue of sea turtle species known to date.* FAO Species Catalogue, FAO Fisheries Synopsis, Rome; 11(125): 81 pp.
- FAO (Food and Agriculture Organization of the United Nations). 2004. *Expert Consultation on Interactions Between Sea Turtles and Fisheries Within an Ecosystem Context.* FAO Fisheries Report No. 738. Rome:FAO.
- Gaos, A, R., F.A. Abreu-Grobois, J. Alfaro-Shigueto, D. Amorocho. R. Arauz, A. Baquero, R. Briseno, D. Chacon, C. Duenas, C. Hasbun, M. Liles, G. Mariona, C. Muccio, J.P. Munoz, W.J. Nichols, M. Pena, J.A. Seminoff, M. Vasquez, J. Urteaga, B. Wallace, I.L. Yanez and P. Zarate. 2010. Signs of hope in the eastern Pacific: international collaboration reveals encouraging status for the severely depleted population of hawksbill turtles *Eretmochelys imbricate*. *Oryx*: 1-7
doi:10.1017/S0030605310000773
- Gardner, S. and W. Nichols. 2001. Assessment of sea turtle mortality rates in the Bahia Magdalena region, Baja California Sur, Mexico. *Chelonian Conservation and Biology*, 4(3): 197–199.
- Gausland, I., 2003, *Seismic Surveys Impact on Fish and Fisheries, Norwegian Oil Industry Association (OLF)*, 41 pp.
- Gilman, E. L., P. Dalzell, and S. Martin. 2006. Fleet communication to abate fisheries bycatch. *Marine Policy* 30:360–366.
- Gilman, E., Zollett, E., Beverly, S., Nakano, H., Davis, K., Shiode, D., Dalzell, P. and I. Kinan. 2006. Reducing sea turtle by-catch in pelagic longline fisheries. *Fish and Fisheries*. Vol 7:2–23.
- Gilman, E., Kobayashi, D., Swenarton, T., Brothers, N., Dalzell, P. and I. Kinan-Kelly. 2007. Reducing sea turtle interactions in the Hawaii-based longline swordfish fishery. *Biological Conservation*, 139: 19–28.
- Gilman E, Gearhart J, Price B, Eckert S and others. 2009. Mitigating sea turtle bycatch in coastal passive net fisheries. *Fish Fish* 11:57–88.
- Gjertsen, H. ; Rice, R. ; Dutton, P. ; Squires, D. ; Hardner, J. 2008 Comparing costs of protecting leatherbacks at nesting beaches in the western Pacific. In: *Proceedings of the Twenty-Fifth Annual Symposium on Sea Turtle Biology and Conservation.* NOAA Technical Memorandum NMFS-SEFSC-582. p.27.
- Gjertsen, H. and E. Niesten. 2010. Incentive-based approaches in marine conservation: applications for sea turtles. *Conservation and Society*, v.8 (1): 5-10.
- Hall, R.J., A.A. Belisle & L. Sileo, 1983. Residues of petroleum hydrocarbons in tissues of turtles exposed to the Ixtoc oil spill. *Journal of Wildlife Disease* 19: 106.
- Hawkes, L.A., A.C. Broderick, M.H. Godfrey, and B.J. Godley. 2009. Climate change and marine turtles. *Global Change Biology* 7: 137-154.
- Hays, G. C., Broderick, A. C., Glen, F. and Godley, B. J. 2003. Climate change and sea turtles: a 150-year reconstruction of incubation temperatures at a major marine turtle rookery. *Global Change Biology*. v. 9(4): 642-646.
- Hazel, J., Lawler, I.R., Marsh, H., and S. Robson. 2007. Vessel speed increases collision risk for the green turtle, *Chelonia mydas*. *Endang Species Res*: Vol. 3: 105–113.
- Hazel, J., Lawler, I.R. and M. Hamann. 2009. Diving at the shallow end: green turtle behavior in near-shore foraging habitat. *J.Expt. Mar.Biol.Ecol.*, 371: 84-92.

- Hirth, H.; Kasu, J., and Mala, T. 1993. Observations on a Leatherback Turtle *Dermochelys coriacea* Nesting Population near Piguwa, Papua New Guinea. *Biological Conservation*. 65:77-82.
- Hitipeuw, C., P. H. Dutton, S. R. Benson, J. Thebu, and J. Bakarbessy. 2007. Population status and interesting movement of leatherback turtles, *Dermochelys coriacea*, nesting on the northwest coast of Papua, Indonesia. *Chelonian Conservation and Biology* 6:28–36.
- Howell, EA., Kobayashi, DR., Parker, DM, Blazs, GH and JP Polovian. 2008. TurtleWatch: A tool to aid in the bycatch reduction of loggerhead turtles (*Caretta caretta*) in the Hawaii-based pelagic longline fishery. *Endang Species Res*, doi:10.3354/esr00096.
- Howell, E., Dutton, P., Polovina, J., Bailey, H., Parker, D., and Balazs, G. 2010. Oceanographic influences on the dive behaviour of juvenile loggerhead turtles (*Caretta caretta*) in the North Pacific Ocean. *Marine Biology*, 157: 1011–1026.
- Hutchinson, J. and MP. Simmonds. 1992. Escalation of threats to marine turtles. *Oryx*, 26:95-102.
- IOSEA Conservation and Management Action Plan [IOSEA CMP]. 2009. Memorandum of Understanding on the Conservation and Management of Marine Turtles and Their Habitats of the Indian Ocean and South-East Asia. Concluded under the auspices of the Convention on the Conservation of Migratory Species of Wild Animals Manila, 23 June 2001, Amended by consensus, 1 March 2009.
- Ishihara T. 2007. Japan coastal bycatch investigations. In: North Pacific Loggerhead Sea Turtle Expert Workshop December 19–20, 2007. Western Pacific Regional Fishery Management Council and US National Marine Fisheries Service, Honolulu, HI, p 21–22
- Ishihara, T. 2009. Status of Japanese Coastal Sea Turtle Bycatch. In: Gilman, E. (Ed.). Proceedings of the Technical Workshop on Mitigating Sea Turtle Bycatch in Coastal Net Fisheries. 20-22 January 2009, Honolulu, U.S.A. Western Pacific Regional Fishery Management Council, IUCN, Southeast Asian Fisheries Development Center, Indian Ocean – South-East Asian Marine Turtle MoU, U.S. National Marine Fisheries Service, Southeast Fisheries Science Center: Honolulu; Gland, Switzerland; Bangkok; and Pascagoula, USA.
- Iwamoto, T., M. Ishii, Y. Nakashima, H. Takeshita, and A. Itoh. 1985. Nesting cycles and migrations of the loggerhead sea turtle in Miyazaki, Japan. *Japanese Journal of Ecology* 35:505-511.
- Kamezaki, N., I. Miyakawa, H. Suganuma, K. Omuta, Y. Nakajima, K. Goto, K. Sato, Y. Matsuzawa, M. Samejima, M. Ishii, and T. Iwamoto. 1997. Post-nesting migration of Japanese loggerhead turtle, *Caretta caretta*. *Wildlife Conservation Japan* 3:29-39.
- Kamezaki, N., Y. Matsuzawa, O. Abe, H. Asakawa, T. Fujii, and 24others. 2003. Loggerhead Turtles Nesting in Japan. Pages 210-217 in: A.B. Bolten and B.E. Witherington (eds.), *Loggerhead Sea Turtles*. Smithsonian Institution, Washington. 319pp.
- Katahira, L., C. Forbes, S. Pultz, and G. Balazs (1994) Summary of recommendations agreed upon at an informal interagency planning meeting on issues relating to the endangered hawksbill turtle in Hawaii. Held on February 3, 1994 at Hawaii Volcanoes National Park.
- Keller, J.M., Kucklick, J.R., Stamper, M.A., Harms, C.A., and P.D. McClellan-Green. 2004. Associations between organochlorine contaminant concentrations and clinical health parameters in loggerhead sea turtles from North Carolina, U.S.A. doi:10.1289/ehp.6923 (available at <http://dx.doi.org/>).
- Kinch, J. 2006. Socio-economic Baseline Study of Communities involved in Leatherback Turtle Nesting Beach Projects along the Huon Coast, Morobe Province, Papua New Guinea. Final report prepared for the Western Pacific Regional Fishery Management Council, Honolulu, Hawaii.

- Kinch, J., S. Benson, P. Anderson and K. Anana. 2009. Leatherback Turtle Nesting and Consumptive Use in the Autonomous Region of Bougainville, Papua New Guinea. Final Contract report to the Western Pacific Fishery Management Council, Honolulu, Hawaii.
- Koch, V., W.J. Nichols, H. Peckham, and V. de la Toba. 2006. Estimates of sea turtle mortality from poaching and bycatch in Bahía Magdalena, Baja California Sur, Mexico. *Biological Conservation* 128:327-334.
- Kobayashi, D.R., J.J. Polovina, D.M. Parker, N. Kamezaki, I-J. Cheng, I. Uchida, P.H. Dutton, and G.H. Balazs. 2008. Pelagic habitat characterization of loggerhead sea turtles, *Caretta caretta*, in the North Pacific Ocean (1997-2006): insights from satellite tag tracking and remotely sensed data. *Journal of Experimental Marine Biology and Ecology* 356:96-114.
- Kobayashi, D. R., Cheng, I-J., Parker, D. M., Polovina, J. J., Kamezaki, N., and Balazs, G. H. 2011. Loggerhead turtle (*Caretta caretta*) movement off the coast of Taiwan: characterization of a hotspot in the East China Sea and investigation of mesoscale eddies. – *ICES Journal of Marine Science*, doi:10.1093/icesjms/fsq185.
- Kubis, S. and G.H. Balazs. 2007. Research plan for the Hawaiian green turtle, *Chelonia mydas*. November 2007 manuscript, PIFSC.
- Kuen, C.Y. 2011. Genetics investigation of green turtle carcasses from the 2007 poaching incidence in Sabah waters. Presented at: 31st Annual Symposium on Sea Turtle Biology and Conservation, San Diego, California. April 10-16, 2011.
- Kudo, H. Murakami, A., Watanabe, S. 2003. Effects of sand hardness and human Beach use on emergence success of loggerhead sea turtles on Yakushima island, Japan. *Chelonian Conservation and Biology*, 4(3): 695-696.
- Lawalata, J. and C. Hitipeuw 2006 Community Based Management of Leatherback Turtles Residing in Kei Islands: Reducing Mortality Due to Traditional Practices (October 2005 – November 2006). Final Contract Report to the Western Pacific Fishery Management Council, Honolulu, Hawaii.
- Law, K., S. Moret-Ferguson, N. Maximenko, G. Proskurowski, E. Peacock, J. Hafner, and C. Reddy. 2010. Plastic Accumulation in the North Atlantic Subtropical Gyre. *Science Express*. 19 August 2010 issue.
- Lewison, R. L., L. B. Crowder, A. J. Read, and S. L. Freeman. 2004. Understanding impacts of fisheries bycatch on marine megafauna. *Trends in Ecology and Evolution* 19:598–604.
- Lewison, R.L. and L.B. Crowder. 2007. Putting longline bycatch of sea turtles into perspective. *Conservation Biology* 21:79-86.
- Lewison, R.L. Soykan, C.U.. and J.Franklin. 2009. Mapping the bycatch seascape: multispecies and multi-scale spatial patterns of fisheries bycatch. *Ecological Applications*, 19(4): 920–930.
- Limpus, C.J. and D.J. Limpus. 2003. “Loggerhead Turtles in the Equatorial Pacific and Southern Pacific Ocean: A Species in Decline.”pp. 93-113 In: A.B. Bolten and B.E. Witherington (eds.). *Loggerhead Sea Turtles*. Smithsonian Institution, Wash., D.C.
- Limpus, C.J. 2006. Impacts of climate change on marine turtles: A case study. In: Frisch, H. Ed. *Migratory species and climate change: impacts of a changing environment on wild animals*. UNEP/CMS Secretariat; Bonn; 2006, p. 34-39.
- Limpus, C.J., M. Boyle, and T. Sunderland. 2006. New Caledonian loggerhead turtle population assessment: 2005 pilot study. Pages 77-92 in Kinan, I. (compiler). *Proceedings of the Second Western Pacific Sea Turtle Cooperative Research & Management Workshop. Volume II: North Pacific Loggerhead Sea Turtles*. Western Pacific Regional Fishery Management Council, Honolulu, Hawaii.
- Limpus, C. J. and J. D. Miller. 2008. Australian Hawksbill Turtle Population Dynamics Project. Queensland Environmental Protection Agency funded by the Japan Bekko Association. Pgs. 140.

- Limpus, C.J. 2009. A biological review of Australian marine turtles. 1. Loggerhead turtle *Caretta caretta* (Linnaeus). Queensland Environmental Protection Agency report.
- Lutcavage ME, Lutz PL, Bossart GD, Hudson DM. 1995. Physiologic and clinicopathologic effects of crude oil of loggerhead sea turtles. *Arch Environ Contamin Toxicol* 28:417-422.
- Lutz, P. and J. Musick. 1997. *The Biology of Sea Turtles*. CRC Press. 887pgs
- Maison KA, Kinan Kelly, I., Frutchey KP. 2010. Green turtle nesting sites and sea turtle legislation throughout Oceania. NOAA Tech Memo NMFS-F/SPO-110.
- Marcovaldi, M. A. and G.G. Marcovaldi. 1999. "Marine turtles of Brazil: the history and structure of Projeto TAMAR-IBAMA." *Biological Conservation* 91(1):35-41.
- Marquez-M.R, MA Carrasco, MC Jimenez, C Penaflores-S. and R Bravo-G. 2005. Kemps and olive ridley sea turtles population status. Pgs 237-239 In: 21st Annual Symposium on Sea Turtle Biology and Conservation. NOAA Tech Memo NMFS-SEFSC-528.
- Matsuzawa, Y., K. Sato, W. Sakamoto, and K.A. Bjorndal. 2002. Seasonal fluctuations in sand temperature: effects of the incubation period and mortality of loggerhead sea turtle (*Caretta caratta*) pre-emergent hatchlings in Minabe, Japan. *Marine Biology* 140: 629-646.
- Matsuzawa, Y., K. Sato, W. Sakamoto, and K.A. Bjorndal. 2002. Seasonal fluctuations in sand temperature: effects of the incubation period and mortality of loggerhead sea turtle (*Caretta caratta*) pre-emergent hatchlings in Minabe, Japan. *Marine Biology* 140: 629-646.
- Matsuzawa, Y. 2006. Nesting beach management of eggs and pre-emergent hatchlings of north Pacific loggerhead sea turtles in Japan. pgs 13-22. In: WPFMC (Kinan, I. compiler). *Proceedings of the Second Western Pacific Sea Turtle Cooperative Research & Management Workshop. Volume II: North Pacific Loggerhead Sea Turtles*. Western Pacific Regional Fishery Management Council. March 2-3, 2005, Honolulu, HI.
- Matsuzawa, Y. 2010. Nesting beach management in Japan to conserve eggs and pre-emergent hatchlings of the North Pacific loggerhead sea turtle: 2009 nesting season. *Sea Turtle Association of Japan (STAJ)*. Final Contract Report to the WPFMC.
- McCauley, R. D., Fewtrell, J., Duncan, A. J., Jenner, C., Jenner, M-N., Penrose, J., Prince, R. I. T., Adhitya, A., Murdoch, J., and McCabe, K. 2000. Marine seismic surveys – a study of environmental implications. *Australian Petroleum Production and Exploration Association Journal*, 2000: 692–705.
- Moritz, C. 1994. Defining 'evolutionary significant units' for conservation. *Trends in Ecology and Evolution* 9(10): 373-375.
- Mortiz, C., Broderick, D., Dethmers, K., FitzSimmons, N., and C. Limpus. 2002. Population genetics of Southeast Asian and Western Pacific green turtles, *Chelonia mydas*. Final Report to UNEP/CMS. 42pgs.
- Mrosovsky, N., Ryan, G.D. and M.C. James. 2009. Leatherback turtles: The menace of plastic. *Mar. Pollut. Bull.* (2009), doi:10.1016/j.marpolbul.2008.10.018
- National Marine Fisheries Service (NMFS). 2004. Biological opinion on the authorization of pelagic fisheries under the fisheries management plan for the pelagic. National Marine Fisheries Service, Silver Spring, Maryland, USA.
- National Marine Fisheries Service (NMFS). 2005. Biological Opinion on Continued authorization of the Hawaii-based Pelagic, Deep-Set, Tuna Longline Fishery based on the Fishery Management Plan for Pelagic Fisheries of the Western Pacific Region. Pacific Islands Region, 168 p.
- National Marine Fisheries Service (NMFS). 2006. Biological Opinion on the U.S. Western and Central Pacific Purse Seine Fishery as authorized by the South Pacific Tuna Act and the High Seas Fishing Compliance Act. Pacific Islands Region, 185 p.

- National Marine Fisheries Service (NMFS). 2008. Biological Opinion on Proposed Management Modifications for the Hawaii-based Shallow-set Longline Swordfish Fishery- Implementation of Amendment 18 to the Fishery Management Plan for Pelagic Fisheries of the Western Pacific Region. Pacific Islands Region, 91p.
- National Marine Fisheries Service (NMFS). 2010. Biological Opinion on measures to reduce interactions between Green Sea Turtles and the American Samoa-based Longline Fishery- Implementation of an Amendment to the Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific Region on ESA-listed marine species. Pacific Islands Regional Office, 91 p.
- National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1998a. Recovery Plan for U.S. Pacific Populations of the Loggerhead Sea Turtle (*Caretta caretta*). Prepared by the Pacific Sea Turtle Recovery Team.
- National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1998b. Recovery Plan for U.S. Pacific Populations of the Leatherback Sea Turtle (*Dermochelys coriacea*). Prepared by the Pacific Sea Turtle Recovery Team.
- National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1998c. Recovery Plan for U.S. Pacific Populations of the Olive Ridley Sea Turtle (*Lepidochelys olivacea*) Prepared by the Pacific Sea Turtle Recovery Team.
- National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1998d. Recovery Plan for U.S. Pacific Populations of the Green Sea Turtle (*Chelonia mydas*). Prepared by the Pacific Sea Turtle Recovery Team.
- National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1998e. Recovery Plan for U.S. Pacific Populations of the Hawksbill Sea Turtle (*Eretmochelys imbricata*). Prepared by the Pacific Sea Turtle Recovery Team.
- National Marine Fisheries Service and U.S. Fish & Wildlife Service. 2007a. Loggerhead Sea Turtle (*Caretta caretta*). 5-Year Review: Summary and Evaluation.
- National Marine Fisheries Service and U.S. Fish & Wildlife Service. 2007b. Leatherback Sea Turtle (*Dermochelys coriacea*). 5-Year Review: Summary and Evaluation.
- National Marine Fisheries Service and U.S. Fish & Wildlife Service. 2007c. Olive Ridley Sea Turtle (*Lepidochelys olivacea*). 5-Year Review: Summary and Evaluation.
- National Marine Fisheries Service and U.S. Fish & Wildlife Service. 2007d. Green Sea Turtle (*Chelonia mydas*). 5-Year Review: Summary and Evaluation.
- National Marine Fisheries Service and U.S. Fish & Wildlife Service. 2007e. Hawksbill Sea Turtle (*Eretmochelys imbricata*). 5-Year Review: Summary and Evaluation.
- National Marine Fisheries Service and U.S. Fish & Wildlife Service. 2011 in review. Five Year Action Plan for Research and Management of Endangered Hawksbill Sea Turtles in Hawaii, 2011 – 2015
- National Research Council (NRC). 1990. Decline of the Sea Turtles: Causes and Prevention. National Academy Press. Washington, DC. 355pp.
- National Research Council (NRC). 2010. Assessment of Sea-Turtle Status and Trends: Integrating Demography and Abundance. The National Academies Press, Washington DC. 162pp.
- Navy. 2001. Shock trial of the Winston Churchill (DDG 81): final environmental impact statement.
- Navy. 2007. Shock trial of the Mesaverde (LPD 19): environmental impact statement.
- Neithammer, K.R., Balazs, G.H., Hatfield, J.S., Nakai, G.L. and J.L. Megysi. 1997. Reproductive Biology of the Green Turtle (*Chelonia mydas*) at Tern Island, French Frigate Shoals, Hawai'i. *Pacific Science*, vol. 51: 1: 36-47
- Nichols, W.J., A. Resendiz, J.A. Seminoff, and B. Resendiz. 2000. Transpacific migration of a loggerhead turtle monitored by satellite telemetry. *Bulltin of Marine Science* 67(3):937-947.

- Nichols, W. J., K.E. Bird and C.R. Tambiah 2003. The value of local knowledge in sea turtle conservation: a case from Baja California, Mexico. University of British Columbia Fisheries Centre Research Reports 11(1):178-183.
- Nitta, E.T., Henderson, J.R. 1993. A review of interactions between Hawaii's fisheries and protected species. *Mar. Fish. Rev.* 55: 83–92.
- OHara, J. and J.R. Wilcox, 1990. Avoidance responses of Loggerhead turtles, *Caretta caretta*, to low frequency sound. *Copeia* 2: 564 567.
- O'Keeffe DJ, Young GA. 1984. Handbook on the environmental effects of underwater explosions. Naval Surface Weapons Center, Dahlgren and Silver Spring, NSWC TR 83-240.
- Palau Bureau of Marine Resources. 2008. Palau Marine Turtle Conservation & Monitoring Program Final Report. Unpublished grant report. 31pp.
- Parnesan, C. and G. Yohe. 2003. A globally coherent fingerprint of climate change impacts across natural systems. *Nature* 421: 37-42.
- Parker, D. M., Balazs, G.H., King, C.S., Katahira, L. and W. Gilmartin. 2009. Short-range movements of hawksbill turtles from nesting to foraging areas within the Hawaiian Islands. *Pacific Science*, 63 (3):371-382.
- Parker, D. M., Dutton, P.H., and G. H. Balazs. 2011. Oceanic Diet and Distribution of Haplotypes for the Green Turtle, *Chelonia mydas*, in the Central North Pacific. *Pacific Science* (2011), vol. 65, no. 4:419 – 431 doi: 10.2984/65.4.419.
- Parker, D. & G. Balazs, 2011 [unpublished]. Draft Map Guide to Marine Turtle Nesting and Basking in the Hawaiian Islands. Marine Turtle Research Program, NOAA, National Marine Fisheries Service, Pacific Islands Fisheries Science Center.
- Peckham SH, Maldonado Diaz D, Walli A, Ruiz G and others. 2007. Small-scale fisheries bycatch jeopardizes endangered Pacific loggerhead turtles. *PLoS ONE* 2(10): e1041, doi: 10.1371/journal.pone.0001041.
- Peckham SH, Maldonado Diaz D, Volker K, Mancini A, Gaos A, Tinker MT, Nichols WJ. 2008. High mortality of loggerhead turtles due to bycatch, human consumption and strandings at Baja California Sur, Mexico, 2003 to 2007. *Endang Species Res* 5:171–183.
- Peckham SH, Maldonado-Diaz D (In Press). Empowering small scale fishermen to be conservation heroes: a trinational fishermen's exchange to protect loggerhead turtles. In: Seminoff JA, editor. *Sea Turtles of the Eastern Pacific Ocean: Natural History, Conservation Challenges and Signs of Success*. Tucson AZ USA: Univ. of Arizona Press.
- Pichel, W., J. Churnside, T. Veenstra, D. Foley, K. Friedman, R. Brainard, J. Nicoll, Q. Zheng, and P. Clemente-Colon. 2007. Marine debris collects within the North Pacific Subtropical Convergence Zone. *Marine Pollution Bulletin* 54: 1207-1211.
- Pilcher, N.J., Heng, CE. And R. Trono. 2007 unpublished. Mass turtle poaching on the high and low seas: A case study from Southeast Asia.
- Pilcher, NJ. 2007. Regional Action Plan for the Conservation of Marine turtles and their habitats in the Sulu-Sulawesi Seascape. Conservation International Philippines.
- Pilcher, NJ., et al. 2008. Rapid Bycatch Assessment – Malaysia. Project GLOBAL.
- Pilcher, N.J. and M.S. Siow. 2010. Marine Turtles and Seismic Activity: An Overview. Final report to Niko Resources Ltd. Alberta, Canada. 37pp
- Pilcher, N. 2010. The 2009-2010 Leatherback nesting season, Huon Coast, Papua New Guinea. Final Contract Report prepared for the Western Pacific Fishery Management Council, Honolulu, Hawaii.
- Pilcher, N. 2011. The 2010-2011 Leatherback nesting season, Huon Coast, Papua New Guinea. Final Contract Report prepared for the Western Pacific Fishery Management Council, Honolulu, Hawaii.

- Polovina, J., I. Uchida, G. Balazs, E.A. Howell, D. Parker, and P. Dutton. 2006. The Kuroshio Extension Bifurcation Region: a pelagic hotspot for juvenile loggerhead sea turtles. *Deep-Sea Research II* 53:326-339
- Quaintance, JK., Rice, MR., GH Balazs. 2002. Basking, foraging, and resting behavior of two sub-adult green turtles in Kiholo Bay Lagoon, Hawaii. 22nd Annual Symposium on Sea Turtle Biology and Conservation, Miami, Florida USA
- Rice, M. R., Balazs, G. H., Hallacher, L., Dudley, W., Watson, G., Krusell, K., Larson, B. 2000. Diving, basking, and foraging patterns of a sub-adult green turtle at Punalu'u, Hawaii. In: 18th Annual Symposium on Sea Turtle Biology and Conservation. U.S. Dept. of Commerce. NOAA Technical Memorandum NMFS-SEFSC-436, p. 229-231.
- Robinson, A. R, H. Crick, J.A. Learmonth and 18 others. 2008. Travelling though a warming world: climate change and migratory species. *Endangered Species Research*.
- Russell RJ and GH Balazs. 2009. Dietary Shifts by Green Turtles (*Chelonia mydas*) in the Ka'ne'ohe Bay Region of the Hawaiian Islands: A 28-Year Study. *Pacific Science* (2009), vol. 63, no. 2:181–192.
- Sarti, L.M., A. R. Barragan. D.G Munoz, N. G. P. Huerta, and F. Vargas. 2007. Conservation and Biology of the Leatherback Turtle in the Mexican Pacific. *Chelonian Conservation and Biology*, 6(1): 70–78.
- Secretariat of the Pacific Regional Environment Program (SPREP). 2008. Marine Turtle Action Plan: 2008-2012. SPREP technical report, Apia Samoa.
- Secretariat of the Pacific Regional Environment Program (SPREP). 2010. Turtle Research and Monitoring Database System (TREDS) 2009 Annual Report.
- Seitz, W.A., K. Kagimoto, B. Luehers, and L. Katahira. 2011 in Prep. A Summary of Findings by the Hawaii Island Hawksbill Turtle Recovery Project on Nesting Hawksbill Turtles from 1989 to 2009. University of Hawaii at Manoa Pacific Cooperative Studies Unit Technical Report.
- Seminoff, J.A. 2004. Sea Turtles, Red Listing and the need for regional assessments. *Marine Turtle Newsletter*. 106:4-6.
- Seminoff, JA., TT Jones, T Eguchi, M Hastings, DR. Jones. 2009. Stable carbon and nitrogen isotope discrimination in soft tissues of the leatherback turtle (*Dermochelys coriacea*): Insights for trophic studies of marine turtles. *Journal of Experimental Marine Biology and Ecology* 381 (2009) 33–41
- Senko, J., Schneller, AJ, Solis, J., Ollervides, F., and WJ Nichols. 2011. People helping turtles, turtles helping people: Understanding resident attitudes towards sea turtle conservation and opportunities for enhanced community participation in Bahia Magdalena, Mexico. *Ocean & Coastal Management*, 54: 148-157.
- Shillinger GL, Palacios DM, Bailey H, Bograd SJ, Swithenbank AM, et al. (2008) Persistent leatherback turtle migrations present opportunities for conservation. *PLoS Biol* 6(7): e171. doi:10.1371/journal.pbio.0060171.
- Shillinger GL, Swithenbank AM, Bograd SJ, Bailey H and others (2010) Identification of high-use interesting habitats for eastern Pacific leatherback turtles: role of the environment and implications for conservation. *Endang Species Res* 10:215–232
- Smith, J.E., Hunter, C.L., and C.M. Smith. 2010. The effects of top-down versus bottom-up control on benthic coral reef community structure. *Oecologia*, 163:497–507. DOI 10.1007/s00442-009-1546-z.
- Snover, M., Baker, J. and M. Sullivan. 2007. US Pacific Islands Research Plan for Green (excluding Hawaii) and Hawksbill Turtles. February 2007 draft manuscript, PIFSC.
- Snover, M. 2008. Comments on “Using Bayesian state-space modelling to assess the recovery and harvest potential of the Hawaiian green sea turtle stock”. *Ecological Modelling*, 212: 545–549.

- Southwood, A., K. Fritches, R. Brill and Y. Swimmer, 2008. Sound, chemical, and light detection in sea turtles and pelagic fishes: sensory-based approaches to bycatch reduction in longline fisheries. *Endangered Species Research* 5: 225–238.
- Spotila, JR., Reina, R.D., Steyermark, A.C., Plotkin, P.T., and F.V. Paladino. 2000. Pacific leatherback turtles face extinction. *Nature* 405:529–530.
- Stewart, K.R., Keller, J.M. Templeton, R., J.R. Kucklick and C. Johnson. 2011. Monitoring persistent organic pollutants in leatherback turtles (*Dermochelys coriacea*) confirms maternal transfer. *Mar. Pollut. Bull.* doi:10.1016/j.marpolbul.2011.04.042
- Stewart KR, Lewison RL, Dunn DC, Bjorkland RH, Kelez S, et al. (2010) Characterizing Fishing Effort and Spatial Extent of Coastal Fisheries. *PLoS ONE* 5(12):e14451. doi:10.1371/journal.pone.0014451
- Starbird, C. and A. Suarez. 1994. Leatherback sea turtle nesting on the North Vogelkop Coasts of Irian Jaya and the discovery of a leatherback sea turtle fishery on Kei Kecil Islands. In: *Proceedings of the Fourteenth Annual Symposium on Sea Turtle Biology and Conservation*. NOAA Tech Memo NMFS-SEFSC-351, p. 143-146.
- Suarez, A and CH Starbird. 1996. Subsistence hunting of leatherback turtles, *Dermochelys coriacea*, in the Kai Islands, Indonesia. *Chelonian Conservation and Biology*; v. 2(2): 190-195.
- Swimmer, Y. and R. Brill. 2006. Sea Turtle and Pelagic Fish Sensory Biology: Developing Techniques to Reduce Sea Turtle Bycatch in Longline Fisheries. NOAA Technical Memorandum NMFS-PIFSC-7.
- Tapilatu, R.F. and M. Tiwari. 2007. Leatherback Turtle, *Dermochelys coriacea*, Hatching Success at Jamursba-Medi and Wermon Beaches in Papua, Indonesia. *Chelonian Conservation and Biology*, 6(1): 154 -158.
- Tiwari, M, Balazs GH, S Hargrove. 2010. Estimating carrying capacity at the green turtle nesting beach of East Island, French Frigate Shoals. *Mar Ecol Prog Ser*. Vol. 419: 289–294. doi: 10.3354/meps08833
- TRAFFIC Southeast Asia-Indochina 2004. The trade in marine turtle products in Viet Nam. Report to the marine turtle conservation and management team, Viet Nam, TRAFFIC Southeast Asia-Hanoi, Viet Nam.
- Troeng, S. and E. Rankin. 2005. “Long-term conservation efforts contribute to positive green turtle (*Chelonia mydas*) nesting trend at Tortuguero, Costa Rica.” *Biological Conservation* 121:111-116.
- Van Houtan KS, Hargrove SK, Balazs GH (2010) Land Use, Macroalgae, and a Tumor-Forming Disease in Marine Turtles. *PLoS ONE* 5(9): e12900. doi:10.1371/journal.pone.0012900
- Van Houtan, KS. 2011. Future climate impacts to marine turtle populations, with a focus on the North Pacific Ocean. NMFS PIFSC Internal Report-10-022.
- Van Houtan KS and JM Halley. 2011. Long-Term Climate Forcing in Loggerhead Sea Turtle Nesting. *PLoS ONE* 6(4): e19043. doi:10.1371/journal.pone.0019043
- Vermaat, J.E., N.S.R. Agawin, M.D. Fortes, J.S. Uri. 1997. The capacity of seagrasses to survive increased turbidity and siltation: the significance of growth form and light use. *Ambio* 26(8): 499-504.
- Vargo S, Lutz P, Odell D, Van Vleet E, Bossart G. 1986. Final Report Study of the Effects of Oil on Marine Turtles. Minerals Management Service Contract Number 14-12-0001-30063, Florida Institute of Oceanography, St. Petersburg, FL.
- Wabnitz, C. and W. J. Nichols. 2010. Plastic Pollution: An Ocean Emergency. *Marine Turtle Newsletter*, 129:1-4.
- Wabnitz CC., Balazs GH, Beavers S, Bjornda KA, Bolten AB, Christensen V, Hargrove S, and D Pauly. 2010. Ecosystem structure and processes at Kaloko Honoko–hau, focusing on the

- role of herbivores, including the green sea turtle *Chelonia mydas*, in reef resilience. *Mar Ecol Prog Ser*. Vol. 420: 27–44.
- Wallace BP, DiMatteo AD, Hurley BJ, Finkbeiner EM, Bolten AB, et al. 2010a. Regional Management Units for Marine Turtles: A Novel Framework for Prioritizing Conservation and Research across Multiple Scales. *PLoS ONE* 5(12): e15465. doi:10.1371/journal.pone.0015465.
- Wallace BP, Lewison RL, McDonald SL, McDonald RK, Kot CY, Kelez S, Bjorkland RK, Finkbeiner EM, Helmbrecht S and LB Crowder. 2010b. Global patterns of marine turtle bycatch. *Conservation Letters*. doi: 10.1111/j.1755-263X.2010.00105.x
- Wallace BP, DiMatteo AD, Bolten AB, Chaloupka MY, Hutchinson BJ, et al. 2011. Global Conservation Priorities for Marine Turtles. *PLoS ONE* 6(9): e24510. doi:10.1371/journal.pone.0024510.
- Wang JH, Boles LC, Higgins B, Lohmann KJ. 2007. Behavioral responses of sea turtles to lightsticks used in longline fisheries. *Anim Conserv* 10:176–182.
- Wang, JH, Fisler, S and Y Swimmer. 2010. Developing visual deterrents to reduce sea turtle bycatch in gill net fisheries. *Mar Ecol Prog Ser* Vol. 408: 241–250.
- Whittow, G.D. and G.H. Balazs. 1982. Basking behavior of the Hawaiian green sea turtle (*Chelonia mydas*). *Pacific Science*, 36(2): 129-139.
- Witherington, B.E. & Bjorndal, K.A., 1990. Influences of artificial lighting on the seaward orientation of hatchling loggerhead turtles *Caretta caretta*. *Biol. Cons.*, 53: 139-149.
- Western Pacific Fishery Management Council (WPFMC). 2002. Proceedings of the Western Pacific Sea Turtle Cooperative Research and Management Workshop. (Edited by I. Kinan) February 2-5, 2002, Honolulu, HI.
- Western Pacific Fishery Management Council (WPFMC). 2005a. Proceedings of the Second Western Pacific Sea Turtle Cooperative Research and Management Workshop. Volume I: West Pacific Leatherback and Southwest Pacific Hawksbill Sea Turtles (Edited by I. Kinan). May 17-21, 2004, Honolulu, HI.
- Western Pacific Fishery Management Council (WPFMC). 2005b. Final report of the Council's second Sea Turtle Advisory Committee meeting, March 3-4, 2005.
- Western Pacific Fishery Management Council (WPFMC). 2006. Proceedings of the Second Western Pacific Sea Turtle Cooperative Research and Management Workshop. Volume II: North Pacific Loggerheads (Edited by I. Kinan). March 2-3, 2005, Honolulu, HI.
- Western Pacific Fishery Management Council (WPFMC) and National Marine Fisheries Service (NMFS). 2008. North Pacific Loggerhead Sea Turtle Expert Workshop. December 19-20, 2007, Honolulu, HI.
- Western Pacific Fishery Management Council (WPFMC). 2010. Protected Species Conservation and Management Program in the Western Pacific Region: January 1, 2010 - December 31, 2014. Program proposal submitted to NMFS PIRO.
- Wurlianty, B. and C. Hitipeuw. 2009. Leatherback Conservation at Warmon Beach, Papua-Indonesia: Nesting Beach Management. WWF-Indonesia final contract report for November 2008 – November 2009 to the Western Pacific Fishery Management Council.
- Zug, R.G., Balazs, G.H., Wetherall, J.A., Parker, D.M., and S.K. Murakawa. 2002. Age and growth of Hawaiian green turtles (*Chelonia mydas*): an analysis based on skeletochronology. *Fish. Bull.* 100:117–127.