United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaiʻi 96850

In Reply Refer To:
2022-0064915-S7-001

March 10, 2023

Ms. Meesa Otani
Federal Highway Administration
Hawaiʻi Federal-Aid Division
300 Ala Moana Blvd., Rm. 3-229
Honolulu, Hawaiʻi 96850

Subject: Biological Opinion for the Proposed Kūhiō Highway Emergency Shoreline Mitigation Project, Wailuā Beach, Kauaʻi, Federal-aid Project No. ER-24(004)

Dear Ms. Otani:

This document transmits the U.S. Fish and Wildlife Service's (USFWS) biological opinion based on our review of the Federal Highway Administration (FHWA) funding of proposed Kūhiō Highway Emergency Shoreline Mitigation Project located in Wailuā Beach, Kauaʻi and its effects on the endangered hawksbill sea turtle (*Eretmochelys imbricata*) and the threatened Central North Pacific Distinct Population Segment (DPS) of the green sea turtle (*Chelonia mydas*) (hereafter collectively referred to as sea turtles) in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq*.). The USFWS consults on sea turtles and their use of terrestrial habitats (beaches where nesting and/or basking is known to occur), whereas NOAA Fisheries consults on sea turtles in aquatic habitats. Therefore, our biological opinion only addresses project impacts to sea turtles in their terrestrial habitat. Your request for formal consultation was received on November 4, 2022.

This biological opinion is based on information provided in your November 4, 2022, biological assessment, and other sources of information available to us. A complete administrative record of this consultation is on file in our office.

A separate informal consultation (USFWS number 2022-0064915-S7-002) is found in Appendix A for project impacts that may affect but is not likely to adversely affect the endangered ʻōpeʻapeʻa (Hawaiian hoary bat, *Lasiurus cinereus semotus*); the endangered aeʻo (Hawaiian stilt, *Himantopus mexicanus knudseni*), ʻalae keʻokeʻo (Hawaiian coot, *Fulica alai*), ʻalae ʻula

(Hawaiian gallinule, *Gallinula galeata sandvicensis*), and koloa (Hawaiian duck, *Anas wyvilliana*) (hereafter collectively referred to as Hawaiian waterbirds); and the endangered ‘ua‘u (Hawaiian petrel, *Pterodroma sandwichensis*), threatened ‘a‘o (Newell’s shearwater, *Puffinus auricularis newelli*), and endangered Hawai‘i DPS of the ‘akē‘akē (band-rumped storm-petrel, *Oceanodroma castro*) (hereafter collectively referred to as Hawaiian seabirds).

CONSULTATION HISTORY

July 15, 2022: The FHWA submitted a Biological Assessment and requested formal consultation with the USFWS.

August 9, 2022: The USFWS responded to the FHWA’s request to inform them that the Biological Assessment received was insufficient, and asked for additional information. The USFWS

September 21, 2022: The USFWS met with the FHWA and the project consultants to discuss details of the project description and conservation measures and provide technical assistance regarding the Biological Assessment.

November 4, 2022: The FHWA submitted the final Biological Assessment and requested formal consultation from the USFWS.

December 2, 2022: The USFWS initiated formal consultation with the FHWA (USFWS Reference Number: 2022-0064915-S7-001).

January 1, 2023: The USFWS requested additional information from the FHWA regarding the installation of the ungrouted revetment in potential turtle nesting areas, lighting at night for safety purposes, a fence or barrier being constructed during construction of the ungrouted revetment, the size of the tripod for the ADCPs, and recommended the FHWA increase the frequency of sea turtle surveys during operation of the Sandsaver.

January 2, 2023: The USFWS requested additional information from the FHWA regarding the use of barbed wire fencing and additional details about the equipment being used and/or staged on the beach during debris removal, installation of the ungrouted revetment, and installation of the Sandsaver.

February 3, 2023: The FHWA provided responses to the USFWS’s additional information requests from January 1, 2023 and January 2, 2023.

BIOLOGICAL OPINION

Description of Proposed Action
The FHWA is proposing to fund the project, to be completed by the Hawai‘i Department of Transportation (HDOT), the designated non-federal representative of FHWA. This project proposes to restore the highway and rehabilitate the beach from the effects of a storm that occurred in March 2021. The storm resulted in the loss of large areas of beach sand dunes, naupaka vegetation, and large ironwood trees on Wailuā Beach; and consequently, the adjacent roadway was undermined. Approximately 2,030 feet (ft) (619 meters (m)) of Kūhiō Highway will be restored, from the Wailuā River to Papaloa Road. The proposed work includes installation of an ungrouted rock revetment, signs, traffic delineators, a concrete slab, boulders, and naupaka plants to restore the area to pre-existing conditions. The HDOT will also remove a concrete slab, sandbags, concrete column, and trees and debris. Work is anticipated to begin June 2022 through February 2023 during daylight hours but may be extended as late as June 2023.

The HDOT will also collaborate with the University of Hawai‘i (UH) to restore the beach to provide a more sustainable function. To do so, the HDOT will install a new beach nourishment technology called the Sandsaver (www.sandsaver.com). The Sandsaver works by using the energy of breaking waves to disperse suspended and particles up the beach while simultaneously dissipating the energy of the waves. The HDOT will regrade the sand on the beach to previous conditions and place Acoustic Doppler Current Profilers (ADCPs) at various locations along the ocean floor to collect wave spectrum and velocity data. The information will be transmitted through underwater cables to a solar-powered telemetry system. The information gathered will help identify appropriate locations for the Sandsaver devices.

The proposed work comprises the following: (1) deploying six ADCPs in the nearshore waters, (2) removal of damaged items such as a concrete slab, sandbags, concrete column, and debris and installation of an ungrouted rock revetment along the highway, (3) installation of Sandsaver blocks in one or two arc formations, and (4) operation of the ADCPs and the Sandsaver.

Installation of ADCPs
Prior to installing the Sandsaver, UH will deploy six ADCPs in the nearshore waters of the project area. ADCPs will gather data to inform the full wave spectrum and current velocity of the water column. These data are necessary to support models used to determine the installation position of the Sandsaver on Wailuā Beach relative to the revetment and beach profile, and to study beach accretion processes once the Sandsaver is in place.

Each ADCP unit is enclosed in a plastic casing and measures about 7 inches (in) (18 centimeters (cm)) in diameter (Figure 1). Each ADCP will be installed on corrosion resistant aluminum DeepWater Buoyancy’s BTM-AL50 tripod bottom mounts holding the equipment in place (Figure 2). The tripod mount will also be encased in plastic, the same material encasing the ADCP. The total size of the tripod that the ADCPs will be on in the water will be 3 ft x 3 ft x 3 ft (3 m x 3 m x 3 m).

The ADCPs are powered by both an internal battery and an external battery system. The external batteries are fully contained and attached to the tripod mounts for providing power to the ADCPs and an SD card for data storage. The ADCPs and tripod mounts will be weighed to the bottom by lead weights attached to the feet of the tripod mount and placed on the seafloor at specified locations. The lead weights will be encased in epoxy (i.e., a glass fiber reinforced polymer wrap) one-eighth inch thick. All six ADCPs will be standalone units that will store data on SD cards. UH divers will install the ADCPs in July 2023. The entire installation is estimated to take about 1-2 days for deploying and setting up the ADCPs. After a period of about two years, all ADCPs will be removed. The retrieval process is also estimated to take about 1-2 days.

Figure 1. Acoustic Doppler Current Profilers in plastic casing.

Figure 2. Acoustic Doppler Current Profilers installed on corrosion resistant aluminum Deepwater Buoyancy's BTM-AL50 bottom mounts holding the equipment in place.

Removal of Debris and Installation of the Ungrouted Riprap

The ungrouted rock revetment is used to protect the highway infrastructure from extreme events such as storm surges, wave run-up, and hurricane force surges. Ungrouted riprap can reduce wave energy impacts and is preferred over grouted riprap revetments by state agencies managing the coastal areas. The work to remove any existing debris and install the ungrouted riprap will be advertised by HDOT under one contract. This phase of the project is expected to take approximately nine months (tentatively from April 2023 to December 2023) to complete. The damaged concrete slab, sandbags, and debris (above high-water mark) will be removed from the project area using heavy equipment such as cranes, backhoes, bobcats, bulldozers, dump trunks, pick-up trucks, and excavators. All removal work will be conducted out of water; no equipment will be operating in the water, but it will be operated on the sandy area of the beach. Following removal of damaged structures and debris, the same heavy equipment machines will also be used to install the ungrouted revetment. The work area for site preparation and installing the revetment will parallel the existing bike path (and Kūhiō Highway) and encompass an area that is about 2,030 ft (619 m) long and about 30 ft (9 m) wide and overlapping the beach. Figure 3 (below) illustrates the cross-sectional view of the revetment installation. The revetment installation begins approximately 5-7 ft (1.5-2.5 m) seaward from the bike path such that the existing narrow band of coastal vegetation between the bike path and the beach will mostly stay intact. The sandy area on the ocean-side of the vegetation will be disturbed during the installation of the ungrouted revetment. Following excavation to about 5 ft (1.5 m) below mean sea level (msl), a Triton Marine Mattress will form the foundation upon which the new riprap will be installed. After installation is complete, the excavated sand and sand from the south side of the project area will be used to fill and bury the newly installed revetment.

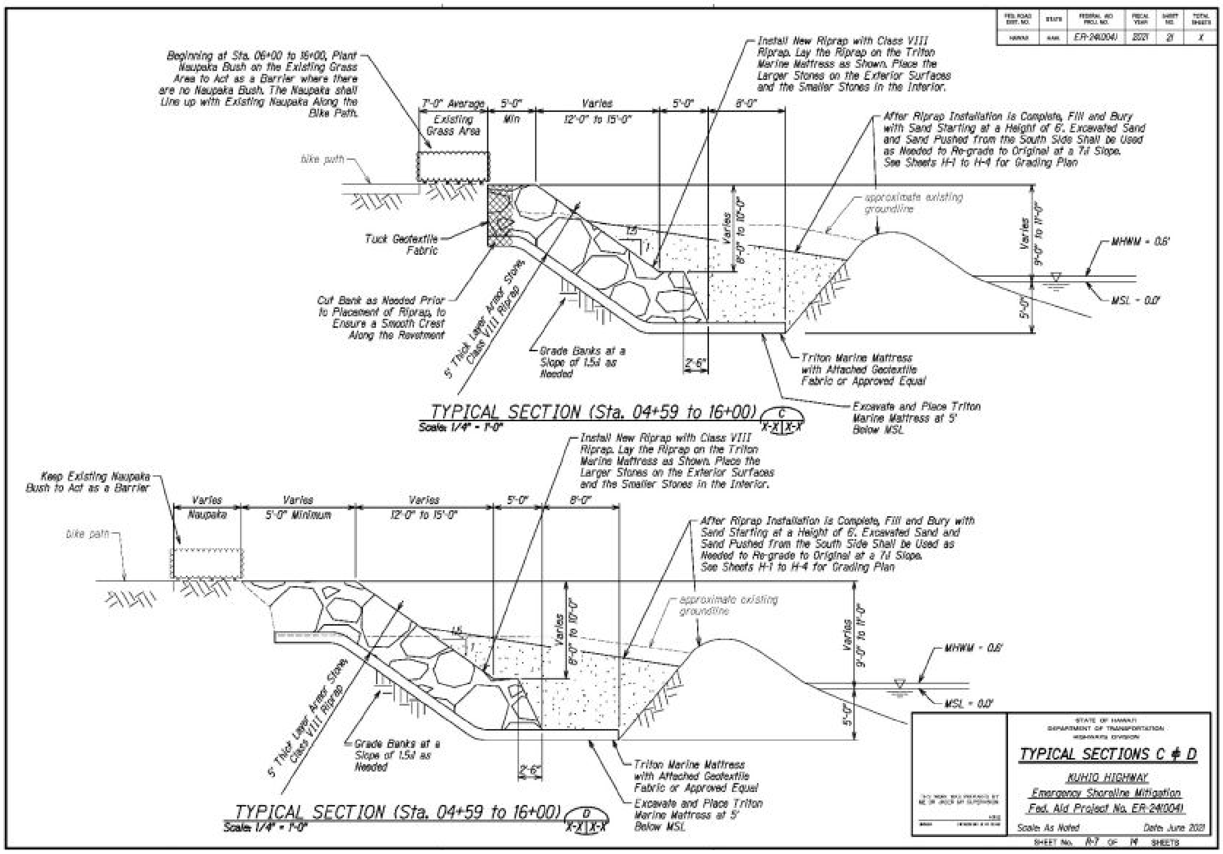

Figure 3. Cross sectional view detailing installation of new ungrouted revetment in Wailuā Beach project area.

No night-work will occur during this or any stage of the project. In addition, no lights will remain on overnight. Areas that may be deemed unsafe for the public will be protected with appropriate fencing, signs, and barriers.

Since this portion is anticipated to take approximately nine months to complete, temporary fencing will be erected at the end of each workday to minimize sea turtles and other wildlife from becoming entrapped in the project area. This temporary fencing will be made of plastic, a minimum of 3 ft (0.9 m) in height and have individual holes no larger than 3 inches.

<u>Installation of the Sandsaver</u>

HDOT is proposing to install the Sandsaver blocks at Wailuā Beach as a pilot project to stabilize eroding shorelines in Hawai‘i. The Sandsaver technology comprises the use of Sandsaver blocks made from polyethylene and weigh about 250 pounds (lbs) (113 Kilograms [kg]). Each block measures about 5 ft (1.5 m) wide x 3 ft (0.9 m) high x 4.75 ft (1.45 m) deep and contains larger (7.5 in or about 19 cm diameter) openings/holes on the seaward side which taper through the block and have smaller (3 in or about 7.6 cm diameter) openings on the upland side (Figure 4). The Sandsaver works by first breaking the wave energy and thereby significantly reducing wave energy-induced beach erosion. Seawater transporting large amounts of sand and sediment passes through the large holes facing the seaward side. The reduced velocity of retreating water passing through the tapered holes allows sufficient time for the sand to settle and not retreat back into the surf, thereby over time retaining sand and progressively building the beach.

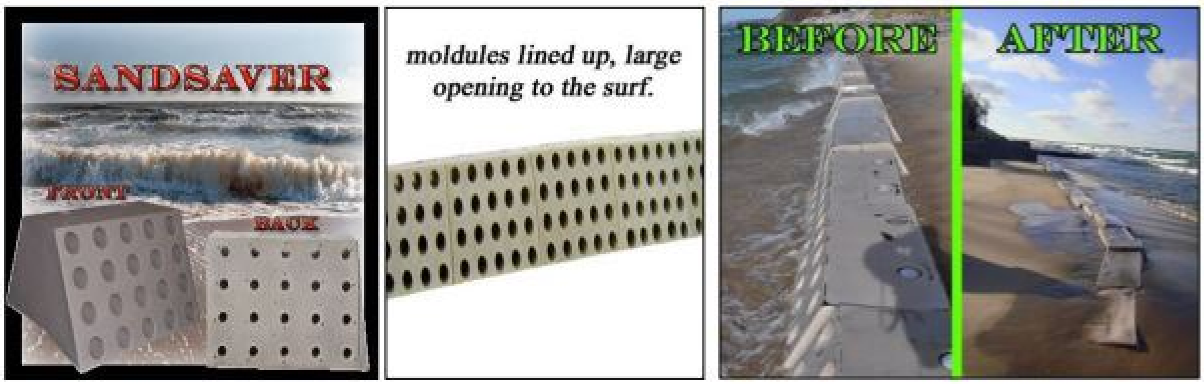

Figure 4. Sandsaver, a patented product manufactured by Granger Plastics Company (www.sandsaver.com). Note: The figure to the right is a “before” and “after” example of Sandsaver installed in Middletown, Ohio.

The exact position of the Sandsaver arc(s) will be determined in the future with data gathered from the ADCPs and the subsequent modeling being conducted by UH. Installation of the Sandsaver blocks will occur in the wash zone between the high and low water mark. The Sandsaver blocks may be installed at elevations between -4 ft (1.2 m) and 0 ft (0 m) msl. At these elevations the Sandsaver blocks will mostly be submerged at high tide and be partially exposed at lower tides. Installing the Sandsaver blocks within this range will ensure wave motion can transport the suspended sand through the holes in the Sandsaver blocks, resulting in a net accumulation of sand on the landward side of the Sandsaver. Because the Sandsaver placement needs to be “closed” at the landward ends to prevent water and sand from escaping, an arced orientation was chosen such that the bottom of the Sandsaver blocks at the ends of the arcs extended to higher elevations (-1 ft (0.3 m) to +3 ft (0.9 m) msl). The Sandsaver blocks that comprise the upland beach portions of the arc will be all or mostly buried moving inshore along the arc and generally conforming with the gradient of the revetment. The Sandsaver blocks at the Wailuā Beach project area will likely be deployed in either one (or two) arc formations. In a two-arc formation, the gap between the arcs would continue to fill in with sand and enable the two adjacent arcs to converge on each other, creating a uniform beach in which the Sandsaver blocks, and arc formations are well embedded in the beach profile.

Figure 5. Example location of the Sandsaver arcs relative to the location of the revetment to be built at the Wailuā Beach project area.

For this project, the Sandsaver blocks will be precast off-site with concrete and transported to the project area on a flatbed trailer. After being precast with concrete, each block will weigh around 5000 lbs (2268 kg). The Sandsaver blocks will be placed in position with the help of heavy equipment such as a crane or an excavator, one at a time. Workers will assist the crane or excavator with the final placement of the block. As each unit is installed, it will be mechanically clamped together on the side with the adjacent unit to form one or two continuous arcs. The clamping device will not have any loose tails, snag points, or potential for entanglement. To prevent scour, a weighted geotextile apron will be placed below the Sandsaver blocks that are set in the wave wash zone. Markers and signage will be appropriately placed on the beach to inform beach users about the presence of the Sandsaver blocks. As mentioned above, the exact locations of the Sandsaver blocks will be determined after analyzing the local tide and wave climate statistics, nearshore bathymetry, and sand characteristics; all data will be gathered by UH and the deployed ADCP instrumentation. An example location of a two-arc scenario is illustrated above in Figure 5.

In the absence of bad weather conditions, Sandsaver installation is expected to occur in January 2024 and take about 6-10 days of daytime work. The current concept is to keep the Sandsaver in place for a minimum of two years.

<u>Operation and Maintenance of the ADCPs, Revetment, and Sandsaver</u>

During the two-year of operation, UH divers will monitor the ADCPs once every three months to recover data, change batteries, and SD cards. In addition to monitoring every three months, the UH team will also monitor the entire operation after a storm event as soon as it is possible to do so safely.

After approximately 9-months, most of the 30 ft (9 m) width of the beach where the base of the revetment will be placed is expected to be covered with sand following installation of the Sandsaver. This area will be monitored along with monitoring the Sandsaver.

Given the dynamic wind and ocean driven sedimentation patterns and some of the unknowns pending further analysis of the ADCP data, it could take several weeks to several months to determine the effectiveness of the Sandsaver regarding sand accretion, stability, and shoreline protection. Monitoring Sandsaver performance will also occur under the range of expected conditions, such as large tidal exchange cycles and high surf events. The following scenarios are anticipated: 1.) When filled each Sandsaver unit is nearly 5000 lbs (2,268 kg) and is not likely to be dislodged or move around during high surf or storm events. The Sandsaver blocks can be removed and reset if needed. It is possible that a block or portion of the arc could become dislodged. HDOT will contract out the maintenance, repair, and replacement of the Sandsaver and resetting of the arc if such a situation arises. Although, it should be noted that HDOT currently does not intend to move the Sandsaver any further seaward to build more beach at Wailuā. 2.) Periodic monitoring of the Sandsaver will also help determine how long the Sandsaver should remain in place and if the Sandsaver is functioning as intended. The following scenarios are possible: a. The Sandsaver is not found to be effective, and a decision is made to remove them before the anticipated two-year period. b. It is determined that further monitoring beyond two years is needed to determine the effectiveness of the Sandsaver. A Section 7 consultation would be reinitiated in this scenario. c. The Sandsaver is found to be effective in restoring the beach and a decision is made to leave it in place in perpetuity as the units are completely buried in sand and no longer visible from shore. d. The Sandsaver is found to be ineffective in restoring the beach and a decision is made to remove the Sandsaver.

Conservation Measures

The following conservation measures will be incorporated into the general project design:

- Project footprints will be limited to the minimum area necessary to complete the Project.
- During all construction work in the project area, constant vigilance will be kept for the presence of ESA-listed sea turtles during all phases of the proposed actions.
- All construction plans contain standard HDOT written water pollution and erosion control measures that will be used throughout the Project. The USFWS's recommended BMPs to avoid impacts to aquatic habitats will also be adopted. The following measures will be implemented to avoid and minimize indirect impacts to the marine habitat in the project area:
    - Authorized dredging and filling-related activities that may result in the temporary or permanent loss of aquatic habitats will be designed to avoid indirect, negative impacts to aquatic habitats beyond the planned project area.

- Project construction-related materials (fill, revetment rock, pipe, etc.) will not be stockpiled in, or in close proximity to aquatic habitats and will be protected from erosion (e.g., with filter fabric, etc.), to prevent materials from being carried into waters by wind, rain, or high surf.
- All deliberately exposed soil or under-layer materials used in the project near water will be protected from erosion and stabilized as soon as possible with geotextile, filter fabric or native or non-invasive vegetation matting, hydro-seeding, etc.
- All project construction-related materials and equipment (dredges, vessels, backhoes, silt curtains, etc.) to be placed in an aquatic environment will be inspected for pollutants including, but not limited to; marine fouling organisms, grease, oil, etc., and cleaned to remove pollutants prior to use.
- Daily pre-work inspections of heavy equipment will be conducted for cleanliness and leaks, with all heavy equipment operations postponed or halted until leaks are repaired and equipment is cleaned.
- Proper installation and maintenance of silt fences, biosocks/sausages, equipment diapers, and/or drip pans will be implemented.
- An approved contingency plan to control, contain, clean, and dispose of spilled petroleum products and other toxic materials will be implemented and the plan will be retained on site with the person responsible for compliance with the plan.
- Appropriate materials to contain and clean potential spills will be stored in proper containment at the work site and be readily available.
- Fueling of project-related vehicles and equipment will take place at least 50 ft (15 m) away from the water, over an impervious surface.
- A plan will be developed to prevent trash and debris from entering the marine environment during the project. For example, turbidity and siltation from project-related work will be minimized and contained within the project area by silt containment devices and work will be curtailed during flooding or adverse tidal and weather conditions. BMPs will be maintained for the life of the construction period until turbidity and siltation within the project area is stabilized. All project construction-related debris and sediment containment devices will be removed and disposed of at an approved site.
- All construction discharge water (e.g., concrete washout, pumping for work area isolation, vehicle wash water, drilling fluids) will be treated before discharge.
- Project related activities will not result in any debris disposal, nonnative species introductions, or attraction of non-native pests to the affected or adjacent aquatic or terrestrial habitats. A litter-control plan and a Hazard Analysis and Critical Control Point plan (see https://www.fws.gov/policy/A1750fw1.html) will be implemented to help prevent attraction and introduction of non-native species.

- Before project components are removed, installed, and implemented a qualified biologist will train the UH divers, the project foreman and an appropriate number of project personnel selected by the foreman to be trained as "competent observers." The training will be conducted on-site as a tailgate training session. The training will be designed to provide the divers the knowledge and competency to avoid interaction with sea turtles and to take the proper informed steps to address the presence or activities of sea turtles during the project. In particular, this training exercise will cover sea turtle identification, how and where to systematically look for sea turtles or sea turtle activity (e.g., sea turtle tracks) in the project area, response procedures if sea turtles are seen in the project area, and reporting requirements. The biologist will also provide the trainees with relevant photos of sea turtles and a daily monitoring log for use during the project implementation phase.

- Biological surveys of the work area will be conducted within three days prior to initiating any project activities occurring on land. These surveys will be conducted by a qualified biologist to determine whether there is visible evidence of sea turtle activity or presence in or around the terrestrial work area. During the project implementation phase, prior to the start of daily work, the designated competent observer will walk the beach looking for signs of any turtle activity including individual turtles or their tracks within the work area. The competent observer will also populate the daily monitoring log with relevant notes and details of any instances during a workday when turtles were observed, or work delays resulting from sea turtles being observed or reported in the vicinity of the project area. Project activities will commence only after the biologist finds no evidence that turtles are active or present in the terrestrial work area and following the competent observer training.
- To minimize entrapment hazards from staged equipment, temporary plastic fencing that will be a minimum of 3 ft in height and have individual holes no larger than 3 inches will be erected at the end of each workday.
- A combination of the following methods will be used to monitor for sea turtles and the perceived hazard presented by the Sandsaver:
  - A qualified biologist to monitor and train one or more competent observer(s).
  - Trained competent observer(s) capable of performing monitoring requirements.
  - Remote-virtual monitoring capacity using roadway-mounted surveillance video or still-camera imagery augmented by trained and competent observer(s).
  - Effective outreach with the beach-going public using informational kiosks.

The entrapment hazard posed by the Sandsaver arcs varies depending upon the level of exposure of the Sandsaver blocks. Given the dynamic nature of the beach and surf zone turbulence, the level of exposure of the Sandsaver blocks over time may change and may not be consistent across all sections of the arc. Several factors such as the final position of the Sandsaver arc, variability of wind and waves, and the natural slope and profile of the beach may cause sand to accumulate unevenly along the arc resulting in variation in the extent of the perceivable entrapment hazard (barrier). Therefore, the following two scenarios are proposed to determine when the Sandsaver arc might present an exclusion from habitat or entrapment risk for adult, subadult, and hatchling sea turtles and the corresponding type of monitoring that will occur under these scenarios.

Criterion A: ≥ 75 Percent Vertical and ≥ 25 Percent Curvilinear Accumulation of Sand on Arc

One scenario where criterion A would apply is if the Sandsaver blocks are installed at the lower end of the exposure range wherein most of the blocks in the arc are buried. Criterion A will exist whenever the arc is mostly or completely buried in sand. This set of conditions allows unrestricted movement for sea turtles into or out of the arc configuration. Once criterion A is validated by the biologist or trained and competent observer and concurred with HDOT, the monitoring of Sandsaver performance and sea turtle activity will entail regular remote surveillance using the roadway mounted camera system.

HDOT will install cameras specifically for the purpose of monitoring sand accumulation around the arc and the camera specifications should allow for clear remote observations. The real-time footage can be virtually monitored from the HDOT office on Kauaʻi by HDOT staff trained as competent observers. If needed in order to make a visual determination of the vertical and horizontal sand accumulation level, a horizontal line delineating the 75 percent height could be painted along the upper portions of the Sandsaver blocks so that the level of sand accumulation along the arcs can be identified with relative ease both visually, in the field, and remotely via cameras. The Sandsaver blocks potentially could also be made with different colors. The cameras will enable early detection of beach effects following high surf events that could temporarily remove some sand or cause a short-term entrapment or displacement risk; loss of enough sand that a Sandsaver arc falls short of the 75 percent vertical and 25 percent of the curvilinear length criteria, thereby initiating monitoring under criterion B (see below).

It should be noted that if sea turtle activity is observed at the arc when monitoring sand accumulation then the in-person monitoring described under criterion B will be initiated to identify any potential nesting activity at the beach. It should also be noted that if ADCP data informs the Sandsaver arc to not be buried in the sand above the low water mark or within a range where this criterion is not met, then the monitoring described below under criterion B will be implemented.

Criterion B: ≤ 75 Percent Vertical and ≤ 25 Percent Curvilinear Accumulation of Sand on Arc

There could be several scenarios such as high surf events or storms that might cause sand to be removed or redistributed around the Sandsaver blocks. If changes result in the conditions as described above for criterion B, an entrapment hazard for sea turtles would exist. In this situation a trained and competent observer will commence Sandsaver beach checks once every two days. One inspection each on Mondays, Wednesdays, and Fridays (excluding holidays) will entail conducting a visual inspection of the entire length of the Sandsaver and adjacent beach, on foot from the beach, searching for evidence of activity or presence of sea turtles (individuals or tracks). The beach and Sandsaver inspections will be performed shortly after sunrise when turtle tracks, if present, are likely to remain visible to the observer.

If sea turtle tracks are found, monitoring will be increased to daily rather than every other day. The roadway surveillance camera system will also be used at this time to evaluate efficacy as a monitoring component and to augment the competent observer. Checks every two days will continue until the potential hazard of entrapment is low because the 75 percent or greater level of sand accumulation criterion has been reached along a cumulative 25 percent or greater curvilinear length of the Sandsaver arc (criterion A). For example, after a storm event, the Sandsaver blocks are expected to facilitate the process of restoring sand to the beach, and over time, the amount of exposed surface area presented by the Sandsaver blocks in the lower section of the arc should decrease, thereby lowering the overall hazard of entrapment or displacement for sea turtles.

Table 1. Summary of effects determination for the affected species.

Project Phase	Type of Monitoring	Estimated Duration
ADCP Deployment	Visual, exercise avoidance	2 days
ADCP Operational	Visual, exercise avoidance	60-90 day intervals
ADCP Removal	Visual, exercise avoidance	2 days
Debris Removal and Revetment Installation	**Preconstruction survey followed by daily inspection** of the beach and work area prior to construction activity; spot checks; trained competent observer on site	9 months
Sandsaver Installation	**Preconstruction survey followed by daily inspection of the beach and work area** prior to construction activity and spot checks by, trained competent observer on site	6-10 days
Sandsaver Operations ≥ 75% vertical and ≥ 25% curvilinear accumulation of sand on arc ≤ 75% vertical and ≤ 25% curvilinear accumulation of sand on arc	**Virtual monitoring using surveillance cameras** and as needed visual inspection on site by trained competent observer	as long as this criterion or entrapment risk remains low or no longer exists
	Beach and Sandsaver arc inspections Monday, Wednesday, and Friday (excluding holidays) combined with camera surveillance **until 75% vertical and 25% curvilinear sand accumulation threshold is achieved**	As long as this criterion or entrapment hazard is high l

Note: ADCP = Acoustic Doppler Current Profilers.

Action Area

The action area is defined at (50 CFR 402.02) as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." The project is situated on the east coast of the island of Kauaʻi. The project area encompasses approximately 53 acres (22 hectares) along Kūhiō Highway from Papaloa Road to the northern end of the Wailuā Bridge and extends about 2,000 ft (610 m) east into the nearshore waters. The project area is bound by Kūhiō Highway to the west, Pacific Ocean to the east, Wailuā Bay View Hotel to the north and the Wailuā River mouth to the south. For this proposed project, the action area will largely be composed of the project area (52.7 acres or 21.3 hectares) plus some additional land area surrounding the project area; totaling 88.3 acres (35.7 hectares) (Figure 6).

Figure 6. Project area and action area.

Analytical Framework for the Jeopardy/Adverse Modification Analysis

Jeopardy Analysis Framework

In accordance with regulation (see 84 FR 44976), the jeopardy determination in this biological opinion relies on the following four components:

1. The *Status of the Species*, which evaluates the species' current range-wide condition relative to its reproduction, numbers, and distribution; the factors responsible for that condition; its survival and recovery needs; and explains if the species' current range-wide population is likely to persist while retaining the potential for recovery or is not viable;
2. The *Environmental Baseline*, which evaluates the current condition of the species in the action area relative to its reproduction, numbers, and distribution absent the consequences of the proposed action; the factors responsible for that condition; and the relationship of the action area to the survival and recovery of the species;
3. The *Effects of the Action*, which evaluates all future consequences to the species that are reasonably certain to be caused by the proposed action, including the consequences of other activities that are caused by the proposed action, and how those impacts are likely to influence the survival and recovery role of the action area for the species; and
4. *Cumulative Effects*, which evaluates the consequences of future, non-Federal activities reasonably certain to occur in the action area on the species, and how those impacts are likely to influence the survival and recovery role of the action area for the species.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the consequences of the proposed Federal action in the context of the species' current range-wide status, considering any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the hawksbill sea turtle and green sea turtle in the wild.

The jeopardy analysis in this biological opinion places an emphasis on consideration of the range-wide survival and recovery needs of the hawksbill sea turtle and green sea turtle and the role of the action area in the survival and recovery of the species as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination

Status of the Species

Hawksbill Sea Turtle (*Eretmochelys imbricata*)

Listing Status and Critical Habitat

The hawksbill sea turtle was federally listed as endangered on June 2, 1970 (NMFS-USFWS 2013, USFWS 1970). Terrestrial critical habitat was designated for the hawksbill sea turtle on July 26, 1982 (USFWS 1982). The rule to designate terrestrial critical habitat are as follows: Puerto Rico: (1) Isla Mona, all areas of beachfront on the west, south, and east sides of the island from mean high tide inland to a point 492 ft (150 m) from shore, including all 4 mi (7.2 km) of beaches on Isla Mona; (2) Culebra Island, the following areas of beachfront on the north shore of the island from mean high tide to a point 492 ft (150 m) from shore: Playa Resaca, Playa Brava, and Playa Larga; (3) Cayo Norte, South beach, from mean high tide inland to a point 492 ft (150 m) from shore; and (4) Island Culebrita, all beachfront areas on the southwest facing shore, east facing shore, and northwest facing shore of the island from mean high tide inland to a point 492 ft (150 m) from shore. Terrestrial critical habitat has not been designed for hawksbill sea turtles in the Hawaiian Islands or in the action area.

Species Description

Hawksbill turtles have mottled shells consisting of an irregular combination of shades of amber, orange, red, yellow, black, and brown. The shells typically have serrated edges, with overlapping scutes. Their head comes to a tapered point and their lower jaw is V-shaped, giving them a hawk-like appearance. Hawksbills grow up to 2 to 3 feet in shell length and can weigh between 100 and 150 pounds at maturity. Hatchlings are only 2 to 3 inches long and mostly brown in color. Hawksbills have four scales (two pairs) between their eyes and four scutes along the edge of each side of their carapace.

Life History

Neonate hawksbills are believed to enter an oceanic phase (living in the open ocean beyond 656 ft (200 m) in depth) and are potentially carried great distances by surface gyres (NMFS-USFWS 2007b). The oceanic phase of neonate juveniles remains one of the most poorly understood aspects of the life history of this species (NMFS-USFWS 2007b). Early juveniles have been found associated with brown algae, *Sargassum* spp. (Musick and Limpus 1997). Larger juveniles exhibit a neritic (found at or near the sea floor) foraging habit and some may associate with the same feeding locality for more than a decade, while others apparently migrate from one site to another (Musick and Limpus 1997; Mortimer et al. 2003, unpublished data, cited in NMFS-USFWS 2007b). Hawksbill adults, once considered to be relatively non-migratory, have been revealed by post-nesting tagging, satellite telemetry, and genetic studies, to be highly mobile, traveling hundreds to thousands of miles/kilometers between nesting beaches and foraging areas (review by Plotkin 2003). Shorter overall migration distances are documented for hawksbills nesting on isolated islands (NMFS-USFWS 2013). In Hawaiʻi, post-nesting distances ranged from 90 to 345 km (Parker et al. 2009). Hawksbill sea turtles utilize a variety of food items depending on their developmental stage and their location. Food items include sponges, soft corals, invertebrate species, and algae (NMFS-USFWS 1998b, 2007b, 2013).

Flipper tagging of nesting females has shown that females have a strong fidelity in their choice of nesting sites (Witzell 1983). Genetic studies have demonstrated natal homing of nesting female hawksbills in Atlantic and Pacific populations (Bass 1999, Broderick et al. 1994). Hawksbill sea turtles nest on insular and mainland sandy beaches throughout the tropics and subtropics and females prefer to nest under beach vegetation (Horrocks and Scott 1991, Mortimer 1982, NMFS-USFWS 2007b). They are nocturnal in nesting behavior and normally lay between three to five clutches of eggs in a nesting season (Beggs et al. 2007, Mortimer and Bresson 1999, Richardson et al. 1999). Based on data from a number of studies, consistent with slow growth, age-to-maturity is long and has been estimated as 20 or more years in the Caribbean and Western Atlantic and a minimum of 30 to 35 years in the indo-Pacific (Boulon 1983, 1994, Chaloupka and Musick 1997, Diez and van Dam 2002, Limpus 1992, Mortimer et al. 2002, 2003, NMFS-USFWS 2007b). The present distribution of breeding sites has been largely affected by historical patterns of human exploitation, such that the most significant rookeries remaining today are at sites that have not been permanently inhabited by humans or have not been heavily exploited until recently (Groombridge and Luxmoore 1989).

Mean remigration intervals range from 2 to 5 years, and reproductive longevity estimates suggest that a female may nest 3 to 11 seasons over the course of her natural life. Females typically lay three to five nests per season, each containing an average of 130-160 eggs (NMFS-USFWS 2013).

After about two months incubating in the warm sand, the eggs hatch, and the hatchlings make their way to the water. Hatchlings orient seaward by moving away from the darkest silhouette of the landward dune or vegetation to crawl towards the brightest horizon. On undeveloped beaches, this is toward the open horizon over the ocean.

<u>Population Dynamics/Status and Distribution</u>

Hawksbill sea turtles were once abundant in tropical and subtropical regions throughout the world, but the species has declined over the last century in most areas and stands at only a fraction of its historical abundance (NMFS-USFWS 2007b). Hawksbill sea turtles are highly migratory and use a wide range of broadly separated localities and habitats during their lifetimes (Musick and Limpus 1997, Plotkin 2003). The dispersed nesting observed today is believed to be the result of overexploitation of large colonies (Limpus 1995, Meylan and Donelly 1999). Circumtropical in distribution, they generally occur from 30°N to 30°S latitude within the Atlantic, Pacific, and Indian Oceans and associated bodies of water (NMFS-USFWS 1998b). Along the eastern Pacific Rim, hawksbill sea turtles were apparently common to abundant as recently as 50 years ago in nearshore waters from Mexico to Ecuador, particularly the east coast of Baja California Sur in the vicinity of Concepción Bay and Paz Bay, Mexico (Cliffton et al. 1982). Today, the hawksbill sea turtle is rare to nonexistent in most of those localities; there are no known nesting beaches remaining on the Pacific coast of Mexico (Cliffton et al. 1982). Within the Central Pacific, nesting is widely distributed but scattered and in low numbers

(NMFS-USFWS 1998b). Foraging hawksbill sea turtles have been reported from virtually all the islands of Oceania, from the Galapagos Islands in the eastern Pacific to the Republic of Palau in the western Pacific (Pritchard 1982a, b, Witzell 1983).

Based on the mean annual reproductive effort reported the 2013 hawksbill sea turtle 5-year review, an estimated total of 22,004 to 29,035 hawksbills nest each year among 88 sites included in the annual reproductive evaluation (NMFS_USFWS 2013). This is a rough estimate of total annual reproductive effort since not all nesting sites have been surveyed and included in the evaluation, some data are for single years, and some represent a professional judgment of the estimate of annual reproductive output (e.g., Micronesia—see NMFS and FWS 1998). Nevertheless, it provides a good baseline to estimate annual global nesting effort since most of the major nesting assemblages were included in the analysis.

In the Pacific areas under U.S. jurisdiction or U.S. affiliation, fewer than 20 females nest annually in Hawai‘i (NMFS-USFWS 2013). While the population trend is unknown, the Hawai‘i population was significantly more abundant historically (Van Houtan et al. 2012). Nesting activity has been monitored since 1989 on Hawai‘i Island and data indicate the nesting population may be stable where three to 18 females nest per year while only a few hawksbill sea turtles nest on Maui and Moloka‘i (Seitx et al. 2012, NMFS-USFWS 2013). The Hawai‘i Wildlife Fund has been conducting research and monitoring nesting activities of hawksbill sea turtles since 1996 (HWF 2015). In 2015, at least two hawksbill sea turtles nested on two beaches on Maui (HWF 2015). No nesting activity has been documented in the U.S. Pacific Remote Island areas (Wake, Johnston, and Palmyra Atolls, Kingman Reef, and Jarvis, Howland, and Baker Islands) although hawksbills do occur foraging throughout the area (NMFS-USFWS 2013). In the Republic of Palau, 15-25 females nest annually, but the population trend is unknown (NMFS-USFWS 2013). American Samoa has less than 30 females, and anecdotal information suggests the population has declined (NMFS-USFWS 2013). In Guam and the Commonwealth of the Northern Mariana Islands, less than 10 females nest annually, which likely represents a significant decrease from historic levels (NMFS-USFWS 2013). Information on nesting activity is lacking for the Republic of the Marshall Islands and the Federated States of Micronesia; however, Micronesia, probably supports about 300 females annually with its thousands of islands and atolls (NMFS-USFWS 2013). The populations in Micronesia, Melanesia and Polynesia (with exception of Hawai‘i) are exploited for shell, meat and eggs for local consumption, and are considered overall depleted and declining (NMFS-USFWS 2013).

Threats

Impacts to hawksbill sea turtles include the destruction, modification, or curtailment of nesting and marine habitat; overutilization for commercial purposes; disease and predation; inadequacy of existing regulatory mechanisms; and other natural or manmade factors as described below.

Destruction, Modification or Curtailment of Nesting and Marine Habitat
Structural impacts to nesting habitat include the construction of buildings and pilings, beach

armoring and renourishment, and sand extraction (Bouchard et al. 1998; Lutcavage et al. 1997). These factors may directly, through loss of beach habitat, or indirectly, through changing thermal profiles and increasing erosion, serve to decrease the amount of nesting area available to nesting females, and may evoke a change in the natural behaviors of adults and hatchlings (Ackerman 1997; Witherington et al. 2003, 2007). Sea-level rise resulting from climate change may increase practices to fortify the coast, further exacerbating the problem (Hawkes et al. 2009). In addition, coastal development is usually accompanied by artificial lighting. The presence of lights on or adjacent to nesting beaches alters the behavior of nesting adults (Witherington 1992) and is often fatal to emerging hatchlings as they are attracted to light sources and drawn away from the water (Witherington and Bjorndal 1991) or may even cause them to change course offshore (Harewood and Horrocks 2008). In many countries, coastal development and artificial lighting are responsible for substantial hatchling mortality. Although legislation controlling these impacts does exist (Lutcavage et al. 1997), many countries do not have regulations in place.

Tropical coastlines are rapidly being developed for tourism, which often leads to destruction of hawksbill nesting habitat (Mortimer and Donnelly 2008). Because hawksbills prefer to nest under vegetation (Horrocks and Scott 1991; Mortimer 1982), they are particularly impacted by beachfront development and clearing of dune vegetation (Mortimer and Donnelly 2008). The loss of native vegetation cover on nesting beaches will increase the number of nests exposed to elevated temperatures due to climate and may impact natural sex ratios (Kamel 2013). Daytime nesting hawksbills in the Western Indian Ocean are especially sensitive to disturbance from human activity on the coast and in internesting habitat (Mortimer 2004). In other parts of the world, such as the Middle East and Western Australia, gas and oil refineries seriously disrupt nesting habitat (Limpus 2002; Miller 1989; Mortimer and Donnelly 2008).

Considering that coastal development and beach armoring are detrimental to hawksbill nesting behavior (Lutcavage et al. 1997), the pending human population expansion is reason for major concern. This concern is underscored by the fact that over the next few decades the human population is expected to grow by more than 3 billion people (about 50 percent). By the year 2025, the United Nations Educational, Scientific and Cultural Organization (UNESCO) (2001) forecasts that population growth and migration will result in 75 percent of the world human population living within 60 km of the sea. Such a migration undoubtedly will change the coastal landscape that, in many areas, is already suffering from human impacts. The problems associated with development in these zones will progressively become a greater challenge for conservation efforts, particularly in the developing world where wildlife conservation is often secondary to other national needs.

In addition to impacting the terrestrial zone, anthropogenic disturbances also threaten coastal marine habitats. These impacts include removal of mangroves, contamination from herbicides, pesticides, oil spills, and other chemicals, as well as destruction of benthic habitat from excessive boat anchoring, dredging, and fishing gear (Francour et al. 1999; Gaos et al. 2012b; Lee Long et al. 2000; Shester and Micheli 2011; Waycott et al. 2005). Hawksbills often associate with coral reefs, which are among the world's most endangered marine ecosystems (Wilkinson 2000).

Warmer water temperatures cause corals to expel algae (zooxanthellae) living in their tissue. The coral turns white (called ‘bleaching’) and may survive the event but is more susceptible to mortality. Climate change has led to massive coral bleaching events with permanent consequences for local habitats (Donner et al. 2005; National Oceanic and Atmospheric Administration 2013). Depending on the geographic area, hawksbills also associate with macroalgae, seagrass pastures, and mangroves. Climate change is anticipated to impact these marine habitats by, for example, alternating growth rates, increasing mortality from heat stress and frequency and severity of storms, severely reducing, or redistributing existing habitats due to changes to water depth and tides (Harley et al. 2006; Short and Neckles 1999).

Overutilization for Commercial Purposes

Hawksbills, like all sea turtle species, are vulnerable to anthropogenic impacts during all life stages (from eggs to adults). The greatest threats to hawksbills result from harvest for commercial and subsistence use. These include directed take of eggs and females on nesting beaches and juvenile and adults in foraging areas. Hawksbills are harvested largely for their shell, but also for subsistence, medicine, and oil.

Recent and historical tortoiseshell trade statistics are key to understanding the enormous and enduring effect that trade has had on hawksbill populations around the world (Mortimer and Donnelly 2008). Within the last 100 years, millions of hawksbills have been killed for the tortoiseshell markets of Europe, the United States, and Asia. The global plight of the hawksbill in the latter half of the 20th century has been recognized by the inclusion of the species in the most threatened category of the IUCN’s Red List since its creation in 1968 and the listing of all hawksbill populations on Appendix I of CITES, the Convention on International Trade in Endangered Species of Wild Fauna and Flora, since 1977. Nevertheless, trade continued, and nearly 400,000 adult female hawksbills were killed for the Japanese market from 1950 through 1992 (Mortimer and Donnelly 2008). Although Cuba implemented a moratorium on its sea turtle fisheries in 2008, the country retains the right to dispose of its tortoiseshell stockpile and significant domestic trade in hawksbill products continues to be a major problem in many other countries (Bräutigam and Eckert 2006; Chacón 2002; Fleming 2001; Lam et al. 2011; Mortimer and Donnelly 2008; Reuter and Allan 2006; TRAFFIC Southeast Asia 2004; van Dijk and Shepherd 2004).

One of the most detrimental human threats to hawksbill turtles is the intentional and intensive exploitation of eggs from nesting beaches. Egg exploitation has impacted hawksbill populations throughout the world but has been especially detrimental in Asia. In some countries, very few eggs hatch outside protected hatcheries (Mortimer and Donnelly 2008), particularly in Indonesia, Thailand, Malaysia, and Sri Lanka. As each nesting season passes and populations continue to suffer from egg harvest, they will progressively lose the juvenile cohorts that would have recruited from the post-hatchling phase (Mortimer 1995). In some instances, present nesting populations may appear hardy, but without recruitment into the juvenile population and a well-balanced distribution of turtles among all cohorts, populations are more vulnerable to decline (Crouse et al. 1987; Frazer 1992).

Notwithstanding recent measures to protect hawksbills, harvest of adults and juveniles in foraging areas remains a major concern in many countries. Although adult mortality in foraging habitats results in more quickly observable abundance changes on the nesting beach, the mortality of immature turtles in marine habitats may be as great a threat to the population stability. This life-stage is the most valuable in terms of recovery and stabilization of sea turtle populations because not only have large juveniles already survived many mortality factors, thus having a high reproductive value, but also there are typically more juveniles than adults in a population (Crouse et al. 1987; Ogren 1989). Therefore, relatively small changes in the survival rate of this life-stage impact a large segment of the population (Crouse 1999). As with the delayed feedback from egg harvest, the hawksbill's slow maturation delays the observable effects of juvenile harvests, and this threat may not be observed as a decline in nesting females for decades. Once there is a crash in the adult nesting population because of non-recruitment, it is substantially more difficult to achieve population recovery with an equally (or more so) depleted juvenile population (Mortimer 1991d).

Genetic research has shown that hawksbills of multiple nesting beach origins commonly mix in foraging areas (Bowen et al. 1996; Broderick and Moritz 1996; Mortimer and Broderick 1999). Thus, a significant harvest of hawksbills at one site can impact multiple other sites (e.g., harvest at a nesting beach can impact multiple feeding grounds, and harvest at a feeding ground can impact multiple nesting sites) (Broderick 1998; Kinch 2007; Limpus and Miller 2008; Mortimer et al. 2007; however, see Campbell and Godfrey 2010), thus reinforcing the need for regional cooperation.

Disease or Depredation
Fibropapillomatosis has been reported in all sea turtle species, including the hawksbill. This disease is characterized by the presence of internal and external tumors (fibropapillomas) that may grow large enough to hamper swimming, vision, feeding, and potential escape from predators (Herbst 1994). The frequency of fibropapillomatosis in hawksbills is relatively low and is not presently a major source of concern for this species.

Predators of hawksbill eggs include feral pigs (Diez et al. 1998), mongoose (Leighton et al. 2008; Nellis and Small 1983), raccoons and coatimundis (Smith 1991), dogs (Lagueux et al. 2003; Meylan et al. 2006), fox and feral cats (Ficetola 2008), ghost crabs (Hitchins et al. 2004; Wood 1986), and monitor lizards, ants, and fly larvae (Chan and Liew 1999). Natural depredation on hatchling hawksbills by birds and fish is also undoubtedly high, although documented cases are scarce (Witzell 1983). Juvenile and adult hawksbills are also taken by carnivorous fish (Witzell 1983).

At Playa Chiriqui, Panama, the most significant hawksbill nesting beach in the region, threats from predators (especially dogs) have proven difficult to address (Meylan et al. 2006). In the Andaman and Nicobar Islands in India, egg predation by feral dogs and pigs is a major concern at several beaches (Andrews et al. 2006). Within the U.S. Caribbean, feral pig predation was formerly a major threat to the survival of hawksbill nests laid on Mona Island, Puerto Rico, with

44 to 100 percent of all hawksbill nests deposited outside fenced areas from 1985 to 1987 destroyed (Kontos 1985, 1987, 1988). However, the installation of protective fencing to exclude feral pigs from Mona Island nesting beaches has significantly reduced this threat (Mona Island Research Group 2012). In northeastern Brazil, an eradication program for brown rats was implemented to prevent depredation of hawksbill eggs and hatchlings (Zeppelini et al. 2007). In the U.S. Virgin Islands, mongooses were destroying up to 55 percent of all nests on Buck Island Reef National Monument until they were eradicated in 1987 (Small 1982). In Qatar, Arabian Gulf, the sand fox (Vulpes rueppelli) and feral cats are a significant problem at beaches adjacent to cities, but netting placed over nests was shown to stop predation (Ficetola 2008).

Inadequacy of Existing Regulatory Mechanisms
The conservation and recovery of sea turtles is enhanced by several regulatory instruments at international, regional, national, and local levels. On June 15, 2006, the Papahānaumokuākea Marine National Monument in the northwestern Hawaiian Islands was established prohibiting oil and gas exploration and vessel anchoring on live or dead coral, which will likely protect hawksbill habitat. On October 10, 2014, NMFS published a final rule (79 FR 53852) to list 20 coral species as threatened (5 in the Caribbean and 15 in the Indo-Pacific) for protection under the ESA. Actions to protect and conserve corals may result in beneficial effects to hawksbills, especially in the Caribbean where hawksbills are closely associated with coral reefs. In addition, several conservation actions to reduce directed take have been implemented. The following countries banned the harvest of hawksbills: Cuba in 2008, Cayman Islands in 2008 (Blumenthal et al. 2009a), and the Bahamas in 2009. Community conservation programs to decrease or eliminate poaching of nesting female and eggs have been implemented in many areas. For example, poaching decreased to approximately 1 percent of total nests in Tanzania since the establishment of the Tanzania Turtle & Dugong Conservation Programme (Muir and Abdallah 2008). In 2008, the Eastern Pacific Hawksbill Initiative (http://hawksbill.org) was established to promote recovery, and programs to protect nests and nesting females have been supported in Mexico and Central America. In 2009, the United States established the Mariana Trench, Rose Atoll, and Pacific Remote Islands National Monuments, which prohibited commercial and recreational fisheries in an area encompassing over 95,000 square miles.

As a result of these designations, agreements, and legal actions, many of the anthropogenic threats have been lessened: harvest of eggs and adults has been slowed at several nesting areas through nesting beach conservation efforts and an increasing number of community-based initiatives are in place to slow the capture and killing of turtles in foraging areas. Moreover, there is now a more concerted effort to reduce global sea turtle interactions and mortality in artisanal and industrial fishing practices.

Despite these advances, human impacts continue throughout the world. The lack of comprehensive and effective monitoring and bycatch reduction efforts in many pelagic and nearshore fisheries operations still allows substantial direct and indirect mortality, and the uncontrolled development of coastal and marine habitats threatens to destroy the supporting ecosystems of hawksbill turtles. Although several international agreements provide legal protection for sea turtles, additional multi-lateral efforts are needed to ensure they are sufficiently implemented and/or strengthened, and key non-signatory parties need to be encouraged to accede. Considering the worldwide distribution of hawksbills, virtually every legal instrument that targets or impacts sea turtles is almost certain to cover hawksbills. A summary of the main regulatory instruments from throughout the world that relate to the conservation and recovery of hawksbills is provided in the hawksbill sea turtle 5-year reviews (NMFS-USFWS 2007, 2013).

Other natural or manmade factors affecting its continued existence

Hybridization has been documented between hawksbills and loggerheads, and hawksbills and olive ridleys in Brazil (Lara-Ruiz et al. 2006; Vilaca et al. 2012), loggerheads in Florida (Meylan and Redlow 2006), and greens in the Eastern Pacific (Seminoff et al. 2003a). Hybridization of hawksbills with other species of sea turtles is especially problematic at certain sites where hawksbill numbers are particularly low (Mortimer and Donnelly 2008). There are also several manmade factors that affect hawksbill turtles in foraging areas and on nesting beaches. Two of these are truly global phenomena: climate change and fisheries bycatch. Impacts from climate change, especially due to global warming, are likely to become more apparent in future years (IPCC 2007a). The global mean temperature has risen 0.76ºC over the last 150 years, and the linear trend over the last 50 years is nearly twice that for the last 100 years (IPCC 2007a). There is a high confidence, based on substantial new evidence, that observed changes in marine systems are associated with rising water temperatures, as well as related changes in ice cover, salinity, oxygen levels, and circulation. These changes include shifts in ranges and changes in algal, plankton, and fish abundance (IPCC 2007b) and damage to coral reefs (Sheppard 2006).

Climate change will impact sea turtles through increased temperatures, sea-level rise, ocean acidification, changes in circulation patterns, and increased cyclonic activity. As global temperatures continue to increase, so will sand temperatures, which in turn will alter the thermal regime of incubating nests and alter natural sex ratios within hatchling cohorts (e.g., Glen and Mrosovsky 2004). Because hawksbill turtles exhibit temperature-dependent sex determination (reviewed by Wibbels 2003), there may be a skewing of future hawksbill cohorts toward strong female bias (since warmer temperatures produce more female embryos). The effects of global warming are difficult to predict, but changes in reproductive behavior (e.g., remigration intervals, timing and length of nesting season) may occur (reviewed by Hawkes et al. 2009). In the southern Gulf of Mexico, hawksbill nesting data from 1980 to 2010 were analyzed in relation to sea surface temperatures associated with the Atlantic Multidecadal Oscillation (del MonteLuna et al. 2011). In the past 30 years, overall temperatures have increased in the North Atlantic, and in years of anomalously warm temperatures, there were proportionately fewer hawksbill nests. Although the causal relationship is unclear, it highlights the complexity of basin-wide decadal environmental processes and long-term hawksbill population trends (del Monte-Luna et al. 2011). The sea-level rise from global warming is also a potential problem for areas with low-lying beaches where sand depth is a limiting factor. For these areas, the sea will inundate nesting sites and decrease available nesting habitat (Daniels et al. 1993; Fish et al. 2005; Fuentes et al. 2010). Sea-level rise is likely to increase the use of shoreline stabilization practices (e.g., sea walls), which may accelerate the loss of suitable nesting habitat (reviewed by

Hawkes et al. 2009). The loss of habitat because of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as the frequency and timing of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Fuentes and Abbs 2010; Van Houtan and Bass 2007). At sea, hatchling dispersal, adult migration, and prey availability may be affected by changes in surface current and thermohaline circulation patterns (reviewed by Hawkes et al. 2009). Climate change has increased water temperatures and acidity, which cause corals to bleach and lose their ability to calcify. Damage to coral reefs caused by global warming (Sheppard 2006) threatens to impact hawksbill foraging populations at the global level. However, the impact may be beneficial in certain areas where sponge abundance is predicted to increase (reviewed by Hawkes et al. 2009).

Fisheries bycatch in artisanal and industrial fishing gear is also a major impact. Although other species such as leatherback turtles and loggerhead turtles have received most of the attention relative to sea turtle bycatch, hawksbill turtles are also susceptible, particularly in nearshore artisanal fisheries gear. These fisheries practices include drift-netting, long-lining, set-netting, and trawl fisheries, and their adverse impacts on sea turtles have been documented in marine environments throughout the world (Epperly 2003; Lutcavage et al. 1997; National Research Council 1990; Wallace et al. 2010). In Malaysia, gill nets, hook and line fishing, purse seiners and trawl fishing boats had the greatest impacts to sea turtles with mortality of some 4,490 marine turtles and an average of 10 turtles caught by fishermen/vessel each year, a proportion of which are likely hawksbills (Pilcher et al. 2008). Hawksbills are particularly susceptible to entanglement in gill nets and to capture on fishing hooks of artisanal fishers (Mortimer 1998). Several fisheries in the eastern Pacific use explosives, which have killed adult hawksbills (Gaos et al. 2010). The majority of the world's 17 major fisheries zones are either considered depleted or are in early stages of collapse (Pauly et al. 2005). Unfortunately, rather than elicit a closure of fisheries, declines in catch rate are often greeted with new fisheries and expanding fleets (Pauly et al. 2005). Without effective management practices, such expansion likely will result in increased mortality of all sea turtle species.

In addition to climate change and fisheries, natural impacts on hawksbill turtles may include the effects of aperiodic hurricanes and catastrophic environmental events such as tsunamis. In general, these events are episodic and, although they may affect hawksbill hatchling production, the results are generally localized to a small area (but see Hamann et al. 2006) and they rarely result in whole-scale losses over multiple nesting seasons (Hamann et al. 2006). The negative effects of hurricanes on low-lying and/or developed shorelines may be longer-lasting and a greater threat overall.

Additional factors affecting hawksbill turtles, albeit perhaps not as globally significant as those mentioned above, include increasing incidence of exposure to heavy metals and other contaminants in the marine environment. Contaminants such as organochlorine pesticides, polychlorinated biphelyls, flame retardants, emulsifiers to make plastics, mercury, copper, and other metals have been found in sea turtle tissue and eggs from numerous areas (Al Rawahy et al. 2006; Hermanussen et al. 2008; Keller et al. 2012; Lewis 2006; Malarvannan et al. 2011; Miao et al. 2001, Presti et al. 1999; van de Merwe et al. 2008). Although their explicit effects on hawksbills have yet to be determined, such exposure may lead to immunosuppression, enlarged livers, thyroid disruption, and neuro-behavioral changes (Keller et al. 2012). Heavy metals have been detected in corals (Huang et al. 2003), which diminish the health of coastal marine ecosystems and, in turn, adversely affect hawksbills. Arsenic is also found in hawksbills, but this compound may be accumulated from dietary sources (Agusa et al. 2008; Fujihara et al. 2003; Saeki et al. 2000). In fact, the hawksbill may be unsuitable for human consumption due to bioaccumulation and magnification of toxic compounds from its diet (Aguirre et al. 2006; Meylan and Whiting 2008; Warwick et al. 2013). For instance, several Micronesians died and approximately 90 others became sick after they ingested hawksbill meat (Buden 2011).

In the southeast United States., boat strikes are a concern. For example, in Florida, over 560 hawksbills stranded dead on coastal beaches from 1980 to 2007 (Foley et al. 2009). Of these stranded turtles, 9% had definitive propeller wounds indicating the turtle collided with a motorized boat (Foley et al. 2009).

Oil spills may be a concern. There is evidence that oil pollution has a greater impact on hawksbills than on other species of turtle (Meylan and Redlow 2006; Yender and Mearns 2003). In 2010, a major oil spill occurred in the north central U.S. Gulf of Mexico, affecting multiple habitats used by hawksbills of various life stages. Assessment of the harm is ongoing as part of the Natural Resources Damage Assessment. In some parts of the world, especially in the Middle East, oil pollution poses a major problem for hawksbills (Mortimer and Donnelly 2008). In addition, sea turtle interaction with oils spills may lead to immunosuppression and other chronic health issues (Sindermann et al. 1982). Ingestion of and entanglement in marine debris is also a concern as it can reduce food intake and digestive capacity (Bugoni et al. 2001, Meylan and Redlow 2006).

Green Sea Turtle (*Chelonia mydas*)

<u>Listing Status and Critical Habitat</u>

The green sea turtle was federally listed as threatened on July 28, 1978, except for the breeding populations nesting on the coast of Florida and Pacific coast of Mexico that were listed as endangered (NMFS-USFWS 1978, 2007a). On May 6, 2016, NMFS and USFWS issued a final rule to remove the current range-wide listing of the green sea turtle and, in its place, listed eight DPSs as threatened (North Atlantic, South Atlantic, Southwest Indian, North Indian, East Indian-West Pacific, Southwest Pacific, Central North Pacific, and East Pacific) and three as endangered (Central South Pacific, Central West Pacific, and Mediterranean) and to apply existing protective regulations to the DPSs (NMFS-USFWS 2016). The range of the Central North Pacific DPS covers the Hawaiian Archipelago and Johnston Atoll National Wildlife Refuge (NWR) (NMFS-USFWS 2016).

Critical habitat for the North Atlantic DPS includes waters surrounding Culebra Island, Puerto Rico, and its outlying keys (63 FR 46693, September 2, 1998). Critical habitat for the other ten DPSs have not been designated.

Species Description

The green sea turtle is the largest of the hard-shell marine turtles, growing to a weight of 350 lbs (159 kg) and a straight carapace length of greater than 3.3 ft (1 m). Green sea turtles have a smooth carapace with four pairs of lateral (or costal) scutes and a single pair of elongated prefrontal scales between the eyes. They typically have a black dorsal surface and a white ventral surface.

Life History

The green sea turtle has a circumpolar distribution and is found throughout tropical, subtropical, and to a lesser extent, temperate waters (NMFS-USFWS 2015). This species was once abundant in tropical and subtropical regions throughout the world but has declined over the last century in most areas and stands at a fraction of its historical abundance (NMFS-USFWS 2007a). Green sea turtles are highly mobile and move through geographically disparate habitats during their lifetimes (Musick and Limpus 1997, Plotkin 2003). The periodic migration of adult green sea turtles between nesting sites and foraging areas is a prominent feature of their life history (NMFS-USFWS 2007a). However, the Central North Pacifc DPS is the most isolated of all green sea turtle populations, with an apparent biogeographic boundary with the Eastern populations and oceanic boundaries with the Central West and Central South Pacific populations, such that there is little evidence of significant gene flow (NMFS-USFWS 2015). If green sea turtles were lost from this large geographic area, it would result in a significant gap in the species' global range (NMFS-USFWS 2015).

Adults feed on seagrasses and marine algae as well as invertebrates such as jellyfish, sponges, sea pens, and pelagic prey (Godley et al. 1998, Hatase et al. 2006, Heithaus et al. 2002, Parker and Balazs 2005, Seminoff et al. 2002). Green sea turtles are generally found in fairly shallow waters (except when migrating). Certain nearshore habitats constitute essential living space and behavior at these sites includes feeding on marine vegetation (algae and or sea grass), resting, being groomed by fishes to remove ectoparasites (Balazs et al. 1994, Losey et al. 1994) and courtship and copulation in waters proximal to nesting beaches (NMFS-USFWS 1998a). In contrast, post-hatchling and juvenile green sea turtles (up to about 35 cm in carapace length) inhabit pelagic or open-ocean habitats far removed from land (NMFS-USFWS 1998a). Newly emerged hatchlings are strongly photopositive and can be disoriented from their path to the ocean through artificial lighting (NMFS-USFWS 1998a). The movements of immature green sea turtles are less well known than adults, however, tagging in the Hawaiian Islands and Australia suggests that immature sea turtles reside for many years in the same location, provided there is food, shelter, and environmental stability (NMFWS-USFWS 1998a). Hatchling green sea turtles eat a variety of plants and animals, however, the diets of post-hatchlings and juveniles living in pelagic habitats appear to be entirely carnivorous, for example invertebrates and fish eggs (NMFS-USFWS 1998a).

Flipper tagging studies have demonstrated that female green sea turtles make long distance migrations between feeding grounds and nesting beaches. Green sea turtles are philopatric to specific nesting beaches, returning to the same beach in subsequent nesting seasons (Carr et al. 1978). Genetic studies have shown these beaches are also the natal beaches of the female (Meylan et al. 1990). Thus, after departing as hatchlings and residing in a variety of marine habitats for up to 40 or more years (Limpus and Chaloupka 1997), green sea turtles make their way back to the same beach from which they originated (NMFS-USFWS 2007a). Green sea turtles are long-lived, and exhibit slow growth, and it is estimated that an average of at least 25 years is needed to achieve sexual maturity (NMFS-USFWS 1998a). Females migrate to breed only once every two or possibly many more years and in Hawaiʻi, lay up to six clutches of around 100 eggs per season (NMFS-USFWS 1998a).

Population Dynamics/Status and Distribution

Most green sea turtles in Hawaiʻi historically nested in the French Frigate Shoals, where 96 percent of the population nested (Balazs 1980, Lipman and Balazs 1983). During the years 2009-2012, the mean annual nesting abundance was 464 females (Balazs and Chaloupka 2006; G. Balazs, NMFS, unpublished data cited in NMFS-USFWS 2015). This is an annual increase of 4.8 percent over the past 40 years (NMFS-USFWS 2015). In addition, the number of immature green sea turtles residing in foraging areas of the main Hawaiian Islands has also increased as has the number of basking turtles (Balazs 1996). However, nesting was historically abundant at various sites throughout the Hawaiian archipelago as recently as 1920 (Kittinger et al. 2013). Within the main Hawaiian Islands, green sea turtle nests have been recorded on all islands, except Kahoʻolawe, although most beaches are not scientifically monitored (HWF 2014). The number of green sea turtles nesting in the main Hawaiian Islands is not known, however, nine nests from three turtles were found on three different beaches of Maui in 2014 (HWF 2014). Hatchling success of the nine nests varied from 29.5 to 72.9 percent (HWF 2014). Current nesting of green sea turtles occurs in low numbers in other northwest Hawaiian Islands (including Laysan, Lisianski, Pearl and Hermes Reef, and Midway); 3 to 36 nesting females at any one site (NMFS-USFWS 2015).

Since completion of the listing determinations for the 11 DPSs in 2015, the Central North Pacific DPS was documented to have low nesting abundance, with an estimated total of 3,846 nesting females at 13 nesting sites (NMFS-SWFSC 2015). The most recent published study on this DPS estimates the total nester abundance at roughly 4,000 nesting females (Balazs et al., 2015). Of these breeding females, less than 40 females were estimated to nest in the main Hawaiian Islands (NMFS-SWFSC 2015). Nesting site diversity is extremely limited: 96 percent of nesting occurs at one low-lying atoll (i.e., FFS). The USFWS has observed a significant increase in nesting females in the main Hawaiian Islands since 2016, with nesting on Oʻahu increasing from 2 verified nests in 2016 to 32 verified nests in 2022, with a peak of 67 verified nests in 2021 (USFWS unpublished data 2022). It is likely that nesting on the other main Hawaiian Islands have experienced a similar increase, but surveys have not been conducted consistently on the other islands to date as they have on Oʻahu.

Threats

In the Hawaiian population, fibropapillomatosis disease represents the single most significant threat to the survival of the green sea turtle and of the highest priority for ongoing research (NMFS-USFWS 1998a). Fibropapillomatosis, a disease of sea turtles characterized by the development of multiple tumors on the skin and internal organs, is also a mortality factor and has seriously affected green sea turtle populations in Florida, Hawai‘i, and other parts of the world (NMFS-USFWS 2007a). The tumors interfere with swimming, eating, breathing, vision, and reproduction, and turtles with heavy tumor burdens may become severely debilitated and die (Herbst 1994). As stated in a recent study, FP continues to cause the majority of green turtle strandings in Hawai1i (Work et al., 2015) and may be linked to environmental factors (Keller et al., 2014; Van Houtan et al., 2014; Work et al., 2014; NMFS, in progress).

A major factor contributing to the green turtle’s decline worldwide is commercial harvest for eggs and meat. In the Central North Pacific, nesting and basking habitats are degraded by coastal development and construction, beach armoring (including marina construction, artificial beach development, siltation from agricultural runoff, contamination of forage areas from toxic spills, resort development, and increased vessel traffic), vehicular and pedestrian traffic, beach pollution, tourism, disorientation of hatchlings by beachfront lighting, nest predation by native and non-native predators, degradation of foraging habitat, marine pollution and debris (including entanglement and ingestion of marine debris), watercraft strikes, incidental take from channel dredging and commercial fisheries, and other human related activities (NMFS-USFWS 1998a, 2007a).

Foraging habitat is degraded by coastal development, marina construction, siltation, pollution, sewage, military activities, vessel traffic, and vessel groundings. Existing regulatory mechanisms do not adequately address the threat of bycatch in international fisheries. In addition to incidental capture in foreign longline fisheries, interactions with nearshore recreational fisheries occur (Work et al., 2015). Marine debris is a significant threat (e.g., Wedemeyer-Strombel et al., 2015); entanglement in lost or discarded fishing gear is the second leading cause of strandings and mortality in the MHI (Work et al., 2015). Vessel strikes result in injury and mortality. Vessel traffic excludes turtles from their preferred foraging areas. The extremely limited nesting diversity (i.e., 96 percent of nesting at FFS) increases extinction risk by rendering the DPS vulnerable to random variation and environmental stochasticity (81 FR 20058, April 6, 2016).

Sea level rise and the increasing frequency and intensity of storm events are likely to reduce available nesting habitat. A recent study indicated that increasing temperatures are likely to modify beach thermal regimes that are important to nesting and basking (Van Houtan et al., 2015). Temperature increases are also likely to result in increased hatchling mortality, skewed sex ratios, and changes in juvenile and adult distribution patterns. Limited spatial diversity in the DPS is an additional threat to the population.

Environmental Baseline

Regulations implementing the ESA (50 CFR 402.02) define the environmental baseline as the past and present impacts of all federal, state, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated and/or ongoing impacts of all proposed federal projects in the action area that have undergone Section 7 consultation, and the impacts of state and private actions which are contemporaneous with the consultation in progress.

Green sea turtles in the Central North Pacific DPS are increasing (NMFS-USFWS 2015). In October 2018, a Category 3 storm, Hurricane Walaka, passed through the Northwestern Hawaiian Islands (Papahānaumokuākea Marine National Monument), wiping out most of East Island, where 96 percent of the green sea turtles in Hawaiʻi historically nested. Although this would not lead to more turtles nesting in the main Hawaiian Islands, it increased the vulnerability and importance of the 4 percent of nesters in the main Hawaiian Islands, since the population at FFS lost so much of their nesting grounds (Staman 2023, in litt.).

We believe that the increase in the number of green sea turtles in the main Hawaiian Islands is due to multiple factors: green sea turtles that were federally protected in 1978 reaching sexual maturity; less crowded beaches during the COVID19 pandemic; and a huge increase in monitoring effort in the main Hawaiian Islands in recent years (Staman 2023, in litt.).

During the COVID-19 pandemic, tourism numbers significantly decreased in the Hawaiian Islands, including on the island of Kauaʻi. Due to this decrease in visitors, sea turtles encountered less anthropogenic factors during nesting seasons from 2020-2022. We believe that this could be a factor in the increased observation of nesting in the main Hawaiian Islands.

In the last seven years, there has been a huge increase in monitoring efforts of sea turtles in the main Hawaiian Islands by the USFWS and partner agencies. With this increase in monitoring efforts, we have simultaneously observed an increase in the nests recorded, mostly on the island of Oʻahu where most of the monitoring efforts have occurred. Nesting numbers on Oʻahu have increased significantly in the last seven years, going from 2 verified green sea turtle nests in 2016 to 32 verified nests in 2022, with a peak of 67 verified nests in 2021 (USFWS unpublished data 2022).

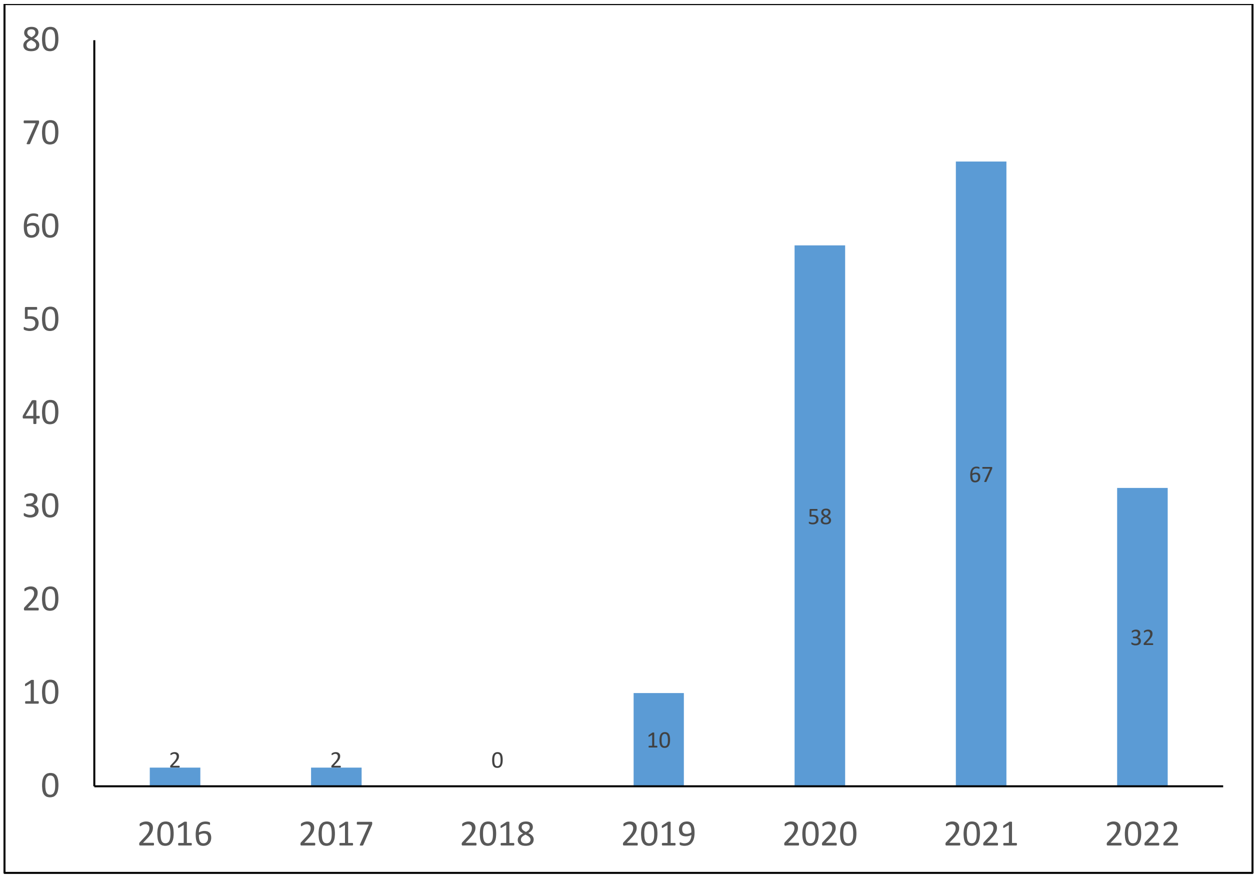

Figure 7. Graph of verified green sea turtle nests on O‘ahu from 2016 through 2022 (USFWS Unpublished data 2022).

While no formal surveys have been completed for sea turtles at Wailuā Beach on the island of Kaua‘i and limited data exists for this area, we know that both hawksbill sea turtles and green sea turtles have been documented nesting on this beach. There has been one incident of a hawksbill sea turtle nesting on Wailuā Beach in 2013, and one incident of a green sea turtle nesting on Wailuā Beach prior to 2016 (Roberson, Kendall, Parker, and Murakawa 2016). In addition to these nesting activities, there have been six stranding incidents for hawksbill sea turtles and green sea turtles at Wailuā Beach from the years 1993 through 2013 (Roberson, Kendall, Parker, and Murakawa 2016).

Green sea turtles are known for a unique behavior in the Hawaiian Islands where they are found basking on the beach (Whittow and Balazs 1982). Basking has not yet been observed at Wailuā Beach. However, surveys are not regularly conducted there, and the behavior has been observed in other locations on the island of Kaua‘i, thus we would assume similar behavior at this beach.

Due to the historic occurrence of nests and stranding observations at Wailuā Beach, as well as the increase in nesting numbers in the main Hawaiian Islands in recent years, it is likely that nesting activity has increased on Wailuā Beach. From this information, we believe that it is reasonable to estimate that at least one hawksbill sea turtle and up to three green sea turtles are likely to use Wailuā Beach for nesting each year. This represents approximately less than 0.004 to 0.003 percent of the total hawksbill sea turtle nests each year (1/22,004 = 0.004 percent to 1/29,035 = 0.003 percent) and less than 5 percent of females that nest in Hawaiʻi each year (1/20 = 5 percent). Also, for the Central North Pacific DPS of the green sea turtle, this represents approximately less than 0.075 percent of the total estimated number of the DPS' range (3/4,000 = 0.075 percent) and less than 7.5 percent of the total nesters in the main Hawaiian Islands (1/40 = 7.5 percent).

Effects of the Action

The proposed action's stressors and benefits may include the following actions within the action area: (1) removal of debris and installation of the ungrouted riprap, (2) installation of the Sandsaver, and (3) operation and maintenance of the revetment and Sandsaver.

Each stressor and benefit caused by the proposed action may have consequences to the hawksbill and green sea turtle. The consequences of the proposed action on the hawksbill and green sea turtle are discussed below.

Consequences of the Proposed Action on the Hawksbill and Green Sea Turtle

1) Effects Associated with Removal of Debris and Installation of the Ungrouted Riprap

The proposed action is expected to have direct adverse effects on the hawksbill sea turtle and green sea turtle within the action area. Construction activities are anticipated to occur for approximately nine months (tentatively from April 2023 to December 2023), which overlaps directly with the sea turtle nesting season in the Hawaiian Islands. Using heavy equipment to remove damaged concrete slabs, sandbags, and debris from the sandy area of the beach can result in direct adverse consequences by crushing basking or stranded turtles, and nests (Mann 1977; NMFS and USFWS 1991a, 1991b, 1992, 1993; Ernest et al. 1998). Sea turtles on the beach at some stage of nesting may be difficult to see and may be run over by vehicles or heavy equipment. However, we expect that because a qualified biologist will train project personnel to be "competent observers" to avoid interaction with turtles it will help to avoid unintentional crushing of adults when using heavy machinery or vehicles.

Hatchlings may emerge at night or early in the morning from *in situ* nests missed by sea turtle monitors. Because of their extremely small size, live hatchlings on the beach during the day are vulnerable to being run over and killed. In addition, removal of debris and installation of the revetment results in sand displacement while operating machinery or digging and removing debris from the site. This activity may directly dig up or bury unobserved sea turtle nests. Turtle nests are likely to be disturbed and fail.

Compaction of sand from equipment and vehicles on the beach could also make it more difficult for hatchlings to emerge from an undetected nest. Many factors, including speed, weight, and size of the vehicle, the timing of the event with respect to the incubation period; the depth of the nest (below grade) at the time of impact, and the physical characteristics of the nest itself, will influence whether, and the extent to which, mortality or injury occurs. Further, there is no established relationship between the cumulative number of times a particular nest has been run over and the extent and duration of the mortality or injury event. Also confounding this analysis are other factors that may affect the viability of a particular sea turtle nest. For example, tidal inundation, storm events, predation, and accretion/erosion of sand could have adverse consequences on a sea turtle nest deposited in areas where beach driving also occurs (NMFS and USFWS 1991a; 1991b; 1992; 1993).

Schroeder (1994) found that even under the best of conditions, experienced sea turtle nest surveyors can misidentify about seven percent of nesting attempts as false crawls, in which a female turtle comes ashore to nest but returns to the water without digging a nest or laying eggs. Turtle patrollers and/or monitors locate nests primarily by searching for the tracks left in the sand and locating females during their nesting activity. The passage of heavy equipment or construction vehicles could remove sea turtle tracks, making it difficult for the monitor to find a nest for investigation and protection. Therefore, even when turtle monitors are employed, sea turtles and their nests could be harmed by the proposed construction activities. Likewise, undetected nests could be buried by sand resulting in crushing of eggs or hindering hatchlings from climbing out of the nest and reaching the ocean. Burying nests and the associated reduced hatching and emergence success are known adverse consequences to sea turtle reproduction (Crain et al. 1995).

The storage of construction equipment and vehicles on the beach at night can also be a source of entrapment hazard. Female turtles attempting to nest may become entangled or disoriented, and later stranded, if attempting to nest on the beach with heavy machinery and debris. Project equipment also has the potential of trapping or impeding hatchlings during their nest to sea migration. Additionally, if the trained observers miss any nests that have been laid during implementation of the project hatchlings emerging from the nest could become entangled or disoriented.

2) Effects Associated with Installation the Sandsaver

Installing the Sandsaver will be an indirect benefit effect for the hawksbill and green sea turtle by providing a more suitable beach habitat for turtle nests. The project's goal is to ultimately restore Wailuā Beach. The operation of the Sandsaver blocks is anticipated to reduce erosion rates along the project area on Wailuā Beach. Therefore, the proposed project could create a more stable beach and reestablish additional turtle nesting habitat where it is currently at risk due to high erosion rates caused by increase storm frequency and severity.

Alternatively, the installation and possible removal of the Sandsaver is expected to have direct adverse effects on hawksbill and green sea turtle nests. Nests may be dug up or buried when installing and removing Sandsaver blocks resulting in mortality of any unobserved nests. To minimize this impact, project personnel will designate a trained competent observer to walk the beach looking for signs of any turtle activity including individual turtles or their tracks within the work area prior to the start of daily construction work during this phase of the project. However, as described above nests have the potential to be missed and undetected and therefore, nests are likely to be disturbed and fail as a result. Also, covering existing sea turtle nest with additional sand could result in decreased potential for the nest to properly incubate and/or the hatchlings ability to emerge from the nest chamber.

3) Effects Associated with Operation and Maintenance of the Revetment and Sandsaver

Operation of the Sandsaver blocks is anticipated to occur for approximately two years after installation is complete (tentatively from January 2024 to January 2026), which overlaps with two sea turtle nesting seasons in the Hawaiian Islands. The proposed action is expected to have direct adverse effects on the hawksbill sea turtle and green sea turtle within the action area. When portions of the Sandsaver are exposed at low tide early in project implementation, blocks may trap or disorient emerging hatchlings during their nest to sea migration.

Construction activities during sea turtle nesting season could result in adults and nests being crushed by heavy equipment on the beach or being displaced by removing sand and moving it to other areas of the beach. Also, covering existing sea turtle nest with additional sand could result in decreased potential for the nest to properly incubate and/or the hatchlings ability to emerge from the nest chamber.

Construction and installation activities are expected to last for at least 9 months, while operation and maintenance activities are expected to last for a minimum of two years. The USFWS does not expect long-term, permanent alteration of the natural coastal processes.

To minimize impact, the applicant is proposing to have a designated and trained competent observer walk the beach looking for signs of any turtle activity including individual turtles or their tracks within the work area prior to the start of daily construction work during the construction phase of the debris removal and installation of the ungrouted revetment portion of the project. Also to minimize impacts, if the Sandsaver hits criterion B, a trained and competent observer will commence Sandsaver beach checks once every two days and a roadway surveillance camera will be used as a monitoring component in addition to the observer. This is expected to reduce the mortality of adults and nests that may use the beach habitat.

The proposed action is also expected to have indirect beneficial effects on the hawksbill sea turtle and green sea turtle within the action area. The construction of the ungrouted revetment and the operation of the Sandsaver blocks should reduce erosion rates along the project area on Wailuā Beach. Therefore, the proposed Project could create a more stable beach and reestablishing additional turtle nesting habitat where it is currently at risk due to high erosion rates caused by increase storm frequency and severity.

To estimate the number of adult hawksbill and green sea turtles impacted by the proposed project, we looked at the distribution of known nests in previous breeding seasons. Hawksbill sea turtle nests are a rare occurrence on the island of Kauaʻi. Low numbers of nesting hawksbill and green sea turtles have been documented at Wailuā Beach, with one nesting occurrence for each species documented in the last 10 years, although no formal surveys have ever been done to document nesting activity for either species. Although most green sea turtles in Hawaiʻi have historically nested at French Frigate Shoals, where 96 percent of the population previously nested (Balazs 1980, Lipman and Balazs 1983), due to Hurricane Walaka in 2018, this nesting habitat has been severely impacted. Due to the impacts to French Frigate Shoals as well as the steady increase in nesting green sea turtles in the main Hawaiian Islands, it is likely that sea turtle nesting numbers in the main Hawaiian Islands will continue their upward trend (USFWS unpublished GIS data, 2022). It is anticipated that up to 1 adult hawksbill sea turtle, 1 hawksbill sea turtle nest, 3 adult green sea turtles, and 3 green sea turtle nests may be taken in the form of harm leading to injury or mortality as a result of the proposed project. This represents approximately less than 0.004 to 0.003 percent of the total hawksbill sea turtle nests each year (1/22,004 = 0.004 percent to 1/29,035 = 0.003 percent) and less than 5 percent of females that nest in Hawaiʻi each year (1/20 = 5 percent). Also, for the Central North Pacific DPS of the green sea turtle, this represents approximately less than 0.075 percent of the total estimated number of the DPS' range (3/4,000 = 0.075 percent) and less than 7.5 percent of the total nesters in the main Hawaiian Islands (1/40 = 7.5 percent).

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this Biological Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The USFWS is not aware of any future state, tribal, local, or private actions that are reasonably certain to occur within the action area at this time; therefore, no cumulative effects are anticipated.

Conclusion

After reviewing the current status of the species for the hawksbill sea turtle and the green sea turtle, the environmental baseline for the action area, the effects of the proposed action, implementation by FWHA, and the cumulative effects, it is the USFWS's biological opinion that the proposed Kūhiō Highway Emergency Shoreline Mitigation Project, as proposed, is not likely to jeopardize the continued existence of these species because it is not anticipated to appreciably reduce their reproduction, numbers, or distribution. We anticipate take of up to 1 adult hawksbill sea turtle, 1 hawksbill sea turtle nest, 3 adult green sea turtles, and 3 green sea turtle nests. This represents approximately less than 0.004 to 0.003 percent of the total hawksbill sea turtle nests each year and less than 5 percent of females that nest in Hawaiʻi each year. Also, for the Central North Pacific DPS of the green sea turtle, this represents approximately less than 0.075 percent of the total estimated number of the DPS' range and less than 7.5 percent of the total nesters in the main Hawaiian Islands. These impacts are not expected to appreciably reduce the overall long-term total population of hawksbill and green sea turtles since turtle activity and nesting attempts are relatively rare and thus, are expected to have a small effect to the total population of the species.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm in the definition of "take" in the Act means an act which actually kills or injures wildlife. Such [an] act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by FWS as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary and must be undertaken by the FWHA so that they become binding conditions of any grant or permit issued to the FWHA, as appropriate, for the exemption in section 7(o)(2) to apply. The FWHA has a continuing duty to regulate the activity covered by this incidental take statement. If the FWHA (1) fails to assume and implement the terms and conditions or (2) fails to require the FWHA to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the FWHA must report the progress of the action and its impact on the species to the USFWS as specified in the incidental take statement. [50 CFR §402.14(i)(3)].

Amount or Extent of Take Anticipated

The USFWS anticipates the amount or extent of take of hawksbill and green sea turtles summarized below is reasonably certain to occur.

- Up to (1) adult hawksbill sea turtle and (1) hawksbill sea turtle nest over the duration of the project.

- Up to (3) adult green sea turtles and (3) green sea turtle nests over the duration of the project.

Effect of Take

In the accompanying biological opinion, the USFWS determined that this level of anticipated take is not likely to result in jeopardy of the hawksbill sea turtle and the Central North Pacific DPS of the green sea turtle.

Reasonable and Prudent Measures

The USFWS believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of hawksbill sea turtles and green sea turtles:

1. FWHA shall minimize the potential for injury or death of hawksbill sea turtles and green sea turtles.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the FWHA must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

To implement the reasonable and prudent measure above, the following terms and conditions apply:

1. The FWHA will notify the USFWS by telephone and email within 24 hours upon the discovery of an injured or dead sea turtle within the project area. FHWA will provide the USFWS a written notification (Sea Turtle Injury/Mortality Form, Appendix B), summarizing the event, within 30 days. Upon locating a dead or injured specimen, immediately notify the USFWS's Law Enforcement Office at 808-861-8525 and the USFWS at 808-792-9420. Care must be taken in handling any dead or injured specimens of proposed or listed species to preserve biological material in the best possible state. In conjunction with the preservation of any dead specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead or injured specimens does not imply enforcement proceedings pursuant to the ESA. This reporting requirement enables the USFWS to determine if take is reached or exceeded and to ensure that the terms and conditions are appropriate and effective.

2. FWHA will submit bi-annual reports. The reports shall be submitted by January 31st and July 31st following the issuance of this biological opinion and will continue bi-annually throughout the life of the project. Annual reports will summarize any surveys, observations, and monitoring (as described in the project description), along with any

details of the incident(s) that resulted in take.

3. The depository designated to receive specimens that are found is the B.P. Bishop Museum, 1525 Bernice Street, Honolulu, Hawai‘i, 96817 (telephone: 808/847-3511). If the B.P. Bishop Museum does not wish to accession the specimens, contact the USFWS's Division of Law Enforcement in Honolulu, Hawai‘i (telephone: 808/861-8525; fax: 808/861-8515) for instructions on disposition.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The FWHA must immediately provide an explanation of the causes of the taking and review with the USFWS the need for possible modification of the reasonable and prudent measures.

Conservation Recommendations

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

The USFWS recommends the FWHA undertake the following conservation recommendations:

1. Construction activities for this Project and similar future projects should be planned to take place outside of sea turtle nesting and hatching season to the maximum extent practicable.
2. Educational signs should be placed where appropriate at beach access points explaining the importance of the area to sea turtles and/or the life history of sea turtle species that nest in the area.
3. Implement measures to minimize impacts to sea turtles from night lighting along the adjacent roadway, etc. The USFWS can provide guidance on conservation measures to minimize night lighting impacts on sea turtles.
4. The FWHA collaborates with the USFWS to learn more about ESA protected species, and the Section 7 ESA consultation process.

In order for the USFWS to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the USFWS requests notification of the implementation of any conservation recommendations.

Reinitiation-Closing Statement

This concludes formal consultation on the action(s) outlined in this biological opinion. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and: (1) if the amount or extent of take specified in the incidental take statement is exceeded; (2) if new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or (4) if a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, any operation causing such take must cease pending reinitiation.

We appreciate your cooperation and assistance in helping us prepare this biological opinion. If you have any questions about this consultation, please contact Elyse Sachs of my staff at (808) 792-9400.

Sincerely,

Aaron Nadig
Acting Deputy Field Supervisor
Pacific Islands Fish and Wildlife Office