

DRAFT ENVIRONMENTAL ASSESSMENT

Experimental Release of Sihek (Guam Kingfisher) at Palmyra Atoll



December 2022

**Prepared for the United States Fish and Wildlife
Service by Anden Consulting under subcontract to The
Nature Conservancy**

TABLE OF CONTENTS

CHAPTER 1: PURPOSE AND NEED FOR ACTION 1

Introduction, Background, and Proposed Action	1
Purpose of and Need for Action	2
Project Area	4
Relationship to Other Plans or Agreements	6
Issues and Impact Topics	7
Impact Topics Analyzed in this Environmental Assessment	7
Impact Topics Dismissed from Further Analysis	8
Next Steps in the Planning Process	12

CHAPTER 2: ALTERNATIVES 13

No-Action Alternative	13
Action Alternative 1 (Proposed Action)	13
Action Alternative 2	19
Mitigation Measures	21
Alternatives Considered but Dismissed	21

CHAPTER 3: AFFECTED ENVIRONMENT 24

Palmyra Atoll	24
Sihek	26
Terrestrial Ecosystem	27
Wildlife Species	28

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES 32

General Methodology for Establishing Impacts.....	32
Sihek	32
Palmyra Atoll	40
Cumulative Impacts	47

CHAPTER 5: CONSULTATION AND COORDINATION.. 50

Planning and Public Involvement.....	50
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REFERENCES 52

CHAPTER 1: PURPOSE AND NEED FOR ACTION

INTRODUCTION, BACKGROUND, AND PROPOSED ACTION

The U.S. Fish and Wildlife Service (Service) and partners propose to release (meaning introduce) the Guam kingfisher (*Todiramphus cinnamominus*), known locally as the sihek, at The Nature Conservancy's (TNC) Nature Preserve on Cooper Island, encompassed by Palmyra National Wildlife Refuge and the Pacific Remote Islands Marine National Monument, as a non-essential experimental population under the Endangered Species Act (ESA) of 1973, as amended.

Currently, the sihek exists only in captivity and has been extinct in the wild for more than 30 years. The sihek was extirpated from Guam as a result of the accidental introduction of the predatory brown treesnake (*Boiga irregularis*) to Guam in the 1950s. In response to the pronounced population declines of Guam's native birds, the Association of Zoos and Aquariums initiated the Guam Bird Rescue Project. Between 1984 and 1986, 29 sihek were translocated from Guam to zoos in the continental United States to start a captive breeding program as a temporary conservation measure. Currently, there are an estimated 139 birds living in 24 AZA institutions and in the Guam Division of Aquatic and Wildlife Resources (DAWR) facility.

Research is ongoing to identify ways to control or eradicate the brown treesnake on Guam. Meanwhile, the Service, in collaboration with Guam Division of Aquatic and Wildlife Resources (Guam DAWR), TNC, the Zoological Society of London, the Association of Zoos and Aquariums (AZA), and the Palmyra Atoll National Wildlife Refuge (NWR), proposes the conservation release of captive bred sihek as a non-essential experimental population at Palmyra Atoll under section 10(j) of the ESA to allow scientists to monitor and learn how sihek respond to being in wild conditions after more than 30 years existing under human care. This effort will support

future efforts to restore sihek to Guam, once brown treesnake control is effective enough to allow for the survival of a reintroduced population of sihek.

The National Environmental Policy Act (NEPA) requires Federal agencies to identify and disclose the anticipated effects of Federal actions to the human environment. The Federal action considered here consists of the issuance of a new Federal Rule under section 10(j) of the ESA. Because the issuance of a Federal Rule is a Federal action, the Service must ensure that the action complies with the requirements of NEPA. Therefore, this Environmental Assessment (EA) analyzes potential effects to the human environment of the Proposed Action, and alternatives to the Proposed Action, and whether such effects may be significant.

PURPOSE OF AND NEED FOR ACTION

Despite progress in achieving recovery plan objectives for the sihek, this species continues to exist only in captivity. There are currently an estimated 139 birds in human care at 25 AZA facilities and one breeding facility on Guam – the descendants of the initial 29 kingfishers captured between 1984 and 1986. When the captive breeding program began, there was very little information on the nutrition and behavioral ecology of wild sihek.

While breeding success in sihek has improved over time, a limiting factor in achieving the partial recovery objective of 250 captive sihek is space for housing birds as well as the cost associated with holding birds (GUAM DAWR 2019). Sihek are more challenging to raise in captivity than other species in the Coraciiforme order (which includes kingfishers, bee-eaters, hoopoes, and hornbills) due to their aggressive territorial behavior and the expense associated with their feeding (Johnson et al. 2015). The number of institutions participating in sihek management is limited and declining, and the recruitment of new institutions is unlikely in the near future (Newland in litt. 2021b; Johnson et al. 2015).

The current small population size puts the species at risk from stochastic environmental events (e.g., disease outbreaks in the captive population or

changes in the ability of one or more facilities to house and breed sihek) and demographic threats (sex-ratio biases, genetic threats from loss of genetic diversity and accumulation of inbreeding).

Further, two separate population viability analyses (PVAs) demonstrated rapid declines in the captive population under current conditions (Johnson et al. 2015, Trask et al. 2021). In the first PVA, under current management practices (no changes to current reproductive output), the *ex situ* (captive) sihek population would be expected to decline and have a high risk of extinction. Specifically, the population would decline below 100 individuals by the year 2040 with no changes in reproductive output, and with a slight decrease of reproductive output of 7 percent, the population was projected to decrease to 25 individuals by 2040 (Johnson et al. 2015). Increasing breeding from ~29 hatches per year to an average of at least ~36 hatches per year would sustain the population near its current size; increasing breeding from ~29 hatches per year to an average of ~42 hatches per year could support population growth to about 200 birds (Johnson et al. 2015).

The second PVA estimated impacts of inbreeding depression across life-history stages for the sihek, projected population growth under different management alternatives relating to reproductive output, and compared the result to projected population growth without inbreeding depression or with a conventional default estimate for inbreeding depression. Individual inbreeding coefficients were calculated from pedigree data for all birds in the *ex situ* population, and an individual based population model was used. This PVA projected a mean population size of 30 individuals in 50 years, if there was no increase in reproductive output. At the same time, a small increase in average annual reproductive output (from 2.54 hatchlings per female per year to 2.7 hatchlings per female per year) could support long-term sihek population viability as well as a release program (Trask 2021).

Increases in reproductive output require finding locations to house these additional birds. Expansion to existing facilities is being initiated and explored, but doubling existing capacity is unlikely. Suitable release sites remain unavailable on Guam due to the continued presence of the brown

treesnake. A third option was developed: to release sihek into the wild outside its historical range in areas of suitable habitat without threat of brown treesnake or other similar predators.

The Service and partners propose to release sihek at Palmyra Atoll, which is outside its historical range, for the following purposes: (1) support increased reproductive output by the *ex situ* conservation program by providing a location to host the additional birds and potentially motivating new institutions to join the *ex situ* conservation program; and (2) develop and refine release and monitoring methods to be applied when reestablishing populations on Guam necessary to recover the species. Release of sihek at Palmyra Atoll will improve the likelihood of successful reintroduction and recovery on Guam by: (1) providing the opportunity to develop and test release and monitoring techniques, (2) providing information on the sihek's ability to survive in the wild, (3) assessing how much human intervention is required to support a wild population, (4) increasing the global population of sihek as an extension of the *ex situ* population as well as invigorating the breeding program, and (5) serving as a source of wild-hatched birds for future releases on Guam or other sites.

PROJECT AREA

The proposed project area encompasses the 25 ha (618 ac) of emergent land distributed among the islets that make up Palmyra Atoll (Palmyra). Palmyra is located in the northern end of the Line Islands in the equatorial Pacific. Located approximately 1,699 km (1,056 mi) south of Honolulu, Hawaii, and 5,869 km (3,647 mi) east of Guam, Palmyra is approximately 8 km (5 mi) long and 3.2 km (2 mi) wide and features around 40 low-lying heavily vegetated islets, ranging in size from approximately 0.1 to 97.9 ha (0.24 to 242 ac), distributed around three central lagoons. A coral reef as wide as 3.2 km (2 mi) in places surrounds the islets. Seaward from the atoll, the ocean depth increases dramatically just beyond the edge of the coral reef.

The atoll is an incorporated, unorganized territory of the United States whose resources are managed in partnership by the Service and TNC. TNC's land ownership which is managed as a nature preserve includes Cooper-Menge (94.3 ha, 233 ac) and Barren (4.6 ha, 11.4 ac) islands, which are surrounded by the Service's Palmyra Atoll National Wildlife Refuge. The Service established Palmyra Atoll NWR in 2001 "to protect and preserve the natural character of fish, wildlife, plants, coral reef communities and other resources associated with the tidal lands, submerged lands, and waters of Palmyra" (Department of the Interior 2001). Palmyra Atoll NWR includes all marine habitats to 12 nautical miles offshore. Home Island at Palmyra (less than 1 ha, 5 ac) is privately owned in equal shares by multiple descendants and assigns of the Cooper family. TNC owns two islands, the Cooper-Menge island complex and Barren Island, which they manage as a preserve surrounded by the Palmyra Atoll NWR, and the remaining islets (exclusive of Home Island), the waters, and the coral reefs surrounding Palmyra Atoll are owned by the United States.

Palmyra Atoll is also part of the Pacific Remote Islands Marine National Monument, which was established in 2009 and is managed by the Service in consultation with the National Oceanic and Atmospheric Administration. The Monument encompasses approximately 495,000 square miles of ocean and was designated to protect and sustain many endemic species, including corals, fish, shellfish, marine mammals, seabirds, water birds, land birds, insects, and vegetation, and also contains pristine deep sea and open ocean ecosystems with unique biodiversity, including approximately 348 seamounts.

TNC owns and operates the Climate Adaptation and Resilience Laboratory (CARL), a research station located on Cooper Island at Palmyra. TNC's CARL was launched in collaboration with partners in 2019 to build on a legacy of conservation science and research resulting from the Palmyra Atoll Research Consortium. Projects generally fall under one or more of three overarching themes: island conservation, coral reef resilience, and pelagic research (USFWS 2007, TNC 2022).

RELATIONSHIP TO OTHER PLANS OR AGREEMENTS

The Service completed a Recovery Plan for the Native Forest Birds of Guam and Rota (including the sihek) in 1990 and a Revised Recovery Plan for the Sihek in 2008. Recovery actions focus on increasing the size of the captive population, controlling brown treesnakes on Guam, protecting and enhancing habitat for reintroduction, and reintroducing the sihek into the wild on Guam. Criteria for reclassifying the sihek from an endangered to threatened species include establishing two subpopulations on Guam of at least 500 individuals each that are stable to increasing over at least 5 consecutive years; sufficient habitat is protected and managed to achieve the population criteria; and brown treesnakes and other introduced predators are managed at levels sufficient to meet the population criteria. The Revised Recovery Plan acknowledged that the interim step of introducing sihek outside of its historical range may be necessary before populations can be reestablished on Guam (USFWS 2008). Guam DAWR developed a Comprehensive Wildlife Conservation Strategy in 2005, which was updated as the Guam Wildlife Action Plan (WAP) (2019). The goal for the sihek is to restore a wild population on Guam. The release at Palmyra supports the Revised Recovery Plan and the Guam WAP by supporting increased reproductive output of the current population and providing an opportunity to gather information on how the sihek will respond to wild conditions.

The Service is in the process of developing a Monument Management Plan for the Pacific Remote Islands Marine National Monument (with NOAA) and in the future will be developing a Comprehensive Conservation Plan for Palmyra Atoll and Kingman Reef. Service staff involved in the development of these plans are involved in the planning and development of the proposed action and so that the forthcoming plans will recognize and be consistent with the proposed action.

Development of all aspects of the Proposed Action was designed to be consistent with the Biosecurity Plan for Palmyra Atoll (Hathaway and Fisher 2010), the Terrestrial Forest Management Plan for Palmyra Atoll (Hathaway et al. 2011), existing TNC management objectives, the Service's Biological

Integrity, Diversity, and Environmental Health policy (601 FW 3), and ongoing research projects. In addition, the development of the proposal to release sihek at Palmyra was made in accordance with information provided in other relevant conservation plans addressing birds found at Palmyra, including the Regional Seabird Conservation Plan (USFWS 2005), the Pacific Islands Regional Shorebird Conservation Plan (Engilis and Naughton 2004), Birds of Conservation Concern (USFWS 2002), and the North American Water Conservation Plan (Kushlan et al. 2002).

ISSUES AND IMPACT TOPICS

Issues are environmental or cultural problems, concerns, and opportunities that may occur if any of the alternatives are implemented. These issues may describe concerns or obstacles to achieving the purpose of the action or that may result from the actions under consideration. To better understand the environmental impacts of the alternatives being considered, the Service organizes the discussions of affected environment and environmental consequences by “impact topics,” which are headings that represent the affected resources associated with the issues that are analyzed in detail.

IMPACT TOPICS ANALYZED IN THIS ENVIRONMENTAL ASSESSMENT

Issues and impact topics for this EA were developed and refined during internal, agency, and public scoping. Impact topics for analysis in this EA that capture the issues discussed are provided below.

SIHEK

Along with the beneficial impacts anticipated from the release of sihek at Palmyra, other aspects were considered, such as the potential for impacts on the existing *ex situ* population related to the removal of eggs from the population to support this release and the possibility of harm to released sihek as a result of contaminants, marine debris, human interaction, or disease.

PALMYRA ATOLL

The proposed release site is a TNC preserve encompassed by a National Wildlife Refuge and a Marine National Monument. The potential environmental impacts on this sensitive area resulting from the introduction of a species not historically found from the atoll were considered.

IMPACT TOPICS DISMISSED FROM FURTHER ANALYSIS

NEPA and the Council on Environmental Quality (CEQ) regulations direct agencies to prepare NEPA documents that are “concise, clear, and to the point” (40 CFR 1500.2(b)). NEPA reviews should focus on important environmental issues and avoid amassing needless detail. Furthermore, agencies are directed to discuss nonsignificant issues in only enough detail to show why more study is not warranted (40 CFR 1502.2). The Service reviewed relevant issues and considered the impacts that could potentially result from the action and connected actions under consideration. In cases where impacts are not anticipated or are expected to be minimal and are not different among alternatives, the impact topics were dismissed from detailed analysis. These topics and the rationale for their dismissal are described below.

AIR QUALITY

There would be emissions associated with researchers/biologists, supplies, and equipment traveling to and from Palmyra Atoll to translocate the birds and to be present for monitoring activities. Transportation would be scheduled, to the extent possible, on pre-existing flights planned for other ongoing projects to reduce the need to add additional flights. Impacts would be short-term, localized, and not a key issue. Therefore, the topic was dismissed from further analysis.

CULTURAL RESOURCES

Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended (16 USC 470 et seq) and its implementing regulations under 36 CFR Part 800 require all federal agencies to consider effects of federal

actions on historic properties, including historic structures eligible for or listed in the National Register of Historic Places (National Register). Palmyra Atoll was likely explored by Micronesians and Polynesians but was never permanently inhabited. The first known western documentation of the atoll by Edmond Fanning was in 1798; however, the atoll was officially named "Palmyra" in 1802 by Captain Sawle of the ship *Palmyra*. In 1898, Palmyra Atoll was acquired in the U.S. Joint Resolution of the 55th Congress, which annexed the territory of Hawai'i, including Palmyra. In 1911, Judge Henry Cooper of Honolulu bought Palmyra Atoll and later sold all the land with the exception of Home Island to the Fullard-Leo family. The U.S. Civil Aeronautics Authority (CAA) occupied and managed facilities on Palmyra from 1939 to 1951, and the U.S. military made extensive use of the atoll from 1940 to 1945. In 1947, the Fullard-Leo family reclaimed ownership by U.S. Supreme Court decision, and in 1959, Hawaii became the 50th state, but Palmyra was specifically excluded, making it a privately owned U.S. territory. Human use of Palmyra Atoll was fairly minimal before the military activity in the 1940s; there were failed attempts to develop a guano business and to plant coconuts for copra. After the CAA left, use of the atoll gradually reduced in intensity with only a few known long-term stewards and occasional visitation by recreational vessels. In August 2000, TNC purchased emergent lands, and on January 18, 2001, Palmyra Atoll NWR was established.

Archaeological studies at Palmyra have not detected any evidence of permanent early human occupation and there are no historical or cultural resources at Palmyra Atoll that are listed on the National Register of Historic Places. The surface of the islets were highly disturbed by the U.S. government during World War II. A number of old structures are present that date to the World War II era of military and civilian government use including several concrete bunkers, ammunition storage areas, gun emplacements, and a building that was used as a military hospital, and a one-mile long crushed-coral airstrip built on reclaimed land on what is now Cooper Island. The damp climate, concrete construction, and proximity of

these buildings to the groundwater table and the ocean, have compromised the integrity of many of these structures.

Because the activities proposed (installation of temporary aviaries, release of sihek, and post-release monitoring) will involve minimal ground disturbance, are located away from areas of human activity, and are consistent with existing conservation activities, no impacts to historic or cultural features are anticipated. Therefore, this topic was dismissed from further analysis.

WATER RESOURCES

Implementation of the proposed action is not anticipated to impact water resources. Minimal ground-disturbing activities would be associated with the installation of the three aviaries on Cooper Island (composed of pipes, shade cloth, and vegetation), which would not be permanent structures. As such, the installation of the aviaries would not be anticipated to impact normal runoff patterns or drainage. No long-term impacts on water quality or water quality-related values related to aviary installation are expected. The release of up to 20 birds is also not anticipated to have impacts on water resources, given the number of seabird and shorebirds already utilizing Palmyra. The presence of researchers/biologists to translocate the birds and monitor the released sihek is consistent in size and scope with existing research and conservation projects and is not anticipated to have impacts on water resources, given that the researchers/biologists may be accommodated by existing housing. Overall impacts, if any, would be short-term, localized, and not a key issue. Therefore, the topic was dismissed from further analysis.

SOILS

Minimal ground-disturbing activities would be associated with the installation of the three aviaries on Cooper Island (composed of pipes, shade cloth, and vegetation), which would not be permanent structures. No long-term impacts on soil composition or properties are expected from installation of the aviaries. Release of up to 20 birds would result in additional fecal output, but would not exceed a threshold of significance due to the low number of birds to be released and their small size. Impacts would be short-term,

localized, and not a key issue. Therefore, the topic was dismissed from further analysis.

VISITOR AND EMPLOYEE SAFETY

Public access to Palmyra Atoll is self-limiting due to the very high expense of traveling to this remote destination. The Nature Conservancy owns and operates the only airplane runway on Cooper Island at Palmyra and there are no commercial flights. Access by boat is a five to seven day sailing trip from Honolulu.

The activities proposed (installation of temporary aviaries, release of sihek, and post-release monitoring) are consistent with existing conservation and research activities at Palmyra. TNC and the Service are central partners in the proposed action. As a result, no impacts to visitor or employee safety are anticipated. Therefore, this topic was dismissed from further analysis.

ECONOMIC IMPACTS

The only private landowners at Palmyra Atoll are TNC and the owners of Home Island. The primary activities at Palmyra consist of conservation management actions, scientific research, and operations required to support the research station, including the operation of a landing strip for aircraft. The release of sihek would not result in new or additional economic or regulatory restrictions on the private landowners and would not be anticipated to have an adverse impact on existing activities. Therefore, this topic was dismissed from further analysis.

NIGHT SKIES

Through its management of the National Wildlife Refuge system, the Service is required to maintain the biological integrity, diversity, and environmental health of these lands. "A dark night is a resource integral to many natural processes" (USFWS 2022b). Because outside lighting would not be part of the proposed release or necessary during monitoring activities, night sky issues would not occur. Lighting would only be used in emergencies. Therefore, this topic was dismissed from further analysis.

NEXT STEPS IN THE PLANNING PROCESS

Following publication of this EA, the public is invited to submit their comment on this document. The Service will evaluate the comments and finalize the EA. If based on the analysis, the proposed release is found to have no significant impact on the quality of the environment, the Service will publish a Finding of No Significant Impact. If after analysis the proposed release is found to have a significant impact on the quality of the environment, an environmental impact statement would be prepared.

CHAPTER 2: ALTERNATIVES

NO-ACTION ALTERNATIVE

The no-action alternative consists of no introduction of sihek and the continuation of current management at Palmyra Atoll. Current management programs at Palmyra are primarily focused on invasive species management, conservation of the *Pisonia grandis* forest, protection of seabird nesting colonies, and research associated with island conservation, coral reef resilience, and pelagic conservation. Ongoing research and management would continue (including the current rainforest realignment project to replace invasive coconut palms with native forest trees preferred by seabirds). The management of the sihek population exclusively in captivity would continue. The no-action alternative provides a basis for comparing the management direction and environmental consequences of the proposed action.

ACTION ALTERNATIVE 1 (PROPOSED ACTION)

Action alternative 1 consists of designating the population of sihek to be released at Palmyra Atoll as a non-essential experimental population (NEP) under section 10(j) of the ESA, installing three temporary aviaries on Cooper Island, transporting eggs to Honolulu for incubation, hatching, and initial hand-rearing in a quarantine facility, transporting selected birds from Honolulu to Palmyra for release (initially into the temporary aviaries then into the wild), and monitoring and managing the released population in a manner that promotes the conservation of the species.

DESIGNATING THE RELEASED POPULATION AS EXPERIMENTAL UNDER THE ENDANGERED SPECIES ACT

Under action alternative 1, the Service would designate the released population as a nonessential experimental population (NEP). The extent of

the geographic area is the 250 ha (618 ac) of emergent land at Palmyra Atoll, inclusive of the lagoons surrounding the islands and islets.

Based on historical data and the distance of Palmyra from other landforms, the released population is expected to remain in the 10(j) boundary for the foreseeable future. If the proposed 10(j) rule is finalized, incidental take of the sihek at Palmyra Atoll would be allowed, provided that the take is unintentional and not due to negligent conduct. In addition, employees of the Service, TNC, Guam DAWR, Zoological Society of London, AZA facilities holding sihek, and authorized agents acting on behalf of the Service may intentionally take sihek through handling sihek for scientific purposes, relocating individuals or to bring individuals into captivity for the purpose of increasing sihek survival, aiding sick or injured sihek, salvaging or disposing of dead sihek, or aiding in law enforcement investigations involving the sihek.

PRE-RELEASE SIHEK REPRODUCTIVE MANAGEMENT ACTIONS

Under action alternative 1, sihek would be released at Palmyra Atoll. The following information regarding the details of the release is based largely upon the *Management Plan for Sihek on Palmyra Atoll* (Andrews et al. 2022). A series of annual releases would occur until 10 pairs are established. For the initial release, approximately 20 eggs will be selected from existing parent pairs at the varying AZA institutions and Guam DAWR facility, selecting those identified with high quality, well represented genetics, and a history of strong egg and chick production. Based on prior incubation and hand rearing success, it is anticipated that 20 eggs will need to be selected to achieve the 9 chicks proposed for initial release. Eggs will be collected within 15 days after incubation starts and transported to a quarantine rearing facility on the island of Oahu. Collected eggs will be assigned to artificial clutches composed of 3-4 birds each, based on expected hatch dates.

Upon hatching, chicks will be reared by hand in the quarantine facility. The quarantine facility will be a trailer, placed on an existing paved footprint (requiring no ground preparation or vegetation clearing). Strict disinfection

protocols will be in place, and the quarantine facility will be used for the sihek exclusively. The quarantine facility itself will simulate natural nesting conditions of dim lighting and play an ambient soundtrack throughout incubation and chick rearing. Chicks will be fed at regular intervals, monitored and weighed, with health screenings beginning at day 17, in preparation for transport to Palmyra.

If more than 9 birds pass the health screening, chicks will be identified for release with a goal of a 5:4 sex ratio, then selected using the following criteria: those with best appearance and behavior, those closest to optimal weight, the cohort with lowest mean kinship, groups raised together, and those most responsive to stimuli. Healthy chicks not selected for release at Palmyra will either be returned to home AZA institutions or to Guam DAWR.

Chicks will be transported by air to Palmyra in individual transport boxes when they are between 30 and 40 days old. The flight to Palmyra is approximately 2.5 hours. After being off-loaded from the plane, chicks will be taken directly to one of three aviaries.

AVIARY INSTALLATION AND USE

Before the arrival of the chicks, a field team will prepare 3 release aviaries, to host up to 3 chicks each, and will collect prey for pre-release feedings. The 3 initially proposed aviaries are all located on Cooper Island, far enough from the research station to minimize human disturbance and spaced far enough apart from each other to increase their chance of falling into more than one eventual sihek territory. Aviaries are to be constructed with an external frame of galvanized pipe, temporarily anchored using ropes. The inside walls will be lined with locally collected vegetation from floor to ceiling, to provide multiple perching opportunities at various heights, but avoiding use of plants that could be potentially toxic or could cause injury or entrapment. The internal portion of the aviary will be divided into 3 separate units (flights) using shade cloth as walls. The size of each aviary is approximately 3.5 m x 3.5 m x 2.5 m (11.5 ft x 11.5 ft x 8.2 ft) Each flight will also be outfitted with a primary feeding station and a secondary live prey feeder. The primary feeding station will consist of a 30 cm (0.9 in) tall

wooden platform placed centrally within the aviary and a slightly taller T-perch placed 1.5 m (4.9 ft) away on a movable stand. The platform will hold a small shallow feeding dish and a water dish large enough for bathing. The secondary live prey feeder will be placed next to the feeding station platform and consist of a large, upturned plastic bin with the base cut away, where live prey can be put and left for the sihek to capture. All food provided to sihek in release aviaries will be sourced locally at Palmyra.

Sihek chicks will spend at least 14 days in the aviary. Any sihek that have not yet fledged will be fed in their transport boxes, following the quarantine facility protocols. Otherwise, all birds will be fed twice daily, with a mix of food types. Live prey will be provided as additional food. To facilitate weight checks post-release, birds will be trained to associate food with auditory (whistle) and visual (brightly colored feeding platform) cues so they can be called into supplementary feeding stations equipped with electronic scales. During each feeding, staff will blow a whistle one time after placing the food dish on the feeding platform.

To encourage sihek to find food post-release and to recognize new food items, live prey items will be stocked in the live prey feeder from the first day in the aviary. Additional live prey may naturally enter the aviary, providing additional foraging opportunities. Monitoring will occur via GoPro camera (one per flight), so that sihek are left alone as much as possible. Weight will be monitored every three days by placing the feeding dish on an electronic scale. Each sihek will be examined after 14 days in the aviary, with a collection of biological samples and attachment of a transmitter if they meet general health criteria. These health screening protocols are similar to those used to select individuals to translocate, and are used to evaluate overall health and condition before release.

SIHEK RELEASE AND MONITORING

Sihek will be eligible for release beginning 3 days after transmitter attachment, if they pass their health check and have no observed transmitter problems. On the day of release, birds will receive a final pre-release visual health check during their scheduled morning feed. One hour

later, the release hatch will be opened so the birds can leave freely. Hatches will remain open and the normal feeding routine will continue within the aviaries until the birds stop visiting for more than 3 consecutive days and/or post-release monitoring shows that the birds have dispersed well away from the site.

Post-release monitoring is necessary to evaluate the success of the release and to inform future translocations. The following methods are a starting point, but may require modification by the field team once on the ground based on circumstances. Monitoring will follow a three-phase approach:

- (1) Transmitter phase – anticipated to last as long as transmitters remain active, approximately 3.5 months. Transmitter data will provide information on survival and movement patterns and will assist in the retrieval of dead birds, should any deaths occur.
- (2) Intensive phase – consisting of systematic population surveys to develop a formal resighting history for each bird. Formal surveys will be completed monthly during the first year after release.
- (3) Long-term phase – Beyond the first year after each release, survey methods will remain the same as in phase 2, but the frequency will be reduced to once every 4 months (3 per year). Recommended survey protocol is to have a small team of observers attempt to sight as many individuals in the population as possible through a standardized amount of effort.

In addition, focal behavioral observations will commence the day of release and continue at high intensity for one year. At maximum intensity, each sihek should receive at least three hour-long observations per week, balancing morning and afternoon sessions. Aspects of sihek behavior, such as habitat use, foraging activities, and breeding, will be observed and documented through these observations. Initially, released birds would be located through the transmitters; afterwards either a transect or combined transect/territorial search may be used. A general health check would also be performed during each focal follow; if a bird regurgitates a pellet or defecates during observation, a sample will be collected for health and diet

analysis whenever feasible. As sihek settle into territories and begin to form pair bonds, monitoring will shift focus from individual follows to pair follows and record evidence of nest excavation and monitoring of breeding activities through chick fledging. Any wild-born chicks will be banded at 23 days old whenever possible. Observers are encouraged to collect opportunistic observation of birds outside of focal observation sessions. Finally, birds would be caught periodically for transmitter removal and health screening, no more than 2 times per year.

In the event a sihek is observed with an injury or illness, the field team will be prepared to capture the individual and hold them temporarily for further observation, health screening, and treatment.

TERMINATION

The Service may terminate the release program (1) if monitoring indicates the benefits from the Palmyra population no longer outweigh the risks to the species or the welfare of the non-essential population, (2) if ecosystem monitoring shows unacceptable impacts on the ecosystem that can be linked to the introduction of sihek, or (3) when the purposes of the program have been realized. The Service may also temporarily suspend the program to address issues that arise before program termination.

ENVIRONMENTAL MONITORING

Releases of sihek are a conservation introduction, since there is no historical evidence of sihek occurring at Palmyra. Predation of local species was initially identified as the primary impact of sihek releases at Palmyra, but there is little information on sihek feeding preferences in the wild to accurately predict which prey species may be most impacted. Monitoring to identify the occurrence and magnitude of impact on prey species will consist of 1) six monthly trapping and visual surveys for spiders, reptiles, and flying insects, 2) extraction of data from planned focal observations of sihek post-release, and 3) information from fecal samples. Active monitoring surveys will continue for two years after the first release, and then a decision will be

made on whether to continue, downscale, or discontinue monitoring of prey species based on the results.

ACTION ALTERNATIVE 2

Under action alternative 2, the pre-release reproductive management activities, the installation of the aviaries, and the release and monitoring program elements would be the same as described for action alternative 1; however, the Service would not designate the released population as a NEP. Sihek in this population would be treated as endangered under the ESA, and all take prohibitions under section 9 of the ESA would apply to sihek released at Palmyra. Also, sihek would be treated as endangered species for the purposes of section 7 of the ESA.

Table 1: Summary of Alternative Elements

Element	No-action alternative	Action alternative 1	Action alternative 2
Pre-release reproductive management	No transport of 20 eggs, incubation, or hand-rearing would occur	Selection and transport of 20 eggs, incubation and hand-rearing in quarantine facility on Oahu to identify 9 chicks for release at Palmyra	Same as action alternative 1.
Aviary installation and use	No management program	Installation of 3 aviaries, approximately 3.5mx3.5mx3.5m in size, divided into 3 flights for post transport monitoring before possible release on day 14	Same as action alternative 1.
Sihek release and monitoring	No management program	Annual release (approximately 3) of birds to establish 10 breeding pairs. Monitoring of sihek through transmitters and detailed observations to gather information on all aspects of their behavior in the wild.	Same as action alternative 1.
Environmental monitoring	No management program.	Monitoring of potential prey species through combined method to identify large-scale impacts on the environment	Same as alternative 1.
Experimental population	An experimental population would not be designated under the ESA. Sihek would not be introduced to the refuge.	The sihek population released at Palmyra would be designated a nonessential experimental population. Special rules under the ESA would be established for monitoring and management of the population.	An experimental population designation would not be designated under the ESA. Sihek would be designated and released as an endangered species.

MITIGATION MEASURES

The Service's mission is working with others to conserve, protect, and enhance fish, wildlife, plants and their habitats for the continuing benefit of the American people. In furtherance of this mission, the Service has a responsibility to ensure that impacts to fish, wildlife, plants, and their habitats are considered when actions are planned, and that such impacts are mitigated so that these resources may provide a continuing benefit to the American people. To help ensure the overall health of the sihek population and the protection of natural resources at Palmyra Atoll, the Service would implement the following measures and best management practices as part of the action alternatives.

- Briefing for all team members to inform about sensitive areas at Palmyra, including unsafe areas, potential turtle or seabird nesting habitat, ongoing research, etc.;
- Integration of invasive species and disease prevention protocols into all aspects of the project, from transportation, quarantine, and actions at Palmyra, to minimize the potential for the introduction and spread of invasive species or disease;
- Regularly remove all tools, equipment, surplus materials, trash, excess food, and biological equipment from areas when not in use;
- Follow best practices on incubation, hand rearing, and initial feeding of sihek;
- Training on data collection and regular review to ensure that issues are detected early and addressed appropriately.

ALTERNATIVES CONSIDERED BUT DISMISSED

A number of alternatives were identified during internal and agency scoping. During internal project development, these options were deemed not feasible, out of scope of the current planning process, or had several disadvantages and were not carried forward for analysis in this EA. They are described below.

RELEASE OF SIHEK ON GUAM

The Revised Recovery Plan for the sihek includes establishment of at least two populations on Guam as criteria for downlisting (two populations of at least 500 individuals) and delisting (two populations of at least 1,000 individuals each). However, the continued presence of brown treesnake on Guam throughout the landscape currently precludes consideration of Guam as a viable reintroduction site. Brown treesnake are highly cryptic and difficult to control, and the success of tools such as snake traps, toxic bait, and visual surveys partially depends on detectability (Boback 2022). Technological advances, including the development of an aerial delivery system for toxicant baiting, have occurred in recent years. The aerial delivery system tools are operational, but full operational implementation of the aerial suppression program will require further understanding of site-specific effects of the technology and development of efficient monitoring protocols. Future reintroduction to mainland Guam could only be considered if brown treesnakes can be suppressed or eradicated at a scale that would allow for the survival of a reintroduced population.

Cocos Island, an uninhabited offshore islet off the southern tip of Guam, was considered as a release site; it is home to the only wild population of the endangered ko'ko' (Guam rail) on Guam. However, the sighting of brown treesnakes on Cocos Island by local fishermen in September 2020, and confirmed by followup surveys in November 2020 (USGS 2020), paused consideration of this island for sihek release until the distribution and abundance of the brown treesnake on Cocos Island and feasibility of eradication is better understood.

ALTERNATIVE RELEASE SITES ELSEWHERE IN THE PACIFIC

Due to the extremely low number sihek left in the world, with none in the wild, several sites outside the sihek's historical range were considered, including sites in the Federated States of Micronesia and the Commonwealth of the Northern Mariana Islands. The preliminary evaluation of potential project sites considered a variety of factors, including impact on the release site through predation, possible competition and hybridization with native

species at the release site, possible transmission of disease-causing pathogens to native species, timing, and feasibility. While other sites remain under consideration for potential future releases, they require additional research to fully assess potential impacts and further discussion with landowners and governmental entities. As such, these alternatives were not included for analysis in this EA.

CHAPTER 3: AFFECTED ENVIRONMENT

PALMYRA ATOLL

Palmyra Atoll is located at the northern end of the Line Islands in the equatorial Pacific at latitude 5°53'N, longitude 162°05'W. Located approximately 1,699 km (1,056 mi) south of Honolulu, Hawaii, and 5,869 km (3,647 mi) east of Guam, Palmyra Atoll lies in an area of high rainfall near the equator known as the "Intertropical Convergence Zone." The atoll is approximately 8 km (5 mi) long and 3.2 km (2 mi) wide and features many low-lying heavily vegetated islets, ranging in size from approximately 0.1 to 97.9 ha (0.24 to 242 ac), distributed around three central lagoons. The islets generally do not exceed 2 m (6.6 ft) in elevation. The terrestrial ecosystem supports what is considered some of the best remaining *Pisonia grandis* forest and large colonies of seabirds, including one of the largest colonies of red-footed boobies (*Sula sula*) in the world and significant numbers of migratory shorebirds (Hathaway and Fisher, 2010). Seaward from the atoll, the ocean depth increases dramatically just beyond the edge of the coral reef.



Figure 1. Palmyra Atoll Visitor Access Map.
Map By US Fish and Wildlife Service, Public Domain. Created 19 May 2011.
[HTTPS://COMMONS.WIKIMEDIA.ORG/W/INDEX.PHP?CURID=46145949](https://commons.wikimedia.org/w/index.php?curid=46145949)

SIHEK

The sihek is a relatively small forest kingfisher, with adults about 20 cms (8 in) in length and ranging in weight from 1.7 – 3 ounces (53 – 85 grams) (USFWS 2008). Its body is adorned with cinnamon-brown feathers, while its wings and tail shine in a bright blue. A black streak also dashes from its dark eyes towards the back of its head.

Sihek means “to stab or pierce” in Chamorro, its name related to its long, pointed beak and its method of predation (Kerr, 1990). Sihek forage by perching motionless on exposed branches and swooping down to capture prey off the ground with their bill; they have also been known to glean insects from bark or off leaves (USFWS 2008). Sihek feed entirely on animal matter, including skinks, geckos, various insects, segmented worms, and hermit crabs (*Coenobita* spp.) (USFWS 2008). There is no information on prey feeding frequency, preferences, or seasonality of food sources in the wild. In contrast to the variety of food available in the wild, the variety offered to the birds in the *ex situ* population is more limited and often restricted to items available commercially. Captive sihek appear to prefer whole live prey, particularly green anoles (Bahner et al. 1998).

Historically, the sihek occurred throughout Guam in all habitats, except pure savanna and wetlands (USFWS 2008). Described as “fairly common” in 1945, their numbers declined sharply after the accidental introduction of the brown tree snake and it was believed extinct in the wild by 1988. Between 1984 and 1986, 29 sihek were translocated from Guam to several zoos in the mainland US to start a captive breeding program. This *ex situ* population was originally established with the intent of being a short-term rescue program that could ultimately serve to reintroduce the species back into the wild, but has now continued for nearly 40 years due to the widespread presence of brown treesnake on Guam.

Sihek do not live in large groups, but were most often observed by themselves or in pairs. They are aggressive toward conspecifics (members of the same species) as well as individuals of other bird species (USFWS 2008).

Sihek were previously observed harassing flocks of Guam bridled white-eyes and Micronesian starlings; individuals of most avian species co-occurring with sihek give alarm calls when kingfishers are nearby (USFWS 2008). Historical observations suggest that the sihek maintained exclusive year-round territories (USFWS 2008). Territories varied in size with location and cover type, but were stable within and between years. (USFWS 2008).

Relatively little is known about habitat use of sihek. It is anticipated that they require diverse vegetative structure capable of supporting a range of invertebrate and vertebrate prey, as well as exposed perches and areas of open ground for foraging, adjacent to closed canopy forest with large standing dead trees for nesting.

Sihek are socially monogamous, and breeding activity appears to be concentrated from December to July. They nest in cavities, reported in a variety of trees, including *Ficus* spp., *Cocos nucifera* (coconut), *Artocarpus* spp. (breadfruit), *Pisonia grandis* (umumu), and *Tristiropsis obtusangula* (faniok) (USFWS 2008). Pairs may excavate their own nests or use available natural cavities (USFWS 2008). Incubation, nestling, and fledgling periods in the wild are unknown; incubation and nestling periods for captive birds averaged 22 and 33 days, respectively (USFWS 2008). Both parents incubate eggs and brood and feed nestlings. Lifespan in the wild is unknown; in human care, the lifespan of sihek is between 15 and 20 years.

A Species Survival Plan program has been in place for the sihek since 1986, outlining guidelines and responsibilities of participating institutions, summarizing the current knowledge of the captive sihek, and identifying information gaps.

TERRESTRIAL ECOSYSTEM

Palmyra's seasonal climate, with high precipitation and warm temperatures, supports dense vegetation of native and non-native trees, shrubs, and herbaceous understory plants (Hathaway et al. 2011). There are three primary native vegetation types: *Pisonia grandis* forest, coastal strand forest, and grassland. Overall, the three vegetation types support at least 25

native plant species, 14 species of seabirds, six species of shorebirds, at least one native reptile, at least seven native insects, and six native land crabs. Green and hawksbill turtles also forage at Palmyra Atoll (Hathaway et al. 2011).

The *Pisonia grandis* dense jungle-like rainforest supports indigenous bird's-nest ferns (*Asplenium nidus*) in the canopy and laua'e fern (*Phymatosorus scolopendria*) in the understory. Native coastal strand vegetation is found particularly around shorelines and former causeways, consisting primarily of indigenous strand species found on many islands in the Pacific, such as beach heliotrope (*Heliotropium foertherianum*), beach naupaka (*Scaevola sericea*), and *Pandanus tectorius*. Native grassland, composed of an endemic grass (*Lepturus repens* var. *Palmyrensis*), is found in scattered patches in open exposed places throughout the atoll, and covers large areas on Cooper and Menge islands (Handler et al. 2007).

A substantial portion of Palmyra lies under a canopy of non-native coconut palm (*Cocos nucifera*), often in monotypic stands. These palms were likely introduced by Polynesian explorers and expanded through plantings prior to and after military occupation. With the eradication of rats in 2011, the coconut palms increased in abundance, outcompeting native plant species for space and resources in many areas. By 2016, an estimated 29,000 adult palms and two million seedlings covered the islets. A coconut control and rainforest realignment project is underway to restore ecological balance to the atoll; over one million palms had been removed by 2021 (Cruz 2021).

WILDLIFE SPECIES

The wildlife species found in and around Palmyra Atoll is rich in diversity, ranging from a variety of seabirds and shorebirds, marine mammals, various species of reptiles, invertebrates, marine life and flora (USFWS 2022). There are no terrestrial mammals native to Palmyra (Hathaway et al. 2011).

Palmyra is the only seabird nesting area available within 450,000 square miles of ocean and an important marine feeding ground. The native vegetation of Palmyra (the *Pisonia grandis* forest and native coastal strand)

is heavily used by multiple species of seabirds for roosting and nesting (in contrast to the coconut palms, which are less favored). At least twenty-nine species of seabirds have been observed at Palmyra Atoll including the largest nesting colonies of red-footed boobies (*Sula sula*) and black noddies (*Anous minutus*) in the central Pacific. Other important nesting species include brown noddies (*Anous stolidus*), sooty terns (*Onychoprion fuscatus*), white terns (*Gygis alba*), brown boobies (*Sula leucogaster*), great frigatebirds (*Fregata minor*), white-tailed tropicbirds (*Phaethon lepturus*), red-tailed tropicbirds (*Phaethon rubricauda*), and masked boobies (*Sula dactylatra*) (Hathaway et al. 2011).

Table 2. Birds of Palmyra. (Modified from Hathaway et al. 2011 with information from Island Conservation 2011).

Species	Status	Breeding Pairs
<i>Seabirds</i>		
<i>Black noddy (Anous minutus)</i>	Abundant resident	2,500
<i>Black tern (Chlidonias niger)</i>	Rare visitor	-
<i>Brown booby (Sula leucogaster)</i>	Common resident	150
<i>Brown noddy (Anous stolidus)</i>	Common resident	1,000
<i>Great crested tern</i>	Rare visitor	-
<i>Great frigatebird (Fregata minor)</i>	Common resident	500
<i>Lesser frigatebird</i>	Rare visitor	-
<i>Masked booby (Sula dactylatra)</i>	Uncommon resident	20
<i>Red-footed booby (Sula sula)</i>	Abundant resident	5,000
<i>Red-tailed tropicbird (Phaethon rubricauda)</i>	Uncommon resident	20
<i>Sooty tern (Sterna fuscata)</i>	Abundant resident	10,000
<i>White tern (Gygis alba)</i>	Common resident	150
<i>White-tailed tropicbird (Phaethon lepturus)</i>	Uncommon resident	15
<i>Shorebirds</i>		
<i>Bristle-thighed curlew (Numenius tahitiensis)</i>	Abundant migrant	
<i>Pacific golden plover (Pluvialis fulva)</i>	Abundant migrant	
<i>Ruddy turnstone (Arenaria interpres)</i>	Abundant migrant	
<i>Sanderling (Calidris alba)</i>	Uncommon migrant	
<i>Sharp-tailed sandpiper (Calidris acuminata)</i>	Uncommon migrant	
<i>Wandering tattler (Heteroscelus incanus)</i>	Abundant migrant	

Palmyra's rocky shoreline and extensive sandflats provide foraging areas for wintering migratory shorebirds, including the Pacific golden plover (*Pluvialis fulva*), ruddy turnstone (*Arenaria interpres*), wandering tattler (*Tringa incana*), and the bristle-thighed curlew (*Numenius tahitiensis*). The bristle-thighed curlew and the Pacific golden plover are designated as species of high conservation concern in national and regional shorebird conservation plans because of limited breeding and nonbreeding distributions, low relative abundance, and a decline in populations (Hathaway et al. 2011). Both are found in relatively high numbers at Palmyra Atoll.

There have been at least six terrestrial herpetofauna species recorded from Palmyra, including an undescribed native gecko (*Lepidodactylus n. sp.*), a potentially nonnative mourning gecko (*Lepidodactylus lugubris*), and an introduced house gecko (*Hemidactylus frenatus*) (Hathaway et al. 2011).

Palmyra Atoll supports at least nine species of native terrestrial crabs, including two species of land hermit crabs (*Coenobita brevip manus* and *C. perlatus*), four species of native land crabs (*Cardisoma carnifax*, *C. rotundum*, *Geograpsus grayi*, and *Ocypode cordimanus*), the brown tree climbing crab (*Geograpsus crinipes*), and the coconut crab (*Birgus latro*), which is known as the "largest terrestrial invertebrate in the world" (Hathaway et al. 2011, Wegmann et al. 2019). Many of these species are imperiled in other parts of the Pacific due to overexploitation by humans. Crab populations rebounded with the eradication of rats, including the discovery of at least two new-to-Palmyra land crabs (Wegmann et al. 2019).

The surrounding reef supports more than 400 species of fish, including an abundance of sharks, stony coral, and giant clams. Two species of sea turtles, the endangered hawksbill (*Eretmochelys imbricata*) and the threatened green sea turtle (*Chelonia mydas*) are found foraging in the waters offshore, with occasional (every 3-4 years) nesting attempts.

Only a limited number of studies have been conducted of Palmyra's non-coral invertebrates. In addition to terrestrial crabs, a diversity of arthropods, such as crickets, grasshoppers, cockroaches, and spiders, are found. A 2003 arthropod survey identified 113 arthropod taxa at Palmyra (Handler et al.

2007). Flies were the most species-rich (38 species), followed by wasps and ants (20 species), beetles (19 species), hemipterans (9 species), crickets and grasshoppers (6 species) and moths (6 species). These surveys added to taxa reported by historical surveys. Of the 119 taxa identified to the species level from Palmyra, most (106 taxa) are also recorded from the Hawaiian Islands, and most of those are considered accidental or purposeful introductions (102). Thus, the majority of arthropods recorded from Palmyra are considered introduced (102 of 119). (Handler et al. 2007). Only seven contemporary taxa were classified as indigenous species: three odonates: *Anax junius*, *Pantala flavescens*, and *Ischnura aurora*; a predaceous tettigoniid katydid *Phisis holdhausi*, a marine water strider *Halobates micans*; a crane fly, *Styringomyia didyma*; and an isopod *Australophiloscia societatis*. All of these species are distributed in the equatorial Pacific and occur naturally in similar habitats on neighboring islands. Several other taxa are possibly native, but little is known concerning their natural distributions (Handler et al. 2007). It remains possible that endemic species exist among the specimens not identified to the species level. Nevertheless, invasive arthropod species are believed to dominate the atoll in terms of overall richness and qualitative abundance (Handler et al. 2007). The existence of the mosquito *Culex quinquefasciatus* is of concern at Palmyra as a vector for disease, including avian malaria, avian pox, and West Nile virus; the mosquito *Aedes albopictus* was eliminated as a result of the rat eradication (Lafferty et al. 2018).

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

GENERAL METHODOLOGY FOR ESTABLISHING IMPACTS

In accordance with the CEQ regulations, direct, indirect, and cumulative impacts are described (40 CFR 1508.1(g)) and the impacts are assessed in terms the degree of the effects on resources of concern (40 CFR 1501.3(b)). Where appropriate, mitigating measures that are part of the proposed action for adverse impacts are also described and incorporated into the evaluation of impacts.

SIHEK

The sihek is extinct in the wild and limited to a small *ex situ* population. Impacts to individual released sihek at Palmyra Atoll as well as impacts to the sihek global population are considered in this section. In order to analyze these potential impacts, the following were considered: 1) potential mortality during and after release in the wild at Palmyra; 2) anticipated impact on the *ex situ* population resulting from the removal of birds for the release; and 3) anticipated effects of a 10(j) NEP versus an endangered population.

IMPACTS OF NO ACTION

Analysis. The no-action alternative would maintain the existing condition for sihek. Currently, sihek is exclusively found in captivity. The current global population is under 200 birds and is dependent on institutional participation and capacity for its continued existence. Population viability analyses have demonstrated rapid declines in the population under current management conditions; both scenarios indicate a high risk of extinction within the next 50 years. Reduced reproductive output or mortality for any number of reasons (disease transmission within a facility, inbreeding effects, etc.) could further increase the risk of extinction for the sihek.

Conclusion. The no-action alternative would result in the maintenance of current management practices for the *ex situ* population, resulting in population decline and a high risk of extinction within the next 50 years.

IMPACTS OF ACTION ALTERNATIVE 1

Analysis. Under action alternative 1, the Service would release sihek at Palmyra Atoll and designate the released population at Palmyra as a NEP. Risks to birds to be released at Palmyra include 1) mortality at any stage from egg collection to placement within an aviary on Palmyra, due to stress caused by transportation, human error, environmental conditions, or an unanticipated reason; and 2) mortality at Palmyra, due to exposure to environmental contaminants or rodenticide, predation by other wildlife, food insufficiency, human interaction, or for unanticipated reasons.

A conservation translocation is the intentional movement and release of a living organism where the primary objective is a conservation benefit (IUCN 2013). According to IUCN guidelines, assessment of any translocation proposal should include identification of potential benefits and potential negative impacts, and overall, the absolute level of risk should be balanced against the scale of expected benefits (IUCN 2013).

An experimental translocation of the Tuamotu kingfisher (*Todiramphus gambieri gertrudae*) on the French Polynesian atoll of Niau provides limited insight on how sihek may respond to translocation (Kesler et al. 2012). There, wild birds were caught, placed inside a folding canvas pigeon blanket covered with opaque cloth, and then transported to a release site on the opposite side of the island of Niau by bicycle and automobile (Kesler et al. 2012). Total transportation time was 2-4 hours; translocated birds recovered quickly and attempted to forage within several minutes of release (Kesler et al. 2012).

Additional information comes from the sihek's history managed as an *ex situ* population, where eggs and birds have been moved to or from institutions as part of the *ex situ* population management. Generally, the sihek is considered hardy and tolerant of routine handling, with recommended

guidelines for transport crates and for quarantine (Bahner et al. 1998). Protocols for hand rearing are also well-established, as many captive-bred birds are hand-reared (Bahner et al. 1998).

Moving sihek eggs to Oahu, and then the chicks to Palmyra, carries risk. Eggs would be transported from donor institutions. At least 20 eggs will be needed to ensure at least nine birds hatch (70% of sihek eggs showing embryo development successfully hatch) and survive to fledge age (69% of hatchlings survive to 30 days old). Eggs will be incubated together to allow incubation and hand-rearing in artificial clutches in Honolulu, because of proximity to Palmyra (2.5 hour flight), the ability to situate and support a dedicated quarantine facility, access to veterinarian staff if needed, and to avoid a biosecurity risk to species at any of the existing host institutions. The incorporation of strict quarantine protocols to prevent disease transmission during hand-rearing, transportation plans to minimize total travel time, clear guidelines regarding hand-rearing protocols, and extensive health monitoring throughout the process is anticipated to minimize harm to birds due to the stress associated with translocation.

Once released at Palmyra, the ability of the birds to successfully adjust to life in the wild is unknown. Mortality could result from a number of threats. Mortality due to predation is unlikely. There are no known predators of sihek at Palmyra; there are no rats, feral cats, or brown treesnakes.

Mortality due to environmental contaminants is possible. Preliminary surveys conducted broadly across Palmyra determined that contaminant sources, composed of chemical and physical agents, are still present (Hathaway et al. 2011). If the soil is contaminated, ingestion of soil while foraging could result in the direct uptake of toxic substances by sihek. Based on observation of other foraging waterbirds, and their successful existence at Palmyra without noticeable harm from environmental contaminants, it is believed that the potential for sihek to directly or indirectly ingest contaminants in such quantities to cause harm is minimal.

Mortality from direct consumption of rodenticide rat bait is considered highly unlikely, given that captive sihek prefer to forage for whole live prey, that

rodenticide bait is not available outside of bait stations, and that it is presented as “bars” so that non-target species removing bait (crabs, cockroaches) can take only as much as they can eat.

Mortality from indirect consumption of rodenticide rat bait is a possibility. The eradication of rats from Palmyra was completed in 2011. It is known that rodenticide can persist in the ecosystem longer than the time required to eradicate the target rat population and that it could potentially harm non-target species (Wegmann et al. 2019). Studies on non-target species at Palmyra (mullet, cockroaches, geckos, hermit crabs, and fiddler crabs) after rat eradication indicated no brodifacoum (rodenticide) residue remaining any of the samples collected three years after bait application (Wegmann et al. 2019). Current rodent control efforts focus on prevention of reintroduction from plane or boat arrivals. Standard operating procedures at Palmyra aim to prevent crabs from eating rodenticide: rodenticide is used at points of entry within bait boxes on crab-resistant platforms during a limited timeframe before and after arrivals, bait stations are inspected every 48 hours for rodent sign and crab removal, and proper disposal of all rodenticide occurs after a baiting period to prevent crab ingestion (TNC 2018). Under current procedures, the crabs that have been observed able to access the crab-resistant bait stations are large (80 g (2.8 oz)) hermit crabs that are then released. These large hermit crabs are thought to be larger than the sihek’s anticipated prey size; for comparison, aviary feeding will consist of 5 g (0.2 oz) (of total food (geckos and invertebrates)). In addition, there have been no observed negative impacts on the migratory birds (including the bristle-thighed curlew) that eat hermit crabs. As such, the potential for sihek to indirectly ingest rodenticide in such quantities to cause harm is anticipated to be minimal.

There is a limited human footprint on Cooper Island, associated with the airstrip and facilities in place to support research and conservation actions. The locations of the three aviaries were deliberately selected to be situated far enough away from existing infrastructure to prevent disorientation or undesired interactions with humans. As such, the potential for sihek to be negatively impacted in such manner to cause harm is minimal.

Mortality due to disease is possible. During pre-release hand-rearing, strict biosecurity protocols will be implemented to ensure a pathogen and vector free rearing environment. Staff will undergo a disinfection regime each time they enter the quarantine facility on Oahu, consisting of shoe removal and hand disinfection at the entryway and changing to shoes stored in a disinfectant footbath and a clean lab coat and donning disposable gloves. When leaving the facility, staff will leave behind all dedicated clothing and equipment and disinfect their hands again. All activities on Cooper Island will follow the biosecurity protocols for Palmyra Atoll outlined by TNC and the Service. This includes keeping all gear and clothing used on Cooper Island separate from gear and clothing used on all other islands. Any gear that can withstand freezing temperatures will be frozen each time it moves between TNC and Service land. After release, sihek may be exposed to avian diseases from existing native seabird or shorebird populations through mosquito (*Culex quinquefasciatus*) transmission. There is currently no indication of avian disease in the seabird and migratory bird populations visiting Palmyra; no observations of sick or diseased birds have been made. As such, the potential for mortality to sihek resulting from disease is considered moderate due to the unpredictable nature of avian disease transmission and the limited information on sihek susceptibility to avian disease due to limited exposure while in captivity.

Mortality due to general stress related to open spaces or to food unavailability is possible. To minimize overall stress, the aviaries are designed to allow the sihek the ability to come and go freely. After a 14-day period to acclimate to the Palmyra environment and a final health check, hatches to the aviary will be opened so that birds can move freely. Normal feeding will continue until an individual stops visiting for more than three consecutive days. In addition, live prey training will be incorporated into the 14-day acclimation period: unlimited live prey, representing local species found on Cooper Island, will be stocked in the live prey feeder (essentially an open box to contain live prey where sihek still have to capture prey themselves). Birds that are hesitant to leave the aviary, or that have difficulty finding food on their own, would continue to have access to the

aviary and the known food source. Intensive post-release monitoring is planned to evaluate how each individual sihek adjusts to its environment. Protocols to recapture sick or injured individuals for evaluation have been established in advance, and the Sihek Recovery Team will be contacted to consider the appropriate course of action.

While the potential for sihek mortality is not considered high, the possibility does exist. For any sihek found to have died, carcasses will be recovered for post-mortem examination and biological sample collection. Based on the results, an exit strategy may be initiated by the Sihek Recovery Team and decision-makers if monitoring indicates the benefits of continuing the program (including learning) no longer outweigh the risks (e.g., welfare and mortality concerns). If the Service terminates the program, the Service will address the disposition of any remaining released sihek.

The carrying capacity for sihek at Palmyra Atoll is estimated to be 15-20 pairs. No more than 20 eggs will be taken in the first year to minimize the initial impact on the *ex situ* population. Nine birds will be released at Palmyra, but if more than nine birds survive fledging, the additional birds will be returned to the *ex situ* population. Nesting activity and success at Palmyra will be closely monitored. It is not anticipated that all nine released birds will suffer mortality at Palmyra; the exit strategy in place should prevent mortality of all birds if an unforeseen issue arises. However, in a worst case scenario, where all nine released birds do not survive, loss of these birds would not preclude other options, including future efforts to establish sihek populations elsewhere. The majority of the sihek population will remain in *ex situ* population distributed among 26 facilities where they are carefully managed. Population models indicate an increase in breeding is required to ensure the sustainable removal of individuals from the *ex situ* population for release. This has occurred in the past; between 2004 and 2013, the sihek population increased from 61 birds to a peak of 157 birds as a result of increased reproductive output using multiple clutching (Newland et al. 2020). The best available information indicates that increasing *ex situ* reproductive output to rates seen between 2004 and 2013 is likely to

support a release program without negatively impacting the long-term viability of the species (Trask et al. 2021).

The proposed 10(j) boundary covers all of Palmyra Atoll. The Service would be required to a complete formal section 7 consultation with the National Wildlife Refuge System if their actions within the Palmyra Atoll NWR and the Pacific Remote Islands Marine National Monument are likely to adversely affect sihek at Palmyra. Other federal agencies would not be required to conduct formal section 7 consultation on proposed actions that might adversely affect sihek. "Take" of sihek under the ESA would be governed under the special rules defined in the experimental population designation. All incidental take of sihek would be exempted inside the 10(j) boundary under the special rules. Incidental take is inadvertent harm resulting from legal activities; it is not intentional or due to neglect. Given the nature of Palmyra being managed as both a wildlife refuge and nature preserve, and the character of the existing activities designed to support conservation, incidental take is expected to occur infrequently and would not be expected to impact the sihek population.

Conclusion. The Service completed the Revised Recovery Plan for the Sihek in 2008. To contribute to the recovery of the species, the recovery plan calls for the establishment of two wild populations on Guam. While the continued presence of the brown treesnake prevents releases on Guam at this time, there is a need for information on how sihek will respond to natural conditions because this information was not well documented before sihek were extirpated from Guam. Information on prey preferences, nesting activity, breeding success, and general behavior patterns in the wild are all important information to give the best possible chance to avoid extinction of this rare species. In addition, the population viability analyses conducted indicate that the global population needs to increase reproductive output to prevent population declines. With limited capacity in existing institutions, exploring the feasibility of new sites in the wild to host these additional birds could have profound positive effects on the sihek population. As a result, the proposed action (action alternative 1) is likely to have a beneficial effect on the sihek population, sihek conservation, and the overall health and viability

of the sihek population by generating information and stabilizing or increasing the global population.

IMPACTS OF ACTION ALTERNATIVE 2

Analysis. The same actions described under action alternative 1 would apply for action alternative 2, except that the sihek population would be designated as endangered under the ESA. Therefore, incidental take would not be exempted by special rule. Incidental take would need to be authorized through section 7 or section 10 of the ESA and section 7 consultation would be required for all projects with a federal nexus that is likely to adversely affect the sihek. If incidental take is likely to occur, the Service may condition incidental take authorization with reasonable and prudent measures and terms and conditions. For actions without a federal nexus that are likely to result in incidental take, project proponents would need a take authorization through a Habitat Conservation Plan. Authorization for management that involves purposeful take would require a recovery permit; therefore, all actions by Guam DAWR, Zoological Society of London, AZA, TNC, and the Palmyra Atoll NWR staff and their agents associated with translocating the birds that would be considered take for scientific purposes, including relocating individual birds, capturing individual birds for purposes of increasing survival, aiding sick or injured birds, and salvaging or disposing of dead sihek would require a recovery permit. The risk of mortality associated with the release of sihek at Palmyra would be similar to that described under action alternative 1. There would be no practical difference in primary threats to the species between the two action alternatives.

Conclusion. The primary difference between the proposed action and this alternative is that all management actions related to the sihek would require an additional recovery permit from the Service, which could involve additional expense and processing time. The other impacts would remain the same. As a result, action alternative 2 is likely to have a beneficial effect on the sihek population, sihek conservation, and the overall health and viability of the sihek population by generating information and stabilizing the global population.

PALMYRA ATOLL

METHODOLOGY AND ASSUMPTIONS

There are multiple examples of the negative impacts to island ecosystems caused by the introduction of a non-native species; two related examples include the damaging effects of rats at Palmyra (shown fully through their eradication) and of the brown treesnake on Guam. As such, a thorough review of the potential impacts of releasing a species outside its historical range, even for conservation purposes, is of importance. Identified potential impacts on the native ecology of Palmyra atoll include:

- 1) Potential predation on native species;
- 2) Potential impacts on native species due to competition;
- 3) Potential hybridization of native related species;
- 4) Transmission of disease causing pathogens to native species; and
- 5) Other impacts to the existing native plant, invertebrate, or bird populations.

As part of this discussion, this section also considers whether the alternatives to release the sihek at Palmyra Atoll could have unintended consequences for native wildlife species at Palmyra, particularly federally listed species or other species of concern; species sensitive to disturbance; species with low populations levels or restricted ranges; or species that are otherwise important for recreational, cultural or ecological reasons.

IMPACTS OF NO ACTION

Analysis. The no-action alternative would provide no changes to existing research and conservation at Palmyra Atoll.

Conclusion. The no-action alternative would have no impact on the Palmyra ecosystem and the wildlife it supports, and no cumulative impacts would be anticipated.

IMPACTS OF ACTION ALTERNATIVE 1

Analysis. To consider potential impacts on the environment of release sites under consideration, the Sihek Recovery Team created an environmental impact form, based on the Environmental Impact Classification for Alien Taxa (EICAT, Blackburn et al. 2014) and the Generic Impact Scoring System (GISS, Nentwig et al. 2010). The team then asked a range of relevant experts (n=19) to provide their judgment on the potential impact sihek could have through predation, competition, hybridization, and disease transmission on several release sites under consideration, including Palmyra Atoll. Relevant experts possessed expertise in Pacific birds, as well as potential prey taxa, on invasive species, in conservation genetics and genomics, and wildlife health.

Regarding predation, experts considered impacts at Palmyra to range from minimal to moderate. Minimal impacts result in negligible level of predation on native species; moderate impacts include predation directly or indirectly (e.g., via mesopredator release) resulting in a decline of population size of at least one native species, but no changes in community composition.

Prey preferences of wild sihek are unknown. Captive sihek appear to prefer whole live prey, particularly green anoles (Bahner et al. 1998), but it is anticipated that the environment of Palmyra will provide a wider variety of potential prey than institutions are able to provide in captivity. Because of their preference for green anole in captivity, sihek may prefer the lizards of Palmyra, most of which are introduced but there is an undescribed native gecko (*Lepidodactylus n. sp.*). The role of this native gecko in the ecosystem is not well-researched, nor has its distribution or abundance been studied.

There are many other species found on Palmyra that have been identified as potential prey, including insects, spiders, woodlice, crabs, seabird chicks, and fish. The majority of arthropods identified as potential prey species are introduced, but a few species (a fly, a dragonfly, a damselfly, a katydid, local crabs) are native but not known to be rare. Given the small number of sihek to be released (nine initially, to increase over time to 10 pairs) and the wide variety of potential arthropods available as prey, the impact on any one

species is not anticipated to have a significant negative impact on its population, locally or globally.

Sihek historically have been observed chasing and killing chicken chicks (Seale 1901). There are no chickens at Palmyra, but numerous seabird species breed at Palmyra and may leave chicks unattended in nests or breeding sites. Assuming that chicken chicks represent the upper size limit for seabird chicks as prey, some species would not be considered vulnerable because the hatched chick is larger than a newly hatched chicken chick (e.g., masked booby, brown booby, red-footed booby, great Frigatebird). However, several species of seabird chicks could be vulnerable from hatching until approximately 3 weeks old, specifically the white tern, black noddy, brown noddy, and sooty tern. The black noddy and sooty tern nest in large dense colonies (HI SWAP 2015), which could provide protection for newly hatched chicks; the presence of the colony and risk of attack by adults could discourage chicks from these species as a food source. The white terns and brown noddies tend to nest in loosely associated groups or singly, which limits how many chicks may be located within any individual sihek's territory. Given the small number of sihek to be released (nine initially, to increase over time to 10 pairs), the wide variety of potential prey species available, the preference of sihek for moving prey (the smallest chicks move very little), and the overall numbers of breeding seabirds that Palmyra currently supports, predation of seabird chicks is not anticipated to have a significant negative impact on seabird populations at Palmyra, locally or globally.

While the sihek is a terrestrial kingfisher, eating predominantly insects, lizards, and crabs and possibly chicks, fish scales have been found in the stomach contents of collected birds (Marshall 1949). Historical observations indicate sihek maintain exclusive year-round territories and wait on perches for foraging. The availability of marine fish as prey would depend on a sihek selecting a territory with proximity to marine waters. Given the small number of sihek to be released (nine initially, to increase over time to 10 pairs) and the wide variety of other potential prey species available,

predation of aquatic species is not anticipated to have a significant negative impact on aquatic species' populations, locally or globally.

Regarding competition, experts considered impacts at Palmyra to range from minimal to minor. Minimal impacts result in negligible level of competition with native species; minor impacts of competition affect fitness (e.g., growth, reproduction, defence, immunocompetence) of native individuals without decline of their populations. The sihek could potentially compete with migratory shorebirds for food. The sihek is anticipated to eat small animal matter, specifically lizards, insects, and crabs. Many of the sihek's potential prey is also food for migratory birds: the Pacific golden plover eats insects such as cockroaches, moths, caterpillars, and earwigs; the wandering tattler eats invertebrates, such as marine worms, aquatic insects, mollusks, crustaceans and small fish; the ruddy turnstone eats insects, especially flies, spiders, beetles and grubs, mollusks, worms, small fish, and even carrion, rubbish and bird eggs, and the bristle-thighed curlew eats intertidal and terrestrial invertebrates, seabird eggs and hatchlings, carrion, lizards, and fruit (HI SWAP 2015). Habitat use may overlap; the sihek is anticipated to utilize forest with canopy cover and adjacent open areas for foraging, while migratory shorebirds at Palmyra utilize more open areas near the shoreline. Given the small number of sihek to be released (nine initially, to increase over time to 10 pairs), the larger number of migratory shorebirds that Palmyra currently supports, and the wide variety of potential prey at Palmyra, food competition is not anticipated to have a significant negative impact on migratory shorebirds. Any competition on global migratory bird populations is anticipated to be minor.

The sihek could also compete with migratory shorebirds for territory. The sihek has a reputation as an aggressive bird in the wild, both towards conspecifics and other species (Bahner et al. 1998). In captivity, the sihek is held either in breeding pairs or as singletons. Pacific golden plovers also show high fidelity to their wintering grounds and will chase intruders from their territory while foraging (HI SWAP 2015). Again, the sihek is anticipated to utilize forest with canopy cover, while shorebirds utilize more open areas near the shoreline. Monitoring will provide critical information on whether or

how severe competition for territory may be. Given the small number of sihek to be released (nine initially, to increase over time to 10 pairs), the larger number of migratory shorebirds that Palmyra currently supports, and the differing habitat used between the sihek and shorebirds, competition for territory is not anticipated to have a significant negative impact on migratory shorebirds. Any impact on global migratory bird populations would be anticipated to be minimal.

The sihek could possibly compete with native seabirds for nesting space. The sihek excavate nest cavities in soft rotting logs of trees such as coconut palm, *Pisonia grandis* and breadfruit trees in areas with a high degree of canopy cover (over 80%) (Bahner et al. 1998). In contrast, the many seabirds breeding at Palmyra use a variety of nesting techniques (from shallow scrapes on the ground to nesting platforms on top of low bushes or trees) located primarily in coastal strand habitat (e.g., beach naupaka (*Scaevola* sp.) and tree heliotrope (*Heliotropium foertherianum*)) (HI SWAP 2015). The extent of *Pisonia grandis* trees on the atoll supports the largest black noddy colony in the central Pacific (Suchanek 2012); in Hawai'i these birds utilize the same nest year after year, often ledges and crevices (HI SWAP 2015). The white-tailed tropicbird has been observed using tree hollows in Hawai'i, but it also utilizes cliffs and caves. There are approximately 2,500 breeding pairs of black noddies and 15 breeding pairs of white-tailed tropicbirds at Palmyra; given the space available, the low numbers of sihek anticipated to be nesting at Palmyra, and the planned placement of dead logs around sihek territories as nesting opportunities, competition for nesting space between the sihek and other seabirds, if any, is not anticipated to have a significant negative impact on seabirds. Any impact on global seabird populations would be anticipated to be minimal.

Regarding hybridization, experts considered impacts at Palmyra to be minimal (no hybridization between alien species and native species observed in the wild). There are no native species at Palmyra related to the sihek that would be subject to hybridization with the sihek.

Regarding impact through transmission of disease-causing pathogens, experts considered impacts at Palmyra to range from minimal to moderate. For minimal impact, the alien species is not a host of diseases transmissible to native species or could contribute to a very low level of transmission of diseases to native species; for moderate impact, transmission of diseases to native species would result in a decline of population size of at least one native species, but no changes in community composition.

To minimize the risk that sihek will introduce novel pathogens to Palmyra, strict biosecurity protocols will be implemented to ensure a pathogen and vector free rearing environment. Staff will undergo a disinfection regime each time they enter the quarantine facility on Oahu, consisting of shoe removal and hand disinfection at the entryway and changing to shoes stored in a disinfectant footbath and a clean lab coat and donning disposable gloves. When leaving the facility, staff will leave behind all dedicated clothing and equipment and disinfect their hands again. All activity at Palmyra will follow the Service's biosecurity protocols for Palmyra Atoll NWR. This includes keeping all gear and clothing used on Cooper Island separate from gear and clothing used on most other islands within the NWR. Any gear that is permitted to move between TNC and Service land will be closely inspected or will otherwise have designated sets that are only used in the respective areas as outlined in the biosecurity protocols. Finally, the health screening immediately before the aviary hatch is opened will include screening for *Plasmodium*, *Haemoproteus*, and *Leucocytozoon* infections, bacterial cultures for *Salmonella* spp., *Yersinia* spp. and *Campylobacter* spp., PCR testing West Nile virus, avian poxvirus, and *Chlamydophila psittaci*, swabbing for *Trichomonas gallinae*, and a sample to detect intestinal parasite egg flotation (including *Isopora* spp.) to prevent disease transmission from sihek to native birds at Palmyra.

The additional monitoring required to document and assess the sihek's adjustment to the wild and to identify any impacts on the surrounding environment could itself have a negative impact on the natural environment of Palmyra, through the additional movement of humans through the remote natural area, creating pathways for weed movement or

damaging native vegetation. Monitoring teams will be trained and expected to follow invasive species protocols to prevent introduction or movement of non-native species throughout the atoll and will be trained on how to identify and avoid negative impacts to sensitive habitats, such as green sea turtle nests and seabird nests. As such, activities associated with monitoring is not anticipated to have a significant negative impact at Palmyra.

Conclusion. It is anticipated that the sihek itself would be relatively benign in the environment with minimal impacts to native species or the landscape. The small number of birds to be released would be anticipated to have a limited impact on the surrounding environment, and the extensive monitoring to be performed would allow decision-makers to identify and respond to any unanticipated environmental issues that arise. Minimal impacts are anticipated on the global population of migratory shorebirds; the population at Palmyra of the Pacific golden plover, the wandering tattler, the ruddy turnstone and the bristle-thighed curlew is small compared to the global populations for these species.

IMPACTS OF ACTION ALTERNATIVE 2

Analysis. The same actions described under action alternative 1 would apply for action alternative 2, except that the sihek population would be designated as endangered under the ESA in action alternative 2. There would be no practical difference in impacts to the ecology of Palmyra Atoll between the two action alternatives.

Conclusion. Under action alternative 2, it is anticipated that the sihek itself would be relatively benign in the environment with minimal impacts to native species or the landscape. The small number of birds to be released would be anticipated to have a limited impact on the surrounding environment, and the extensive monitoring to be performed would allow decision-makers to identify and respond to any unanticipated environmental issues that arise.

CUMULATIVE IMPACTS

The Council on Environmental Quality (CEQ) regulations for implementing the provisions of NEPA define several different types of effects that should be evaluated in an EA including direct, indirect, and cumulative. Direct and indirect effects are addressed above. This section addresses cumulative effects. Cumulative impacts are defined as “effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time” (40 CFR 15081.1(g)(3)).

Cumulative impacts are the overall, net effects on a resource that arise from multiple actions. Impacts can “accumulate” spatially, when different actions affect different areas of the same resources. They can also accumulate over time, from actions in the past, the present, and the future. Occasionally, different actions counterbalance one another, partially canceling out each other’s effect on a resource. But more typically, multiple effects add up, with each additional action contributing an incremental impact on the resource. In addition, sometimes the overall effect is greater than merely the sum of the individual effects, such as when one more reduction in a population crosses a threshold of reproductive sustainability and threatens to extinguish the population.

PALMYRA CONSERVATION MANAGEMENT

Existing, but unrelated, conservation actions at Palmyra, such as past eradication of rats, the current coconut palm control and native tree restoration, ongoing ecosystem research, and the future possibility to eradicate mosquitos directly and indirectly benefit the sihek under the proposed action. These separate actions cumulatively enhance the suitability of Palmyra as a potential release site.

TRANSLOCATION

The translocation and release of sihek on Palmyra would demonstrate the feasibility of sihek translocation using egg collection, hand-rearing, and release into the wild through temporary aviaries as an effective conservation measure to eventually be used for releases on Guam, and potentially at other suitable sites as an interim measure. If translocation techniques are successful, and monitoring methods are appropriate for identifying issues with wild birds during the process, these actions may enhance the success of future sihek releases but may also provide invaluable information for the translocation of other rare kingfishers. If translocation techniques are unsuccessful, this may also provide valuable information to improve the outcomes for future efforts. Cumulative effects would be beneficial.

CLIMATE CHANGE

Global climate change is supported by a continuously growing body of unequivocal scientific evidence. Global forecasting models offer a variety of predications based on different emission scenarios. The U.S. Government agency Overseas Private Investment Corporation suggests that a further increase in greenhouse gas emissions could double atmospheric concentrations of CO₂ by 2060 and subsequently increase temperatures by as much as 2 – 6.5°F over the next century. Model experiments by the IPCC show that if greenhouse gases and other emissions remain at 2000 levels, a further global average temperature warming of about 0.18°F per decade is expected. Sea level rise is expected to accelerate by two to five times the current rates due to both ocean thermal expansion and the melting of glaciers and polar ice caps. Modeling projects sea level to rise 0.59 – 1.93 feet by the end of the 21st century. These changes may lead to more severe weather, shifts in ocean circulation (currents, upwelling) as well as adverse impacts to economies and human health. The extent and ultimate impact these changes will have on Earth's environment remain under considerable debate (Buddemeier et al. 2004, Solomon et al. 2007, IPCC 2007).

Small islands are increasingly affected by increases in temperature, the growing impacts of tropical cyclones, storm surges, droughts, changing

precipitation patterns, sea level rise, coral bleaching, and invasive species (Mycoo et al. 2022). Small island groups are particularly vulnerable to climate change. The following characteristics contribute to this vulnerability: (1) small emergent land area compared to the large expanses of surrounding ocean; (2) limited natural resources; (3) high susceptibility to natural disasters; and (4) inadequate funds to mitigate impacts (IPCC 2007). Palmyra Atoll would be considered to have a limited capacity to adapt to future climate changes.

Though none of the action alternatives would be anticipated to have an impact on climate change, the longer term ability of Palmyra to host sihek or for the released sihek to contribute to the global population could be impacted by some of the anticipated effects of climate change (e.g., sea level rise, change in weather patterns).

CHAPTER 5: CONSULTATION AND COORDINATION

This chapter describes the public involvement and agency consultation during the planning for the release of sihek on Guam and this environmental assessment. A combination of activities, including internal and public scoping, has helped to guide the development of this proposal and this EA. This chapter provides a detailed list of the various consultations initiated during the development of this document.

PLANNING AND PUBLIC INVOLVMENT

NEPA regulations require an “early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action” (40 CFR 1501.9).

The proposed action builds upon the years of conservation action and research regarding the sihek – beginning with the capture of the 29 birds from Guam between 1984 and 1986, the development of a recovery plan for the sihek in 1990 (which also addressed the Guam rail (*Gallirallus owstoni*), Mariana crow (*Corvus kubaryi*), Guam broadbill (*Myiagra freycineti*), and Guam bridled white-eye (*Zosterops conspicillata*)), the portion of the Guam Wildlife Action Plans relating to the sihek in 2005 and 2019, and the Revised Recovery Plan for the Sihek in 2008. It encompasses the lessons learned from raising sihek in captivity for nearly 40 years, additional research conducted on the sihek, and planning efforts to re-establish these birds back into the wild.

In late 2020, the Service established a Sihek Recovery Team whose purpose was to assist the Service in developing and implementing a conservation strategy for reestablishing sihek in the wild. This recovery team is a global collaboration of federal, state, and private partners made up of the U.S. Fish and Wildlife Service, Guam Department of Agriculture Division of

Aquatic and Wildlife Resources, The Nature Conservancy, Association of Zoos and Aquariums, Sedgwick County Zoo, ZSL (Zoological Society of London), and the International Union for the Conservation of Nature (IUCN).

Prior to the establishment of the Sihek Recovery Team and up until 2015, the Service consulted informally with a group of experts from the AZA, government, and academia. Standardization of husbandry practices, identification of the need to release sihek at a site other than Guam, and the initial identification of potential release sites resulted from the engagement with this group.

The Sihek Recovery Program has engaged both informally with experts in the fields of Pacific birds, Pacific invertebrates, reptiles, and crustaceans, invasive species, conservation genetics and genomics, and wildlife health and formally with the Governor of Guam throughout the planning process and development of the proposed action.

The proposed 10(j) rule for this project was published in the Federal Register on August 30, 2022 and open for public comment and subjected to peer review. Overall, commenters provided support for efforts to promote the continued existence of endangered species, and more particularly, the sihek. Concerns raised centered primarily on impact of the proposed releases on the global population of sihek and on the potential harm to sihek from directly or indirectly ingesting rodenticide related to the rat eradication completed in 2011. These concerns have been evaluated and addressed in this draft environmental assessment.

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