BIOLOGICAL ASSESSMENT
for Invasive Brown Treesnake Eradication
to Protect Natural Resources on Cocos Island, Guam

ANALYSIS OF POTENTIAL IMPACTS ON
THREATENED AND ENDANGERED SPECIES

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Pacific Islands Ecosystem Research Center
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Pacific Islands Fish and Wildlife Office

In partnership with:

GOVERNMENT OF GUAM
Department of Agriculture
Division of Aquatic and Wildlife Resources

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Acronyms Used in the BA

AEG	Airsoft electric gun
APHIS	Animal and Plant Health Inspection Service
ATV	All-terrain vehicle (e.g., one-person “four-wheeler”)
AVMA	American Veterinary Medical Association
BA	Biological Assessment
BO	Biological Opinion
BMP	Best Management Practice
BTS	Brown treesnake
BTSDD	Brown treesnake detector dog
CIR	Cocos Island Resort
CNMI	Commonwealth of the Northern Mariana Islands
CP	USGS Closed Population
DNM	Dead neonatal mouse
DOAG	Department of Agriculture, GovGuam
EA	Environmental Assessment
EFH	Essential Fish Habitat
ESA	Endangered Species Act
GDAWR	Guam Division of Aquatic and Wildlife Resources, DOAG, GovGuam
GDPR	Guam Department of Parks and Recreation
GovGuam	Government of Guam
ISU	Iowa State University
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NWRC	National Wildlife Research Center
PIERC	USGS Pacific Island Ecosystems Research Center
PIFWO	USFWS Pacific Islands Fish and Wildlife Office
RRT	USGS BTS Rapid Response Team
T&E	Threatened and Endangered
UOG	University of Guam
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UTV	Utility terrain vehicle (e.g. two-person gas-powered cart)
WDM	Wildlife Damage Management
WS	Wildlife Services

1 INTRODUCTION

1.1 Background

The brown treesnake (*Boiga irregularis*; BTS) is a slender, nocturnal, arboreal snake that is a generalist predator of vertebrates, primarily lizards, birds, and mammals. As a result of their accidental introduction to the western Pacific Island of Guam in the late 1940s, BTS has had persistent, costly socio-economic and cultural impacts and caused the reduction, extirpation, or extinction of all native vertebrate taxa, particularly the forest avifauna, with multiple cascading ecological effects (Savidge 1987, Hall 1996, Fritts and Rodda 1998, Wiles et al. 2003, Rodda and Savidge 2007, Rogers et al. 2017, Wandrag et al. 2017). Although most BTS are relatively small (less than 1,000 mm snout-vent length and 100 g mass), a low proportion of individuals can grow much larger (greater than 2,000 mm and 1,800 g), especially when prey is abundant. Larger BTS typically feed on endothermic prey and can kill or consume larger prey such as endangered Guam rails (*Rallus owstoni*[1]) and threatened Mariana fruit bats (*Pteropus mariannus mariannus*) (Wiles 1987, Savidge 1988, 1991). Smaller BTS primarily consume ectothermic prey such as small lizards including the endangered Slevin's skink (*Emoia slevini*). On Guam, BTS have achieved densities higher than any naturally occurring nonaggregating snake species (Savidge 1988, Fritts and Rodda 1998, Rodda et al. 1999b).

Due to the pervasive impacts of BTS on Guam, they have been recognized as one of the world's most harmful invasive species (Lowe et al. 2000). The importance of controlling BTS spread and reducing their damages is recognized in the Nonindigenous Aquatic Nuisance Species Prevention and Control Act of 1990, the Brown Treesnake Control and Eradication Act of 2004, and the National Defense Authorization Act of 2009. Multiple agencies engage in intensive interdiction, early detection, and rapid response measures to prevent the introduction and establishment of BTS from Guam to other locations in the Pacific, including the Commonwealth of the Northern Mariana Islands (CNMI) and Hawaii (Stanford and Rodda 2007, Clark et al. 2018, Engeman et al. 2018)

1.2 Purpose and Need for the Proposed Action

In October of 2020, the U. S. Geological Survey (USGS) Brown Treesnake Rapid Response Team (RRT) verified the establishment of a reproducing population of BTS on Cocos Island, Guam (Chamorro name Dåno′), while investigating public reports of snake sightings. Because Cocos Island contains natural resources that are at jeopardy from BTS predation, including species listed as threatened or endangered under the Endangered Species Act (ESA), a multi-agency effort to eradicate this incipient BTS population is being planned.

The invasion on Cocos Island is the first and only known extralimital population of BTS since the species arrived on Guam. Despite important developments and improvements in suppression tools and techniques, to date there has never been a successful and enduring eradication of BTS from any invaded area, nor have any other invasive snake species been eradicated from any island worldwide. The unprecedented nature of this effort requires that all possible measures be taken to improve the probability of success.

[1] Now *Hypotaenidia owstoni*; obsolete name preserved for agreement with species list provided by USFWS

Principles for vertebrate eradication dictate that (i) all target animals can be put at risk by the eradication technique(s), (ii) target animals must be killed at a rate exceeding their rate of increase at all densities, and (iii) immigration must be zero (Cromarty et al. 2002). Putting all BTS on Cocos Island at risk requires employing multiple complementary control tools to ensure that all demographics can be effectively targeted, including differing age classes and accounting for individual variation in foraging ecology (e.g., preference for bird prey) and deploying tools at sufficient density that all individuals encounter tools within their activity area ("home range"). Removing BTS at a rate exceeding their rate of increase requires that removal rates be intensive and sustained so that all problematic size classes (e.g., eggs and hatchlings) can be effectively targeted at some point in their development before becoming reproductively mature, across generations including offspring generated by snakes that are not effectively targeted ("missed") in earlier stages of control efforts. Modeling based on preliminary data from eradication experiments indicates that eradication of BTS from discrete areas is possible but will require at least 3 to 5 years of effort (M. Nafus, USGS, pers. comm., 2020). Lastly, the expanse of ocean surrounding Cocos Island presents a formidable barrier to natural immigration of BTS, greatly improving prospects for eradication; however, biosecurity during and following eradication efforts must be effective to prevent eradication failure or reinvasion.

With this Biological Assessment (BA), we wish to initiate formal consultation with the U. S. Fish and Wildlife Service (USFWS) to ensure that proposed BTS eradication actions on Cocos Island are compliant with Section 7 of the ESA.

1.3 Partner Agency Roles

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service, Wildlife Services (WS) would be the lead agency for the brown treesnake eradication operations on Cocos Island. WS has personnel with expertise in wildlife damage management, island invasive species eradication, and BTS biology and control methods. WS personnel, and non-WS personnel under their direction, may participate in any of the actions covered under this BA. USGS Fort Collins Science Center (USGS-FORT) personnel, including the RRT, are leaders in BTS biological and ecological research and early detection and rapid response. USGS-FORT personnel, and non-USGS personnel under their direction, may also participate in any of the actions covered herein. USGS Pacific Island Ecosystem Research Center (USGS-PIERC) personnel have expertise in island ecosystems, invasive species, and avian conservation. The USGS-PIERC role will primarily address BTS prey monitoring, which would include visual surveys, camera monitoring, radio telemetry, and incidental snake removal. USGS-PIERC may also conduct radio telemetry on BTS prey species (e.g. Micronesian starlings); although their activities associated with capture, marking, and radio-tagging non-BTS species would be covered under separate permits and ESA consultations, their actions such as foot traffic for following non-BTS radio telemetry signals will also be covered by this BA. The U.S. Fish and Wildlife Service (USFWS) Pacific Islands Fish and Wildlife Office (PIFWO) plays a technical assistance and coordination role among BTS interdiction and control partners as mandated by the Brown Tree Snake Control and Eradication Act of 2004. PIFWO personnel in BTS-related roles (e.g. BTS Program Coordinator and CNMI BTS Program Coordinator) and personnel under their supervision may conduct site visits and participate in snake removal activities under the direction of WS or USGS-FORT. The Guam Department of Agriculture, Division of Aquatic and Wildlife Resources (GDAWR) receives annual federal funding for BTS control to support wildlife recovery and captive breeding and release of Guam rails, and maintain responsibility for managing and protecting introduced Guam rails on Cocos island. GDAWR personnel may participate in any of the actions listed in this BA under the direction of any of the Federal participating agencies. Iowa State University (ISU) faculty possess expertise in BTS ecology and consequences of bird loss following predation and extirpation by BTS, including radio telemetry and survival estimation of Micronesian starlings. In coordination with USGS-PIERC, IAS faculty and personnel under their supervision may participate in prey monitoring and radio telemetry of BTS or prey species to the extent that their activities are covered under this BA; other activities (e.g., capture and tagging of non-BTS species) would be covered under additional permits or consultations.

All actions by these entities, including interactions with listed species, will be reported to USDA for tracking and reporting to USFWS. This BA also covers actions of subcontractors, volunteers, etc., working under the direction of these participants as pertains to the activities described here, as coordinated and approved by USDA. Personnel from the listed agencies may also lead site visits for individuals representing entities not covered under this BA (e.g., in garnering support from the public, local government, or NGOs); all such visits will not exceed the actions listed in this BA and will be reported to USDA for inclusion in reporting to USFWS.

1.4 Species Addressed in This Biological Assessment

The threatened and endangered (T&E) species covered in this BA are listed in Table 1, as detailed in a species list provided to the WS, National Wildlife Research Center (NWRC) by USFWS on October 2, 2020 (Ref. # 01EPIF00-2021-SL-0005) and National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) on 9 December 2020.

Table 1. Species list for Cocos Island and species addressed in this Biological Assessment and authority for Section 7 review and concurrence.

Species	Common; Chamorro Name	Status	Authority
Pteropus mariannus mariannus	Mariana fruit bat; fanihi	Threatened	USFWS
Chelonia mydas	Green sea turtle Central West Pacific; haggan	Endangered	USFWS/NOAA
Eretmochelys imbricata	Hawksbill sea turtle; haggan karai	Endangered	USFWS/NOAA
Emoia sleveni	Slevin’s skink; Mariana skink; guali’ek halom tano	Endangered	USFWS
*Rallus owstoni**	Guam rail; ko’ko’	Endangered	USFWS
Acropora globiceps	Coral	Threatened	NOAA
Acropora retusa	Coral	Threatened	NOAA
Seriatopora aculeata	Coral	Threatened	NOAA

* Now classified as *Hypotaenidia owstoni*

1.5 Essential Fish Habitat

Effects of the proposed action on Essential Fish Habitat (EFH) will also be considered, and best management practices (BMPs) and conservation measures will be listed for prevention or minimization of adverse effects. The proposed actions affecting EFH are described in Section 2.3.

2 DESCRIPTION OF PROPOSED ACTIVITIES

2.1 Affected Area

Cocos Island is a 33.6-ha atoll-like island located 2.5 km southwest of Guam near the village of Merizo. The island is 1.93 km long and 0.15 km wide. The northeastern 24.8-ha of the island (approximately two-thirds) is privately owned and managed by Cocos Island Resort (CIR); a daytime-only operation that primarily caters to tourists and limited local clients. Cocos Island Resort operations include aquatic recreational activities (e.g., parasailing, jet ski, introductory scuba, and snorkeling), a restaurant, snack bar, and go-cart rides. The numbers of visitors range from 50 to 400 daily, with a peak during summer months. The resort has been closed from the COVID-19 pandemic. The remaining 8.8-ha parcel is a park co-managed by Guam Department of Parks and Recreation (GDPR) and Guam Agriculture. GDPR requires permits for campers and although an average of two permits are issued per year, there is substantial unpermitted use, as reported by CIR staff.

Because BTS use all terrestrial habitats, including built-up areas, the entire emergent area of Cocos Island would be considered within the proposed action area.

The affected area will also include boat ramps/piers and the in-water marine environment from Umatac Boat Ramp to Achang Marina and the entire Cocos Lagoon (Figure 1) with respect to boat traffic as described below.

2.2 Timing and Duration of Activities

Modeling based on simulated eradication efforts occurring in a USGS Closed Population research study indicates that complete removal of BTS by visual searches and hand capture, trapping, and toxic baiting could be achieved, but would be expected to take a minimum of three to five years (M. Nafus, USGS, unpubl. data, 2020). Upon determination that BTS have likely been eradicated, continued monitoring would be required for at least one to two years to verify eradication. Therefore, we propose that the window for the proposed action should extend for at least 10 years.

Activities would primarily occur between 8:00 a.m. and 12:00 a.m. Most work would likely occur on regular workdays (Monday through Friday), but some weekend and holiday access will be required. The timing of some activities may routinely be limited to minimize disturbance of crepuscular species (i.e. bats and rails). However, we propose that access to all areas of the island be allowed at any time of day or night and any day of the week to facilitate operational exigencies (24/7 access).

2.3 Boat Transportation

Transportation for project personnel from mainland Guam to Cocos would be achieved through a combination of the following means:

- Commercially contracted private watercraft piloted by licensed commercial captains,
- Agency-owned watercraft made available by cooperating entities through interagency agreements or in-kind donation (e.g., GovGuam or Coast Guard),
- Publicly owned or contracted watercraft by cooperators (e.g. University of Guam), and
- CIR-operated ferry.

The CIR ferry will depart from Hambley Pier, Merizo and arrive at the CIR pier. The CIR ferry typically docks only long enough for passengers to disembark (1-3 minutes) then returns immediately to Hambley Pier. However, the ferry may occasionally remain at the CIR pier for longer periods. When the resort is in operation, up to 13 ferry trips per day can occur.

The CIR ferry will be the preferred mode of transportation for project personnel, pending CIR approval. However, alternative craft will be required for work occurring after resort operating hours (evening snake searches) or when the ferry is not operational. At the time of preparation of this document, CIR is closed due to COVID-19 public safety measures and the CIR ferry is not operating.

Apart from the CIR ferry, watercraft will range from 14’ skiffs to 21’ whalers with 20 to twin 115 horsepower motors. Each will be operated by licensed captains that will ensure that their vessel is operated at appropriate speeds and depths for safety, obstacle avoidance including sea turtles, and coral strike avoidance. Boats will be launched from either Merizo Pier, Achang Marina, or the Umatac boat ramp. Once launched, boats may take on passengers and equipment at the site of the launch or at ancillary pier locations (e.g., Guam Boat Tours). Captains will be knowledgeable of the area and abide by all BMPs for transit in this area.

In most cases, watercraft will remain at Cocos only long enough for passengers to disembark with equipment and supplies. Brief dockings/landings reduce the risk of stowaway organisms arriving on Cocos. After disembarkation, the craft will return to Merizo for mooring or removal. On some occasions, it may be necessary for small craft to anchor in the lagoon; anchoring will only occur over sandy substrates to prevent damage to corals.

For smaller craft (14–18’ skiffs) with fewer passengers (2–6), landing is safer and more efficient by shallow approach into sandy reaches on the lagoon side of Cocos. Personnel with appropriate footwear step out and pass gear out as necessary into shallow water while the boat makes brief contact with the sandy bottom but does not emerge onto the beach. Offloading personnel and equipment closer to the day’s work site reduces the amount of foot or vehicle traffic required in listed species habitat.

Watercraft inspections to prevent stowaway organisms are described in the biosecurity portion of this document below.

Because boats typically return to Guam, jet skis may be pre-positioned on Cocos to allow for emergency evacuation of personnel if larger craft are not available or safe. Jet ski use will not be routine but will be available.

Boat transportation will be required during daytime and nighttime hours. Regular continuous boat trips will occur throughout the entirety of the proposed action.

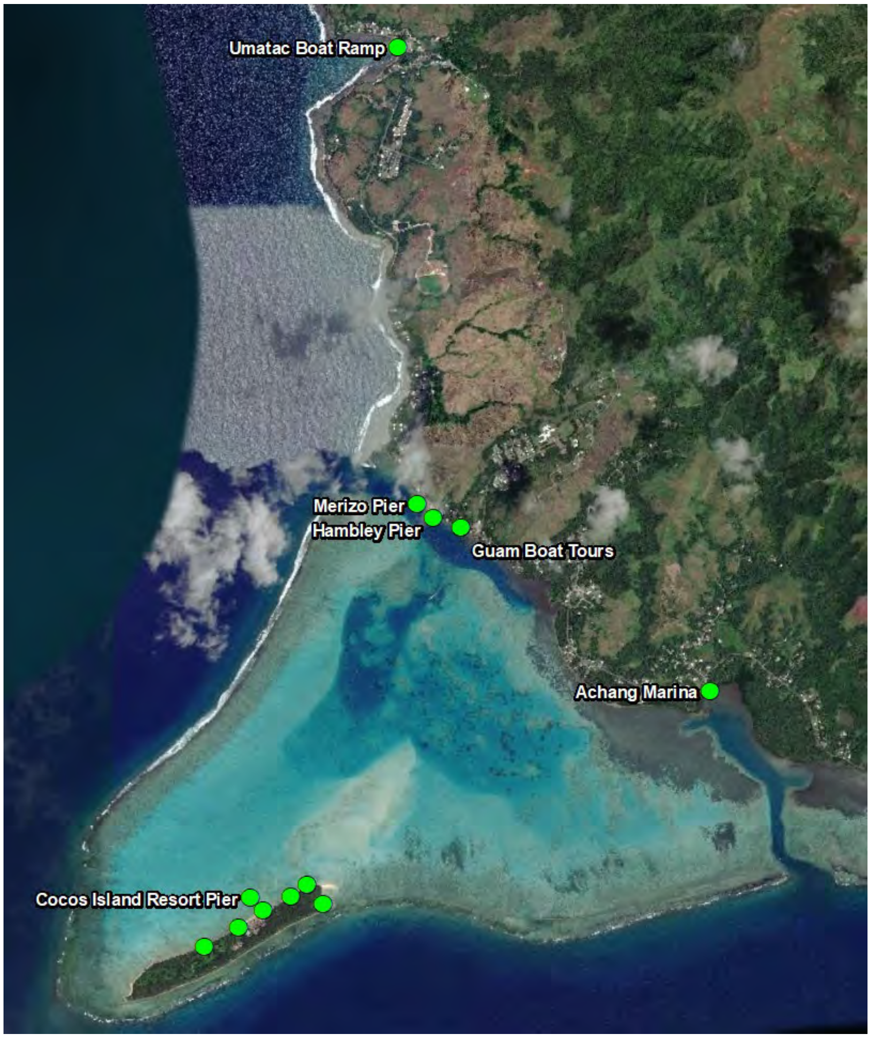

Figure 1. Area of boating operations. Boat travel will commence at Merizo Pier or other suitable docking locations as determined by the licensed captain to be appropriate for the craft (e.g., Guam Boat Tours private pier). Boats will drop passengers at the CIR pier or in shallow water in sandy beach areas without beaching (unlabeled points).

2.4 Maintained Transects

To facilitate multiple eradication and monitoring activities that would occur on Cocos, it would be necessary to establish a system of minimally-maintained transects for visual searches and deployment of snake removal tools such as traps and toxic bait stations (see "Methods Available For Use" below). Transects would require limited but recurring vegetation pruning to ensure ease of passage and must allow visual searches adequate view of vegetation to detect snakes while not being overly distracted by tripping hazards. Established and maintained transects would also improve the ability to detect and avoid rail nests, thus minimizing nest disturbance.

Transects would be maintained at a width of approximately 1 m, though clearing may be as wide as 2 m at time of pruning to ensure that transects remain open as vegetation grows back. Prior experience of project personnel indicates that vegetation around even intensively-maintained transects grows back very quickly, and it is expected that minimally-maintained transects will grow over within six months of ceasing maintenance. No whole plants will be removed or modified unless they can be positively identified as common species with no protective status. Trails maintained in this fashion quickly grow back once pruning ceases (< 6 months; S. Siers and A. Collins, WS, pers. observations). During trail establishment, motor-powered landscaping tools (trimmers, brush cutters, chainsaws) will be required to open existing road surfaces for gas-powered vehicle use following a long period of lapse in maintenance. Power tools may also be required in some areas to open transects for foot traffic. Power tools will primarily be needed to clear paths through invasive bidens (*Bidens alba*), hibiscus trees (*Hibiscus* spp.), and tangles of flagellaria vines (*Flagellaria indica*), and will typically not be needed in more natural forest habitat with a clearer understory. Use of power tools to open paths and transects, enabling use of gas-powered vehicles for personnel and equipment transportation, will reduce demands for labor not associated with snake removal and ensure that resources are more efficiently directed at BTS eradication operations. Paths and transects will be routinely maintained with hand tools, and further power tool use may be avoided; however, occasional power tool use could be needed following any storms, lapses in maintenance, or inability to keep up with encroaching growth using hand tools.

BTS control tools (e.g., traps and bait stations) are typically spaced at intervals of 16 to 40 m (Engeman et al. 2004, Tyrrell et al. 2009, Christy et al. 2010, Klug et al. 2015). Previous research has indicated that a spacing of 20 m or more minimizes competition among traps, avoiding oversaturation of effort (Klug et al. 2015). However, during the course of USGS visual searches in the Closed Population (CP), where transects are spaced at 8 m, subsetting of data to transects spaced at 32 m (every 4^{th} transect) led to capture of >80% of resident snakes; spacing of 16 m (every other transect) resulted in capture of 92% (M. Nafus, USGS, unpubl. data, 2020). The current label for hand-placement of acetaminophen baits in bait stations restricts baiting density to spacing of no less than 20 m; therefore, to minimize habitat modification while balancing an intensity of effort that is likely to result in eradication success, we plan to implement spacing of 20 m between transects; however, we propose that we may establish more or less dense transect spacing as required by local conditions or adaptive management approaches.

We propose a series of transects that laterally traverse the width of the island, averaging approximately 180–220 m in length, along the entire length of Cocos Island, with existing trails used to move longitudinally along the island to access the lateral transects (Figure 2). Because CIR has been closed since the beginning of the COVID pandemic, we would also conduct the necessary trimming of vegetation that has encroached on these existing trails. At the coastline ends of transects, existing clearings or additional minimally cleared trails will connect the ends to enable searching or control tool maintenance to proceed in a ‘zig-zagging’ pattern. Transect markings and control devices would continue to be used through the cleared and built-up areas associated with CIR. At 1600 m in length, approximately 80 transects would be established; at an average transect length of 200 m, approximately 16 km of transect would be cut and maintained. A liberal estimate for clearing to connect the ends of the lateral transects around the perimeter of the island would be less than 4 km. Therefore, we propose to establish and maintain no more than 20 linear km of minimally maintained transects for foot traffic. At a maximum width of 2 m by 20 linear km, the maximum estimate of the entire area affected by pruning and foot traffic would be 4 ha. While this is the initial planned amount of habitat modification proposed for this action, additional trail clearing may be required; maps will be made available for reporting. Transects will be maintained and traversed regularly throughout the duration of the proposed action.

Movement of supplies and materials throughout the transect network will be facilitated by use of non-powered wagons pulled by personnel on foot.

We also propose use of up to two utility terrain vehicles (UTVs, e.g. two-person utility carts) or all-terrain vehicles (ATVs, e.g. “four-wheelers”) for daytime use along the paved paths only, to facilitate movement of personnel and materials for servicing BTS control devices. WS will maintain vegetation clearance from paths unless such maintenance is performed CIR personnel upon reopening. UTVs and ATVs would only be used during daytime hours (1000 to 1600) to avoid the dawn/dusk activity periods of rails and bats.

Figure 2. Representation of a potential system of minimally-maintained hand-pruned transects (gray lines traversing width of the island) at 20 m spacing. Existing trails (orange) connect most transects along the length of the island. Transect lengths: 22 to 233 m, with an average of 185 m.

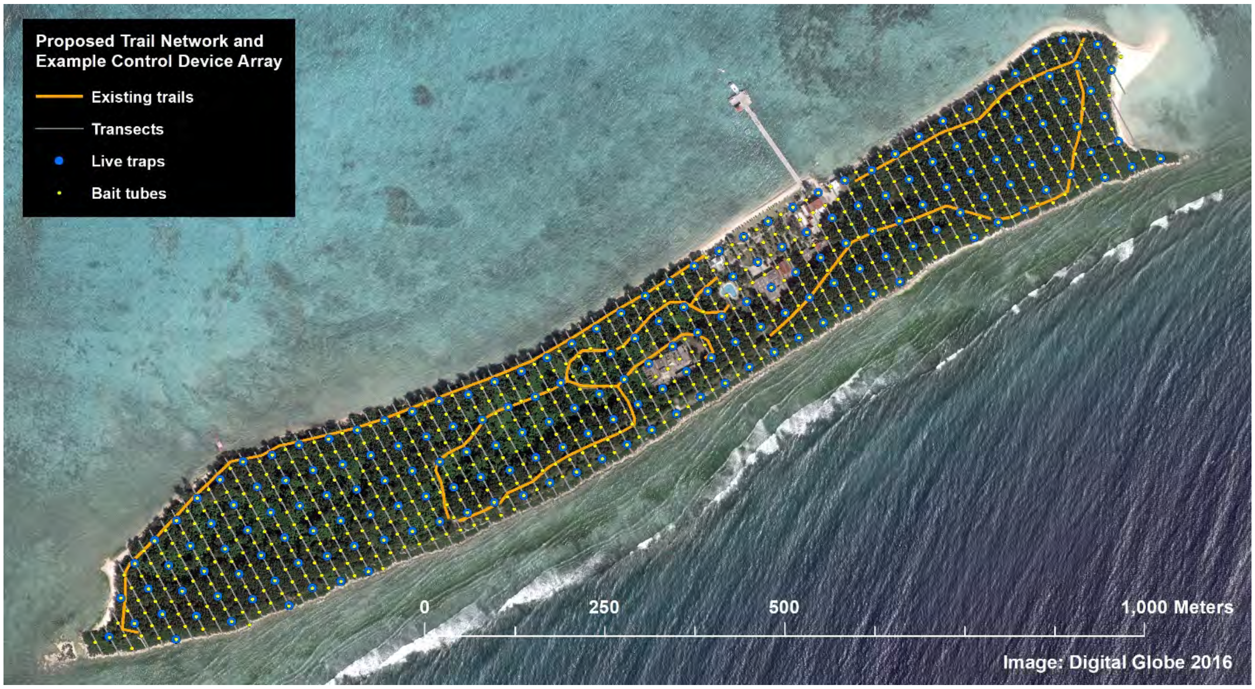

Figure 3. Representation of a potential control tool grid layout superimposed on the transect network, showing bait stations on a 20 m grid and traps on a 40 m grid; actual spacing may vary.

Off-transect foot traffic would also be required, to include radio telemetry of snakes that have ingested transmitters (radio-tagged birds or baits), pursuit of visually-detected snakes, and movement from one transect to the next where other features (e.g. existing trails or beachlines) are not practical. In addition to established transects, the use of unmaintained transects may also be periodically necessary. For instance, visual searchers may need finer scale spatial patterns for removal or to otherwise access areas that are not on maintained transects to ensure contact with every individual occurs. Likewise, weather events such as typhoons may damage or inhibit use of maintained transects and the use of unmaintained transects may be necessary to ensure continuous removal occurs. Off-trail foot traffic over the entire island will be required throughout the duration of the proposed action but will be limited to the extent practical.

3 BTS REMOVAL AND PREY MONITORING METHODS AVAILABLE FOR USE

WS has been conducting operational control of BTS on Guam since 1993 with many of the same methods that are being used today that would be used on Cocos Island, namely cage traps, spotlight searching with hand capture, and detector dogs (Hall 1996). The addition of a toxicant, acetaminophen, and new styles of cage traps have been the primary updates. WS is not known to have adversely affected any T&E species during this time.

Research is ensuring that all BTS have the chance of being targeted by the methods used. Individual BTS can vary widely in size and body condition, ontogenetic prey niche, transient behavioral states (such as not feeding during shedding or mate searching, post-feeding, and dormancy), individual prey preferences based on recent feeding experience (M. Nafus, USGS, unpubl. data, 2020), and might also vary in dimensions that are as yet unknown such as a bold-shy spectrum of behavior (i.e., “animal personality,” an emerging field of behavioral science

(Garvey et al. 2020)). Each of the methods for BTS control listed below varies in cost, effectiveness for particular size classes or behavioral states of BTS, and information that can be gained about the individuals removed. For eradication to be successful, all individuals must be effectively targeted at some time during the effort by a suitable snake removal method. The density, frequency, or spatial arrangement of efforts must be such that all individuals will be seen and captured or encounter and engage with BTS removal tools at a rate that exceeds the rate of BTS reproduction. The complementarity of the methods below compels us to ensure that all reasonable methods are approved for use and included in a comprehensive plan for BTS eradication on Cocos Island.

3.1 Cage Traps

Trapping with cage traps is a common method used by WS to capture target animals. Risks to nontarget species and the environment from the use of cage traps by WS, including the BTS traps, has been analyzed in WS (2019a). The use of cage traps on Guam have not resulted in the take of a T&E species and it is anticipated that cage trap use on Cocos Island will not result in the take any T&E species. WS annually averaged capturing about 6,800 BTS on Guam with cage traps from FY11 (1 Oct. 2010–30 Sept. 2011) through FY20.

Cage traps containing live animal lures have been the most productive means of capturing BTS on Guam. BTS traps currently in use are variations of a two-piece dual-funnel crayfish and minnow trap design, modified with a one-way wire mesh flap over each end; the flap is held closed by gravity until pushed open by the snake, and closes again after the snake has fully entered. With this design, many snakes can enter and be captured by the same trap, and escapes are rare. BTS traps of this type are considered the most effective snake traps in the world (Rodda et al. 1999a). Traps typically used by the USGS RRT retain the original two-piece trap body design, with the lure mouse contained within a separate wire mesh lure chamber placed in the body of the trap (Rodda et al. 1999a). The two-piece body design allows for stacking trap halves for compact storage and shipping. The WS standard trap is an adaptation of the original concept but with a unibody construction, accessed by removing one of the funnel ends, and an integrated lure chamber that allows for servicing the mouse without opening the trap body (Vice et al. 2005). These traps are typically suspended from vegetation, fences, or other existing structures at heights of 1 to 1.5 m using wire, paracord, or bungee material. Tripods made of rebar or similar material may be used where existing vertical structures are not available.

Both funnel trap types usually employ a live mouse as the lure. The mouse is provisioned with a mixed seed and extruded pellet commercial feed that has been immersed in melted paraffin wax to prevent mold and dissolution in rain, along with a section of fresh potato to provide moisture. The top of the trap body is typically fitted with a sheet of opaque plastic to provide the mouse with shelter from rain and direct sunlight.

Funnel traps of either or both designs would be an integral component of BTS eradication efforts on Cocos and these would be spread across the island. The target trap spacing would be a 20 × 20 m grid. Trapping may be more intensive in some areas, if indicated, or at greater spacing if labor or material resources are limited. Twenty m grid spacing equates to 25 traps/ha, or 825 traps for the 33 ha of the island. USGS research indicates an effective trap radius of 20 m, suggesting that traps could be spaced on a 40 m grid while maintaining an attraction effect throughout the landscape (P. Klug and A. Yackel Adams, USGS, unpubl. data, 2020). A 40 × 40 m grid equals 6.25 traps per ha, or 206 traps for 33 ha. In some areas, trap density may be particularly high, such as for the protection of Slevin's skinks; in such cases, trap spacing may be as low as 5 m. Any combination of trap numbers and grid spacing may be employed as the situation dictates.

Live mouse lures will be of a pure domesticated strain (Swiss-Webster) without wild-type mice. Domesticated mice have been bred for docility for many generations and are naïve to predators and unlikely to survive harsh environmental conditions without assistance from human caretakers. A male Swiss-Webster mouse would be placed in a 1/8" galvanized mesh rectangular enclosure with a galvanized sheet metal lid on one side. The lid would have holes drilled along the entire lip to allow the lid to be wired shut along all sides of the mesh enclosure opening to prevent the mouse from chewing out or slipping out between the lid and enclosure. A potato and feed block will be in the enclosure so that the mouse is self-contained the entire time it was on Cocos Island. Only male mice would be used, to prevent reproduction in the highly unlikely case of escape from the lure chamber and BTS trap. Potential escapes could occur, especially from coconut crabs (*Birgus latro*) tearing into the BTS trap and mouse enclosure to feed on the bait block, potato, or live mouse. Following a 2009 rodent eradication on Cocos Island, no evidence of wild mice on Cocos has been found which minimizes potential breeding. Only domesticated male mice will be used to ensure that a new population of rodents will not arise on the island. To our knowledge, no island invasive mouse population originated with domesticated mice strains.

Emerging evidence indicates that unusually large snakes may be less likely to respond to rodent lures, particularly when they have had prior experience with consuming live birds; large females are the most important demographic to target to prevent reproduction (M. Nafus, USGS, unpublished data; Nafus et al. in review, Goetz et al. in review). Furthermore, extremely large snakes may be deterred from entering standard traps, due to the limited diameter of the trap entrance, or may fail to fully enter the trap. Prior research has also demonstrated that traps baited with live quail tend to attract larger snakes in better condition (Yackel Adams et al. 2019). Therefore, novel live trap designs specifically for large snakes, potentially including live birds as lures (e.g., domesticated finches, quails), may be employed in the eradication effort. Custom traps and lures for very large snakes may be particularly important because very large snakes are not reliably killed with a single standard 80 mg dose of acetaminophen (Siers et al. in review; see below). Such traps would be elevated from the ground to prevent access by Guam rails. Beyond mice, live lure use would be contingent on approval by GDAWR and appropriate institutional animal care and use committee approvals.

Trapping is typically ineffective for most snakes under 700 mm SVL (Rodda et al. 2007, Tyrrell et al. 2009), so it is necessary that trapping be complemented by other methods. A benefit of trapping over toxic baiting is that morphometric data can be recorded on the snakes that are removed, providing valuable feedback on the demographics of the trappable population.

3.2 Toxic Baiting (Acetaminophen)

Acetaminophen baits are an effective toxicant to kill BTS. WS annually averaged 12,100 BTS toxic bait takes on Guam from FY11 through FY20. The use of acetaminophen on Guam has not resulted in the known take of a T&E species and it is anticipated that acetaminophen use on Cocos Island will not result in the take any T&E species.

Risks to nontarget species were evaluated by USEPA when the toxicant was evaluated for registration. A fixed-dose tablet of 80 mg acetaminophen has been registered with the USEPA as a BTS pesticide under the label "Acetaminophen for Brown Treesnake Control" (Reg. No. 56228-34) since 2003 and approved for use by the Guam Environmental Protection Agency (GEPA). As typically employed by WS for interdiction and natural resources protection on Guam, the tablet is inserted into the body of a dead neonatal mouse (DNM) bait through the oral cavity. The DNM bait is then usually deployed in 12- to 18-inch length of PVC pipe suspended from forest vegetation. Such bait stations, or "bait tubes" are intended to make the bait accessible to BTS while reducing accessibility to protected species and other nontarget animals (e.g., crabs, rodents, monitor lizards) (e.g., Mathies et al. 2011, Siers et al. 2019b). Bolts across each end of the tube make baits more inaccessible to climbing crabs. When using bait tubes, nontarget bait take rates are generally low, though rates may vary by location and time (Siers et al. 2019b, 2020). Use of acetaminophen baits in bait tubes is a cost-effective mainstay of BTS control on Guam (Clark et al. 2012; Clark et al. 2018).

It is generally presumed that a DNM produces less sensory stimulus than a live trap mouse lure, but bait tubes are much easier for snakes to access than traps. The net effect is that, per unit effort, bait tubes are more efficient at killing snakes than traps; incorporating the relative costs associated with bait tubes and DNM versus traps and live mouse lures, the cost per snake killed by bait tubes was estimated at only 60% of the cost per snake caught in a trap (Clark et al. 2012). Like trapping, bait tubes are relatively ineffective against the smallest size classes of snake. In a USGS Closed Population (CP) trial, despite the known presence of 30 snakes under 843 mm SVL, none took DNM baits from bait tubes, while 77 of 126 snakes ≥ 843 mm took 164 baits; smaller baits did not target smaller snakes (Lardner et al. 2013). Additionally, preliminary evidence from a simulated ADS eradication in the USGS CP indicates that some individuals appear not to be effectively removed with carrion baits (M. Nafus, USGS, unpubl. data, 2021), so trapping with live lures is recommended as a complementary method.

A recent meta-analysis of acetaminophen efficacy data, incorporating new data on extremely large BTS (Siers et al. 2021), demonstrated that the standard fixed 80 mg dose was sufficient to reliably kill approximately 95% of the snakes currently found on Guam. However, efficacy begins to diminish at approximately 200 g of BTS body mass, and by approximately 750 g a single 80 mg dose is largely ineffective, even with repeated dosing at one-week intervals. Trials with 160 mg doses (two 80 mg tablets) demonstrated far greater efficacy; all snakes under 1,000 g died with a single 160 mg dose and all larger snakes (up to 1,734 g) died after a second 160 mg dose administered one week later. Alarmingly, approximately two-thirds of the BTS captured by the RRT on Cocos exceed the size above which a single 80 mg dose is reliable. WS currently has a proposed label revision under review that would allow application of multiple tablets per bait when larger snakes are being targeted.

The rates at which baits are taken from bait tubes has also been routinely employed as an index of BTS relative abundance to measure the effect of BTS control interventions (e.g. Savarie et al. 2001, Dorr et al. 2016, Siers et al. 2020). Typically, bait tube 'take rate' monitoring does not involve application of acetaminophen to the baits, so as not to influence the system being monitored. On Cocos, this monitoring method would also be an integral part of the eradication effort, so all baits offered for take rate monitoring would also be treated with acetaminophen. A limitation of this monitoring method is that demographic information cannot be collected from the snakes that are killed because carcasses are rarely found.

Evolving evidence suggests that BTS that have previously preyed on birds show preference for dead bird baits over dead mouse baits (M. Nafus, USGS, unpubl. data, 2021). The label for "Acetaminophen for Brown Treesnake Control" was recently amended to allow the use of bait types other than mice, to include birds. For the Cocos BTS eradication, we would use a variety of bird and rodent baits procured from a reputable pet food supplier (e.g., mice, rats, and quail and chicken chicks).

For use on Cocos, we recommend that acetaminophen baiting with bait tubes be a component of BTS eradication efforts. If approved by USEPA and GEPA, all baits would contain two tablets (160 mg) of acetaminophen; until then, baiting with the standard 80 mg dose would proceed. We anticipate that baits will have minimal potential to affect the T&E species on Cocos Island. Carrion baits are typically attractive for 2-3 days (Siers et al. 2019) and are replaced at regular intervals (e.g., twice per week). Unconsumed baits containing acetaminophen will be removed when replaced by fresh baits and disposed of in a sanitary landfill; nontoxic baits (e.g., used as lures in traps) may be allowed to decompose or be consumed by detritivores on the forest floor.

3.3 Visual Detection and Hand Capture

Hand capture is another common method used by WS to capture target animals. Visual searches for BTS would be conducted by observers travelling alone or in pairs walking at a consistent rate. Searches would be conducted after sunset and typically last four to five hours. The ground and all surrounding vegetation or other structure would be visually scanned for BTS. If snakes are located, they would be hand-captured unaided or with tools such as snake hooks and tongs.

Nocturnal visual searches will be conducted by trained searchers equipped with powerful headlamps that exposes all size classes of snake to a reasonable probability of detection and capture (Rodda et al. 2007), though even this method does suffer from reduced detectability of very small and very large snakes (Christy et al. 2010). Based on estimates from the USGS Closed Population, the average probability of a snake being detected during a search by a two-person team is approximately 8% for the most detectable size class of snakes (~750 to 950 mm), significantly lower for larger snakes (~5% for 1200 mm), and especially low for smaller snakes (~2% at hatchling size). Despite this variability in detectability, visual searches introduce less bias in detection than trapping (Rodda et al. 2007).

As with trapping, a benefit of visual detection and hand capture is that morphometric data can be collected. Morphometric data will help inform population modeling that can support an adaptive management program. Prey sightings can also be recorded while conducting visual searches for BTS, providing valuable information on the status of prey species (Lardner et al. 2019) as they continue to be consumed during eradication operations.

Risks to nontarget species and the environment from hand capture by WS, including the BTS, were analyzed in WS (2018). WS annually averaged capturing about 1,200 BTS on Guam with hand capture from FY11 through FY20.Hand capture of BTS on Guam is not known to have resulted in adverse effects to any nontarget or T&E species. It is anticipated that conducting visual searches and BTS capture on Cocos Island will have a risk of human and scent disturbance to the Mariana fruit bat and a risk of trampling listed species (e.g., turtle and rail nests, skinks).

Visual search and capture work will continue to occur in the vicinity of Mariana fruit bats. To minimize the risk of trampling during visual search and capture actions, field staff will be trained to identify listed species and the locations of sea turtle and Guam rail nests and areas of high abundance of listed species will be mapped and marked. Visual searchers will monitor and watch for Slevin's skinks and Guam rail and sea turtle nests to reduce the chance of accidentally stepping on one. Because snake capture work will require quick unplanned movements, occur at night when spatial awareness and visibility of nests, markings, and individuals will be lower, and where there is a high density of the listed species, the risk of trampling is unlikely to be completely eliminated by implementation of these minimization measures.

3.3.1 Airsoft Electric Gun (AEG) and Firearm Assistance

Airsoft Electric Guns (AEG) and firearms will be used to incapacitate or kill BTS that are too high in dense vegetation to be captured using other methods.

On Guam, WS operational staff generally search only fence lines and easy access areas without using firearms to take BTS. Firearms other than AEG have not been used to take BTS on Guam but could be if jungle areas were searched. On Cocos, though, AEG and firearm use could be an advantage for tall trees and dense vegetation where snakes could not be captured without other devices.

In many instances, snakes can be reliably hand-captured with standard snake handling tools (hooks, tongs) with little risk of escape. However, any escape on Cocos would be undesirable, and BTS are often seen either too high or in dense vegetation where they cannot be captured without unacceptable risk of escape. The USGS RRT has demonstrated the ability of hobby-grade AEG to reliably incapacitate or kill BTS at distances up to 12 m (Knox et al. 2018). Most AEG, such as the ones used by USGS RRT, are powered by a battery-driven electric motor that activates a spring-loaded piston to propel 6-mm spherical plastic projectiles. Sale and use of AEG and pellets are legal on Guam with no environmental regulations against their use. Plastic pollution is a growing and justified public concern; however, the volume of plastic used to remove BTS from Cocos would likely be minimal compared to larger system-wide plastic inputs, and wholly justifiable in the net environmental benefit associated with BTS removal. Only biodegradable AEG pellets would be used on Cocos. To date, approximately 50% of the BTS removed from Cocos by the RRT were recovered with the assistance of AEG (P. Barnhart, USGS, pers. comm., 2020). We propose that AEG use by trained personnel following agency-approved safety precautions will be an integral and indispensable method for complete removal of BTS from Cocos Island.

If it is determined that BTS may need to be taken at distances greater than 12 m then WS personnel certified to use firearms could use air rifles or pneumatics that are reliable to up to 100 m. Depending on the height of trees, this may be a better option. Air rifles to be used would shoot either 5 mm or .22 caliber pellets. Pellets used on Cocos would be non-lead alloy pellets. Alloy pellets have greater velocities, but not as much knock-down power as lead. These are used typically at distances to about 50 m, but can be sighted-in for even further shots, to 100 m. Where possible, BTS taken by AEG or pellet rifles would be retrieved and removed, although some may hang in trees and will only be removed if it can be done safely.

Risks for the use of firearms by WS personnel were analyzed (WS 2019). To minimize the potential for the AEG and firearm use to adversely affect listed species, all field personnel will be trained to identify listed species and the locations of sea turtle and Guam rail nests and areas of high abundance of listed species will be mapped and marked and care will be taken to avoid trampling nests and individuals during AEG and firearm activities. As with the use of any projectiles, operator awareness of potential accidental impacts on nontargets within the direction of fire is a critical safety concern and all operators will exercise extreme caution to prevent direct strike of Mariana fruit bats by pellets. All air rifles are fitted with a scope that is sighted-in regularly to ensure accuracy. Sound and human activity resulting from AEG and firearm use to kill BTS will not be restricted in the vicinity of the Mariana fruit bat because BTS high in tree canopies pose a much greater threat to the Mariana fruit bat than the noise and human scent disturbance of the proposed action. However, because the Mariana fruit bat is very sensitive to the sound of conventional gunfire, use of quieter AEG and quieter firearms will be maximized.

The above methods may impact T&E species on Cocos Island due to noise disturbance and trampling. They would likely be beneficial in that personnel removing snakes would not be required to climb trees to capture BTS, thus reducing the potential for trampling and worker injury.

3.4 Detector Dogs

Detector dogs may be used to search for BTS on Cocos Island. WS uses BTS detector dogs (BTSDD) on Guam to search high risk cargo, air and seaport areas, and military and commercial supplies for BTS to minimize their potential to leave the island to other islands where they have not been introduced. Detector dogs will be with a WS handler on a leash and primarily used around structures. They have been found not to be highly effective in the jungle (Savidge et al. 2011). The detector dogs along with handlers are routinely challenged with decoy snakes to ensure that the dogs remain vigilant for BTS. From FY11 to FY20, they have taken about one snake per year and no nontarget species. Even though they take relatively few snakes, these are key to the prevention of establishment of snakes elsewhere because these were ready to be shipped to off-island areas such as Hawaii.

The CIR has several buildings (outbuildings, offices, warehouse/power plant) and shipping containers on site that are open to the elements or are periodically left open and could become areas of refuge for BTS that are not easily remediated with conventional control tools. In the late stages of the eradication and during the monitoring phase it will be important to periodically utilize BTSDD to inspect these outbuildings, facilities, and containers to locate any BTS and ensure no BTS are in refuges within these structures and unavailable to other control tools.

The BTSDD handler would conduct a pre-inspection check of the exterior and interior of the structure to look for potential safety hazards to the handler and BTSDD, locate potentially productive areas, and prepare a detailed inspection plan to cover all areas of the structure/facility. An initial inspection is conducted where the BTSDD is then transited sequentially around the outside of the structure and the handler notes any behavior changes in any areas that will be considered areas of special focus during the detailed inspection. The final stage is a detailed inspection of all possible access points to BTS, with special emphasis at any areas where the BTSDD showed interest during the initial inspection. The same protocol of initial inspection and detailed inspection is conducted on the interior of structures and facilities. For buildings with more than one room, a sequential order is determined in the inspection plan so that every room is subjected to an initial and detailed inspection. All BTS located are hand removed by the BTSDD handler and will be retained in a snake bag for data collection and later humane euthanasia.

BTSDD’s are kept in their travel crates when not inspecting items or structures and are always kept on a short leash when out of the crate or during an inspection. This short lead in combination with a pre-inspection check of the BTSDD inspection site likely causing animals to flush, reduces the potential for any negative impacts to T&E species that might be seeking refuge in structures exposed to the elements. These structures are not ideal habitat for any T&E species, further reducing chance encounters with BTSDD’s and handlers.

We feel that detector dogs could be most useful in the late stages of eradications since these will be key snakes to find, those that have eluded take with other methods. Detector dogs will also be particularly useful for confirming eradication success.

Risks associated with the use of detector dogs have been analyzed (WS 2017). Similar to their work in port facilities, the dog will be under the direct control of the handler at all times. If detector dogs are used in the forested areas of Cocos Island, work would occur in the vicinity of Mariana fruit bats. To minimize the risk of detector dog and searcher trampling during search and capture actions, field staff will be trained to identify listed species and the locations of sea turtle and Guam rail nests and areas of high abundance of listed species will be mapped and marked. Detector dog handlers will monitor and watch for Slevin’s skinks and Guam rail and sea turtle nests to reduce the chance of the handler or dog accidentally stepping on one.

3.5 Electronic Monitoring (Cameras and Audio Recorders)

Commercial-grade field/game/trail/wildlife cameras, or ‘camera traps,’ are relatively inexpensive and weather resistant, and are becoming an indispensable tool for wildlife management. Custom cameras may also be required for specific applications to which standard configurations are not suited. Cameras are typically mounted by lashing directly to a tree or other existing structure, on makeshift tripods, or elevated into the forest canopy on extension poles (photos). Detection of BTS with wildlife cameras is most practical when the camera field of view contains a live lure (e.g., mouse or bird; Yackel Adams et al. 2019, Amburgey et al. In press). Cameras may also be oriented at other likely locations of snake activity (e.g., nests of non-listed species). Inclusion of size standards in the field of view allows estimation of snake size from the images that are captured (Siers in review). We propose that any variation on an infrared camera may be employed at any location on Cocos for the entire duration of the eradication effort. However, cameras would be most valuable toward the end of the eradication effort when attempting to determine whether any snakes remain. With appropriate authorizations, lures may include live mice and live birds (finches, sparrows, or quail) in protective chambers to prevent predation by BTS. No cameras with white flash will be employed to reduce light pollution that might disorient nesting sea turtles (see effects determination for sea turtles below). Audio recording devices may also be deployed, to record bird vocalizations for use in long-term monitoring of bird populations. These small devices (the size of a typical commercial wildlife camera or smaller) would be hung from vegetation along existing transects and be visited occasionally to replace batteries and retrieve data. We believe that the use of cameras and audio recorders will have minimal potential to take T&E species, primarily trampling from setting them out and servicing them.

3.6 Radio Telemetry

Radio telemetry is a standard method for locating wildlife and investigating their movement patterns. This is typically achieved using a VHF radio frequency-emitting transmitter that is affixed to the animal either externally (e.g. via harness or adhesive; Smith et al. 2016) or internally (through surgical implantation or ingestion; Tobin et al. 1999, Christy et al. 2017, Siers et al. 2016, 2018, Goetz et al. in review). The signal is then located or recorded with a matched radio frequency receiver. Animal locations are observed or estimated through homing (following the signal strength directly to the source) or triangulation (plotting the signal direction from three or more locations and estimating the origin from the confluence of bearings).

Transmitters may be placed in baits that are also treated with acetaminophen, so that mortality of the snake may be confirmed by locating the carcass (e.g., Dorr et al. 2016, Siers et al. 2019a). Because the objective is complete eradication of BTS from Cocos, it is unlikely that snakes will be captured for transmitter attachment or implantation and then released back onto Cocos; however, if eradication or monitoring methods require it, this may be considered as long as project leaders are reasonably assured that live snakes with transmitters can be recovered and removed (this is not always the case, due to transmitter failure). Other project participants (e.g., IAS and USGS-PIERC) might conduct prey monitoring by affixing transmitters to potential prey species such as Micronesian starlings (*Aplonis opaca*; e.g., Pollock et al. 2019) and recovering and killing the snake that ingested the subject.

Although telemetry methods are not intended as a core component of BTS eradication from Cocos Island, we consider use of telemetry in our effect determinations. Anticipated effects on listed species resulting from the use of radio telemetry would be associated with an increased need for off-trail foot traffic at any location on the island. Wildlife disturbance during telemetry efforts can be minimized by following signals along the established paths until the signal can be approached no further without leaving the path or trail. Minimization measures for radio telemetry will include the same efforts taken to avoid nest or egg trampling and high skink density delineation as employed during trail creation. Radio telemetry work on Cocos Island may continue despite the proximity to Mariana fruit bats in order to ensure that snake removal and prey monitoring are not interrupted. To minimize the risk of trampling during telemetry actions, field staff will be trained to identify listed species and the locations of sea turtle and Guam rail nests and areas of high abundance of listed species will be mapped and marked. Field personnel will monitor and watch for Slevin's skinks and Guam rail and sea turtle nests to reduce the chance of accidentally stepping on them.

3.7 Prey Species Monitoring

The status of BTS prey species on Cocos will be monitored on the trail system that is maintained during the eradication effort to look at trends in their populations. Ongoing work on BTS control on Andersen Air Force Base and other prior work has demonstrated that monitoring prey species (avian or rodent) is a viable approach to measure a reduction in BTS abundance (Kastner, ISU, unpublished Data; Nafus, USGS, unpublished data). Therefore, various approaches to monitoring prey may be desirable Prey observations are routinely collected by USGS personnel while conducting night searches for BTS. However, efforts specifically for prey species monitoring may occur day or night. All live prey monitoring would be observational in nature (visual or electronically recorded), unless covered under separate permissions and approvals. The effects determinations in this Biological Assessment will include effects of foot traffic within the transect system for purposes of visual monitoring of prey animals.

4 ANALYSIS OF POTENTIAL IMPACTS ON FEDERAL T&E SPECIES

Each of the following subsections includes background, effects analysis, and determination for the subject listed species.

4.1 Mariana Fruit Bat (Fanihi; *Pteropus mariannus mariannus*)

4.1.1 Background

Mazurek & Burrell (2017) provided much of the natural history baseline for Mariana fruit bats.

4.1.1.1 Biology

The Mariana fruit bat is a medium-sized bat measuring 195 to 240 mm (7.7 to 9.4 in) from head to rump, with a wingspan of 860 to 1085 mm (33.9 to 42.7) (Wiles 1987). Males are slightly larger than females. The abdomen and wings are dark brown to black with individual gray hairs intermixed throughout the fur. The mantle and sides of the neck are bright gold on most animals but, in some individuals, this region may be pale gold or pale brown. The color of the head varies from brown to dark brown.

Fruit bats are a colonial-roosting species and can form groupings of hundreds to thousands in tree canopies. Colonies are often sexually segregated with females forming maternity colonies, and males roosting individually or in bachelor colonies (Wiles 1987). Fruit bats exhibit strong site fidelity to roost locations, but, if repeatedly disturbed, will abandon sites travelling up to 10 km to different roost locations (USFWS 1990). Fruit bats have been observed to flush from colonies by human presence (U.S. Navy 2017).

The reproductive chronology of fruit bats has not been well-studied, though breeding, pupping, and nursing appear to occur year-round in fruit bats on Rota and Guam (Perez 1972, Wiles 1987, CNMI 2010, 2011). Female bats typically produce one offspring annually (Pierson and Rainey 1992). Gestation period for *Pteropus* fruit bats ranges from 140 to 192 days (Andersen 1912, Neuweiler 1968, Marshall 1947, Nelson 1964, Racey 1973). Sexual maturation for this genus has been documented to be 1.5 to 2.0 years old (Falanruw 1988). The average lifespan of this species is unknown, but is likely similar to that of its close congener, the black flying fox (*P. alecto*), which has a 4 to 5-year lifespan and a maximum documented longevity of 8 years (Vardon and Tidemann 2000).

Fruits, nectar, pollen, and occasionally leaves comprise the diet of fruit bats (Wiles and Fujita 1992; Wiles and Johnson 2004). Fruit bats inhabit a variety of forest types, including both primary and secondary limestone forests, volcanic ravine forests, coconut (*Cocos nucifera*), and ironwood (*Casuarina equisetifolia*) groves (Glass and Taisacan 1988; Worthington et al. 2001; Wiles and Johnson 2004).

4.1.1.2 Distribution and Abundance

The Mariana fruit bat is a geographically isolated subspecies (Brown et al. 2011, Mildenstein and Mills 2013), endemic to the Mariana archipelago (Guam and the CNMI), and is historically found on all islands except Uracas. The species is considered an interbreeding metapopulation based on movement between neighboring islands (Wiles and Glass 1990, USFWS 2005; V. Brown et al. 2011; Mildenstein and Johnson 2017). However, an unpublished 2013 analysis of mtDNA genetic structure suggests that bats on Rota and Guam are, for the most part, genetically isolated from those on the more northerly islands of the Mariana archipelago (Mildenstein and Mills 2013). The Marianas island-wide population estimate for fruit bats is approximately 6,000 individuals (USGS 2010, CNMI 2011). The fruit bat is thought to be extirpated from the island of Tinian (USFWS 2009a, USFWS 2014). Fruit bat presence on Cocos Island is rare and in short duration. Historically, fruit bats have been documented in small numbers on Cocos Island for short periods. In recent years, larger groups of approximately 40 individuals have been documented following devastating typhoons in Saipan. The group was present on Cocos for a few weeks and then moved to an area near Cross Island Road on Guam. Fruit bats are not regularly found on Cocos Island (D. Vice, GDAWR, pers. comm., 2020). Two members of the USGS RRT reported seeing a single bat in February 2021 (P. Barnhart, USGS, pers. comm. 2021).

4.1.1.3 Activity Cycle

Little information is available about the diurnal activity budgets of Mariana fruit bats. The assumption that fruit bats are less active after 0900 hours is based on diurnal observations made by Wheeler (1979). Wheeler (1979) found that the colonial segment of fruit bats on Guam primarily roosted during the day; whereas, some “dispersed, less gregarious” fruit bats were seen “active” during the day (Wheeler and Aguon 1978; Wheeler 1979). Of the diurnally active fruit bats, Wheeler (1979) documented highest diurnal activity (1.4 bat sightings per observer hour) between 0500 and 0900 hours, intermediate diurnal activity (0.7 bat sightings per observer hour) between 1100 and 1500 hours, and lowest diurnal activity (0.4 bat sightings per observer hour) between 1600 and 2000 hours. These observations were based on groups of 1-15 bats sighted on surveys conducted during island-wide surveys (i.e., repeated survey visits to 18 different locations) on Guam in the summer of 1978 (Wheeler 1979).

4.1.2 Analysis

4.1.2.1 Adverse Effects (Stressors)

Potential sources of Mariana fruit bat disturbance include human scent, noise from boat traffic, AEG and air rifle uses, transect cutting and maintenance, on- and off-trail foot traffic, UTV/ATV use, powerful headlamps used during nocturnal snake searches, and physical disturbance during snake capture attempts. Such disturbance could cause Mariana fruit bats to flush and relocate.

Bats are at elevated risk of injury while fleeing the source of disturbance. Dependent pups may be abandoned at the roost or dislodged from the dam in flight, which could result in death of a pup. Disruption of fruit bats at roosting sites can have a number of negative impacts including injury, social and breeding disruption, energetic expenditures, relocation to potentially degraded habitats, and non-volant young abandonment (Wingfield et al. 1998, Heideman 2000, Klose et al. 2006, CNMI 2010).

Mariana fruit bats are frugivores and are not expected to interact with carrion baits. Fruit bats are known to masticate their food (Thomas 1984) and if an individual attempted to consume bait they would be exposed to the bitter taste of the acetaminophen and may spit out or regurgitate the tablet (Yarmolinsky et al. 2009). Bitter flavors are a natural defense mechanism to avoid consuming poisonous compounds (e.g., alkaloids). The ability of fruit bats to recognize bitter taste is not well described, but four species of Pteropodidae show a greater number of intact bitter taste receptor genes compared to vampire bats sampled (Hong and Zhao 2014). Likelihood of bat access to toxic baits is further reduced by placement in nontarget-excluding bait stations that are situated less than 2 m from the forest floor.

Snake cage traps with live lures, or lures for camera monitoring, are not expected to attract bats in any way and bats are not reasonably expected to interact with traps in any way. Aside from the movement required for servicing cage traps, bait stations, and cameras are expected to have no effect.

Mariana fruit bats are known to be sensitive to human scent and the presence of humans within a 150-meter distance. In addition, project noise including vehicles and AEG and air rifles may exceed ambient sound levels and startle the Mariana fruit bats on Cocos Island. AEG or air rifles used to incapacitate or kill BTS create noise at a level of approximately 90-95 decibels (dB) at point blank (Airsoftnewb 2021, Straight Shooters 2021). At close range, AEG use would be expected to startle Mariana fruit bats and could cause flushing. As with BTS (Knox et al. 2018), accidental direct strike from AEG pellets at close range would cause tissue damage and potentially death for Mariana fruit bats. Air rifle pellets on the other hand could kill them. However, AEG and air rifles will only be used when a BTS has been sighted that has an unacceptable risk of escape. The use of AEG and air rifles will not be restricted in the presence of fruit bats as BTS will have greater impacts on them than the disturbance caused by the AEG or air rifle. If fruit bats are detected, USFWS and GDAWR will be notified and the behavior of the bat in the presence of AEG or air rifle use will be monitored. As with the use of any projectiles, operator awareness of potential accidental impacts on nontargets within the direction of fire is a critical safety concern and all operators will exercise extreme caution to prevent direct strike of Mariana fruit bats by pellets; as such, we consider direct pellet impacts on Mariana fruit bats to be highly unlikely.

Based on the history of observations by GDAWR personnel, bats are not likely to be present on Cocos for the majority of activities, though they are likely to use the island infrequently during the duration of the proposed action.

Noise disturbance associated with motor-powered landscaping tools for path and transect establishment and routine UTV/ATV use for movement of personnel and materials would be expected to disturb and potentially flush any Mariana fruit bats in the area.

4.1.2.2 Positive Effects (Benefits)

BTS are known to prey on Mariana fruit bat pups and are one of the factors of decline in fruit bat populations on Guam (Wiles 1987). The persistent negative consequences of failure to remove BTS from Cocos Island would outweigh those of occasional disturbance during a finite eradication operation. Eradication of BTS from Cocos will restore the island to a snake-free oasis for fruit bats. Thus, eradication of BTS from Cocos will have an overall net beneficial effect for Marina fruit bats.

4.1.2.3 Avoidance and Minimization Measures

Daytime activities will be planned for between 0700 and 1700 hours and nocturnal searches will commence 30 minutes after sunset to minimize disturbance during the crepuscular foraging activity period (Wheeler 1979). Most foot traffic would occur on maintained transects; ease of passage on maintained transects reduces the disturbance of vegetation that could flush bats. If Mariana fruit bats are detected, suppression activities, including motorized tool or vehicle use, would not be suspended, as this could jeopardize the success of the action with long-term negative consequences for Mariana fruit bats. If detected, bats, and bat behavior in the presence of project activities, would be reported to GDAWR and USFWS, but BTS eradication actions would continue as planned.

4.1.3 Determination

The proposed action may result in the disturbance of Mariana fruit bats at some point, affecting all individuals using Cocos Island during project implementation due to the requirement to access all portions of the island regularly to ensure BTS eradication. All anticipated effects are direct effects with no anticipated persistent indirect effects, except that BTS eradication on Cocos Island will be beneficial in the long-term. Therefore, we determine that the proposed action May Affect Mariana fruit bats in the activity area.

4.2 Green Sea Turtle Central West Pacific (Haggan; *Chelonia mydas*) and Hawksbill Sea Turtle (Haggan Karai; *Eretmochelys imbricata*)

4.2.1 Background

GDAWR sea turtle biologist provided natural history of sea turtles for this biological assessment (C. Cayanan, pers. comm., 2020).

4.2.1.1 Biology

Hawksbill sea turtles generally nest higher from the coastline of the lagoon side of Cocos Island, in vegetation. Individuals nest every 2 to 3 years, up to 7 times per nesting year with 14 to 16 days between clutches. Green sea turtles nest on open beach or in shoreline vegetation. Individuals nest every 2 to 5 years, laying clutches of ~100 ping pong ball sized eggs approximately every two weeks for 3 to 10 times per nesting season.

4.2.1.2 Activity Cycle

Cocos Island nesting season is generally between December and September with the bulk of activity occurring between April and June (C. Cayanan, pers. comm., 2020)

On-land activities of nesting females include emerging from the ocean, wandering while looking for a place to nest, digging out areas to rest her body (body-pitting), excavating/digging an incubation chamber, laying/depositing eggs, filling and camouflaging the nest, and returning to the ocean. Nest are identified by tracks moving up the beach, large mounds of thrown sand and substrate from excavating the body pit and nest, and tracks back down the beach. Mounds are smaller when placed within heavily vegetated areas. Non-nesting turtle crawls and abandoned nesting attempts may be recognized from smaller mounds, open egg chambers, or only tracks and no pit or mound.

4.2.2 Analysis

4.2.2.1 Adverse Effects (Stressors)

In-water, sea turtles could be negatively affected by increased boat traffic associated with ferrying personnel and materials between Cocos Island and mainland Guam. Effects could be associated with disturbance (increased diving responses from turtles to avoid perceived threat) or direct strike by boat hulls or propellers. On land, adverse effects from foot traffic and vehicle traffic could include sand and sediment compaction, sea turtle nest destruction, beach erosion, and contaminant and nutrient runoff. Off-road vehicle traffic may crush hatchling sea turtles and eggs in nests, and also contributes to habitat degradation through erosion and compaction. Beach and near-shore forest on the lagoon side of the island is nesting habitat for green sea turtles and hawksbill sea turtles; upwards of 70 green sea turtle nests are documented on Cocos annually; hawksbill turtle nest have not been recently documented (C. Cayanan, pers. comm., 2021). Foot and off-road vehicle traffic can cause disturbance to females excavating nests and depositing eggs and trampling of nests can result in destruction of eggs. Emerging hatchlings could be at risk of trampling. Light disturbance caused by use of bright headlamps during nocturnal BTS searches or illumination associated with wildlife cameras may cause confusion of females orienting by light cues or deter beaching for nesting behaviors. Noise disturbance associated with motor-powered landscaping tools for path and transect establishment and routine UTV/ATV use for movement of personnel and materials would be expected to disturb and potentially deter any nesting sea turtles in the area.

4.2.2.2 Positive Effects (Benefits)

BTS persistence on Cocos Island is not expected to have negative impacts on nesting sea turtles. However, if BTS on Cocos are merely suppressed, as opposed to eradicated, the cumulative additional boat and foot traffic required to maintain indefinite suppression would exceed that associated with the eradication operation proposed here.

4.2.2.3 Avoidance and Minimization Measures

To prevent in-water strike of turtles by boats, all vessels will be operated by experienced and licensed captains and speeds will be maintained no more than 14 knots under standard transit operations. NOAA (2021) recommends speeds of 5 to 10 knots for avoiding turtle strikes; however, lower speeds result in reduced vessel operating efficiency, increasing the amount of exhaust and noise pollution and the in-water operating time. The proposed 14 knots speed may be exceeded up to 30 knots in emergency circumstances (e.g. foul weather avoidance or evacuation of injured personnel). Experienced captains take all prudent measures to prevent in-water collisions with any floating objects including resident turtles in the lagoon, but boat traffic in the lagoon will be familiar to resident sea turtles. It has been observed that turtles in the lagoon are less tolerant of boat approaches and dive sooner compared to those outside of the lagoon, further reducing the likelihood of boat strike on turtles (R. Wade, Guam Boat Tours, pers. comm., 2020). Turtles are usually very skittish in Cocos lagoon and boat strikes are very rare or nonexistent; turtles are often sighted in transit but the lagoon is deep enough and open allowing them to avoid any interactions (J. Bass, GDAWR, pers. comm., 2020).

All personnel working on Cocos will receive training from GDAWR on how to recognize, mark, and report sea turtle nesting activities, and to avoid disturbing nests. Nests will be marked in a way that other project personnel can recognize and avoid the nest location without drawing undue attention to the nest. To minimize the potential for disorienting or deterring nesting females, no white-flash wildlife cameras will be oriented toward the lagoon side of the island within 50 m of the coastline. Because of the vital nature of direct sighting and capture of BTS during nocturnal searches, headlamp use will not be restricted within the vicinity of sea turtle nesting habitat. Disembarkation from boats will occur at the CIR pier or at shallow sandy reaches along the lagoon side of the island. Boats will not be beached, so boat landing and disembarkation occurs at or below the waterline and does not present threat to turtle nests. No motorized vehicles or landscaping tools will be used within 100 m of a sea turtle while on land.

4.2.3 Determination

In-water disturbance of sea turtles would be limited to stimulating a dive response upon approach by boats ferrying personnel and equipment to the island, which we determine to be an insignificant effect. Taking reasonable precautions to avoid striking any object in-water as needed for safety and to prevent boat damage (vigilance and maintaining speeds no greater than 14 knots). However, potential does exist for sea turtle collision in the marine environment under NOAA jurisdiction. Although trampling and compaction of sea turtle nests will be avoided, the use of bright lights during nocturnal BTS searches will be unavoidable, the project has the potential to adversely affect breeding and hatchling sea turtles. The proposed use of bright lights at sea turtle nest sites has the potential to reduce egg-laying activity by female sea turtles and it has the potential to disorient hatchling sea turtles. Disorientation of hatchling sea turtles may reduce hatchling survival by increasing the amount of time it takes for the hatchling to enter the ocean. Therefore, we determine the proposed action May Affect green sea turtles and hawksbill sea turtles.

4.3 Slevin's Skink (*Emoia slevini*)

4.3.1 Background

USFWS (2019) provided much of the following information for Slevin's skinks.

4.3.1.1 Biology

The Slevin's skink (*Emoia slevini*) is a small lizard in the reptile family Scincidae, the largest lizard family for total species number worldwide. First described in 1972, the Slevin's skink is the only lizard currently publicly described as endemic to the Mariana Islands, although the littoral skink (*E. atrocostata*) is likely also endemic (R. Fischer, USGS, unpublished data). Overall, iridescently dark brown in color, Slevin's skinks vary slightly from olive to brown, with darker flecks in a checkerboard pattern, and a light orange to bright yellow underside (Brown and Falanruw 1972, Vogt and Williams 2004). Their skin tends to be shiny and is very durable and tough. Juveniles may appear a lighter cream-color (Vogt and Williams 2004). Among the larger of the eight skinks recorded from the Mariana Islands, Slevin's skinks measure 77 mm from snout to cloaca vent (the opening for reproductive and excretory ducts), although length can vary slightly (Brown and Falanruw 1972, Vogt and Williams 2004). To date, no one has conducted studies on the biology or ecology of this species (USFWS 2019). This species typically occurs in forests, with most individuals observed on the forest floor where they use leaf litter and tree debris as cover (Brown and Falanruw 1972, Cruz et al. 2000, GDAWR 2006).

Like many skink species, the Slevin's skink is a fast moving, alert, insectivorous lizard, typically found on the ground or at ground level, and diurnally active. Reportedly a wary species, Slevin's skinks have been seen perching, partially concealed, within low hollows of tree trunks (W. Brown and Falanruw 1972), and typically dives for cover under logs or within palm fronds on the ground when disturbed (USFWS 2019). As with many skink species, female Slevin's skinks are typically slightly smaller than males; they are oviparous (lay eggs that mature and hatch externally).

4.3.1.2 Distribution and Abundance

Historically, the species has been recorded from nine islands including the southern Mariana Islands of Guam, Cocos, Rota, Tinian, and Aguiguan and several of the volcanic, northern islands. The Slevin's skink remains extant at detectable levels on three northern islands including Sarigan, Alamagan, and Asuncion. Prior to the arrival of humans and feral ungulates to the Mariana Islands, Slevin's skink occurred across a much larger range of habitat than its current distribution. Based on the total size of the forest habitat occupied by extant populations, the distribution of Slevin's skink has declined by 99 percent (USFWS 2019). Researchers recently rediscovered E. slevini on Cocos Island in 2012. Its distribution there appears to be limited to a forested area 646 m long immediately west of the resort and to the leeward side of the island

(~4.3 ha; Figure 4), where they are most frequently observed in accumulations of downed vegetation; observation rates for E. slevini are far lower than those of two sympatric skinks (*Emoia caeruleocauda* and *Carlia ailanpalai*; T. Mathies, CSU, pers. comm., 2021).

On Cocos Island, a 1.66 ha area of high Slevin's skink activity has been delineated by T. Mathies of Colorado State University (CSU; unpubl. data, 2020; Figure 4).

Figure 4. High Slevin's skink (*Emoia slevini*) activity area based on a minimum concave hull of observations with outliers excluded (T. Mathies, CSU, unpubl. data, 2020).

Currently, several stressors indirectly threaten the forest habitat of Slevin's skink, including loss and degradation due to impacts from feral ungulates, nonnative plants, and development. The primary direct stressors to the skink likely include predation by rats, shrews, and BTS, and competition from nonnative lizards. Eradication of rats from Cocos Island by GDAWR and WS in 2009 resulted in redetection of the species with increased abundance.

BTS may have played a role in the disappearance of Slevin's skink from mainland Guam (Rodda and Fritts 1992). BTS, especially smaller ones, prey on skinks.

4.3.2 Analysis

Slevin's skinks forage for invertebrates on the forest floor. They may encounter carrion baits but will not consume them. As baits age, they attract invertebrates that are fed on by their larvae as a natural process of decomposition and Slevin's skinks may feed on insects and their larvae associated with the baits. Cameras directed at rodent or bird carrion baits will pose no risk to skinks.

4.3.2.1 Adverse Effects (Stressors)

Slevin's skinks are likely to be disturbed by foot and wagon traffic associated with establishing and maintaining transects, servicing of BTS traps and other control and monitoring devices, nighttime visual survey, radio telemetry, and hand capture of snakes. Traffic on and off trails and transects will likely cause skinks to avoid approaching personnel and seek shelter. It is possible that flushing of skinks could make them more vulnerable to predation; however, potential skink predators such and monitor lizards and Guam rails will also be flushed by oncoming traffic, thus this is very unlikely to occur. As with any *Emoia*, flushing leads to hiding as an escape response, so *E. slevini* tend to dart into nearby refugia when startled rather than flush away from the observer (T. Mathies, CSU, pers. comm., 2020). It has been observed that *E. slevini* perched alongside existing trails don't flee when a surveyor sticks to the trail, even if making noises; only movement away from the trail elicits response (T. Mathies, CSU, pers. comm., 2020). Skinks are very vigilant to movement and it is unlikely that skinks will be tread upon during the course of routine traffic unless they are hiding under debris on the path. Noise disturbance associated with motor-powered landscaping tools for path and transect establishment and routine UTV/ATV use for movement of personnel and materials would be expected to disturb and potentially flush any Slevin's skinks in the vicinity.

Acetaminophen in carrion baits will only be deployed in PVC tube bait stations intended to exclude nontarget species. Bait tubes are affixed to vegetation approximately 1–1.5 m above ground level, outside of the normal activity height of Slevin's skinks. However, some baits could be removed from bait tubes and dropped by BTS or nontargets. There is no risk of primary (direct) exposure of skinks to acetaminophen, as they are not known to forage on carrion. Carrion baits that are not removed by crabs are often rapidly colonized by ants, flies, and fly larvae. Acetaminophen has not proven to be an effective pesticide for invasive small lizards when administered directly (Kraus et al. 2020), so it is highly unlikely (discountable) that Slevin's skinks will be negatively affected by secondary (indirect) exposure to acetaminophen through predation on invertebrates that have scavenged BTS baits.

The greatest risk to Slevin's skinks on Cocos comes from predation. Biosecurity failure leading to the accidental introduction of rats (*Rattus* spp.) or Asian musk shrews (*Suncus murinus*) could jeopardize the entire population on the island, as could failure to eradicate BTS from Cocos. A minor risk from trampling arises from personnel on the island, but they are wary and fast to move away from people; thus, we believe that trampling would be a very minor or nonexistent problem.

4.3.2.2 Positive Effects (Benefits)

Small lizards, including geckos and skinks, are by far the most numerous prey items in BTS stomach contents (Siers 2015). Most species of native lizards on Guam have been negatively affected or extirpated by BTS predation (Rodda and Fritts 1992). Eradication of BTS from Cocos will be wholly beneficial to Slevin's skinks and will likely be required to prevent their extirpation from the island.

4.3.2.3 Avoidance and Minimization Measures

No practical measures can be taken to fully prevent the potential negative impacts of foot, wagon, and UTV/ATV traffic or power tool use on Slevin's skinks, as direct access to all parts of the island will be required in order to ensure BTS eradication. However, establishment of a system of transects will channel the majority of foot traffic and reduce potential impacts from trackless walking and all activity maps will include areas of high Slevin's skink abundance and all personnel will be advised to use extra caution when traversing these areas. Biosecurity measures will be employed to prevent the accidental introduction of other skink predators (rodents and shrews; see below).

4.3.3 Determination

Given proper biosecurity measures (Section 6.1.3), negative impacts from accidental introduction of rodent or shrew predators is so unlikely as to be discountable. Although mostly limited to transects, foot traffic over the entire island will be required. Due to the high level of foot and wagon traffic that will be necessary to eradicate snakes from Cocos Island, some amount of disturbance and accidental injury or death to a low but indeterminate number of skinks may be expected; therefore, we determine that the proposed action May Affect Slevin's skinks. Failure to execute the proposed action would put the entire Cocos Island population at near-certain risk of extirpation, so the net effect of BTS eradication would be beneficial.

4.4 Guam Rail (Ko'ko'; *Rallus owstoni*[2])

4.4.1 Background

Guam rails are flightless terrestrial birds. Adults measure approximately 11 inches (28 cm) high and 11 inches (28 cm) long, weighing 6–11 oz (170–303 g). Omnivorous, they feed on snails, slugs, skinks, geckos, insects, and seeds and other vegetable matter. Foraging most often occurs at dawn and dusk, gleaning through leaf litter. They are secretive and territorial. They are year-round ground nesters that are susceptible to predators such as monitors and rats. They are monogamous and form long-term pair bonds. Clutch size is 1 to 5 eggs (average 3 to 4) and both parents share in construction of a shallow nest of leaves and grass. They mature at six months of age and have been known to produce up to 10 clutches per year in captivity.

Guam rails are endemic to Guam, where they were found in most terrestrial habitats; however, they were extirpated from their native range, primarily by BTS predation, by the 1980s. The species is being bred in captivity by GDAWR. An assurance population of more than 100 birds has been introduced to the island of Rota in the CNMI. Although it is uncertain whether Guam rails ever occurred naturally on Cocos Island, GDAWR introduced rails to Cocos in 2010 after a successful rat eradication by WS. Subsequent to these activities, the International Union for the Conservation of Nature has reclassified the species from "extinct in the wild" to "critically endangered." There are currently an estimated 40 Guam rails on Cocos Island (D. Vice, GDAWR, pers. comm., 2021)

[2] Now classified as *Hypotaenidia owstoni*

4.4.2 Analysis

4.4.2.1 Adverse Effects (Stressors)

Guam rails are likely to be disturbed by foot, wagon, and UTV/ATV traffic and power tool use associated with establishing and maintaining transects, servicing of BTS traps and other control and monitoring devices, nighttime visual survey, radio telemetry, and hand capture of snakes. Flushing of rails may cause injury, energy expenditure, exposure to predation (e.g. by monitor lizards), and temporary or permanent abandonment of eggs or nests. Eggs and nests could also be directly destroyed by accidental trampling. Because of the discrete nature of Guam rail nesting, there is virtually no way of knowing where a nest may occur; however, rails are known to re-nest promptly if disturbed (D. Vice, GDAWR, pers. comm.). The use of headlamps during nighttime searches could also startle and flush rails.

A lapse in biosecurity could result in the accidental introduction of rats (*Rattus* spp.) from mainland Guam. Rats were eradicated from Cocos Island in 2009, prior to the release of Guam rails; reintroduction of rats could jeopardize the persistence of rails on Cocos. It has been suggested that accidental release of live mice from trap or camera lure chambers could result in the founding of a feral mouse invasion on Cocos; however, male mice will be used and domesticated mice used for lures are not well-equipped to survive in the wild with no known instances of an invasive mouse population founded by domesticated strains.

BTS cage traps are not expected to be attractive to Guam rails, though mouse feed block debris containing bird feed pellets may fall to the forest floor where rails could consume them. Traditional BTS snake traps are typically suspended in vegetation at 1–1.5 m above ground level, above the typical activity zone of terrestrial rails, so not risk of physical injury from cage traps is expected. Alternative trap designs may be employed and would be assessed for risk of injury to rails, with modifications made to alleviate such risks.

Carrion baits containing acetaminophen will only be deployed in PVC plastic tube bait stations intended to exclude nontarget species. Elevated 1–1.5 m above ground level, they will not be accessible to terrestrial rails. It is possible that baits could be removed from bait tubes by BTS or nontarget species, then dropped to the forest floor where they could be eaten by rails. Guam rails are omnivores and might be expected to explore baits for dietary value. Dead mouse or bird chick baits are too large to be swallowed whole by rails. It is expected that rail consumption of baits (direct exposure, if any) would involve pecking away and ingesting small parcels of flesh while avoiding the bitter pellet, as was observed when fish crows were offered acetaminophen baits by Avery et al. (2004). Rails may feed on invertebrates such as fly larvae that have fed on baits, but it is expected that any traces of acetaminophen that may be passed on to rails (secondary exposure) would be so low as to be insignificant. We do not expect acetaminophen baiting to adversely affect Guam rails.

Noise associated with the use of AEG in proximity to Guam rails (90–95 dB point blank and 60 dB at 50 m) could startle birds, causing them to flush. It is possible that rails could ingest 6 mm spherical plastic or air rifle alloy pellets found in the environment, but, if ingested, pellets would be expected to pass without issue given the size and shape. Because AEG and air rifles will be used minimally when BTS are at heights where they cannot be easily reached, risk of direct impact of plastic or alloy pellets on Guam rails would most likely be discountable.

Because Guam rails are known to use and nest in built-up areas of Cocos Island, it is possible that rails could be startled and flushed by BTS detector dogs (BTSDD) during inspections of buildings and infrastructure. BTSDD are restrained on short leashed by canine handlers, preventing risk of direct contact between dogs and rails.

4.4.2.2 Positive Effects (Benefits)

BTS caused the extirpation of Guam rails from their native range (Savidge 1987; Wiles et al. 2003), but fortunately some were taken into captivity prior to extinction. Failure to suppress or eradicate BTS on Cocos Island will certainly jeopardize the survival of all Guam rails on Cocos Island. Eradication of BTS from Cocos Island will undoubtably be beneficial for Guam rails.

4.4.2.3 Avoidance and Minimization Measures

Physical disturbance of Guam rails (and their nests and eggs) will be minimized by restricting foot traffic to established transects, where practical. GDAWR will provide training for nest identification and communicate known nest locations to BTS eradication project personnel (D. Vice, pers. comm.). If nests are detected, they will be flagged to reduce the risk of accidental disturbance. To further avoid disturbing rails during their primarily crepuscular activity periods, routine daytime activities will be scheduled to occur between 0700 and 1700, and nighttime snake searches would commence no earlier than 30 minutes after sunset. Interactions of Guam rails with BTS traps and toxic bait stations will be avoided by placement in vegetation 1–1.5 m above ground level. Long-term exposure to risk of ingesting AEG pellets will be reduced by using only biodegradable plastic pellets. Alloy pellets will be used minimally but could be used and likely will not break down as rapidly. Enhanced biosecurity measures will reduce risk of accidental introduction of additional predators (especially rats).

4.4.3 Determination

Despite reasonable avoidance and minimization measures, it is likely that all Guam rails will be disturbed to some degree during the proposed action; we determine that the action May Affect Guam rails. Given that unchecked BTS predation of Cocos Island will likely lead to extirpation of Guam rails, the net effect of the proposed action would be beneficial.

4.5 Corals (*Acropora globiceps, Acropora retusa, Seriatopora aculeata*)

Acropora globiceps, *A. retusa*, and *Seriatopera aculeata* were listed as threatened in October of 2014. Burdick (*in litt.* 2021) of UOG, a corals expert, was consulted on the T&E coral species of Guam. Burdick provided a great deal of background information on these.

4.5.1 Background

Acropora retusa is known from and the listing for Guam is based upon a single, very tentatively identified colony photographed along the seaward reef slope in Asgadao Bay within the Achang Reef Flat Marine Preserve several years ago. The colony, outside of the proposed action area, could not be relocated and is presumed dead. No similar colonies have been reported since.

Seriatopora aculeata was reported from Guam by Randall (2003), but Burdick (*in litt*, 2021) has only seen two colonies in the last 15 years, both just north of Facpi Point outside of the proposed action area; these colonies could not be relocated and are both presumed dead.

Acropora globiceps is commonly-to-uncommonly observed around Guam but is typically found along shallow (usually between 1 and 7 m depth), exposed seaward reef slopes. While colonies are sometimes encountered along the reef margin and even the area of the outer reef flat just shoreward from the reef margin in areas with relatively high degree of water movement, they less commonly encountered in these areas.

4.5.2 Analysis

The proposed action area has not been extensively surveyed for these species. However, based on knowledge of Cocos Lagoon and the abundance and habitat preferences of these species, it is considered highly unlikely that any colonies of these species would occur anywhere near the proposed lane of travel. None of the locations indicated in Figure 1 occur in habitats preferred by these three species, nor are any of the habitat types within potential lanes of transit between these locations considered preferred by these species. As such, it is extremely unlikely that one would encounter any colonies of any of these species. All proposed landing sites are at docks, ramps, and very shallow sandy habitats where few colonies of any coral species would be expected to occur (Burdick *in litt*. 2021)

4.5.2.1 Adverse Effects (Stressors)

If present, adverse effects could result from direct physical damage during shallow-water landings and trampling by personnel (dis)embarking and (un)loading equipment during landings. Injudicious anchoring could also cause physical damage to corals.

Regarding potential concerns for runoff of acetaminophen used for BTS control, acetaminophen has not yet been used in close proximity to the marine environment. However, no acetaminophen will enter the marine environment directly (all use will be over land) and any residues would first be deposited on soil where acetaminophen breaks down rapidly due to bacterial degradation (Li et al. 2014). Testing of groundwater under the Habitat Management Unit on northern Guam associated with repeated aerial treatments – at three times the approved rate for bait stations – demonstrated no detectable amounts of acetaminophen percolating through the soil into the aquifer (NWRC, unpubl. chemistry reports, 2020). Acetaminophen ingested by BTS breaks down so rapidly that it has not been detectable in carcasses of BTS killed by acetaminophen intoxication (D. Goldade, NWRC Chemistry Unit, pers. comm., 2020). There are no anticipated adverse effects to corals from use of acetaminophen when applied in accordance with USEPA label restrictions (USEPA Reg. No. 56228-34).

4.5.2.2 Positive Effects (Benefits)

BTS have no direct negative effects on corals, so the proposed actions would have no direct benefits to corals. However, it has been demonstrated that eradication of rats from islands promotes seabird abundance, with positive benefits for coral reef productivity (Graham et al. 2018); if seabirds on Cocos contribute to coral wellbeing, their extirpation from Cocos by BTS predation could have an indirect adverse effect on corals.

4.5.2.3 Avoidance and Minimization Measures

If these species occur within the proposed action area, loading and offloading of craft at ramps, docks, and shallow sandy habitats eliminates risk of direct contact; most coral heads are far enough away from the shoreline to be out of harm's way of landing vessels. Anchoring of vessels will be rare, and damage to corals will be avoided by anchoring only in open sandy-bottom areas.

4.5.3 Determination

Given the very low likelihood of occurrence of these species in the proposed action area and the measures taken to avoid damage to any corals, we consider effects so unlikely as to be discountable, and determine that the proposed action May Affect but is Not Likely to Adversely Affect listed corals with discountable negative and potentially beneficial effects.

5 ANALYSIS OF POTENTIAL IMPACTS ON ESSENTIAL FISH HABITAT

Analyses of potential impacts to EFH are limited to the boating activities required to transport personnel and material from mainland Guam to Cocos Island and back, as described above in Section 2.3.

Much of the ocean that surrounds the Mariana Islands is designated as EFH. Its boundary is delineated from the shoreline to the Exclusive Economic Zone (EEZ) up to its outer boundary of 200 nautical miles, and includes the water column from its surface to 1,000 m depth, and the substrate from the shoreline to 400 m of the sea floor. Therefore, the water column, substrate, and all surrounding waters and submerged lands around Guam and Cocos are designated as EFH. In addition, EFH is designated within the EEZ for Guam and the CNMI for various life history stages (e.g., eggs, larvae, juveniles, and adults) for the following management unit species (MUS): Pelagics and Bottomfish.

1. EFH for Pelagics includes the water column from the shoreline to the outer boundary of the EEZ, from the surface down to 1,000 m.
2. EFH for Bottomfish includes the water column and all bottom habitat extending from the shoreline to a depth of 400 m
3. Specific types of habitat considered as EFH include coral reef, patch reef, hard substrate, artificial substrate, seagrass, soft substrate, mangrove, lagoon, estuarine, surge zone, deep-slope terraces and pelagic/open ocean.

5.1 Effects Determinations

Federal action agencies are required to consult on EFH for projects that may adversely affect EFH. Regulation 50 CFR 600.810 defines an adverse effect to EFH as any impact that reduces the quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH.

Proposed boat traffic has the potential to cause direct and indirect adverse effects to EFH and NOAA trust resources, including corals and seagrass, from the following stressors:

- Physical damage (e.g., from anchoring, deployment of equipment and personnel, inadvertent grounding of vessels, etc.),
- Pollution stress (e.g., introduction of chemical contaminants from vessels),
- Introduction of invasive species (on vessel hulls).

5.1.1 Adverse Effects (Stressors)

Vessel operations associated with transportation of personnel and equipment from Guam to Cocos may result in adverse effects to EFH substrate for Bottomfish from physical damage (e.g., grounding and anchoring), and water column EFH for Bottomfish and Pelagics due to potential introduction of pollutants and invasive species. BMPs and contingency plans are required to ensure that potential adverse effects are avoided and minimized.

While anchoring is not required for BTS eradication activities, anchoring may be required for other reasons, such as avoidance of adverse weather conditions or in the unlikely event of an engine malfunction and would be at the discretion of the ship's crew. Potential adverse effects of loading/unloading of personnel and equipment from shallow-draft skiffs directly at the shoreline (disturbance of corals, sea grasses, and the water column) are similar to those of anchoring, with the addition of trampling hazard from foot traffic.

5.1.2 Positive Effects (Benefits)

BTS have no direct negative effects on corals or other elements of EFH, so the proposed actions would have no direct benefits to EFH. However, it has been demonstrated that eradication of rats from islands promotes seabird abundance, with positive benefits for coral reef productivity (Graham et al. 2018); if seabirds on Cocos contribute to coral wellbeing, their extirpation from Cocos by BTS predation could have an indirect adverse effect on corals.

5.1.3 Avoidance and Minimization Measures

Prior to mobilizing, vessels will be inspected to ensure there is no pollution potential from oil, fuel leaks etc.

Boats will not anchor unless necessary. While the choice of anchoring location is at the discretion of the ship's captain, if anchoring were necessary, sites would be chosen based on depth, protection from seas and wind, and sensitivity of the bottom type; anchors will only be deployed on areas of sandy bottom, and no anchoring will occur on rocky or coral bottoms or sea grass. Only shallow-draft skiff-type boats will be used to disembark personnel and equipment on the coastline. Boats will not be pulled ashore but held in place by personnel standing in shallow water. The skiff hull may come into brief contact with the sandy substrate but embarking/disembarking only in areas with a clear sandy bottom without sea grass or coral will avoid negative impacts to EFH. See Figures 5 and 6 for photographs and a map of potential boarding locations. Precise landing locations will vary over time as shoreline conditions shift.

Figure 5. Examples of shoreline and benthic conditions considered suitable for shallow-water offloading without beaching of the vessel.


Figure 6. Map of locations of potential shallow-water landing sites as of February 2020. Precise locations will shift with time as shoreline conditions change.

To minimize the risk of aquatic nuisance species introduction, personnel would inspect all vessel hulls prior to mobilizing to ensure they do not pose a risk of introducing new invasive species and will not increase abundance of any invasive species that may be present at the project location. To further reduce the risk of invasive species introductions all vessels would be local to the area and meet all USEPA Vessel General Permit and Coast Guard requirements. Additional BMPs will be employed and are found in Sec. 6.

5.1.4 Determination

A vessel strike on ESA-listed corals would be extremely unlikely to occur as vessel operators have local knowledge of the area (see effects analysis for listed coral species above). Implementing the proposed best management practices makes the likelihood of vessel grounding remote. There is a low probability of direct physical contact with corals during the anchoring process or while anchored, or while loading/unloading personnel and equipment directly ashore in low-draft skiffs. BMPs would be employed to avoid contact with habitat-building EFH. No anchoring or unloading would occur in coral reef habitats, only in clearly visible sandy-bottomed areas.

The potential for fuel or oil leakages is highly unlikely. An oil or fuel leak would likely pose a significant risk to the vessel and its crew and actions to correct a leak would occur immediately to the extent possible. In the event that a leak should occur, the amount of fuel and oil onboard the vessel is unlikely to cause widespread, high dose contamination that would impact ESA-listed species (marine mammals, sea turtles, fishes, corals) directly or pose hazards to their food sources.

Based on the above analysis and the employment of BMPs (Section 6) to avoid and minimize potential adverse effects to EFH, WS determines the vessel activities may have minimal, temporary, or short-term adverse effects to EFH. This is based on the localized scale of the potential impact.

6 CONSERVATION MEASURES

6.1 Conservation Measures for T&E species

We will adhere to the following conservation measures to avoid and minimize undesired impacts to listed species. In addition to the following general measures, more specific measures are summarized in Table 2.

6.1.1 Trail Use

Where practical, all foot and wagon traffic will be limited to established, minimally maintained transects as described previously in this document. This will channel the majority of foot traffic effects to a limited portion of the island. UTV/ATV traffic will be limited to existing paths and trails (with required maintenance to control encroaching vegetation).

6.1.2 Timing of Activities

As a routine measure for minimizing disturbance to rails, daytime activities would typically be scheduled to occur between 0700 and 1700 hours to avoid the dawn/dusk activity period of rails. Nighttime activities would commence after sunset. However, we propose that dawn/dusk operations are not categorically precluded, so that nonroutine activities can procced if necessary (e.g. trail establishment or trap servicing shifts running unexpectedly long, monitoring of crepuscular prey species, etc.)

6.1.3 Biosecurity Measures

To minimize the risk of introducing harmful species of animals and plants, we would adhere to the Cocos Island Biosecurity Plan (WS 2009), to preclude the movement and establishment of undesirable species (some measures listed here exceed those in the plan):

- All research personnel would read the entirety of the plan prior to going to Cocos.
- All observations of nonnative species of concern (e.g., rodents, shrews, predatory flatworms) would be immediately reported to GDAWR and USFWS.
- The ferrying boat would be inspected by NWRC research personnel for signs of rodent or snake activity and additional biosecurity risks such as seeds prior to loading equipment and personnel. Rodent sign includes droppings, gnawed equipment and wiring and food caches. BTS sign includes snake skin sheds.
- All cargo containers (e.g., plastic storage bins) would be opened, unpacked, and repacked prior to loading onto the boat.
- The boat ferrying personnel would not remain moored at Cocos; once passengers and equipment are dropped off, the boat would return to mainland Guam and await a call for pickup.
- To the greatest extent possible, equipment will remain on Cocos for the duration of the study to minimize movement back and forth to Guam.
- All waste generated on Cocos would be packed off daily.

- Each technician would maintain a separate set of field clothing and footwear, thoroughly cleaned of all potential seeds or spores, for exclusive use on Cocos. Soles of shoes would be sprayed with a diluted bleach solution and scrubbed with a brush prior to boarding the boat.
- If a DAWR or other boat not moored in Cocos lagoon is used, it will be inspected for invasive alga and other sea life, which will be removed and cleaned prior to use.

Table 2. Summary of conservation measures.

Measure	**Impacts Reduced/Avoided**
Biosecurity measures (Sec. 6.3)	Prevent introduction of harmful species
Limit ferrying boat speed to 14 knots	Reduce risk of sea turtle strike
Avoid unnecessary boat anchoring	Reduced risk to corals
Offload personnel and equipment at docks, piers, and shallow sandy areas	Prevent coral damage
Establish and mark a minimally-maintained transect system	Channel foot traffic to prescribed trails, reducing overall disturbance from trackless trekking.
Limit routine daytime activities to 0700–1700 hrs. and nocturnal activities to 30 minutes past sunset to 2 hours before sunrise (when practical)	Avoid crepuscular activity periods of Mariana fruit bats and Guam rails
Deploy acetaminophen baits in bait stations designed to reduce nontarget access to baits	Reduce risk of acetaminophen intoxication to Guam rails
Use of biodegradable AEG or alloy air rifle pellets	Reduce potential for ingestion by Guam rails
Sea turtle nest identification and reporting training	Reduce risk of disturbing nests or nesting behavior
No white-flash wildlife cameras oriented toward the lagoon within 50 m of the coast	Reduce potential for disorienting or disturbing nesting sea turtles
No motorized vehicle or tool use within 100 m of a sea turtle while on land	Reduce disturbance of females in the process of nesting
All activity maps will delineate areas of high Slevin's skink abundance; personnel will be advised to exercise caution when traversing these areas	Reduce potential for flushing or trampling skinks
Training for identification and flagging of Guam rail nests by GDAWR	Reduce risk of accidental nest disturbance or destruction

6.2 Conservation Measures for Essential Fish Habitat

The following measures will be carried out when working in and around EFH on Guam and Cocos Island. These measures are intended to avoid and minimize adverse effects to EFH, as well as avoid introducing non-native invasive species. These activities will include small boat operations for transportation of personnel and equipment.

6.2.1 Protocol for Minimizing Benthic Disturbance Including Coral Reefs

- All care will be taken during anchoring small boats, with sand substrate targeted for anchorage to minimize benthic disturbance or coral damage. The anchor will be lowered rather than thrown, and the captain will check the anchor to make sure it does not drag or entangle any benthos or listed species.
- Personnel loading/unloading from vessels in sandy areas of shallow water will take care not to step on any rocky or coral bottom, sea grass, or other materials with live benthic organisms. The proposed activity will avoid or minimize physical interaction (e.g., touching or standing) with habitat-forming EFH including corals and submerged aquatic vegetation (e.g., seagrasses).
- Vessel anchoring, although not required for the proposed activity, if needed, will be conducted in an attempt to avoid or minimize physical damage to habitat-forming EFH, including corals and submerged aquatic vegetation (e.g., seagrasses).
- Speed limits will be followed and course alterations will be mapped out, especially in areas where slower vessel speeds will reduce the risk of grounding a vessel and damaging EFH habitat such as coral reefs.

6.2.2 Protocol for Minimizing Effects to Water Quality and Transporting Invasive Species

- Discharges of chemicals and other fluids dissimilar from seawater into the water column will not be done.
- An oil spill pollution prevention plan and contingencies to avoid and clean up potential spills will be developed and guide boating activities.
- All equipment found to be leaking contaminants will be removed from service until repaired.
- All vessels, machinery, and equipment that enters the marine environment in Cocos Lagoon will be inspected for the presence of invasive species daily and removed and decontaminated or cleaned as necessary.
- All USEPA Vessel General Permits and Coast Guard requirements will be obtained and followed.
- Cleaners with nonylphenols will not be used.
- The anchor will be cleaned with a high-powered hose after retrieval.
- Trash and debris from operations will be disposed of appropriately and not allowed to enter the marine environment.

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APPENDIX A

Agency Correspondence

United States
Department of
Agriculture

233 Pangelinan Way
Barrigada, GU 96913

April 29, 2021

Jacqueline Flores
Island Team Manager
Mariana Islands
U.S. Fish and Wildlife Service
108 Hernan Cortez Avenue
Sirena Building Suite 131
Hagatna, Guam 96910

RE: Request for Consultation under Section 7 of the Endangered Species Act

Dear Ms. Flores,

The USDA-APHIS Wildlife Service program in Guam (WS-Guam) is requesting formal consultation on the effects of a proposed Brown Treesnake (BTS) Eradication on Cocos Island Biological Assessment (BA) on federally listed species in accordance with section 7 (a)(2) of the Endangered Species Act (ESA) of 1973 (as Amended) (Act), codified in 50 CFR §402.02 and §402.14.

Guam-WS will be working with cooperating agencies (US Geological Survey and US Fish and Wildlife Service) and partnering entities (Guam's Division of Aquatic and Wildlife Resources and Iowa State University). These agencies and entities will be working in coordination with WS-Guam on BTS eradication efforts as well as monitoring the prey populations to ensure their continued existence on Cocos Island.

With this letter, we submit our BA containing a description of the proposed management action, species addressed, discussion of effects, and efforts to minimize potential BTS management impacts on the following federally listed species:

Pteropus mariannus mariannus, Mariana Fruit Bat
Chelonia mydas, Green Turtle
Eretmochelys imbricata, Hawksbill Turtle
Emoia slevini, Slevin's Skink
Rallus owstoni, Guam Rail

WS-Guam has determined that the proposed action may affect the Mariana fruit bat, Guam rail, Slevin's skink, and green and hawksbill sea turtles.

We appreciate your review and assistance in this consultation process as we are committed to the conservation of federally listed species. Please contact Jeffrey B. Flores at our office at 671-635-4440 if you have any questions regarding this request.

Sincerely,

Jeffrey B. Flores –
State Director
Guam/Western Pacific Theater

Enclosures: Biological Assessment

United States Department of Agriculture

United States
Department of
Agriculture

233 Pangelinan Way
Barrigada, GU 96913

April 29, 2021

Endangered Species Act POC:
Ann M. Garrett
Assistant Regional Administrator
Protected Resources Division
Pacific Islands Regional Office
Inouye Regional Center, Bldg 176
1845 Wasp Blvd
Honolulu, HI 96818

Essential Fish Habitat POC:
Gerry Davis
Assistant Regional Administrator
Habitat Conservation Division
Pacific Islands Regional Office
Inouye Regional Center, Bldg 176
1845 Wasp Blvd
Honolulu, HI 96818

RE: Request for Consultation under Section 7 of the Endangered Species Act and Essential Fish Habitat

Dear Administrators,

The USDA-APHIS Wildlife Service program in Guam (WS-Guam) is requesting formal consultation on the effects of a proposed Brown Treesnake (BTS) Eradication on Cocos Island Biological Assessment (BA) on federally listed species in accordance with Section 7 (a)(2) of the Endangered Species Act (ESA) of 1973 (as Amended) (Act), codified in 50 CFR §402.02 and §402.14, and on Essential Fish Habitat (EFH) provisions of the Magnuson-Stevens Fishery Conservation and Management Act (section 305(b)) as described by 50 CFR 600.920..

Guam-WS will be working with cooperating agencies (US Geological Survey and US Fish and Wildlife Service) and partnering entities (Guam's Division of Aquatic and Wildlife Resources and Iowa State University). These agencies and entities will be working in coordination with WS-Guam on BTS eradication efforts as well as monitoring the prey populations to ensure their continued existence on Cocos Island.

With this letter, we submit our BA containing a description of the proposed management action, species addressed, discussion of effects, and efforts to minimize potential BTS management impacts on the following federally listed species:

Chelonia mydas, Green Turtle Central West Pacific
Eretmochelys imbricata, Hawksbill Turtle
Acropora globiceps, Coral
Acropora retusa, Coral
Seriatopora aculeata, Coral

Additionally, we request consultation on effects to EFH within the action area described in the BA.

WS-Guam has determined that the proposed action may affect sea turtles, corals, and EFH, but that effects are either unlikely or minimal and short-term given the conservation measures and best management practices to which we will adhere as addressed in the BA..

We appreciate your review and assistance in this consultation process as we are committed to the conservation of federally listed species and habitats. Please contact Jeffrey B. Flores at our office at 671-635-4440 if you have any questions regarding this request.

Sincerely,

Jeffrey B. Flores –
State Director
Guam/Western Pacific Theater

Enclosures: Biological Assessment

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Office of the Rocky Mountain Regional Director
Box 25046 M.S. 911
Denver Federal Center
Denver, Colorado 80225

May 6, 2021

Jacqueline Flores
Island Team Manager
Mariana Islands
U.S. Fish and Wildlife Service
108 Hernan Cortez Avenue
Sirena Building Suite 131
Hagatna, Guam 96910

RE: Request for Consultation under Section 7 of the Endangered Species Act

Dear Ms. Flores,

The US Geological Survey is requesting formal consultation on the effects of a proposed Brown Treesnake (BTS) Eradication on Cocos Island Biological Assessment (BA) on federally listed species in accordance with section 7 (a)(2) of the Endangered Species Act (ESA) of 1973 (as Amended) (Act), codified in 50 CFR §402.02 and §402.14.

The US Geological Survey will be working with USDA-APHIS Wildlife Service program in Guam (WS-Guam), the US Fish and Wildlife Service, Guam's Division of Aquatic and Wildlife Resources and Iowa State University. These agencies and entities will be working in coordination with WS-Guam on BTS eradication efforts as well as monitoring prey populations to ensure their continued existence on Cocos Island.

With this letter, we submit our BA containing a description of the proposed management action, species addressed, discussion of effects, and efforts to minimize potential BTS management impacts on the following federally listed species:

Pteropus mariannus mariannus, Mariana Fruit Bat
Chelonia mydas, Green Turtle
Eretmochelys imbricata, Hawksbill Turtle
Emoia slevini, Slevin's Skink
Rallus owstoni, Guam Rail

WS-Guam has determined that the proposed action may affect the Mariana fruit bat, Guam rail, Slevin's skink, and green and hawksbill sea turtles.

We appreciate your review and assistance in this consultation process

Sincerely,

Peter Griffiths
Regional Director (Acting), Rocky Mountain Region
US Geological Survey

Enclosure: Biological Assessment

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Office of the Rocky Mountain Regional Director
Box 25046 M.S. 911
Denver Federal Center
Denver, Colorado 80225

May 6, 2021

Endangered Species Act POC:
Ann M. Garrett
Assistant Regional Administrator
Protected Resources Division
Pacific Islands Regional Office
Inouye Regional Center, Bldg 176
1845 Wasp Blvd
Honolulu, HI 96818

Essential Fish Habitat POC:
Gerry Davis
Assistant Regional Administrator
Habitat Conservation Division
Pacific Islands Regional Office
Inouye Regional Center, Bldg 176
1845 Wasp Blvd
Honolulu, HI 9681

RE: Request for Consultation under Section 7 of the Endangered Species Act and Essential Fish Habitat

Dear Administrators,

The US Geological Survey is requesting formal consultation on the effects of a proposed Brown Treesnake (BTS) Eradication on Cocos Island Biological Assessment (BA) on federally listed species in accordance with section 7 (a)(2) of the Endangered Species Act (ESA) of 1973 (as Amended) (Act), codified in 50 CFR §402.02 and §402.14, and on Essential Fish Habitat (EFH) provisions of the Magnuson-Stevens Fishery Conservation and Management Act (section 305(b)) as described by 50 CFR 600.920.

The US Geological Survey will be working with the USDA-APHIS Wildlife Service program in Guam (WS-Guam), the US Fish and Wildlife Service, Guam's Division of Aquatic and Wildlife Resources and Iowa State University. These agencies and entities will be working in coordination with WS-Guam on BTS eradication efforts as well as on monitoring prey populations to ensure their continued existence on Cocos Island.

With this letter, we submit our BA containing a description of the proposed management action, species addressed, discussion of effects, and efforts to minimize potential BTS management impacts on the following federally listed species:

Chelonia mydas, Green Turtle Central West Pacific
Eretmochelys imbricata, Hawksbill Turtle
Acropora globiceps, Coral
Acropora retusa, Coral
Seriatopora aculeata, Coral

Additionally, we request consultation on effects to EFH within the action area described in the BA.

WS-Guam has determined that the proposed action may affect sea turtles, corals, and EFH, but that effects are either unlikely or minimal and short-term given the conservation measures and best management practices to which we will adhere as addressed in the BA.

We appreciate your review and assistance in this consultation process

Sincerely,

Peter Griffiths
Regional Director (Acting), Rocky Mountain Region
US Geological Survey

Enclosure: Biological Assessment

APPENDIX B

EPA Label Reg. No. 56228-34

Acetaminophen for Brown Treesnake Control

ACETAMINOPHEN FOR BROWN TREESNAKE CONTROL

ACTIVE INGREDIENT	
Acetaminophen	72.73%
OTHER INGREDIENTS	27.27%
TOTAL	100.00%

This product may be used only to control brown treesnakes (Boiga irregularis) in non-crop areas in and around military bases, airports, shipping ports, urban and residential areas, and other areas where brown treesnakes may be present. For use only by employees of the U.S. State and Federal governments, the Government of Guam or the Commonwealth of the Northern Mariana Islands trained in brown treesnake control, or persons under their direct supervision.

KEEP OUT OF REACH OF CHILDREN

CAUTION

PRECAUTION

FIRST AID

IF SWALLOWED:

- Call a poison control center or doctor immediately for treatment advice.
- Have person sip a glass of water if able to swallow.
- Do not induce vomiting unless told to by a poison control center or doctor.
- Do not give anything by mouth to an unconscious person.

IF ON SKIN OR CLOTHING:

- Remove contaminated clothing.
- Rinse skin immediately with plenty of water for 15-20 minutes.
- Call a poison control center or doctor for further treatment advice.

IF INHALED:

- Move person to fresh air.
- If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.
- Call a poison control center or doctor for further treatment advice.

IF IN EYES:

- Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing.
- Call a poison control center or doctor for treatment advice.

Have the product label with you when calling a poison control center or doctor, or going for treatment. If you need immediate medical attention, call the Poison Control Center at 1-800-222-1222 or a doctor. For non-emergency information concerning this product, call the National Pesticide Information Center at 1-800-858-7378.

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
4700 RIVER ROAD, UNIT 149
RIVERDALE, MD 20737

EPA Reg. No. 56228-34
EPA Est. No. 56228-CO-01

Net Contents: _______________

Batch Code No.: _______________

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION

Si usted no entiende la etiqueta, busque alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)
READ THIS LABEL: Read the entire label and follow all applicable directions, restrictions and precautions. This label must be in the possession of the user at the time of pesticide application.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

People who handle the product must wear:

- Long-sleeved shirt and long pants
- Socks and shoes
- Waterproof or rubber gloves

Applicators who handle bait must wear:

- Waterproof or rubber gloves

Follow manufacturer's instructions for cleaning/ maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

USER SAFETY RECOMMENDATIONS

Users should wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet. Users should remove PPE immediately after handling this product. As soon as possible, wash thoroughly and change into clean clothing. Users should remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

ENVIRONMENTAL HAZARDS

Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment washwaters or rinsate.

ENDANGERED SPECIES CONSIDERATIONS

Notice: It is a Federal offense to use any pesticide in a manner that results in the death of an endangered species. Before undertaking any control operations with the product, consult with local, State, and Federal wildlife authorities to ensure the use of this product presents no hazard to any endangered species.

To reduce the hazard baiting may present to non-target species, consultation and concurrence will be obtained from Federal and local wildlife management authorities (e.g., U.S. Fish and Wildlife Service (FWS) Ecological Services, and Government of Guam Division of Aquatic and Wildlife Resources) prior to use in threatened or endangered species habitat (including habitat of the Mariana crow, Guam rail, or other reintroduced species).

Threatened or Endangered Species – Guam

Animal Species:
Bat, little Mariana fruit (*Pteropus tokudae*)
Bat, Mariana fruit (*Pteropus mariannus mariannus*)
Butterfly, Mariana eight-spot (*Hypolimnas octocula marianensis*)
Butterfly, Mariana wandering (*Vagrans egistina*)
Crow, Mariana (*Corvus kubaryi*)
Kingfisher, Guam (*Todiramphus cinnamominus*)
Megapode, Micronesian (*Megapodius laperouse*)
Moorhen, Mariana common (*Gallinula chloropus guami*)
Rail, Guam (*Gallirallus owstoni*), except where listed as an experimental population
Sea turtle, green (*Chelonia mydas*)
Sea turtle, hawksbill (*Eretmochelys imbricata*)
Skink, Slevin's (*Emoia slevini*)
Snail, fragile tree (*Samoana fragilis*)
Snail, Guam tree (*Partula radiolata*)
Snail, Humped tree (*Partula gibba*)
Swiftlet, Mariana gray (*Aerodramus vanikorensis bartschi*)
Warbler, nightingale reed (*Acrocephalus luscinia*)
White-eye, bridled (*Zosterops conspicillatus conspicillatus*)

Plant Species:
Aplokating-palaoan (*Psychotria malaspinae*)
Fadang (*Cycas micronesica*)
Halomtano, Berenghenas (*Solanum guamense*)
Halomtano, Cebello (*Bulbophyllum guamense*)
Iagu, Hayun or Guafi, Tronkon (*Serianthes nelsonii*)
Dendrobium guamense
Eugenia bryanii
Maesa walkeri
Nervilia jacksoniae
Phyllanthus saffordii
Tabernaemontana rotensis
Tinospora homosepala
Tuberolabium guamense
Paudedo (*Hedyotis megalantha*)
Ufa-halomtano (*Heritiera longipetiolata*)

Threatened or Endangered Species – Commonwealth of the Northern Mariana Islands

Animal Species:
Bat, Mariana fruit (*Pteropus mariannus mariannus*)
Bat, Pacific sheath-tailed (*Emballonura semicaudata rotensis*)
Butterfly, Mariana wandering (*Vagrans egistina*)
Crow, Mariana (*Corvus kubaryi*)
Damselfly, Rota blue (*Ischnura luta*)
Megapode, Micronesian (*Megapodius laperouse*)
Moorhen, Mariana common (*Gallinula chloropus guami*)
Sea turtle, green (*Chelonia mydas*)
Sea turtle, hawksbill (*Eretmochelys imbricata*)
Skink, Slevin's (*Emoia slevini*)
Snail, fragile tree (*Samoana fragilis*)
Snail, Langford's tree (*Partula langfordi*)
Swiftlet, Mariana gray (*Aerodramus vanikorensis bartschi*)
Warbler, nightingale reed (*Acrocephalus luscinia*)
White-eye, Rota bridled (*Zosterops rotensis*)

Plant Species:
Fadang (*Cycas micronesica*)
Halumtano, Cebello (*Bulbophyllum guamense*)
Iagu, Hayun or Guafi, Tronkon (*Serianthes nelsonii*)
Dendrobium guamense
Maesa walkeri
Nervilia jacksoniae
Nesogenes rotensis
Osmoxylon mariannense
Tabernaemontana rotensis
Tuberolabium guamense
Ufa-halomtano (*Heritiera longipetiolata*)

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. A copy of this label must be in the possession of the user at the time that the product is applied.

For use only by employees of the U.S. State and Federal governments, the Government of Guam or the Commonwealth of the Northern Mariana Islands trained in brown treesnake control, or persons under their direct supervision.

USE RESTRICTIONS

DO NOT apply this product in a manner that will contaminate food, feed, and water.
DO NOT apply this product in a manner where it is accessible to children or domestic animals.
DO NOT apply treated baits in areas where there is a danger that threatened or endangered species will consume baits unless special precautions are taken to limit such exposures. Such precautions shall include applying treated baits inside bait stations that will exclude threatened or endangered species that otherwise might feed upon baits.

APPLICATION DIRECTIONS

SINGLE BAIT PREPARATION:

Acetaminophen baits may be made using any of the following items as a substrate for the tablet: 1) dead mice or rats, 2) dead birds, such as chicken or quail, 3) dead lizards, or 4) artificial Brown Treesnake baits. Bait size should be appropriate for the targeted size class of snake and the number of acetaminophen tablets used per bait.

For most snake size classes:
Prepare baits using one of the two following methods: 1) insert one 80-mg acetaminophen tablet into the throat or body cavity of the dead animal bait or into the matrix of the artificial bait, or 2) affix one 80-mg acetaminophen tablet to the outside of the bait substrate.

When targeting large snakes (approximately 200 g body mass/1.2 m snout-vent length or larger):
Prepare baits using the following method: 1) insert two 80-mg acetaminophen tablets into the throat or body cavity of the dead animal bait or into the matrix of the artificial bait. For extra-large snakes (approximately 500 g body mass/1.5 m snout-vent length or larger), additional 80-mg tablets (up to six) may be used in bait substrates that are too large in volume to be eaten by snakes under 500 g/1.5 m.

BAIT STATIONS:

Construct bait stations from lengths of PVC pipe that are 2 to 4 inches (5.1 to 10.2 cm) in diameter and 12 to 18 inches (30.5 to 45.8 cm) in length. Alternatively, use wire mesh funnel traps.

Hang bait stations in trees and on fences at heights of approximately 4.9 feet (1.5 meters) or more above ground. Place single baits inside individual bait stations.

Place bait stations at intervals of approximately 22 yards (20 meters) or greater in and around forested areas and along fence lines, or in and around urban and residential areas at heights or locations out of the reach of children and pets. The density of 80-mg acetaminophen tablets must not exceed 15 tablets per acre (36 tablets per hectare). Where bait station placement opportunities are unevenly distributed, bait stations may be placed less than 22 yards (20 meters) apart providing tablet density does not exceed 15 tablets per acre (36 tablets per hectare).

Unconsumed baits in bait stations may be replaced at a minimum interval of two days and may be operated continuously throughout the year. Consumed baits may be replaced immediately.

BROADCAST APPLICATION:

Baits may be hand broadcast or dropped from helicopters and fixed-wing aircraft. If the desired bait placement is in the forest canopy, use pre-packaged bait designed for aerial broadcast uses, or manually attach a small piece of netting or other material to the bait.

The density of 80-mg acetaminophen tablets must not exceed 50 tablets per acre (120 tablets per hectare) per aerial drop, with a minimum interval between drops of 3 days. No more than 150 tablets per acre (360 tablets per hectare) may occur within a 2-month period, and no more than 450 tablets per acre (1,080 tablets per hectare) may occur within a single year.

DIRECTIONS FOR USE, continued

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage and disposal.

Pesticide Storage: Store only in a closed container in a freezer at or below 0 °F (-18 °C) that is inaccessible to children, pets and domestic animals.

Pesticide Disposal: If the product cannot be disposed of through use in accordance with product label directions, contact your Territorial Pesticide or Environmental Control agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Container Disposal: Nonrefillable container. Do not reuse or refill this container. Triple rinse container (or equivalent) promptly after emptying. Offer for recycling, if available. Otherwise, puncture and dispose of in a sanitary landfill or incinerator.

{Container Label}

PRECAUTIONARY STATEMENTS HAZARDS TO HUMANS AND DOMESTIC ANIMALS

Si usted no entiende la etiqueta, busque alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

READ THIS LABEL: Read the entire label and follow all applicable directions, restrictions and precautions. This label must be in the possession of the user at the time of pesticide application.

PERSONAL PROTECTIVE EQUIPMENT (PPE)
People who handle the product must wear:
- Long-sleeved shirt and long pants
- Socks and shoes
- Waterproof or rubber gloves

Applicators who handle bait must wear:
- Waterproof or rubber gloves

Follow manufacturer's instructions for cleaning/ maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

USER SAFETY RECOMMENDATIONS

Users should wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet. Users should remove PPE immediately after handling this product. As soon as possible, wash thoroughly and change into clean clothing. Users should remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

ENVIRONMENTAL HAZARDS

Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment washwaters or rinsate.

Label ID 56228-34-DEC-29-2020
Container Label: Page 1 of 1

ACETAMINOPHEN FOR BROWN TREESNAKE CONTROL

ACTIVE INGREDIENT
Acetaminophen 72.73%
OTHER INGREDIENTS 27.27%
TOTAL 100.00%

This product may be used only to control brown treesnakes (Boiga irregularis) in non-crop areas in and around military bases, airports, shipping ports, urban and residential areas, and other areas where brown treesnakes may be present. For use only by employees of the U.S. State and Federal governments, the Government of Guam or the Commonwealth of the Northern Mariana Islands trained in brown treesnake control, or persons under their direct supervision.

KEEP OUT OF REACH OF CHILDREN
CAUTION

NOTE: **This is the container label.** See the enclosed full product label for Acetaminophen for Brown Treesnake Control (EPA Reg. No. 56228-34) for complete **Directions For Use** and all other label and use information, including Endangered Species Considerations. **It is a violation of Federal law to use this product in a manner inconsistent with its labeling.**

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage and disposal.

PESTICIDE STORAGE: Store only in a closed container in a freezer at or below 0 °F (-18 °C) that is inaccessible to children, pets and domestic animals.

PESTICIDE DISPOSAL: If the product cannot be disposed of through use in accordance with product label directions, contact your Territorial Pesticide or Environmental Control agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

CONTAINER DISPOSAL: Nonrefillable container. Do not reuse or refill this container. Triple rinse container (or equivalent) promptly after emptying. Offer for recycling, if available. Otherwise, puncture and dispose of in a sanitary landfill or incinerator.

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
4700 RIVER ROAD, UNIT 149
RIVERDALE, MD 20737

EPA Reg. No. 56228-34
EPA Est. No. 56228-CO-01
Net Contents: __________
Batch Code No.: __________