
APPENDIX R: MAINTAINING THE BIOSECURITY OF DESECHEO ISLAND

INTRODUCTION

Island biosecurity refers to the policies and protocols designed to protect island ecosystems from the threat of invasive species. Invasive species are responsible for the majority of extinctions on islands. Historically, Desecheo Island has been greatly impacted by invasive species. Restoration of Desecheo through the removal of invasive species has been ongoing since the 1980s; these restoration efforts will allow the island to return to its role as a major breeding ground for seabirds. In order to maintain the benefits of these efforts, it is critical to prevent further introductions of non-native species. Rats, mice, mongoose, the *Harrisia* cactus mealybug, and weeds pose the greatest risk to Desecheo, but any non-native species (including species that are native to Puerto Rico but not found on Desecheo) has the potential for causing damage.

PURPOSE

The purpose of this biosecurity plan is to provide guidelines to implement effective and sustainable biosecurity measures to protect Desecheo Island. Desecheo is currently being restored via the eradication of multiple invasive species. These eradications will provide significant conservation benefits that can only be maintained if the island is kept free of such species. This plan provides measures that will prevent, detect, and respond to the introduction of non-native species. The focus is primarily on rodents and invertebrate pests. Prevention measures tend to be the most practical and cost effective, and are emphasized most heavily to ensure this plan is financially sustainable.

ACCESS TO DESECHEO ISLAND

The Desecheo National Wildlife Refuge (NWR) is administered by the United States Fish and Wildlife Service (USFWS) under the Caribbean Islands NWR Complex. The waters within a .5 mile radius around the island are designated as a Marine Reserve and a no-take zone by the Puerto Rico Department of Natural and Environmental Resources (DNER). The access to the island is restricted due to the presence of unexploded ordinance (UXO); only refuge personnel and other government agencies are allowed to visit the island. A limited number of Special Use Permits (SUP) may be issued for purposes necessary for management of the island's resources (Table 1).

Table 1. Parties/organizations that access Desecheo Island

Parties and Organizations	Reason	Pathway
Fish and Wildlife Service or entity with SUP	monitoring, research, law enforcement	USFWS, other agency or contracted boat or helicopter
Puerto Rico Commonwealth Department of Natural Resources (DNER)	monitoring, research, law enforcement	USFWS, other agency or contracted boat or helicopter
Fuerzas Unidas de Rápida Acción (Puerto Rico)	law enforcement	Boat, helicopter

Police, FURA)		
U.S. Coast Guard, U.S. Customs and Border Patrol, U.S. Immigration and Customs Enforcement	law enforcement	boat, helicopter
Puerto Rico Emergency Management	search and rescue	other agency boat or helicopter
DNER permitted operator (not authorized to access island, only adjacent waters)	offshore tourism	Boat
U.S. Army Corps of Engineers	survey and removal of unexploded ordnance	other agency or contracted boat or helicopter

RISK OF PEST INVASION

Desecheo is beyond the swimming distance for most of the invasive species known to occur on Puerto Rico, therefore, people pose the largest risk of introducing non-native species to the island. Boats, supplies, and equipment offer the most viable pathways for introducing non-native species. Boats are the most frequent means of transporting people and goods to the island or visiting the adjacent Marine Reserve and pose the highest risk for accidentally introducing stowaways. Helicopters most often simply touch down on the helipad; occasionally they land and stay a short while and are infrequently used to transport cargo. Supplies and equipment that are not used or cleaned regularly are at the highest risk inadvertently harboring non-native species.

Rodents, invertebrates, and small reptiles are the most likely stowaways. Many of the boats used to transport people and goods to Desecheo and its adjacent waters have inboard motors or storage compartments that put them at risk of inadvertently stowing rodents or small reptiles. The largest boats, with the highest risk of stowaways, do not usually come in direct contact with Desecheo as most permitted landings on the island occur on either small open deck tenders or go-fast boats. However, these larger boats do anchor well within the swimming distance of rodent and reptile species. The go-fast boats operated by law enforcement agencies pose the most direct and preventable pathway for introducing non-native species, particularly those boats that are not used regularly and are tied at dock for long periods of time.

In addition, illegal activities pose an unmitigated threat to biosecurity making it necessary to conduct rapid assessment and response activities following unpermitted landings. Most of the permitted law enforcement landings are directly related to these illegal landings. Law enforcement personnel bring only duty gear to the island (water and medical supplies). During significant interdiction operations the majority of people are transferred on and off the island by helicopter instead of by boat. Given the uncontrolled nature of the landings and the number of parties involved, illegal landings represent an elevated biosecurity risk that should initiate a prompt response to assess the potential for pest introductions.

HIGH RISK SPECIES

The following table provides a list of invasive species with a high risk of introduction to Desecheo by accident, due to stowaways or intentional release.

Type	Invasive species	Biosecurity Risk Description
Rodent	Black Rat (<i>Rattus rattus</i>) Norway Rat (<i>Rattus norvegicus</i>) House Mouse (<i>Mus musculus</i>)	Known to occur on the main island of Puerto Rico. Most likely to be introduced accidentally. Would impact seabirds and endemic reptiles through predation.
Invertebrate	Harrisia Cactus Mealybug (suspected <i>Hypogeococcus pungens</i>) Cactus moth (<i>Cactoblastis cactorum</i>)	Risk of introduction in clothing, field gear, or machinery. Small size makes them difficult to detect. Would likely have a significant negative impact on native columnar cacti such as the federally listed <i>H. portoricensis</i> .
Reptile	Reptile spp. closely related to those on Desecheo Green Iguana (<i>Iguana iguana</i>)	Smaller species have high likelihood of hiding in cargo and vehicles. Potential risks of breeding w/ closely related species. Impacts of introduction could vary widely based on amount of predation and competition.
Mammalian Predators	Cats (<i>Felis catus</i>) Dogs (<i>Canis lupis familiaris</i>) Mongoose (<i>Herpestes auro punctatus</i>)	Risk of introduction through escaped pets, stowaway, or intentional release. Unlikely to quickly establish a population. Possible predation of birds and reptiles.

Several mammalian species have been introduced to Desecheo Island including feral goats, feral cats, rhesus macaques and black rats. Cats were eradicated in 1987 and the final goats were removed in 2009. Macaque removal efforts are in their final stages and rat eradication is expected to occur in 2016. Green iguanas have been recently confirmed on island but additional information is needed to determine if a population has established and to assess the biosecurity risk.

BIOSECURITY MEASURES

Effective biosecurity measures consist of three principal factors: prevention, surveillance and incursion response.

PREVENTION

People are the most important tool for preventing introductions to islands. By focusing resources on biosecurity awareness and education, transportation of non-native species and subsequent population establishment can be prevented. Prevention is relatively low cost and can be achieved by developing simple habits. Flyers or brochures outlining the importance of biosecurity and some key actions implemented will be prepared for use by USFWS employees (Appendix 1). They will be distributed to other agencies that visit the island as well as DNER permitted operators that regularly use the waters near Desecheo. All communication materials should include specific instructions on how to report any sightings or suspicions (e.g. incidents such as pest escaping or being released onto the island).

Biosecurity Management Standard Operating Procedures (SOP)

Prevention measures during planned visits are largely the same regardless of the mode of transportation to the island. The Biosecurity Management SOP (Appendix 2) will be followed during each visit to ensure that prevention measures are in place. The checklist in this SOP will be completed and returned to the FWS law enforcement supervisor on completion of the trip for record keeping.

Key actions:

- Ensure all visitors know the risks of biosecurity, the most likely pathways and what to look for
- Inspect all clothing, boots, gear and cargo
- Inspect all vessels
- Report any suspected pest sightings
- Return completed biosecurity checklist to FWS law enforcement

Prevention measures at Cabo Rojo NWR

The USFWS will:

- Maintain a rodent proof room or structure to store all biosecurity related supplies.
- Manage for pests where equipment is stored on the refuge.
- Purchase and use rodent proof containers.

Prevention measures for permitted island users

- All parties that access the island legally will be required to obtain a Special Use Permit (SUP).
- The SUP will specify protocols that must be followed by the entity including but not limited to: requirement to certify the vessel utilized as pest free; certifying compliance with Biosecurity Management SOP; use of rodent proof containers; cleaning of boots and equipment at points of entry.

Prevention measures for permitted island marine reserve users

- USFWS will develop biosecurity protocols similar to those used for SUPs for vessels authorized by DNER to operate in waters adjacent to Desecheo NWR (e.g. dive operators). These will be incorporated into any DNER permit issued for such purpose.

SURVEILLANCE

Many species can be difficult to detect at low densities and require intensive monitoring or expert knowledge to determine their presence, making continuous surveillance cost prohibitive. Annual intensive assessment of the highest risk species (rodents and invertebrates) should be able to detect small populations before they spread across the entire island and will be conducted once the island is declared rat-free. Prior to such confirmation, monitoring will be conducted more frequently in accordance with the post-eradication and operational plan. These annual assessments should be combined with other planned assessments of the island's native biota outlined in the Desecheo NWR Comprehensive Conservation Plan (CCP). The procedures for conducting an annual assessment for non-native species on Desecheo National Wildlife Refuge are outlined in Appendix 3.

In an effort to monitor illegal visitation to Desecheo or nearby waters several measures will be implemented including the placement of cameras and sensors to detect human presence on island. The USFWS will work with other law enforcement agencies to coordinate the use of ground sensors, satellite cameras, or other methods that such agencies use. These detection methods are of common interest to all parties, and where possible information should be shared.

The USFWS will place remote time-lapse cameras with a view of Puerto de los Botes and mooring buoys. Collecting and reviewing this data during monitoring trips will allow the USFWS to quantify if island visitation has increased or if any high risk events have occurred that require additional action. Most importantly, remote cameras will help identify which groups present the highest biosecurity risk so that resources can be prioritized to promote biosecurity awareness and prevention where it is most needed.

INCURSION RESPONSE

An incursion is when a non-native species makes it to an island and may consist of one or multiple individuals. The response to an incursion should be focused around the area of introduction and/or detection, but larger or island-wide monitoring may be necessary to confirm if the response was sufficient. Incursion response must occur before the species has had an opportunity to establish a population because once a population has been established the removal action would no longer be an incursion response but would be considered a full eradication. For the purposes of response decision making and response, a Biosecurity Officer will be designated.

The following table provides the actions of any response to an incursion of any invasive species on Desecheo that will be led by the designated Biosecurity Officer.

	Action	Responsible
1	Law enforcement agency reports illegal landing event or a third party reports a suspected incursion.	Law Enforcement Supervisor
2	Confirm the incursion or illegal landing by gathering additional information.	Law Enforcement Supervisor
3	Assess the level of risk posed by the incursion (number of individuals, what damage might be caused by the incursion, likelihood of population establishing, etc.)	Law Enforcement Supervisor, Biosecurity Officer
4	Decide what actions should be taken, and when.	Biosecurity Officer
5	Carry out response actions.	Biosecurity Officer
6	Review outcome of response actions. Review should include an analysis of likely incursion route, and identify any changes that can be made to the biosecurity plan to prevent another incident.	Biosecurity Officer

The operational response will depend on the exact details of a particular incursion. As there are many different factors that affect a scenario a detailed operational response plan cannot be pre-planned for

every likely scenario. Appendix 4 outlines the strategies for responding to high risk events and confirmed incursion response.

In order to be ready to respond to a high risk event or confirmed incursion the following key actions need to be taken:

- Maintain a rapid response team that will be activated by the Biosecurity Officer.
- Maintain biosecurity supplies in a secure and easy to access location.
- Maintain options for transportation to the island up-to-date.
- Maintain compliance that provides the flexibility to quickly carry out any possible response actions.

Section 1. Awareness & Education Plan for Desecheo National Wildlife Refuge

Prevention (Education & Outreach):

- An informative fact sheet (Spanish/English) concerning the rat eradication project at Desecheo NWR will be prepared and distributed to individuals, local stores, hotels, government agencies etc. near the staging site during the project's implementation as an awareness and education tool.
- A boat sticker (Spanish/English) highlighting the most important biosecurity measures needed to maintain a rat free vessel will be distributed to permitted operators that regularly use the waters near Desecheo including LE agencies, DNER, FURA, Coast Guard and dive operators. The sticker will also include specific instructions on how to report any sightings or suspicions.
- A pocket sized plastic card with a checklist (Spanish/English) highlighting the most important biosecurity measures will be distributed to USFWS staff, researchers, partners, agencies and organizations that have permission to visit the Island or have access to the adjacent waters. The card will also include images of tracks of the most likely non-native species to be introduced to the Island and specific instructions on how to report any sightings or suspicions.
- In order to keep local and federal agencies and other key groups informed of the Service's conservation efforts on Desecheo, a poster (Spanish/English) outlining the importance of biosecurity and emphasizing the conservation efforts will be created. These posters should be displayed in plain sight of USFWS staff and distributed to other partner agencies and organizations that have permission to visit the Island or have access to the adjacent waters. The poster will include the following information:
 - Importance of Biosecurity
 - Background of Desecheo Island
 - Conservation efforts: importance of removing invasive species/rat eradication
 - Long term benefits to the flora and fauna
 - How can you help us prevent future invasions? (key biosecurity measurements)

- Specific instructions on how to report any sightings or suspicions (POC)
- A brochure (Spanish/English) with a summary of the poster's information will also be prepared and distributed to partner agencies and organizations. In addition, these brochures will be provided to dive shops and other stores currently visited by people who operate boats; this will serve as a public outreach tool to educate the public about the Service's conservation efforts in Desecheo.
- A video production highlighting the biological assessments, planning, implementation, anticipated outcomes, ecological changes, importance of project partnerships and the benefits to trust species, non- trust species, and ecosystem services.
- All materials will be uploaded to the Desecheo NWR official webpage to orient and educate the virtual audience.
- The official USFWS sign indicating that Desecheo is a National Wildlife Refuge will be prepared; with this sign the boat operators and other visitors that use the waters near Desecheo will know that the Island is a National Wildlife Refuge and that access is restricted to the general public.
- A second sign summarizing the most important biosecurity measures that should be followed by permitted visitors and staff will be displayed at the Island.

Section 2. Biosecurity Management Standard Operating Procedures for Staff & Visitors to Desecheo National Wildlife Refuge

General Protocols

- A Biosecurity Officer role is to be assigned to one staff or field team member for each visit to Desecheo. This person is responsible for implementing the “Desecheo Island Biosecurity Plan” and to ensure all visitors to Desecheo adhere to the biosecurity protocols.
- The Biosecurity Officer will brief all visitors to Desecheo on biosecurity protocols.
- The Biosecurity Officer will be responsible for maintaining any biosecurity monitoring in place on Desecheo Island, and for checking monitoring equipment on-island.
- The Biosecurity Officer will ensure that any vehicles (boats, helicopters) going to Desecheo Island are inspected for animals and seeds prior to loading and before departure. Larger boats have a greater chance of harboring rodents. It may be necessary to implement rodent control measures (such as bait stations) well in advance of departing for the island.
- When contracting or chartering boats, agreements should include the right to inspect the vehicle and/or require necessary preventative measure be in place.
- The Biosecurity Officer will ensure that all cargo is inspected immediately before loading onto the boat/helicopter. Particular attention will be placed on high-risk cargo such as food, timber, fabric, and other items that may attract or hide non-native species. All food will be packed in rodent-proof containers.
- All small cargo will be packed in rodent-proof containers.
- All boxes, containers, bags, etc. will be closed tightly /sealed to minimize opportunities for animals to hide inside.
- All cargo, clothing, boots etc. must be clean and free of invertebrates, mud, debris and seeds. Even items that “look clean” can harbor seeds and small invertebrates such as the cactus mealybug.
- Items including clothes, backpacks, sleeping bags, etc. should be freshly washed and not worn or used elsewhere prior to travelling to the island.
- Any observations or signs of non-native species on Desecheo Island will be immediately reported to the designated Biosecurity Officer or the Caribbean Islands NWR Office. Record as much detailed information about the observation/sign as possible. Take photos and collect any sign (e.g. scat) for analysis.

Protocols for Packing Equipment and Supplies

- **Common modes of unintentional transport of non-native species include:**
 - Avoid utilizing used shoes, clothing, soft sided bags ; ud, dirt, seeds, insects etc. could be attached in treads, soles, laces, seams, cuffs, pockets, and folds.
 - Avoid clothes or other equipment with Velcro or fabrics with similar textures that could trap and hold seeds.
 - Fumigate the equipment to kill insect pests prior to departure.

- Do not use corrugated cardboard to store food or equipment (older cardboard represents a higher risk).
- Remain vigilant at all times especially when handling cargo.

- **Protocols for packing personal gear:**

- Clean and inspect all clothing, shoes, and fabrics.
- Physically remove all traces of mud and seeds.
- For soft items, if difficult to clean entirely, place in a freezer for 48 hours before leaving for the island.
- Pack all items at one time; do not leave bags/boxes open overnight or for an extended time period as this is when invertebrates, geckos, and seeds can enter. Securely close each bag/container after each item is added.
- Once packed, place a strip of duct tape across the opening of the bag with the current date to indicate that it has been checked and is ready for transport.
- Avoid opening your bag before arriving on Desecheo.
- Pack bags/boxes/containers in a clean, preferably enclosed, area away from the risk of wind-blown seeds, and insects. Packed bags should be placed in a designated area away from the threat of collecting seeds, invertebrate, and reptile pests.

- **Protocols for packing camping equipment and supplies:**

- Ensure that totes are completely clean, check that seeds, geckos, and invertebrates are not hidden in grooves of the lid/handles.
- Pack each tote, bucket, or Action Packer at one go.
- Securely replace the lid on the tote after each item is packed inside.
- Once packing is complete, secure lid, seal shut with duct tape, and label each tote with the current date on the outside as complete. If needed, attach inventory to outside of tote.

- **Protocols while on-island**

- The helipad provides a good opportunity to see and capture any unintentional escapes during unpacking. Gear should be unpacked in the open on the helipad. If anything is found while unpacking, capture and dispose of it. If possible, a can of insect spray should be available to deal with any invertebrates that may be found while unpacking.
- Rodent bait stations and/or traps should be maintained around the point of entry or the duration of the visit.
- Waste and food management at the camp is very important to reduce the chances of rodents, invertebrates, or plant pests from establishing on the island if they

arrive accidentally. Taking fruits and vegetables with small seeds that could establish, such as papaya, tomatoes, fresh chili, should be discouraged.

Protocols for Waste Disposal on Desecheo Island

If a rat or mouse accidentally arrives on Desecheo, human food sources such as garbage, food scraps, and perishable food items increase the chances of the animal becoming established on the island. In addition, non-native fruits such as papaya, and insects such as fruit flies and weevils, could be introduced. For this reason, all waste food and food containers must be collected in garbage bags, sealed, and removed from the island. In addition, the campsite, especially the kitchen area, must be kept clean and all food scraps removed from the ground and the stove.

- All garbage including waste/unused perishable food **MUST** be removed from the island.
- All garbage and waste perishable food must be collected on-island in sealed garbage bags, inside rodent proof containers (i.e. sealed garbage bins).
- Ensure that all totes/Action Packers containing food are sealed tightly with lids in place; tinned food is the only packaging that rats *cannot* chew into.
- Routine inspections will occur daily to assess if all rodent proofing barriers remain intact and in functional condition; signs of rodent activity will result in additional baiting actions (hand-spread or bait stations, depending on type and location of sign) in the vicinity.
- Ensure that no food items or food wrappers remain in your backpack at night, remove to a sealed tote.
- Do not discard any foodstuffs, empty food containers/tins/packaging into vegetation or into the sea on Desecheo (e.g. do not throw your banana skin into the bush after eating); portable sealed rodent-resistant containers will be provided to all staff on island as a receptacle for these items.
- For used dishes and kitchen utensils, scrape all remaining food into garbage bags and/or wipe with kitchen paper then wash.
- After use, pour washing water through a colander/sieve to collect all food scraps before disposing of the water; dispose of food scraps in garbage bag.
- Ensure that all kitchen utensils, pots, pans etc. are cleaned after each meal and packed in totes.
- Clean-up and dispose of food scraps on the ground and keep the stove clean.
- Maintain a clean and hygienic camp.
- All staff are to remain vigilant and take action to identify waste disposal risks and remove food sources where identified.

- **Camp bathroom facilities**

Rats will use human excrement as a food resource. For this reason, toilet facilities that ensure that all human waste is collected and removed from the island should be utilized. In addition field staff should be encouraged to use the toilet facilities at the field camps at the beginning of each day before hiking out onto the island. Human waste deposited elsewhere on the island will be an additional food source for rats. If it is necessary to use bushes/vegetation on your rest stop, cover completely any excrement with rocks and/or soil.

Also note that using the camp toilet reduces the risk of introducing plants to Desecheo; excrement is a nice fertilizer package for any seeds that may have eaten (tomatoes, papaya etc.)

After the trip:

- Biosecurity is important in both directions, to ensure nothing is carried from Puerto Rico to Desecheo but also to ensure that nothing is carried from Desecheo to Puerto Rico or the next field site. On return, all clothes should be washed, and boots and equipment should be thoroughly cleaned.

We would like to thank you for your participation in this program; your efforts will ensure that Desecheo NWR remains an important sanctuary for its native and endemic biodiversity, and a significant legacy for Puerto Rico and the Caribbean.

Biosecurity Management Checklist

Please use the checklist to confirm that you have carried out the requires protocols

Items/Actions	Required action	Check
Communications	Has a Biosecurity Officer been assigned for our trip?	
Packs, bags, and containers	Have I emptied all packs, bags and containers and inspected them before packing other items inside?	
Clothing and footwear	Are my clothes and boots completely clean of mud, debris and seeds? Pay extra attention to the soles, seams, laces, and nockets.	
Food	Has all food been inspected and packed in a rodent proof container (e.g. hard sided and closes tightly)?	
Other Equipment	Have I thoroughly cleaned and inspected all gear to ensure it is free of biosecurity risks?	
	Have I packed all possible gear into containers that closes tightly (e.g. rodent proof containers, contractor	
Freezing/Fumigation	Have I frozen all appropriate gear for 48 hours or fumigated prior to going out to island? This is especially critical for gear that has been used at other locations	
Vehicles	Has my transportation (e.g. boat) been cleaned and inspected for the presence of biosecurity	
	If using a larger boat, does it have biosecurity measures such as traps or bait stations in place? If so have they been maintained and checked? Am I confident my vessel is rat free?	
Waste Management	Do we have the appropriate garbage and human waste disposal facilities.	
Other	Does this trip have any special biosecurity risks or concerns? If so, have they been addressed sufficiently?	
After the trip	Have all items returning to the Cabo Rojo NWR storage been cleaned, inspected, and properly	

Section 3. Biosecurity Management Standard Operating Procedures for Annual Assessments of Non-native Species on Desecheo National Wildlife Refuge

Island biosecurity refers to the policies and protocols designed to protect island ecosystems from the threat of invasive species. Invasive species are responsible for the majority of extinctions on islands. Historically, Desecheo Island has been greatly impacted by invasive species. Restoration of Desecheo through the removal of invasive species has been ongoing since the 1980s. These restoration efforts will allow the island to return to its role as a major breeding ground for seabirds. In order to maintain the benefits of these efforts, it is critical to prevent further introductions of non-native species. Rats, mice, mongoose, the *Harrisia* cactus mealybug, and weeds pose the greatest threats to Desecheo, but any non-native species including species that are native to Puerto Rico but not found on Desecheo have the potential of causing damage. A single lapse in biosecurity has the potential to undo decades of restoration work. The following information provides the biosecurity management SOP that will be followed by the staff assigned to conduct the annual assessment of non-natives on the Island.

To secure the longevity of the native biota on Desecheo and ensure that the island is maintained as an invasive-free island, annual assessments for non-native species will be conducted. These assessments will provide confidence that the biosecurity protocols developed are in place and allow the FWS to make informed decisions about response actions if non-native species are detected.

Personnel

- The Service will assign 3 people to conduct the annual assessment.
- The staff assigned will have some experience detecting the non-native species most likely to invade Desecheo, particularly rodents, the *Harrisia* cactus mealybug.
- The staff will stay for three days or more on island to give the described methods sufficient time to detect the presence of non-native species.
- The staff will follow the Biosecurity Management SOP for staff & visitors already established to effectively communicate good biosecurity practices.
- This assessment will be combined if possible with other assessments of Desecheo's biota or a rapid deployment response to maximize cost and staff efficiency.

Methodology

Rodents

Chew Tags

Chew tags are an excellent tool for detecting rodents. The tags can be easily made by cutting sturdy corrugated plastic sheets into one inch squares and then injecting candied peanut butter into one edge to act as an attractant. Chew tags can be made in advance and taken along on any extended trips to the island. For short term deployment, plain peanut butter can be used.

- Chew tags will be placed around landing points, camp, along trails being used with a primary focus on key rodent habitat. These will be elevated on small stakes or wired to rocks and trees to inhibit access by crabs.

- Chew tags showing evidence of chewing will be kept by the staff. Afterwards, chew marks should be analyzed by an expert in identifying rodent chew marks.
- If a formal monitoring program is put in place, additional tools such as traps, bait stations, and tracking tunnels will be used.

Traps

Traps are an efficient method to detect and capture rodents. A variety of traps and bait types will be used to maximize the chances of capturing rodents. The monitoring team will aim to place a total of 100 – 200 traps/night per assessment.

- Traps will be placed around landing points, camp, along trails being used with a primary focus on key rodent habitat
- Traps will be placed in locations with plenty of natural cover, and where animals are likely to be active.
- Additional traps will be located near any footprints or scat.
- Traps will be covered and/or placed in locations (e.g. attached to tree limbs) that reduce the chance of interference by non-targets.
- Snap traps will only be set as active at night to minimize impacts and interference by non-targets.
- Bait traps with known attractants: the team will check all traps and bait stations daily or every other day (peanut butter mixed with rolled oats makes good rodent bait).
- Detailed records of the assessment will be kept and any signs will be recorded and analyzed.
- If possible DNA will be collected from any animals removed; DNA analysis may help determine source population.

Invertebrates

- The HCM can only be detected through direct surveying by experienced personnel.
- Inspections of columnar cacti on Desecheo Island would be adequate to detect and take appropriate action.
- The infected area will be cut and placed in a Zip-lock bag labeled with date, cactus species it was found on, area of the island it was found and GPS coordinates
- Samples will be sent to USDA for identification and confirmation.

Multispecies

Cameras

- Camera traps are able to detect a variety of animals, and 5 – 10 cameras will be placed around the helipad and Puerto de los Botes.
- Cameras will be baited with a variety of attractants and lures to maximize the potential of detecting different species.

Sign Search

- Pocket sized plastic cards with the images of tracks of the most likely non-native species to be introduced to Desecheo will be prepared.
- Sign search will be conducted around landing points, camp, and along trails being used.

- Sign search will also be conducted at night with spotlights to search for nocturnal species.

Equipment

Item	Quantity
Photocopies of map for writing on	5
Copy of Desecheo Island Biosecurity Plan	1
Copy of instructions on how to monitor using items in kit	5
Copy of locations of long term monitoring tools (if applicable)	5
Copy of user's manuals of any applicable monitoring tools	1 for each item
Key to identifying likely invaders	5
Waterproof notebooks	5
Zip-lock bags	200
Pens/pencils	10
Permanent markers	10
Disposable gloves	50
GPS unit and spare batteries	2
Colored Flagging	5 rolls
Replacement blocks for bait stations	Enough to meet needs
Insect spray	1
Rodent proof container to hold kit	1
Headlamps/spotlights for nighttime searches	3-5
Camera traps	10
SD Cards	10
AA Batteries	Enough to meet needs
Snap traps (deploy only at night, rat and mouse sizes)	20
Cage traps (Tomahawk size 201 for rats)	10
Elliott traps (Sherman SFAL folding for mice)	10

Section 4. Biosecurity Management Standard Operating Procedures for Incursion Response

Island biosecurity refers to the policies and protocols designed to protect island ecosystems from the threat of invasive species. Invasive species are responsible for the majority of extinctions on islands. Historically, Desecheo Island has been greatly impacted by invasive species. Restoration of Desecheo through the removal of invasive species has been ongoing since the 1980s. These restoration efforts will allow the island to return to its role as a major breeding ground for seabirds. In order to maintain the benefits of these efforts, it is critical to prevent further introductions of non-native species. Rats, mice, mongoose, the *Harrisia* cactus mealybug, and weeds pose the greatest threats to Desecheo, but any non-native species including species that are native to Puerto Rico but not found on Desecheo have the potential of causing damage. A single lapse in biosecurity has the potential to undo decades of restoration work. The following information provides the biosecurity management SOP that will be followed by the designated incursion response team.

Roles and Responsibilities

FWS Project Leader

- Maintain a rapid response team and designate a Biosecurity Officer:
 - The team will consist of FWS staff with some experience detecting non-native species most likely to invade Desecheo. Staff involved with the eradication efforts at Desecheo and knowledgeable in monitoring methods will be preferred.
 - The team could be created through a contract with an outside firm, or a combination of contractors and FWS staff.
 - Ensure funding is in place to support at least 2 multiday response trips per year.
- Maintain regulatory compliance:
 - USFWS policy requires a Pesticide Use Proposal (PUP) before any federal action involving the application of pesticides. The FWS Project Leader should request a PUP annually in case it is necessary to apply a rodenticide.
- Ensure that pest control measures are actively in place around biosecurity supplies.
- Direct rapid response team response actions.

FWS Law Enforcement Supervisor

- Maintain good communication with law enforcement agencies.
- Coordinate placement of law enforcement cameras/sensors to detect human presence on the island.
- Prepare and maintain an invasive-species proof structure on Desecheo to store biosecurity related supplies and equipment such as rodent proof containers, traps, baiting stations etc.. Since part of the equipment will be already stored in the Island, this will facilitate a faster incursion response.
- Create and maintain a rapid response kit:
 - All non-perishable items will be acquired in advance and stored together in an easily accessible location (e.g. Desecheo storage facility, Refuge office).
 - A list of perishable items (i.e. peanut butter, oats) will be kept with the kit to facilitate purchasing these items before responding.
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Rapid Response Team

- Pre-establish location of monitoring and removal tools.
- Be on call to respond quickly to a high risk event.

Confirming the Incursion

- Any sightings or evidence of incursions will be confirmed before planning further response actions. If the evidence is unclear or an illegal landing has occurred, the assigned team will be sent to Desecheo with a variety of detection tools.
- Monitoring should include, but not be limited to, tools capable of removing any non-native species.
- Records of the circumstances surrounding the initial detection will be kept including the following: who detected the animal, location, date, time, method of detection, number of animals, and who the detection was reported to.
- Information gathered during this stage will be used when determining response.

Illegal landing information checklist

The following information will be collected by the FWS LE supervisor:

- Presence of boat on island
- Type of vessel
- Description of landing site
- Presence of animals brought aboard the boat
- Number of migrants
- Nationality of migrants
- Number of agencies and pathways involved
- Number of days migrants were on Desecheo
- Document the illegal landing with pictures and/or video

Response Actions

Illegal Landing

The following actions should be undertaken following a confirmed illegal landing on Desecheo:

- Place bait and Good Nature traps near the point of entry, Puerto de los Botes, and the helipad
- Conduct sign search in the point of entry looking for signs of high risk species that may have traveled with migrants.
- Place 1 – 2 cameras near the point of entry; these can be reviewed and collected during the annual assessment.
- Inspect carefully foreign articles such as clothing and back packs; these items could be a pathway for introduction of non-native species.

Confirmed Incursion

The following are recommended response actions following a confirmed incursion on Desecheo:

Rodents

- Use a variety of removal methods including bait stations, snap traps, cage traps, and/or hand broadcast of bait.
- Trapping and bait station grid should cover all habitat types across the island. Traps and bait stations should be placed at a higher density around key habitat and detection sites.
- All trap and bait station locations should be numbered, visibly marked, and mapped. Any member of the response team should be able to easily locate every location.
- Place traps in locations with plenty of natural cover, and where animals are likely to be active. Place additional traps near any footprints or scat.
- Traps should be covered and/or placed in locations (e.g. attached to tree limbs) that reduce the chance of interference by non-targets.
- Bait traps with known attractants: the team will check all traps and bait stations daily or every other day (peanut butter mixed with rolled oats makes good rodent bait).
- Keep detailed records; any sign should be recorded and analyzed.
- DNA should be collected from any animals removed; DNA analysis may help determine source population.
- Staff should continually search for sign and new trap locations.

Mammalian Predators

- A variety of trap types should be used including snares, foothold traps, conibear traps, and box traps. Exact size and trapping techniques will be dictated by the target animal. Experienced trappers must be employed to ensure the most effective placement and setting of individual traps.
- Hunting is an effective removal tool for many mammals. Night hunting including spotlights, thermal, and night vision technology should be used where possible particularly for evasive individuals.
- It is important to use experienced hunters; animals that are shot at and missed will become even more difficult to remove.

Reptiles and Amphibians

- Active search and capture of individuals by hand or using nets or nooses.
- Drift fences with funnel traps.
- Hunting with firearms or air guns.

Harrisia Cactus Mealybug

- Contact the lead botanists in USFWS, Dept. of Natural Resources of PR and the USDA to determine appropriate control measures.
- Continue to monitor other cacti and treat as necessary.

Recommended Equipment

The table below provides guidance on what items may be necessary for responding to an incursion. The kit can also serve as an example of what things may be necessary to implement a long term monitoring program on the island. Note that not all items will be needed for each incursion, the nature of the incursion will dictate what exactly must be taken.

Ideally, these supplies will be acquired in advance and stored at the Desecheo storage facility and/or Refuge office. However, many of the items can be purchased easily before a trip to the island however a delayed response to the site may be the result. Items that require greater lead time to source (e.g. 1” plastic squares for chew tags) should be obtained in advance.

Item	Quantity
Laminated map of Desecheo Island with likely incursion sights noted	1
Photocopies of map for writing on	5
Copy of Desecheo Island Biosecurity Plan	1
Contact information for experts in various species	1
Copy of locations of long term monitoring tools	5
Copy of user’s manuals of any applicable monitoring tools	1 for each item
Key to identifying likely invaders	5
Waterproof notebooks	5
Zip-lock bags	50
Pens/pencils	10
Permanent marker	10
Disposable gloves	50
GPS unit	2
Digital Camera	2
Colored flagging	5 rolls
Spare batteries	Enough to meet needs
Tape measure	1
Sharp knife	1
Various tools (pliers, wire cutters, hammers, spades, etc.)	
Radios/satellite phones for communication on island and with mainland	Enough for crew
Personal protective equipment needed for work (e.g. leather gloves, eye protection, earplugs)	Enough to meet needs
Insect spray	1-2
Rodent proof containers	Enough to meet needs
For rodents	
Corrugated plastic cut into 1” squares (sourced in advance)	1000
Supplies for making candied peanut butter (pan, peanut butter, sugar)	1
Spool of wire	1
Pin flags	500
Spotlight/headlamps for nighttime searches	1-5
Snap traps (rat and mouse sizes)	50
Cage traps (Tomahawk size 201 for rats)	50
Elliott traps (Sherman SFAL folding for mice)	50
Bait stations	50
Toxic bait	Enough to meet needs
For predators (specifics will vary by species)	
Spotlight	1 per hunter
Batteries for spotlight or a charger and generator	
Traps other than cage traps (such as leg-hold, conibear, and snare traps; exact	25

type/size will determined by target species)	
Cage traps (Tomahawk size 205 for mongoose, size 207 for cats)	25
Bait/lure (e.g. urine and catnip oil for cats, cat food or meat for mongoose)	Enough to meet needs
Firearms (if hunting is selected as a removal method)	1 per hunter
Ammunition	Enough to meet needs
Gun cleaning kit	1-2
For amphibians (specifics will vary by species)	
Funnel traps	72
Metal flashing to make drift fence (3'x15" segments)	270
Key to reptiles and amphibians	1
For <i>Harrisia cactus</i> mealybug	
Sharp knives/tools for cutting out tumors	3
Sprayer to apply pesticides	3