

## APPENDIX 3: Threats Assessment

Threat rating is a method for making an implicit assessment of threats more explicit and more objective. It involves determining and defining a set of criteria and then applying those criteria systematically to the direct threats to conservation targets so that conservation actions can be directed where they are most needed (FOS 2009). It is desirable to have a systematic and repeatable threat assessment, which may be updated as new information becomes available.

Many tools for threats rating assess the extent of the threat and the level of its impacts on the conservation targets (CMP 2020). We used the **Simple Threat Rating** system build into the Miradi (Version 4.5). This system involves assigning a category of the *relative magnitude and impact* of each direct threat to a target with a four-point qualitative scale (very high, high, medium, or low) using three criteria: scope, severity and irreversibility.

We applied the three criteria to threat-to-target threat combinations for all confirmed nesting sites and birds at sea. We relied on local or on-the-ground knowledge based on field observations or camera trap photographs, reports of grounded birds, or notes regarding towers or other hazards in the area. In the case of probable or suspected sites (no confirmation of nesting), threats rating is complicated because exact nesting sites are not characterized. However, scope and severity can be estimated in a general sense based on conditions of the island, the particular mountain ranges or even peaks where sites would most likely occur.

### Criteria

#### **Scope**

Most commonly defined spatially as the proportion of the target population that can reasonably be expected to be affected by the threat **within ten years** given the continuation of current circumstances and trends. The criteria for rating scope are as follows:

- Very High, affecting most or all of the target (e.g., 71-100%);
- High, affecting much of the target (e.g., 31-70%);
- Medium, affecting some of the target (e.g., 11-30%); or
- Low, affecting just a small percent of the target (e.g., 1-10%).

#### **Severity**

*Within the scope*, the level of damage to the target from the threat that can reasonably be expected given the continuation of current circumstances and trends. For ecosystems and ecological communities, typically measured as the degree of destruction or degradation of the target within the scope. For species, usually measured as the degree of reduction of the target population within the scope. Seabirds based on general life parameters (long-lived, slow to reproduce) we know that threats affecting adult and subadult survival have greater impact than those affecting egg and small chick success and first year survival.

- Very High: Within the scope, the threat is likely to destroy or eliminate the target, or reduce its population by 71-100% within ten years or three generations.

- High: Within the scope, the threat is likely to seriously degrade/reduce the target or reduce its population by 31-70% within ten years or three generations.
- Medium: Within the scope, the threat is likely to moderately degrade/reduce the target or reduce its population by 11-30% within ten years or three generations.
- Low: Within the scope, the threat is likely to only slightly degrade/reduce the target or reduce its population by 1-10% within ten years or three generations.

**Irreversibility**

The degree to which the effects of a threat can be reversed and the target affected by the threat restored, if the threat no longer existed.

- Very High: The effects of the threat cannot be reversed and it is very unlikely the target can be restored, and/ or it would take more than 100 years to achieve this.
- High: The effects of the threat can technically be reversed and the target restored, but it is not practically affordable and/or it would take 21-100 years to achieve this.
- Medium: The effects of the threat can be reversed and the target restored with a reasonable commitment of resources and/or within 6-20 years.
- Low: The effects of the threat are easily reversible and the target can be easily restored at a relatively low cost and/or within 0-5 years.

Combining Criteria and Summarizing Across Threats

Once assigned, the ratings for scope, severity and irreversibility were combined using established rule sets (an automated process in Miradi) to give an overall rating for each threat-target combination, which are then summarized across all threats and across all targets.

The rule sets for combining criteria involve first combining the Scope and Severity variables to assess magnitude, then combining that with Irreversibility to derive the threat-target rating:

		Scope			
		Very High	High	Medium	Low
Severity	Very High	Very High	High	Medium	Low
	High	High	High	Medium	Low
	Medium	Medium	Medium	Medium	Low
	Low	Low	Low	Low	Low

		Irreversibility			
		4-Very High	3-High	2-Medium	1-Low
Magnitude	4 -Very High	4-Very High	4-Very High	4-Very High	3-High
	3-High	4-Very High	3-High	3-High	1-Low
	2-Medium	3-High	2-Medium	2-Medium	1-Low
	1-Low	2-Medium	1-Low	1-Low	1-Low

Miradi also provides a combination of rules for rolling up ratings across targets and threats, and for the project as a whole. We chose not to present roll-ups because of the varying level of uncertainty in threats at sites.

Tables A3-1 and A3-2 present the ratings and justifications for threats by target.

**Table A3-1 On-Land Threat Ratings and Justifications**

Threat	Overall Miradi	Scope	Severity	Irreversibility
<b>Site: Loma del Toro</b>				
<b>Justifications based on interviews with Ernst Rupp and Adam Brown, April 21 and 22, 2020 with supplemental comments inserted June 24, 2020.</b>				
Agriculture (meaning planted crops farming)		Not Occurring (N/O) and unlikely to occur. Currently, agriculture into this part of park is very hypothetical as are other incursions.	N/O	N/O
Fire (damaging habitat, but also some mortality in nests or adults)	Low	MEDIUM: Fires have been sweeping through, but only every few years. Conceivably up to a third of nests affected in an event.	MEDIUM: Damage depends on timing (birds in burrows) and severity of fire. "On average," effects could be moderate degradation of target.	LOW: Habitat typically heals pretty quickly e.g., big pines survive, if seed bank present, vegetation back within a few years. Fire may actually be part of ecosystem/germination.
Livestock grazing		N/O. Not occurring and unlikely to occur.	N/O	N/O
Non-timber Forest Product collection		N/O. Not occurring and unlikely to occur.	N/O	N/O
Harvest by humans		N/O. Not occurring and unlikely to occur.	N/O	N/O
Predation by introduced mammals - cats	High	HIGH: Cats are present but not abundant (usually one cat at a time). No mongoose yet seen; no pigs probably because of human presence.	HIGH: Impact being studied... presence has been linked to complete loss at other sites. Lack of data about severity of predation; defaulted to "high" based on studies of other petrel species (Rodríguez et al. 2019)	MEDIUM: Reversibility depends on petrel productivity, which is generally slow; moreover, cats known to take older age classes (Le Corre 2008).
Predation by introduced mammals - rats	High	VERY HIGH: <i>Rattus rattus</i> is everywhere, potentially visiting every nest.	HIGH: Observations so far indicate that the effects are low, but collecting data now with camera traps. Lack of data about severity of predation; defaulted to "high" based on studies of other petrel species.	LOW: Reversibility depends on petrel productivity, which is generally slow. Chicks replaced more easily than adults.
Strandings in populated areas due to light attraction	Medium	All transiting birds are exposed to lights on the coasts; how much depends on exact route (e.g., Pederenales, DR (well lit up) or Belle Anse (not producing much light).	MEDIUM: Severity hard to know as all reporting is incidental. Expect that there are more downed birds than are found.	MEDIUM: Losses believed mostly to fledglings, which have a lower survival rate generally (losses are likely compensatory). (Rodríguez et al. 2017)
Towers/structures mortality	High	HIGH: Site has a lighted tower that majority of the birds must navigate.	HIGH: In fogs and winds, 1 - 3 downed birds each year.	MEDIUM: Adult losses might be rarer (occurring mostly during foul weather) than for fledglings. Fledglings have a lower survival rate generally (losses are likely compensatory).
Wood harvest		Not Occurring (N/O) and unlikely to occur.	N/O	N/O
<b>Site: Morne Vincent</b>				
<b>Justifications based on interviews with Ernst Rupp and Adam Brown, April 21 and 22, 2020 with supplemental comments inserted June 24, 2020.</b>				
Agriculture - Current	Low	LOW: Activities and conditions of the last 10 years have stopped agricultural movement in monitored area. With intervention, threat greatly reduced and the number of occupied nests seems stable.	MEDIUM: Farming practices generally very destructive, if it occurred, would affect excavated nests (in soil, not stone) particularly.	MEDIUM: The decreased quality of nesting habitat could be reversed, but with soil quality damaged and vegetation removed, restoration would take 6-20 years.

Agriculture with no intervention 10 years ago	Very high	HIGH: Without intervention, likely agriculture would have spread and been very destructive in the monitored area. In a nearby area: looking back the last 9 years, Rupp estimates the loss of 20 to 50 nests on what was likely former petrel habitat. (Basically, the amount lost equal to the amount remaining).	VERY HIGH: Nests can hold on in grazed areas (just grassy cover) but eventually these burrows won't persist in areas overrun by agricultural effort (row crops).	VERY HIGH: Once the area is severely degraded, it would take a lot of effort to restore it to any kind of ecological function. The nesting site is "lost." Adults could attempt to find new locations, but unknown amount of energy to re-nest.
Fire (damaging habitat, mortality in nests)	Low	MEDIUM: Fires have been sweeping through, but only every few years. Conceivably up to a third of nests affected in an event.	MEDIUM: Damage depends on timing (birds in burrows) and severity of fire. "On average," effects could be moderate degradation of target.	LOW: Habitat typically heals pretty quickly e.g., big pines survive, if seed bank present, vegetation back within a few years. Fire may actually be part of ecosystem/germination.
Livestock grazing	Low	LOW: Some grazing, but livestock don't seem to be going in the steepest part where nests are.	LOW: Grazing not on itself damaging but could be a step towards full clearing.	MEDIUM: The decreased quality of nesting habitat could be reversed, but with soil quality damaged and vegetation removed, restoration would take 6-20 years.
Non-timber Forest Product collection	Low	HIGH: Wild tubers gathered.	LOW: No direct effects on petrels' needs, unless actual burrow damaged.	MEDIUM: Damaged burrow may be unused for years.
Harvest by humans		Not occurring (N/O). In the past, people went looking for petrels, but this stopped some time ago. Haven't really seen it happening 10 years.	N/O	N/O
Predation by introduced mammals - cats	High	HIGH: Cats are present but not abundant (usually one cat at a time). No mongoose yet seen; no pigs probably because of human presence.	HIGH: Impact being studied... presence has been linked to complete loss at other sites. Lack of data about severity of predation; defaulted to "high" based on studies of other petrel species (Rodríguez et al. 2019)	MEDIUM: Reversibility depends on petrel productivity, which is generally slow; moreover, cats known to take older age classes (Le Corre 2008).
Predation by introduced mammals - rats	High	VERY HIGH: <i>Rattus rattus</i> is everywhere, potentially visiting every nest.	HIGH: Observations so far indicate that the effects are low, but collecting data now with camera traps. Lack of data about severity of predation; defaulted to "high" based on studies of other petrel species.	LOW: Reversibility depends on petrel productivity, which is generally slow. Chicks replaced more easily than adults.
Strandings in populated areas due to light attraction	Medium	HIGH: All transiting birds are exposed to lights on the coasts; how much depends on exact route (e.g., Pedernales, DR (well lit up) or Belle Anse (not producing much light).	MEDIUM: Severity hard to know as all reporting is incidental. Expect that there are more downed birds than are found.	MEDIUM: Losses believed mostly to fledglings, which have a lower survival rate generally (losses are likely compensatory). (Rodríguez et al. 2017)
Towers/structures mortality	High	HIGH: Site has a lighted tower that majority of the birds must navigate.	HIGH: In fog and wind, 1 - 3 downed birds each year.	MEDIUM: Adult losses might be rarer (occurring mostly during foul weather) than for fledglings. Fledglings have a lower survival rate generally (losses are likely compensatory).
Wood harvest	Low	HIGH: Wood harvest here is primarily women and children collecting deadwood, axing down some bushes, chipping on the pine trees for fire starting. It's widespread.	LOW: Will ultimately kill trees, but does not directly harm the petrel habitat requirements. (Danger is if people are accompanied by dog. )	MEDIUM: Damaged woody growth takes a while to recover and collectors aren't likely to ease up. Growth of new trees is slow.
Site: Loma Quemada		Justifications based on interviews with Ernst Rupp and Adam Brown, April 21 and 22, 2020 with supplemental comments inserted June 24, 2020.		

Agriculture		Not Occurring (N/O) and unlikely to occur.	N/O	N/O
Livestock grazing (in this case, feral pigs).	High	VERY HIGH: Wild pigs -- rooting up large areas the soil looking for yams, insects, etc. Human presence in park is mostly pig hunters	HIGH: May have limited petrel populations in the past. Lack of data about severity of pig rooting damage; defaulted to "high" in Miradi.	MEDIUM: The decreased quality of nesting habitat could be reversed, but with soil quality damaged and vegetation removed, restoration would take 6-20 years. Legal pig hunting is feasible and would prob. be effective.
Harvest by humans		Not Occurring (N/O) and unlikely to occur.	N/O	N/O
Fire (damaging habitat, mortality in nests)	Medium	MEDIUM: Fires popping up - fire risk similar to Loma del Toro, maybe less.	MEDIUM: Damage depends on nature of fire.	MEDIUM: Broadleaf takes longer to recover. (Based on observations from nearby fire 15 years ago).
Non-timber Forest Product collection		Not Occurring (N/O) and unlikely to occur.	n/a	n/a
Predation by introduced mammals - cats	High	HIGH: Higher frequency of cats than Loma del Toro, but abundance unknown (usually see one cat at a time).	HIGH: Impact being studied... presence has been linked to complete loss at other sites. Lack of data about severity of predation; defaulted to "high" based on studies of other petrel species (Rodríguez et al. 2019)	MEDIUM: Reversibility depends on petrel productivity, which is generally slow; moreover, cats known to take older age classes (Le Corre 2008).
Predation by introduced mammals - rats	High	VERY HIGH: <i>Rattus rattus</i> is everywhere, potentially visiting every nest.	HIGH: Observations so far indicate that the effects are low, but collecting data now with camera traps. Lack of data about severity of predation; defaulted to "high" based on studies of other petrel species.	LOW: Reversibility depends on petrel productivity, which is generally slow. Chicks replaced more easily than adults.
Strandings in populated areas due to light attraction	Medium	HIGH: Transiting birds encounter wind farm at base of flyway, coming over towns with lights.	MEDIUM: Severity hard to know as all reporting is incidental. Expect that there are more downed birds than are found.	MEDIUM: Losses believed mostly to fledglings, which have a lower survival rate generally (losses are likely compensatory). (Rodríguez et al. 2017)
Towers/structures mortality		Not Occurring (N/O) and unlikely to occur. No lights/towers in breeding area.	n/a	n/a
Wood harvest		Not Occurring (N/O) and unlikely to occur.	n/a	n/a
<b>Site: Valle Nuevo</b>		<b>Justifications based on interviews with Ernst Rupp and Adam Brown, April 21 and 22, 2020 with supplemental comments inserted June 24, 2020.</b>		
Invasive fern species (unique to Valle Nuevo)	Low	LOW: Guess - low. Spatial extent not mapped.	HIGH: Heavy thickets, sticky paste, out-compete other plants, bad for petrels. Spread with fire.	MEDIUM: Petrels who have left might return; immatures might come to prospect?
Agriculture	Low	LOW: Farming close (not as close as Morne Vincent, but is going on.) Intensive strawberry, root crops farming in the past, could come back.	MEDIUM: Agriculture may have reduced nests nearby; terrain may provide some protection for remaining nests. June: Valle Nuevo is more difficult to judge, since there should be more active nesting sites than presently known.	MEDIUM: The decreased quality of nesting habitat could be reversed, but with soil quality damaged and vegetation removed, restoration would take 6-20 years.
Harvest by humans		Not Occurring (N/O) and unlikely to occur.	N/O	N/O
Fire (damaging habitat, mortality in nests)	Medium	LOW: Fire speeds fern invasion, which affects petrel habitat requirement (access to ground). So guess of low, based on spatial extent of ferns.	HIGH: Heavy thickets, sticky paste, out-compete other plants, bad for petrels. Spread with fire.	MEDIUM: Based on fern eradication, above.

Livestock grazing		Not Occurring (N/O) and unlikely to occur.	N/O	N/O
Non-timber Forest Product collection	Low	LOW: Complex situation - when commercial farms are active, rely on migrant workers, who may extract from forest. Commercial farms not currently active.	LOW: Will ultimately thin vegetation or cause other damage, but does not directly harm the petrel habitat requirements. (Danger is if people are accompanied by dog. )	MEDIUM: Damaged broadleaf takes a while to recover.
Predation by introduced mammals - mongoose	High	HIGH: Mongoose seen, documented. Maybe cats, but not seen. No pig sign.	HIGH: Impact being studied... presence has been linked to complete loss at other sites. Lack of data about severity of predation; defaulted to "high" based on studies of other petrel species.	MEDIUM: Reversibility depends on petrel productivity, which is generally slow; moreover, mongoose known to take older age classes.
Predation by introduced mammals - rats	Medium	VERY HIGH: Rattus rattus is everywhere, potentially visiting every nest.	HIGH: Observations so far indicate that the effects are low, but collecting data now with camera traps. Lack of data about severity of predation; defaulted to "high" based on studies of other petrel species.	LOW: Reversibility depends on petrel productivity, which is generally slow. Chicks replaced more easily than adults.
Strandings in populated areas due to light attraction	Medium	HIGH: Most pass Ocoa (bigger town of 82,000) to big bay. Big highway, lots of disturbance on coast.	MEDIUM: Severity hard to know as all reporting is incidental. Expect that there are more downed birds than are found.	MEDIUM: Losses believed mostly to fledglings, which have a lower survival rate generally (losses are likely compensatory). (Rodríguez et al. 2017)
Towers/structures mortality		HIGH: Abandoned towers/antennas. 2600-m peak with antennas, no lights. No nests up that high. Not likely to come back on line.	N/O	N/O
Wood harvest	Low	LOW: Complex situation - when farms are active, rely on migrant workers, who may extract from forest.	LOW: Will ultimately kill trees, but does not directly harm the petrel habitat requirements. (Danger is if people are accompanied by dog. )	MEDIUM: Damaged woody growth takes a while to recover and collectors aren't likely to ease up. Growth of new trees is slow.
<b>Site: LaVisite - Tet Opak specifically</b>		<b>Justifications based on interviews with Ernst Rupp and Adam Brown, April 21 and 22, 2020 with supplemental comments inserted June 24, 2020.</b>		
Agriculture	Very high	HIGH: Based on 3 years evidence, estimate is 10 out of 42 nests have been severely impacted by encroachment.	VERY HIGH: Actually, nests holding on farmed areas (just grassy cover). Accompanying disturbance prob. low. However, eventually these burrows won't persist in areas overrun by agricultural effort (row crops).	VERY HIGH: Once the area is severely degraded, it would take a lot of effort to restore it to any kind of ecological function. The nesting site is "lost." Adults could attempt to find new locations, but unknown amount of energy to re-nest.
Fire on habitat.	Low	LOW: Yet to see a fire on the escarpment; no signs of fire.	MEDIUM: No data on this yet so rating is an estimate	HIGH: Damaging to broadleaf vegetation, and recovery efforts require a number of factors to converge (i.e. restoration could work if people re-located, there was adequate seed bank remaining in the soil, precipitation patterns were conducive.)
Livestock grazing	High	HIGH: On upper part of colony now but creeping down slope and up slope	HIGH: Grazing is a step towards full clearing. Exposes burrows.	HIGH: Once the area is degraded down to pasture, it would take a lot of effort to restore it to any kind of ecological function. The nesting site might be "lost." Adults could attempt to find new locations, but unknown amount of energy to re-nest.

Non-timber Forest Product collection	Medium	MEDIUM: Tree fern harvest identified as primary reason for entry - stumps and stacks.	LOW: Can cause mortality by blocking nests. Ratings based on guesses, three years data.	MEDIUM: Effects depends if chick or adults trapped and die. Restoration of degraded habitat could happen if tree fern nurseries, replanting.
Fire Mortality: Fires to expand agriculture or for celebrations (fatal attraction)	High	VERY HIGH: Incidents of adults attracted to fires right near nesting areas.	HIGH: Mortality event in 2019; 110 adults burned. 5 nests were abandoned after. Fires are in pine areas within a kilometer of nesting area.	MEDIUM: Reversing this threat is based on behavior change in human populations (seasonal clearing technique). Over time, maybe sustainable agriculture could be put in place to prevent lighting of fires in farmed areas.
Harvest by humans	Low	LOW: Haven't documented this but humans are farming in colony	MEDIUM: No education so people likely to take a petrel encountered.	LOW: Recovery extended if adults lost.
Predation by introduced mammals	High	VERY HIGH: Predators documented by camera trap at all nests monitored: cats, mongoose, black rats.	HIGH: Defaulted to high.	MEDIUM: Recovery depends on age class. Note: Is it possible this is a more manageable area, being more confined?
Strandings in populated areas due to light attraction	Medium	HIGH: Pass over Marigot, HT (estimate lesser light problem), Port-au-Prince (estimate larger light problem)	MEDIUM: Severity hard to know as all reporting is incidental. Expect that there are more downed birds than are found.	MEDIUM: Losses believed mostly to fledglings, which have a lower survival rate generally (losses are likely compensatory). (Rodríguez et al. 2017)
Towers/structures mortality	Low	LOW: Towers at Tet Kay Jak ~1km west from Tet Opak. Tower strikes documented at these towers in the past. Light altered.	MEDIUM: Mostly fledglings	LOW: Most egregious spotlight now removed.
Wood harvest	Medium	MEDIUM: Haven't seen yet but probably happening around because seeing charcoal piles	HIGH: Removal of woody vegetation is a step towards greater clearing.	MEDIUM: Damaged woody growth takes a while to recover and collectors aren't likely to ease up. Growth of new trees is slow.
<b>Site: Macaya</b>		<b>Interview with Anderson Jean, May 14, 2020</b>		
Agricultural encroachment	Very high	HIGH: No real farming up in petrel area now, but farming at the bottom of hill. Fires for clearing. Definitely getting closer.	VERY HIGH: Eventually burrows won't persist in areas overrun by agricultural effort (row crops).	VERY HIGH: Once the area is severely degraded, it would take a lot of effort to restore it to any kind of ecological function. The nesting site is "lost." Adults could attempt to find new locations, but unknown amount of energy to re-nest.
Harvest by humans		Not Occurring (N/O) and unlikely to occur. Not many people even know about the petrel; no one is seeking them out.	N/O	N/O
Fire (damaging habitat, mortality in nests)	Low	LOW: Most common fires are human activities, burn during dry season. Rain starts May and June. June and July will burn and plant beans, during fledging. But no evidence of wildfires up in suspected nest area.	MEDIUM: Guess. Damage depends on nature of fire.	HIGH: Guess. Broadleaf takes longer to recover.
Livestock grazing		Not Occurring (N/O) and unlikely to occur.	N/O	N/O
Non-timber Forest Product collection		Not occurring (N/O) No ferns or other non-timber products known to be collected.	N/O	N/O
Pig Damage	High	VERY HIGH: Now there are pigs (not mentioned in 1980s). Last visit, saw where they were rooting in the ground.	HIGH: May have limited petrel populations in the past. Severity of pig rooting damage unknown; defaulted to "high".	MEDIUM: The decreased quality of nesting habitat could be reversed, but with soil quality damaged and vegetation removed, restoration

				would take 6-20 years. Note: Legal pig hunting is feasible and would prob. be effective.
Predation by introduced mammals - cats	High	HIGH: Abundant, can see cats on walks at night.	HIGH: Impact being studied... presence has been linked to complete loss at other sites. Lack of data about severity of predation; defaulted to "high" based on studies of other petrel species (Rodríguez et al. 2019)	MEDIUM: Reversibility depends on petrel productivity, which is generally slow; moreover, cats known to take older age classes (Le Corre 2008).
Predation by introduced mammals - rats	High	VERY HIGH: Full suite of introduced predators there... high abundance of rats in Macaya, can see them swarming your camp. On trails up Pic Formon and La Selle... easy to see.	HIGH: Observations so far indicate that the effects are low, but collecting data now with camera traps. Lack of data about severity of predation; defaulted to "high" based on studies of other petrel species.	LOW: Reversibility depends on petrel productivity, which is generally slow. Chicks replaced more easily than adults.
Strandings in populated areas due to light attraction	Medium	HIGH: No strandings reported in nearby communities, the smaller towns at either end of the flyway have lights (though not like coming down from Massif la Selle... Jacmel and Port au Prince are dense population centers), buildings, towers.	MEDIUM: Severity hard to know as all reporting is incidental. Expect that there are more downed birds than are found.	MEDIUM: Losses believed mostly to fledglings, which have a lower survival rate generally (losses are likely compensatory). (Rodríguez et al. 2017)
Towers/structures mortality	Low	LOW: Towers and antennas are a great distance from Macaya, 15-20 km away. In general, this area has less technological development than other Haitian sites.	MEDIUM: Guessing mostly fledglings.	LOW: Recovery based on age class. Resources for recovery: Not as many hazards to deal with.
Wood harvest	High	VERY HIGH: Firewood, people cut trees for construction, housing, cooking/starter every day. Hardwood is the focus. In the past, there was a project with park rangers to mitigate number of trees cut; now, rangers not paid.	HIGH: Removal of woody vegetation is a step towards greater clearing.	MEDIUM: Damaged woody growth takes a while to recover and collectors aren't likely to ease up. Growth of new trees is slow.
<b>Site: Dominica</b>		<b>Interview with Adam Brown, May 13, 2020</b>		
Agriculture (meaning planted crops farming)		Not Occurring (N/O) and unlikely to occur. All on peaks; all in Park	N/O	N/O
Barn Owl		Information gap	n/a	n/a
Fire (damaging habitat, but also some mortality in nests or adults)		Not Occurring (N/O) and unlikely to occur. All on peaks; all in Park	N/O	N/O
Livestock grazing		Not Occurring (N/O) and unlikely to occur. All on peaks; all in Park	N/O	N/O
Non-timber Forest Product collection		Not Occurring (N/O) and unlikely to occur. All on peaks; all in Park	N/O	N/O
Pig rooting	Low	HIGH: Pigs definitely overlap with petrels; but people pig hunt already so density maybe not that high	MEDIUM: Pigs damage burrows and cause mortality.	LOW: Recovery depends on degree of damage to burrow.
Predation by humans		Not Occurring (N/O) and unlikely to occur. All on peaks; all in Park	N/O	N/O



Predation by introduced mammals - cats	High	VERY HIGH: No mongoose. All areas subject to these introduced animals.	HIGH: Impact being studied... presence has been linked to complete loss at other sites. Lack of data about severity of predation; defaulted to "high" based on studies of other petrel species (Rodríguez et al. 2019)	MEDIUM: Reversibility depends on petrel productivity, which is generally slow; moreover, cats known to take older age classes (Le Corre 2008).
Predation by introduced mammals - rats	High	VERY HIGH: No mongoose. All areas subject to these introduced animals.	HIGH: Impact being studied... presence has been linked to complete loss at other sites. Lack of data about severity of predation; defaulted to "high" based on studies of other petrel species.	MEDIUM: Reversibility depends on petrel productivity, which is generally slow. Chicks replaced more easily than adults.
Strandings in populated areas due to light attraction	Medium	HIGH: Documented but not often. Enough awareness that word would get out. Varied level of coastal development around island, but Roseau is at the head of lots of flyways.	MEDIUM: Severity hard to know as all reporting is incidental. Expect that there are more downed birds than are found.	MEDIUM: Losses believed mostly to fledglings, which have a lower survival rate generally (losses are likely compensatory). (Rodríguez et al. 2017)
Towers/structures mortality	Low	MEDIUM: 2015- towers mapped. On Flyways. Morne Micotrin has array. Near Morne Anglais. Below Morne Trois Piton. Estimated that 30% of population is exposed.	LOW: Birds rarely found.	LOW: Recovery depends on age classes harmed.
Wood harvest		Not Occurring (N/O) and unlikely to occur. All on peaks; all in Park	N/O	N/O
<b>Site: Guadeloupe</b>		<b>Interview with Adam Brown, May 13, 2020</b>		
Agriculture (meaning planted crops farming)		Not Occurring (N/O) and unlikely to occur.	N/O	N/O
Barn Owl		Wondering about their presence/effect	n/a	n/a
Fire (damaging habitat, but also some mortality in nests or adults)		Not Occurring (N/O) and unlikely to occur.	N/O	N/O
Livestock grazing		Not Occurring (N/O) and unlikely to occur.	N/O	N/O
Non-timber Forest Product collection		Not Occurring (N/O) and unlikely to occur.	N/O	N/O
Pig rooting	Low	HIGH: Guess - Ask Parc staff/Antoine	MEDIUM: A guess	LOW. Guess
Harvest by humans		Not Occurring (N/O) There is bird hunting in parks, but certainly not petrels.	n/a	n/a
Predation by introduced mammals - mongoose	High	VERY HIGH: Overrun by mongoose. Raccoons also widespread; possums?	HIGH: Impact being studied... presence has been linked to complete loss at other sites. Lack of data about severity of predation; defaulted to "high" based on studies of other petrel species (Rodríguez et al. 2019)	MEDIUM: Reversibility depends on petrel productivity, which is generally slow; moreover, cats known to take older age classes (Le Corre 2008).
Predation by introduced mammals - cats	High	VERY HIGH: All areas subject to these introduced animals, so assuming all nests.	HIGH: Impact being studied... presence has been linked to complete loss at other sites. Lack of data about severity of predation; defaulted to	MEDIUM: Reversibility depends on petrel productivity, which is generally slow; moreover,

			"high" based on studies of other petrel species (Rodríguez et al. 2019)	cats known to take older age classes (Le Corre 2008).
Predation by introduced mammals - rats	High	VERY HIGH: All areas subject to these introduced animals, so assuming all nests.	HIGH: Impact being studied... presence has been linked to complete loss at other sites. Lack of data about severity of predation; defaulted to "high" based on studies of other petrel species.	LOW: Reversibility depends on petrel productivity, which is generally slow. Chicks replaced more easily than adults.
Strandings in populated areas due to light attraction	Medium	HIGH: Big city on routes out to sea; no record of groundings (but very few birds).	MEDIUM: Severity hard to know as all reporting is incidental. Expect that there are more downed birds than are found.	MEDIUM: Losses believed mostly to fledglings, which have a lower survival rate generally (losses are likely compensatory). (Rodríguez et al. 2017)
Towers/structures mortality	Low	MEDIUM: Not mapped, but exist on flanks on flyways	LOW: Birds rarely found.	LOW: Recovery depends on age classes harmed.
Wood harvest		Not Occurring (N/O) and unlikely to occur.	N/O	N/O
<b>Notes</b>	<b>MIRADI/Conservation Standards Definitions:</b>			
Overall rating for introduced predators ultimately set at worst-case scenario (scope Very High, severity High, irreversibility Medium) regardless of site (which may differ in density of various predators).		Notes on Scope (used criteria in Miradi): Ranges of 1-10%, 11-30%, 31-70% and 71-%100.	Notes on Severity (used criteria in Miradi): Ranges of 1-10%, 11-30%, 31-70% and 71-%100.	Notes on Irreversibility (used criteria in Miradi, which is intended to look at reversibility of the effects, not the threat): Ranges of 1-5 years/low cost, 6-20 years/reasonable cost, 21-100 years/not affordable, 100+ years/can't be done.

**Table A3-2 At-Sea Threat Ratings and Justifications**

Threat	Overall Miradi	Scope	Severity	Irreversibility	Uncertainty
<b>Target: Breeding adults (spatial use: 70% Caribbean Sea, 30% Gulf Stream)</b>					
Depleted prey base *^	High	HIGH: The foraging areas for breeding adults (mostly southern Caribbean Sea) are limited in size (available habitat) and location (central-place foraging); upwelling processes in the southern Caribbean Sea are negatively impacted by climate change and show reduced upwelled nutrient, and fishery collapse (Taylor et al 2012). Oceanic processes in the NW Atlantic are also expected to shift as a consequence of climate change and may affect prey distribution and availability (see Target: Non-breeding adults and immatures). Therefore most individuals in the target population will be spatially impacted.	MEDIUM: Petrels may adjust to other prey if they are available, and be moderately affected by the threat. Under extreme scenario, death of breeding adults may occur as changes in prey quality can have substantial effects on body condition (e.g. shearwater die offs). Other effects of the threat may include decreased fitness, potentially decreased life expectancy. Reduced reproductive success is a consequence but does not directly affect the target.	VERY HIGH: The threat is pervasive and its effects (decreased life expectancy, potential mortality) cannot affectively be reversed by compensation measures at nest sites.	High
Plastic *	Medium	HIGH: Plastic pollution is diffuse and widespread in the marine environment. Relative debris density is low in the Caribbean Sea but higher in the western north Atlantic and enclosed Gulf of Mexico (Wilcox et al. 2015).	LOW: The effects of the threat are likely sublethal for self-feeding birds (here, breeding adults) but may result in reduced body condition, decreased fitness, reduced survival and shorter life expectancy. High exposure can be lethal. Reduced reproductive success is a consequence but does not directly affect the target.	VERY HIGH: The effect of the threat (decreased survival and life expectancy) cannot be reversed. Increased survival at nest sites could compensate the decreased survival due to the threat but with difficulty and over several generations. Other compensation measures at nest sites (higher nest site availability, predator control) could compensate reduced fitness and early loss of breeding adults by increasing recruitment but with difficulty and over several generations. Rate of improved recruitment may not compensate reduced survival.	Medium
Mercury *	Medium	HIGH: Breeding adults are expected to be spatially affected by mercury and methylmercury in the Caribbean Sea and Gulf Stream.	LOW: Concentrations of mercury in the southern Caribbean Sea are estimated to be on the lower spectrum (Semeniuk and Dastoor 2016). Bioaccumulation may occur in other areas such as Gulf Stream waters. The effects of the threat are likely sublethal for the target population (reduced fitness, reduced survival and shorter life expectancy) but high exposure can be lethal. Reduced reproductive success is a consequence but does not directly affect the target.	VERY HIGH: The effect of the threat (decreased survival and life expectancy) cannot be reversed. Increased survival at nest sites could compensate the decreased survival due to the threat but with difficulty and over several generations. Other compensation measures at nest sites (higher nest site availability, predator control) could compensate reduced fitness and early loss of breeding adults by increasing recruitment but with difficulty and over several generations. Rate of improved recruitment may not compensate reduced survival.	Medium
Other contaminants *	Medium	HIGH: In the southern Caribbean Sea, sources include O&G, shipping and agricultural runoff. We suspect that most breeding adults use the	LOW: The threat has likely sublethal effects on the target population but high exposure can be lethal (impact on survival in the lower spectrum).	VERY HIGH: The effect of the threat (decreased survival) cannot be reversed. Increased survival at nest sites could compensate the decreased	Medium

		Caribbean Sea for foraging, hence scope affecting >70% of population.	Other impacts may include decreased fitness. Reduced reproductive success is a consequence but does not directly affect the target.	survival due to the threat but with difficulty and over several generations. Other compensation measures at nest sites (higher nest site availability, predator control) could compensate reduced fitness and early loss of breeding adults by increasing recruitment but with difficulty and over several generations. Rate of improved recruitment may not compensate reduced survival.	
Oil spills (O&G, shipping) *	High	MEDIUM: The most likely area for breeding adults to encounter oil spills is discrete areas of the south Caribbean Sea, during foraging. If most breeders use the same foraging areas in the south Caribbean Sea, diffuse oil spills may potentially impact a medium proportion of breeding adults (11-30% in Miradi).	MEDIUM: The target population will be impacted through direct mortality. Sudden death of breeding adults will impact the population over several generations but proportion of reduction is difficult to estimate. Proportion of individuals affected is difficult to estimate but seems reasonable to expect 11-30% of population to be impacted. The number of oil platforms in foraging areas is limited (2-3 in extraction and <5 in exploration) but could increase in the future (Agencia Nacional de Hidrocarburos 2020).	VERY HIGH: The effect of the threat (acute mortality) cannot be reversed by compensation measures at nest sites. Increased fledging success could compensate early loss of breeding adults but with difficulty and over several generations. If low numbers of individuals are affected, improved adult survival at nest sites (predation control) and/or improved fledging success could compensate for early loss of breeding adults but it could take 20-100yrs to achieve this at the population level.	Medium
Attraction and/or Collisions with infrastructure *	Low	LOW: This is a discrete, point-source threat: in the south Caribbean Sea, 3 O&G platforms are in active extraction in areas used by petrels. More exploration platforms or ships are located in the area (<10). Lighted squid fishery present in that area could attract petrels.	LOW: Maybe medium. The target population will be impacted through direct mortality. Sudden death of breeding adults will impact the population over several generations but proportion of reduction is difficult to estimate. Proportion of individuals affected is difficult to estimate but seems reasonable to expect 1-10% of population to be impacted. The number of oil platforms in foraging areas is limited (2-3 in extraction and <5 in exploration); although it could increase in the future).	HIGH: The effect of the threat (direct mortality) cannot be reversed by compensation measures at nest sites. Increased fledging success could compensate early loss of breeding adults but with difficulty and over several generations. Low numbers of individuals affected suggest that improved adult survival at nest sites (predation control) and/or improved fledging success could compensate for early loss of breeding adults but it could take 20-100yrs to achieve this at the population level.	Medium
Fisheries bycatch *	Low	MEDIUM: Active international fisheries (including squid and longline) are present in the southern Caribbean Sea and overlaps somewhat with petrel foraging areas there. Local fisheries also present but unquantified. A medium scope can be expected.	LOW: No bycatch of petrels has been observed in US Atlantic fisheries. Pterodroma petrels are usually surface feeders and are not usually subject to bycatch in hook fisheries. Even considering differences in fisheries between Atlantic and Caribbean, it is reasonable to expect a low severity. The target population would be impacted through direct mortality.	HIGH: The effect of the threat (direct mortality) cannot be reversed by compensation measures at nest sites. Increased fledging success could compensate early loss of breeding adults but with difficulty and over several generations. Low numbers of individuals affected suggest that improved adult survival at nest sites (predation control) and/or improved fledging success could compensate for early loss of breeding adults but it could take 20-100yrs to achieve this at the population level.	Medium
Hurricane fallout *^	NA	Not Occurring (N/O) during the breeding season	N/O	N/O	NA

Target: Offspring: eggs to fledglings (spatial "use": same as their parents, unless specified otherwise)

Depleted prey base *^	High	HIGH: Similar to that of Breeding Adults.	MEDIUM: Depleted prey base may affect chicks more than adults: under feeding stress, adults may abandon chick. There may also be decreases in the provisioning rate or decreases in meal quality that can impact growth and survival.	VERY HIGH: The threat is pervasive and, although some of its effects (decreased fledging success) may be temporarily reversed, compensation measures will likely not be effective or be too expensive (supplemental feeding).	High
Plastic *	Medium	HIGH: Similar to that of Breeding Adults.	MEDIUM: The effects of the threat can be lethal for juveniles. Sublethal effects include reduced body condition, which is linked to lower fledging success.	HIGH: Similar to that of Breeding Adults. The effects of the threat (decreased fledging success) may be temporarily reversed by compensation measures but long-term effects on the population will not be compensated.	Low
Mercury *	Medium	HIGH: Similar to that of Breeding Adults - or higher, if pre-breeding females use contaminated areas outside the considered scope for Breeding Adults.	MEDIUM: Mercury in offspring may impact fetal development, reduce hatching success, reduce development success and impact fledging success. Rate and extent unknown. Developmental effects are difficult to quantify and failure to hatch or fledge may be due to other factors but 10-20% of the population affected seems reasonable.	HIGH: Similar to that of Breeding Adults. The effects of the threat (decreased fledging success) may be temporarily reversed by compensation measures but long-term effects on the population will not be compensated.	Medium
Other contaminants *	Medium	HIGH: Similar to that of Breeding Adults. Similar to that of Breeding Adults - or higher, if pre-breeding females use contaminated areas outside the considered scope for Breeding Adults.	MEDIUM: Developmental effects are difficult to quantify and failure to hatch or fledge may be due to other factors but 10-20% of the population affected seems reasonable.	HIGH: Similar to that of Breeding Adults. The effects of the threat (decreased fledging success) may be temporarily reversed by compensation measures but long-term effects on the population will not be compensated.	Medium
Oil spills (O&G, shipping) *	Medium	MEDIUM: Similar to that of Breeding Adults.	HIGH: Similar to that of Breeding Adults. Direct mortality of adults may induce the death of their offsprings: if parent(s) die, then chick mortality is probable (e.g., chicks may fledge if near to fledging age and single parent can provision final meal(s)). With one offspring per pair, the size of the offspring population is half the size of the adult population, therefore the proportion of offsprings being affected is higher. Also, the reduction of population of breeding adults will impact the subsequent populations of offsprings (number of offsprings produced) at a higher rate until breeding adult population is regenerated.	MEDIUM: The effects of the threat (acute mortality in population) may be temporarily reversed by compensation measures.	Low
Attraction and/or Collisions with infrastructure *	Low	LOW: Similar to that of Breeding Adults.	MEDIUM: Direct mortality of adults may induce the death of their offsprings: if parent(s) die, then chick mortality is probable (e.g., chicks may fledge if near to fledging age and single parent can provision final meal(s)). With one offspring per pair, the size of the offspring population is half the size of the adult population, therefore the proportion of offsprings being affected is higher. Also, the reduction of population of breeding adults will impact the subsequent	HIGH: Similar to that of Breeding Adults. The effects of the threat (chronic mortality in population) may be temporarily reversed by compensation measures but long-term effects on the population will not be compensated.	Medium

			populations of offsprings (number of offsprings produced) at a higher rate until breeding adult population is regenerated.		
Fisheries bycatch *	Medium	MEDIUM: Similar to that of Breeding Adults.	MEDIUM: Direct mortality of adults may induce the death of their offsprings: if parent(s) die, then chick mortality is probable (e.g., chicks may fledge if near to fledging age and single parent can provision final meal(s)). With one offspring per pair, the size of the offspring population is half the size of the adult population, therefore the proportion of offsprings being affected is higher. Also, the reduction of population of breeding adults will impact the subsequent populations of offsprings (number of offsprings produced) at a higher rate until breeding adult population is regenerated.	HIGH: Similar to that of Breeding Adults. The effects of the threat (chronic mortality in population) may be temporarily reversed by compensation measures but long-term effects on the population will not be compensated.	Medium
Hurricane fallout *^	NA	Not Occurring (N/O) during the breeding season	N/O	N/O	NA
<b>Target: Non-breeding adults; immatures (spatial use: 90% Gulf Stream, 10% Gulf of Mexico)</b>					
Depleted prey base *^	High	MEDIUM: Changes in Gulf Stream regime are expected from climate change (Yang et al. 2016). Since they are not constrained by central-place foraging (as breeding adults are), individuals in the target population may be able to spatially adjust their distribution to follow geographic changes in prey availability.	MEDIUM: Petrels in the target population may be able to adjust to other prey and, depending on the characteristics of available prey, may be moderately affected by the threat. Under extreme scenario, death of breeding adults may occur as changes in prey quality can have substantial effects on body condition (e.g. shearwater die offs). Other effects of the threat may include decreased fitness and lower reproductive success, potentially decreased life expectancy.	VERY HIGH: The threat is pervasive and its effects (decreased life expectancy, potential mortality) cannot affectively be reversed by compensation measures at nest sites.	High
Plastic *	Medium	HIGH: Similar to that of Breeding Adults. Plastic pollution is diffuse and widespread in the marine environment. Relative debris density is low in the Caribbean Sea but higher in the western north Atlantic and enclosed Gulf of Mexico (Wilcox et al. 2015).	LOW: The effects of the threat are sublethal for self-feeding birds but may result in reduced body condition, decreased fitness, and shorter life expectancy.	VERY HIGH: The effect of the threat (decreased survival and life expectancy) cannot be reversed. Increased survival at nest sites could compensate the decreased survival due to the threat but with difficulty and over several generations. Other compensation measures at nest sites (higher nest site availability, predator control) could compensate reduced fitness and early loss of breeding adults by increasing recruitment but with difficulty and over several generations. Rate of improved recruitment may not compensate reduced survival.	Low

Mercury *	Medium	VERY HIGH: The target population is spatially impacted in the Atlantic (where its distribution is largely near-pelagic) and Gulf of Mexico. Concentrations of mercury are higher in the Atlantic, due to the ingress of the southern Labrador Current carrying arctic waters with high mercury concentrations (Semeniuk and Dastoor 2016). Note that mercury accumulates, so the distinction between breeding and non-breeding adults may be irrelevant.	LOW: The threat has sublethal effects on the target population, with an impact on survival in the lower spectrum.	VERY HIGH: The effect of the threat (decreased survival and life expectancy) cannot be reversed. Increased survival at nest sites could compensate the decreased survival due to the threat but with difficulty and over several generations. Other compensation measures at nest sites (higher nest site availability, predator control) could compensate reduced fitness and early loss of breeding adults by increasing recruitment but with difficulty and over several generations. Rate of improved recruitment may not compensate reduced survival.	Medium
Other contaminants *	Medium	MEDIUM: Non-breeding and dispersal areas include western north Atlantic and Gulf of Mexico, which are areas with medium to high pollution.	LOW: The threat has sublethal effects on the target population, with an impact on survival in the lower spectrum.	VERY HIGH: The effect of the threat (decreased survival) cannot be reversed. Increased survival at nest sites could compensate the decreased survival due to the threat but with difficulty and over several generations. Other compensation measures at nest sites (higher nest site availability, predator control) could compensate reduced fitness and early loss of breeding adults by increasing recruitment but with difficulty and over several generations. Rate of improved recruitment may not compensate reduced survival.	Medium
Oil spills (O&G, shipping) *	Medium	MEDIUM: The most likely areas for non-breeding adults and immatures to encounter oil spills are the Gulf of Mexico and shipping channels in the Atlantic. O&G activity may occur in Canadian waters in the future but we did not include it in this threat rating. Because the threat is relatively discrete, only a portion of the population will be affected at a time by an oil spill. The worst area for a spill would be off Cape Hatteras and could spatially affect up to 30% of the population.	HIGH: Similar to that of Breeding Adults. The target population will be impacted through direct mortality. This threat could impact both adults and immatures (as compared to only adults in the Breeding Adults target). Dead immatures will not recruit into the target population therefore the proportion of the target population that is impacted should be higher than in Breeding Adults (into which immatures will recruit - if a spill affects Breeding Adults, it does not affect immatures).	HIGH: Similar to that of Breeding Adults. The effect of the threat (acute mortality) cannot be reversed by compensation measures at nest sites. Increased fledging success could compensate early loss of breeding adults but with difficulty and over several generations. If low number of individuals are affected, improved adult survival at nest sites (predation control) and/or improved fledging success could compensate for early loss of breeding adults but it could take 20-100yrs to achieve this at the population level.	Low
Attraction and/or Collisions with infrastructure *	Low	MEDIUM: There are no marine infrastructures in the western north Atlantic (though Canada may authorize O&G exploration in areas used by petrels). Wind farms proposed in the US are currently too coastal to impact the target. O&G infrastructure are widespread in the Gulf of Mexico and petrels have been observed as close to O&G platforms as 10km; however, the proportion of petrels using the Gulf of Mexico appears to be low. If occurring, attraction to lighted fishing vessels is low because lighted fisheries are uncommon in the areas of interest.	LOW: Maybe medium. The target population will be impacted through direct mortality. Impact on population is difficult to estimate. The Gulf of Mexico is an area with very dense concentration of lighted O&G platforms so it seems reasonable to expect that 1-10% of the target population could be impacted.	HIGH: Similar to that of Breeding Adults. The effect of the threat (direct mortality) cannot be reversed by compensation measures at nest sites. Increased fledging success could compensate early loss of breeding adults but with difficulty and over several generations. Low number of individuals affected suggest that improved adult survival at nest sites (predation control) and/or improved fledging success could compensate for early loss of breeding adults but it could take 20-100yrs to achieve this at the population level.	Low

Fisheries bycatch *	Low	LOW: Pelagic fisheries occur in the Atlantic and Gulf of Mexico but their overlap with petrel distribution are limited. Therefore it is reasonable to assume a low scope.	LOW: No bycatch of petrels has been observed in US Atlantic fisheries. Pterodroma petrels are usually surface scavengers and are not usually subject to bycatch in hook fisheries.	HIGH: Similar to that of Breeding Adults. The effect of the threat (direct mortality) cannot be reversed by compensation measures at nest sites. Increased fledging success could compensate early loss of breeding adults but with difficulty and over several generations. Low number of individuals affected suggest that improved adult survival at nest sites (predation control) and/or improved fledging success could compensate for early loss of breeding adults but it could take 20-100yrs to achieve this at the population level.	Low
Hurricane fallout *^	Low	MEDIUM: Most of the target population from the Gulf of Mexico to Cape Hatteras is subject to hurricanes but not all at the same time. Therefore, it is reasonable to assume the maximum scope to be medium, for the individuals in the path of a hurricane.	MEDIUM: Satellite tracking has shown that petrels can avoid, precede or follow a storm. Therefore, individuals may have the capacity to avoid being blown on land. At most, it is reasonable to expect a maximum severity at medium. Hass et al. model 100s of groundings, which is 5<<10% of the population i.e. low-medium severity.	HIGH: Similar to that of Breeding Adults. Given the low number of individuals affected, the effects of the threat (acute mortality) could be reversed by compensation measures at nest sites but with difficulty and over several generations.	Low

\* = data gap; ^ = impacted by climate change

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