Conserving the Diablotin

Black-capped Petrel *(Pterodroma hasitata)* Conservation Update and Action Plan

2021

Jennifer Wheeler, Yvan Satgé, Adam Brown, James Goetz,
Brad Keitt, Hannah Nevins, Ernst Rupp

INTERNATIONAL WORKING GROUP AND PLANNING TEAM

The **International Black-capped Petrel Conservation Group** is a collaborative association of organizations and individuals with a shared interest in the conservation of species across its range. The working group coalesced in 2008 as a forum for members to share information and generate a comprehensive and cooperative conservation plan. The first version of the Conservation Action Plan for the Black-capped Petrel (Goetz et al. 2012) was produced following a 2010 workshop held in Santo Domingo, Dominican Republic.

The working group operates in collaboration with the regional organization, BirdsCaribbean, to take advantage of its international reach and influence. However, members are voluntary and self-identified, and democratically direct themselves. Group notes and newsletters, as well as unpublished field reports, are archived at https://www.birdscaribbean.org/our-work/working-groups/black-capped-petrel-wg/

Naturally, some members of the International Black-capped Petrel Conservation Group are more active, especially those involved in research, monitoring and conservation interventions in the field. Of these, a subset committed to a course of weekly conferences from February to September 2020 to revisit and refine the Conservation Action Plan. This core planning team signed a Memorandum of Understanding in which they agreed to share data openly and freely to the benefit of greater understanding and conservation action for the species.

2020 Core Planning Team

- **Adam Brown**: Environmental Protection in the Caribbean - USA/Haiti
- **James Goetz**: Cornell University, Dept. of Nat. Res. & Env. - USA/Haiti
- **Brad Keitt**: American Bird Conservancy - USA
- **Hannah Nevins**: American Bird Conservancy - USA
- **Ernst Rupp**: Grupo Jaragua - Dominican Republic
- **Yvan Satgé**: Clemson University - USA/France
- **Jennifer Wheeler**: BirdsCaribbean - USA

The core planning team's product was made possible by the contributions of several others:

Collaborators

- **Dean Demarest**: US Fish and Wildlife Service - USA
- **Stephen Durand, Machel Sutton**: Forestry, Wildlife and Parks Division - Dominica
- **Antoine Chabrolle**: Muséum National d'Histoire Naturelle - Guadeloupe
- **Anderson Jean**: Jeunes en Action pour la Sauvegarde de l'Ecologie en Haïti (JASCEH) - Haiti
- **Patrick Jodice**: USGS in South Carolina - USA
- **Milmer Martinez Vergara**, Plant With Purpose - USA/Haiti
- **Matthew McKown**: Conservation Metrics, Inc. - USA
- **Yasit Segovia**, BioECO - Cuba
- **Nicasio Viña Dávila**, Corredor Biológico del Caribe - Cuba

Field technicians

- **René Jeune, Tinio Louis, Lionel Raymond, Jonel Bazil** - Haiti
- **Pirrín Jairo Matos, Gerson Feliz, José Luis Castillo** - Dominican Republic

Reviewers of the 2019 Action Tables: **Francoise Benjamin** (JACSEH), **Nick Holmes** (The Nature Conservancy), **Robby Kohley** (Pacific Rim Conservation), **Steve Holmer** (ABC), **Shaye Wolfe** (CBD) and others.
Reviewers of this document: to be added.

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INTRODUCTION

A DECADE OF PROGRESS

Figure 1: Cover and illustration from the 2012 Conservation Action Plan.

Tremendous advances in our understanding of the Black-capped Petrel (*Pterodroma hasitata*) have been made since the publication of the 2012 Conservation Action Plan (Goetz et al. 2012) by the International Black-capped Petrel Conservation Group (hereafter IBPCG) (Figure 1). That document featured an image of a chick in what was then only the second known active burrow in the world. Now, about a hundred active burrows have been located on Hispaniola, at five different sites (IBPCG 2020). Radar surveys and habitat modeling indicate they likely persist in additional areas on Hispaniola and searches are ongoing (Satgé et al. 2020). Radar surveys five years apart on the East Caribbean island of Dominica provide strong evidence of a breeding population there (Brown 2020a); preliminary radar surveys in Jamaica and Guadeloupe have produced tantalizing results (Brown 2016, Brown 2020b); and some coastal surveys off Cuba support previous suspicions of nesting there (Pointon pers. com., Plasencia León et al. 2020).

Our understanding of the movements of petrels at sea has also expanded. Captured at their burrows in the Dominican Republic, three individual petrels were tracked by satellite in 2014 (Jodice et al. 2015) and three others were tracked with GPS in 2018 (Satgé et al. 2019). In 2019, 10 petrels captured at-sea off Cape Hatteras, North Carolina were tracked by satellite (Satgé et al. *In prep*.). Moreover, observations of Black-capped Petrels during seabird surveys in the northern Gulf of Mexico have led to a proposition to expand the accepted marine range for the species to include this area (Jodice et al. 2021). These studies have given us a wealth of information about marine range and foraging patterns, as well as potential exposures to marine threats.

By monitoring nests on Hispaniola, members of the IBPCG have expanded our knowledge of the natural history of the species, have been able to characterize with more specificity the nature of terrestrial threats to Black-capped Petrels, and have begun to develop and implement strategies to reduce these threats. At the main colonies along the border between Haiti and the Dominican Republic, strategies include engagement with local people (citizens, youth, park staff) to increase awareness and concern for the petrel, and to provide them with skills and resources to improve environmental conditions in their fields and forests. Observations of predation by introduced mammals and collisions and groundings due to light attraction have prompted preliminary predator control and public awareness activities.

The policy context for the conservation of the species has also shifted to some degree. As of 2014, the species is listed on Annex II of the SPAW Protocol to the Cartagena Convention (UNEP 2019) and in 2019 the species was proposed to be listed as Threatened under the U.S. Endangered Species Act (USFWS 2018a). The UNESCO La Selle-Jaragua-Bahoruco-Enriquillo Transboundary Biosphere Reserve was created in 2017, spanning the Haiti/Dominican Republic border and encompassing known nest sites there (UNESCO 2019).

All of this progress has been challenged and shaped by the large perturbations associated with political unrest in Haiti, natural disasters in the Caribbean exacerbated by climate change, and a global pandemic.

PURPOSE OF THE PLAN UPDATE

The information gained during the last decade provided us the impetus to reaffirm or refine the vision, goals, and actions laid out in the 2012 Black-capped Petrel Conservation Action Plan. Specifically, we undertook writing this update because:

- Improved techniques for finding petrels in new places has given us opportunities to study threats and to implement various forms of management, which were only hypothetical in 2012.
- We wanted to assess the relative importance of various threats to the viability of the species, to articulate the factors that drive these threats, and to share our assumptions about the way conservation actions are to counteract them.
- We initiated the step of adapting and becoming more explicit in our measures of conservation success, such as Key Ecological Attributes (KEAs) and began to employ new tools, including habitat suitability and population viability models to expand our understanding of future outcomes.
- Finally, we wanted an updated plan with which we could engage new partners and supporters interested in securing the future of the Black-capped Petrel.

USE OF CONSERVATION STANDARDS

In undertaking this Conservation Plan update, the planning team chose to use Open Standards for the Practice of Conservation (hereafter, Conservation Standards), a systematic, comprehensive framework designed to support conservation decision making (CMP 2020). We recognized that although resources for petrel conservation have grown, they remain modest and finite, so in face of multiple new opportunities and threats, strategic action is critical.

Figure 2: Overlapping elements in a project cycle following Conservation Standards

The Conservation Standards framework encourages conservationists to think of management of a project as a cycle (Figure 2). The IBPCG activities since 2012, organized by the elements of the cycle, are presented in Appendix 1: Planning Process. The eight-month planning process that generated this document during 2020 was a concerted effort that involved formally establishing a team to work through the many aspects of a conservation challenge together. It promoted learning by sharing, with team members being encouraged to share information and assumptions, providing for dialogue and a common understanding. Most attractive was that Conservation Standards compelled us to develop clear criteria for success, which is necessary for determining effectiveness of actions and overall strategies.

Conservation Standards also encourage disciplined recordkeeping, which supports adaptive implementation and serves as a reference for future plan updates. For this purpose, we used Miradi Software (CMP and Sitka Technology Group 2020), to document our discussions. The Miradi elements of the plan are publicly available at www.miradishare.org

CONSERVATION UPDATE

VISION

The Black-capped Petrel is flourishing throughout its range on land and at sea.

The planning horizon for this vision remains long-term (i.e., 25-50 years) given the low reproductive rate of the Black-capped Petrel species and the magnitude of threats it faces.

MISSION

While working to secure the long-term viability of the species, the IBPCG is committed to a mission that involves four principles. We will:

1. Engage with diverse stakeholders;
2. Find, conserve, restore breeding populations in the species' range by addressing key threats on land and at sea;
3. Support the co-existence of Black-capped Petrels and people in surrounding communities; and
4. Use the best science and methods available to advance adaptive, participative, and equitable results-based management.

CURRENT SPECIES OVERVIEW

Since 2012, several publications provide detailed descriptions of the Black-capped Petrel and its status, including a monograph in the journal Marine Ornithology (Simons et al. 2013), a species status assessment (SSA) prepared as the basis for a ruling under the U.S. Endangered Species Act (USFWS 2018b), an update to the IUCN Red List account (BirdLife International 2018), and a Birds of the World account (Satgé et al. *In prep*.). The following is a summary of information most essential to developing the conservation framework.

Known regionally as Diablotin, the Black-capped Petrel is a gadfly petrel endemic to the Caribbean. A pelagic seabird using marine habitat associated with upwelling and eddies, its marine distribution covers the western North Atlantic, Caribbean Sea, and northern Gulf of Mexico (Jodice et al. 2015, Winship at al. 2018, Jodice et al. 2021; Figure 3). While it was previously thought that Black-capped Petrels mostly foraged in the western North Atlantic during the breeding season (Simons et al. 2013), recent tracking studies highlighted the importance of the southern Caribbean Sea as a key foraging area for breeding petrels (Jodice et al. 2015, Satgé et al. 2019). There, Black-capped Petrels are most common in the central Caribbean Sea, with few records in the east and west despite observation effort in these areas (Leopold et al. 2019).

Until the nineteenth century, Black-capped Petrels were widespread in the Caribbean and nested in abundance on several islands (Simons et al. 2013). To date, 100 nests at five nesting sites have been confirmed in Haiti (Massif de la Selle) and the Dominican Republic (Sierra de Bahoruco and Cordillera Central). Although the only confirmed breeding areas are located on Hispaniola, historic records and recent surveys suggest probable nesting populations in Dominica (Brown 2015 and Brown 2020a) and other areas of Hispaniola (Rupp pers. obs.), and suspected populations in Guadeloupe (Chabrolle 2017, Brown 2020b), Cuba (Plasencia León et al. 2020) and Jamaica (Brown 2016). Criteria used to assign site status are shown in Table 1.

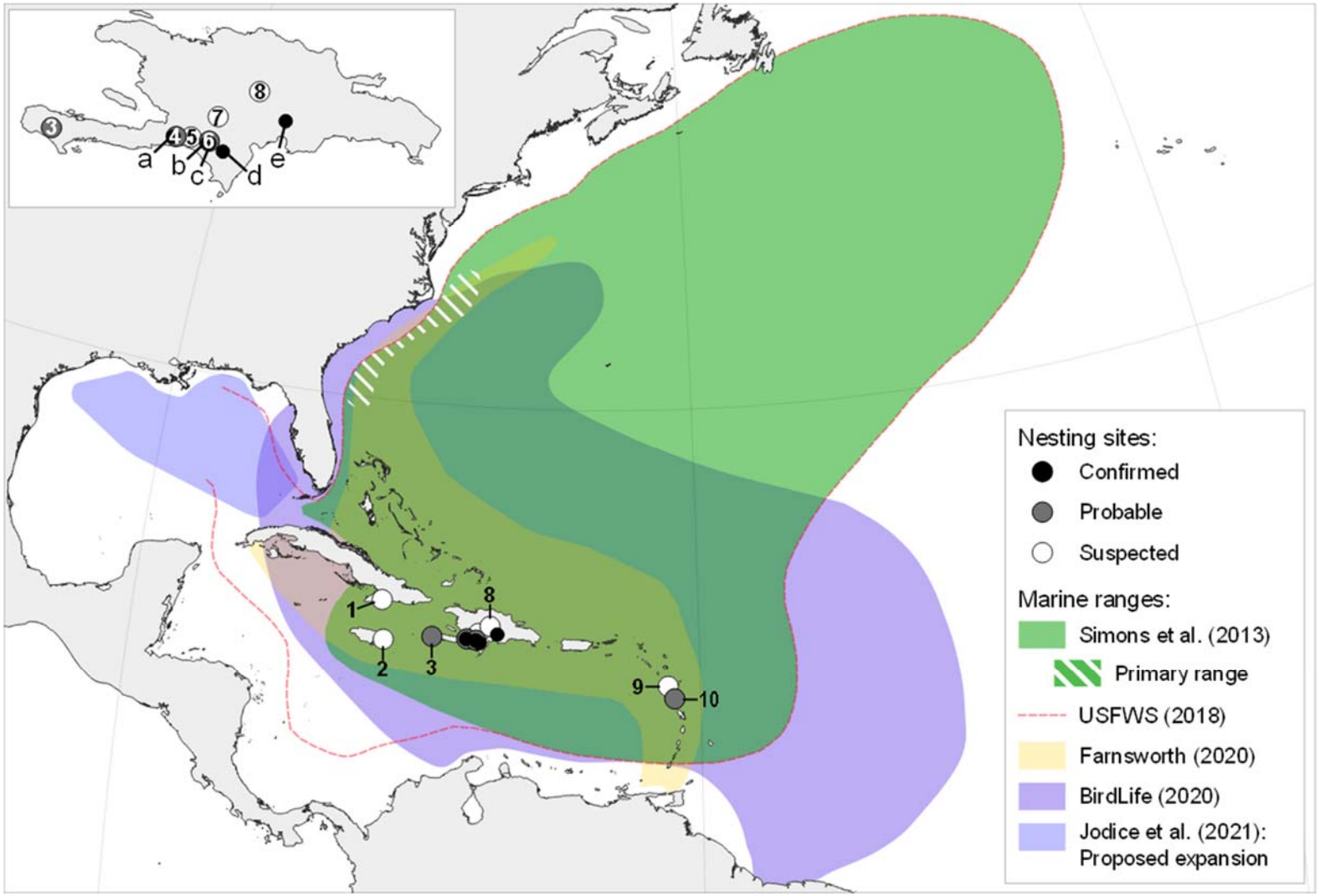


Figure 3: Distribution of the Black-capped Petrel on land and at sea

Letters indicate confirmed breeding sites: a: La Visite - Tet Opak; b: Morne Vincent; c: Loma del Toro; d: Loma Quemada; e: Valle Nuevo. Numbers indicate probable and suspected sites: 1: Pico Turquino and Pico Bayamesa, Cuba; 2: Blue Mountains, Jamaica; 3: Macaya, Haiti; 4: La Visite Escarpment, Haiti; 5: Pic de la Sell, Haiti; 6: Zapoten, Dominican Republic; 7: Sierra de Neiba, Dominican Republic; 8: Central and northwest Cordillera Central, Dominican Republic; 9: La Soufrière, Guadeloupe; 10: Dominica.

Table 1. Criteria for status of nesting sites

Status	Evidence of breeding
Confirmed	Active nests found since 2000
Probable	Detections on radar, groundings, and/or acoustic evidence
Suspected	Flyway observations or proximity to confirmed sites
Extirpated (not shown)	Extirpated = Historic (>80 years), habitat model only

All known nesting sites are in mountainous areas (ca. 2000m above sea level), < 30km from the nearest coastline, and in the understory of montane forests. Spatial modelling suggests that the most highly suitable habitat on Hispaniola is limited to a total area of ca. 170 km^2 spread out over the Massif de la Hotte, Massif de la Selle, Sierra de Bahoruco and the southeastern Cordillera Central (Satgé et al. 2020; see Breakout: Habitat Modelling).

Black-capped Petrels nest underground, in limestone cavities or in burrows excavated in soil or under tree roots. The topography at known nest sites is generally steep ravines and canyons, but nests have also been found on flatter ridgelines. Nest monitoring in Haiti and the Dominican Republic since 2012 suggests a highly variable reproductive success between years and nest areas, ranging from complete failure to presumed complete success at all nests at a given site. Most failures are attributed to predation and/or abandonment, and unknown causes (Rupp et al. 2012, Rupp and Garrido 2013, ABC 2014, Rupp and Garrido 2016, Rupp 2017, Jean et al. 2018, Rupp 2018, Brown and Jean 2019). Table 2 presents the location, survey effort, habitat characteristics, and management status at confirmed, probable or suspected Black-capped Petrel nesting sites. Detailed information on each site is available in Appendix 2: Site Profiles.

Two color forms (aka morphs) of the Black-capped Petrel have been described: a dark and a light form (with intermediate phenotypes), differing by the amount of white plumage on the face, neck and underwing (Howell and Patteson 2008). Studies suggest a strong genetic divergence between light and intermediate, and dark forms (Manly et al. 2013). Recent tracking of petrels of both forms captured at sea (Satgé et al. In prep.) and camera trap pictures at breeding sites (Rupp pers. obs.) suggest that both forms may use similar nesting areas but light form petrels may start to breed about one month before dark forms. Such differences in phenology among meta-populations have been documented in other *Pterodroma* species.

In 2018, BirdLife International reaffirmed the species as Endangered on the IUCN Red List, because of its very small, fragmented and declining breeding range and population (BirdLife International 2021). The estimate given for the global population has remained as “no more than 1,000 breeding pairs, perhaps as few as 500, and a total population of 2,000–4,000 birds”. The trend justification is that “the population undoubtedly declined through the 19th and 20th centuries during which time breeding populations on [some islands] may have been entirely extirpated. This decline is thought to have continued during recent years but requires confirmation”. Five-year follow-up radar surveys in 2017 (Hispaniola) and 2020 (Dominica) do suggest population declines are ongoing (Brown 2017, Brown 2020a), as does loss of suitable habitat in Hispaniola, including at known nest sites (Satgé et al. 2020).

Table 2 - Location, survey effort, habitat characteristics, and management status at confirmed, probable and suspected Black-capped Petrel nesting sites.

Location			Survey effort [a]			Habitat characteristics				Management			
Site Name	**Geographic Area**	**Country**	**Audio/ Visual**	**Ground Searches**	**Radar**	**Number of known Nests [b]**	**Known nesting surface (km^2) [c]**	**Suitable contiguous habitat? [d]**	**Habitat Quality [e]**	**National Park [f]**	**IBA [g]**	**KBA [h]**	**Management level [i]**
CONFIRMED BREEDING LOCATIONS													
La Visite (Tet Opak)	Massif de la Selle	Haiti	high	high	fully covered	57	0.06	Y	2	La Visite	Y	Y	1
Morne Vincent (Boukan Chat)	Massif de la Selle	Haiti	high	high	fully covered	17	0.13	N	3	Foret de Pins I	N	Y	1
Loma del Toro	Sierra de Bahoruco	Dominican Republic	high	thorough	fully covered	28	1.48	Y	5	Sierra de Bahoruco	Y	Y	3
Loma Quemada	Sierra de Bahoruco	Dominican Republic	med	med	fully covered	7	0.11	Y	5	Sierra de Bahoruco	Y	Y	3
Valle Nuevo	Cordillera Central	Dominican Republic	low	med	fully covered	11	0.14	Y	4	Valle Nuevo	Y	Y	4
PROBABLE OR SUSPECTED LOCATIONS ON HISPANIOLA													
Macaya [(1)]	Massif de la Hotte	Haiti	low	low	¾ covered	0	-	N	5	Macaya	N	Y	2
La Visite (remainder of escarpment)	Massif de la Selle	Haiti	medium	low	fully covered	0	-	Y	2	La Visite	Y	Y	1
Zapoten	Sierra de Bahoruco	Dominican Republic	medium	medium	fully covered	0	-	Y	5	Sierra de Bahoruco	Y	Y	4
Pic de la Selle	Massif de la Selle	Haiti	low	low	¼ covered	0	-	Y	3	Foret de Pins II	N	Y	1
Neiba (suspected)	Sierra de Neiba	Dominican Republic	low	low	⅓ covered	0	-	N	5*	Sierra de Neiba	Y	Y	3
Central and Northern range (suspected)	Cordillera Central	Dominican Republic	none	none	¼ covered	0	-	Y	5*	Del Carmen Ramirez, Bermudez	Y	Y	4

PROBABLE OR SUSPECTED LOCATIONS ON OTHER ISLANDS													
Dominica	Various peaks	Dominica	medium	medium	covered	0	-	N	5	Morne Trois Pitons, Morne Diablotin	Y	Y	4
Guadeloupe (suspected)	Nez Cassé/Soufrière	Guadeloupe	low	low	½ covered	0	-	N	5	Guadeloupe	Y	Y	5
Pico Turquino (suspected)	Sierra Maestra	Cuba	low	none	None	0	-	N	5	Pico Turquino Pico La Bayamesa	Y	Y	?
Blue Mountains (suspected)	Blue Mountains	Jamaica	low	low	1/10 covered	0	-	N	5	Blue Mountains	Y	Y	2

Geographic location of each site may be found in Figure 3. Detailed information on each site is available in Appendix 2: Site Profiles.

[a] Survey effort information provided by Rupp (pers. comm.) and Brown (2015, 2016, 2017, 2020a,2020b). Due to variation in habitat and conditions, the level of effort for audio/visual and ground searches are the surveyors' qualitative rating of coverage, rather than a specific number of hours spent listening, recording or searching. For radar coverage, coverage refers to the proportion of likely flyways (drainages) surveyed.
[b] Number of known nests at the site as of October 2020.
[c] Calculated as the surface of the 95% minimum convex polygon around known nest sites in the nesting area.
[d] Refers to the likelihood that nests are likely to be found nearby, based on surveyor's opinion and habitat suitability modelling by Satgé et al. (2020).
[e] Defined as: 5 = intact vegetative cover, to 1 = cleared of vegetation. * Indicates that habitat modelling did not define areas as suitable for nesting (Satgé et al. 2020).
[f] UNEP-WCMC and IUCN (2020).
[g] Area defined within an IBA: Important Bird Area (BirdLife International 2020).
[h] Area defined within a KBA: Key Biodiversity Area (Key Biodiversity Areas Partnership 2020).
[i] Defined institutional infrastructure, services and activities to protect and manage the area as it relates to the Black-capped Petrel: 5 = park fully staffed (guards or rangers); park leads projects that benefit petrels, 4 = staff present regularly; park supportive with equipment, housing or services, 3 = staff presence irregular; periodic logistical support for activities, 2 = staff rarely present; rarely support for activities, 1 = essentially none.

(1) Macaya was listed as confirmed in the 2012 Conservation Action Plan, based on the observations of flying and vocalizing birds; however, in the 2020 Plan, this site was considered "probable" based on the fact that no nests have been located yet.

TARGETS FOR PLANNING

In the terminology of the Conservation Standards, **targets** are specific, tangible entities that a project is working to conserve. Targets represent and encompass the ultimate aims of the project, and they form the basis for goals, selecting strategies, and measuring effectiveness.

The Black-capped Petrel as a species is the overarching target for our conservation planning. Our team also developed sub-population targets based on terrestrial location. Petrel populations at each nesting site or island were considered as separate targets, because of the varying threats at these nesting areas and the nature of conservation interventions that are possible there. In defining targets by a particular site, we include consideration of the habitat used by the petrels and its specific characteristics (vegetative cover, burrow availability). Birds at sea were also conceived as a discrete target for conservation planning, for the reason that marine threats and conservation interventions are quite different than on land. The marine range was assessed by location – Caribbean Sea, Gulf Stream waters, and Gulf of Mexico – but the target of "birds at sea" was not subdivided.

Conservation targets may be re-defined or refined in the future, especially as more information emerges about Black-capped Petrel distribution and population dynamics. Specifically:

- Nest site names were generated for the purposes of planning and may be split or grouped in the future depending on where nests are discovered.

- The two Black-capped Petrel color forms reflect important genetic and behavioral diversity in the species. However, not enough information is available to assess, much less manage, the forms as distinct targets. Thus far, most nesting areas are composed of dark form petrels, with intermediate forms observed recently in Valle Nuevo.

- Tracking results support the idea that sub-populations, defined by age class, breeding status, breeding location, and color form, potentially use marine areas differently.

Additionally, it is anticipated that future range-wide plans, and those made at the national or local level, may include explicit human well-being targets. Human welfare targets are components of human well-being affected by the status of conservation targets and associated ecosystem services. The mountainous forest areas comprising petrel habitat do provide important services such as water retention, erosion control, wood and other forest products. Moreover, it is recognized that the conservation of the petrel and its habitat, especially in Haiti, relies on improving the welfare of local communities. In accordance with our Mission, IBPCG will pursue human well-being targets in partnership with organizations for which human well-being is a primary focus.

THREATS IDENTIFICATION

Direct threats are anthropogenic in nature and negatively affect petrel populations (i.e., increased mortality, reduced reproduction) or their habitats (i.e., decreased quality or quantity) (CMP 2020). Natural phenomenon can also be considered direct threats if they are altered or exacerbated by human activities or human influences (e.g., changing patterns of hurricane activity due to anthropogenic climate change). We identified the following threats as significant to one or more of the conservation targets (petrel populations at confirmed, probable or suspected nesting sites, and petrels at sea)[a]:

- **On Land Threats of Direct Mortality**
  - Introduced Mammalian Predators
  - Fire Mortality
  - Tower Collisions and Groundings
  - Harvest by Humans
  - Light Pollution Collisions and Groundings*

- **On Land Threats of Degradation and Loss of Nesting Habitat**
  - Agricultural Expansion
  - Expansion of Grazing
  - Fire Damage to Habitat
  - Invasive Ferns
  - Wood Harvest
  - Non-timber Forest Product Collection
  - Destruction of Burrows by Feral Pigs*

- **Threats at Sea**
  - Reduced Prey Availability
  - Oil spills
  - Fisheries Bycatch
  - Attraction/Collision with Marine Infrastructure
  - Mercury
  - Plastics*
  - Other contaminants*
  - Hurricane Fallout*

*Added to the suite of threats described in the 2012 Conservation Action Plan (Goetz et al. 2012), based on emerging information.

[a] Threats are ordered by the numbering scheme in the CMP Direct Threats Classification v2.0. https://conservationstandards.org/library-item/direct-threats-classification-v2-0/

THREATS PRESENTATION

On Land -- Direct Mortality

Predation by Introduced Mammals: Introduced mammals known to prey on Black-capped Petrel are present at all probable and suspected nesting sites within the Caribbean region (Threatened Island Biodiversity Database Partners 2018). The introduced, non-native mammals that have been documented by camera trap or human observation at confirmed petrel nesting sites in Hispaniola include Norway rats (*Rattus norvegicus*), black rats (*Rattus rattus*), Indian mongoose (*Herpestes javanicus*), domestic dogs (*Canis familiaris*), domestic cats (*Felis domesticus*), and feral pigs (*Sus scrofa*) (Rupp and Garrido 2016, Rupp 2017, Rupp 2018, Jean et al. 2018, Brown and Jean 2019).

Monitoring at Hispaniola sites has shown that the presence of cats and mongoose can cause overall colony failure (Rupp 2018, Brown and Jean 2019). Based on 20+ species of *Pterodroma* petrels worldwide, predation of eggs and chicks by non-native mammals is a main driver of nest failure (Rodríguez et al. 2019). Although not yet documented for the Black-capped Petrel, direct mortality of adult petrels by introduced mammals is likely; studies show that predation of adults can reduce petrel populations and increase the risk of extinction (Rodríguez et al. 2019). Feral cats are particularly damaging, and a single individual may cause numerous fatalities during one predation event (Raine pers. comm.).

Fire Mortality: Black-capped Petrels may die in natural or intentional forest fires affecting nesting areas; fires during incubation could be fatal to adults, chicks or eggs in burrows. There are documented cases of as many as one hundred Black-capped Petrels fatally attracted to large fires burning at night during peak breeding season (IBPCG 2014, Brown and Jean 2019).

Light Pollution Collisions and Groundings: Black-capped Petrels, like many other seabird species, are highly attracted to light (Rodríguez et al. 2017). A myriad of sources of light pollution from towns and cities may disorient birds as they traverse a flyway, causing collisions or groundings. Fledgling juveniles are more likely to become disoriented as they leave the nesting area for the first time (Rodríguez et al. 2017), but adults are attracted as well, particularly during periods of no moon. Over the last decade, several grounded petrels have been collected around homes and businesses, inland and in coastal towns (Rupp pers. obs.).

Tower Collisions and Groundings: Communication towers, wind turbines, or other tall, lighted structures, especially those near nesting areas, pose a particular threat for collisions and groundings. Protruding into Black-capped Petrel flyways, lighted towers attract petrels in courtship flights or commuting in and out of nesting sites. Petrels also collide with hard-to-see supporting cables (guy wires) or fences associated with towers, especially on foggy nights. Mortalities have been documented at towers near La Visite and Loma del Toro nest sites (Hardesty and Rupp 2012, Brown 2013).

Harvest by Humans: Systematic harvest of Black-capped Petrels as a food source is known only from historical records; planned collection has not been documented in recent times. Petrels burnt in fires, or discovered as habitat is being cleared, are collected for human consumption, but this harvest appears to be purely opportunistic (Rupp and Goetz pers. obs.).

On Land -- Nesting Habitat Degradation and Loss

Agricultural expansion: All Black-capped Petrel habitat remaining in Haiti is adjacent to communities that work hard for daily existence. Observed deforestation at known and probable Haitian nesting sites

is primarily for row crop agriculture, undertaken by people who struggle economically, use poor agronomic techniques and lack environmental knowledge. Estimates of existing forest cover and conversion of land to agriculture vary depending on data sources and classification, but there is widespread agreement that Haiti has suffered significant deforestation and agricultural land degradation (FAO 2010, Churches 2014, Pauleus and Aide 2020).

In all countries, most of the confirmed, probable or suspected Black-capped Petrel nesting sites fall within protected area (i.e., national parks and reserves) boundaries. However, in Haiti, this designation provides no real protection from clearing for agriculture, as land is occupied and worked by citizens. In the Dominican Republic and on other islands, national parks are better protected from conversion, although incursions into parks for commercial and subsistence agriculture have occurred.

Expansion of Grazing & Destruction of Burrows by Feral Pigs: In Haiti, the expansion of row crop agriculture into forest areas is often preceded by the use of forested land for **livestock grazing**. Grazing removes understory vegetation and burrows can be destroyed by trampling ungulates or rooting feral pigs. Feral pigs can also depredate the burrow occupants (Rodríguez et al. 2019); feral pig presence was most notable at Loma Quemada (Dominican Republic), Dominica, and Guadeloupe.

Fire Damage to Habitat & Invasive Ferns: Fires lit intentionally (for clearing underbrush) or unintentionally are rarely big enough to destroy trees or destroy burrows, but they may pave the way for agriculture or facilitate the spread of invasive vegetation. The invasive fern *Dicranopteris pectinata* is particularly noted in the Valle Nuevo nesting site in the Dominican Republic; these fern thickets are too dense for petrel use, and are an obstruction to field teams (Rupp pers. obs.).

Wood Harvest & Non-timber Forest Product Collection: In addition to livestock grazing, expansion of row crop agriculture into forest areas is often preceded by the harvest of wood and other forest products. These practices appear to be less damaging to petrel habitat than tilling, but cause gradual deforestation and/or disturbance. In La Visite, the recent harvest of live tree ferns (sold for landscaping purposes) has impacted Black-capped Petrel reproduction (Jean et al. 2018).

Threats at Sea

Black-capped Petrels at sea face a range of suspected threats but data gaps about exposures and impacts in the marine environment preclude more definitive statements. Petrels at sea may be directly harmed by **lethal, discrete marine pollution, notably oil spills** (Lee 1999). Spills are more likely to occur near oil and gas infrastructures in the south Caribbean Sea and the Gulf of Mexico but may also happen in dense shipping lanes along the North American coast. Exploration is ongoing in the southeastern Canadian exclusive economic zone, with the possibility of future oil extraction in this area used by petrels. Direct mortality may also result from **attraction to and collisions with at-sea structures** (e.g., oil platforms, offshore wind farms) especially if lighted or flaring (Montevecchi 2006). Petrels may also face **threats linked to fisheries**, through entanglement in gear, collision with trawling cables, or attraction to lighted vessels (Zhou et al. 2019). Finally, the changing pattern of **hurricanes**, an effect of climate change, may be causing increased mortality of petrels blown off-course (Hass et al. 2012).

Some threats at sea such as **sublethal, diffuse pollution** (i.e., plastic, Moser and Lee 1992, Wilcox et al 2015; mercury, Whitney and Cristol 2017; and other contaminants) are more likely to reduce fitness or productivity (e.g. low hatching success, death of offspring), than cause direct mortality of adults. Finally, climate change is expected to weaken or disturb oceanic processes such as the Guajira upwelling (Taylor et al. 2012) and the Gulf Stream (Yang et al. 2016) which may **reduce prey availability**.

THREATS RATING

Evaluating threats is a central part of conservation planning and forms the basis for identifying and rating conservation strategies. For this reason, our team attempted to assess the relative importance of the identified threats to the viability of the Black-capped Petrel (something that had not been included in the 2012 Conservation Action Plan, Goetz et al. 2012). Our planning team used the Simple Threats Rating system within the Miradi software (Version 4.5) to rate each threat at individual nesting sites and at sea. We also used a new population viability analysis (PVA) model designed specifically of seabirds in order to explore the effects of threats (or their reduction) on the global petrel population (Croll et al. 2019, Seabird mPVA 2020). See Breakout: Population Viability Analysis Model.

The Simple Threats Rating system (TNC 2007) involves using a four-level qualitative scale (Low, Medium, High, and Very High) applied to three criteria:

- **Scope:** The proportion of the target population (or geographic extent of a nesting site) that can reasonably be expected to be affected by a threat within 10 years given the continuation of current circumstances and trends.
- **Severity:** The level of damage to the conservation target that can reasonably be expected within 10 years given the continuation of current circumstances and trends.
- **Irreversibility:** The degree to which the effects of a threat can be undone (and the target restored).

Ratings for Scope, Severity, and Irreversibility are combined according to a set of rules, to provide an overall threat rating for each target. See Appendix 2 and Appendix 3: Threats Assessment for a full description of site-specific threats, scales, the rule sets, and specific target-threat ratings.

The suite of on-land threats and their ratings are shown in Table 3.

For threats to Black-capped Petrels at sea, we used the same Simple Threats Rating, considering as targets both directly-affected foraging birds (adults and subadults) and their indirectly-affected offspring on land. All marine threats were rated Medium or Low. There is, however, a notable amount of uncertainty associated with marine exposures and impacts, as shown in Table 4.

Table 3: On land threats to Black-capped Petrels at select nest sites [a]

RATING OF THREATS TO PETRELS AT NESTING SITES	Haiti			Dominican Republic			Dominica, Guadeloupe, Cuba, Jamaica[e]
	La Visite Tet Opak[b]	Morne Vincent	Macaya[c]	Loma del Toro[d]	Loma Quemada	Valle Nuevo	
Threats of direct mortality							
Predation by Introduced mammals	High	High	High	High	High	High	High
Fire Mortality	High	Medium	Medium	Medium	Medium	Medium	Medium
Tower Collisions and Groundings[f]	Low	High	Low	High	Not occurring	Not occurring	Data needed
Light Pollution Collisions and Groundings	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Harvest by Humans	Low	Low	Low	Not occurring	Not occurring	Not occurring	Not occurring
Threats of nesting habitat degradation and loss							
Agricultural Expansion	Very High	Very High [g]	Very High	Not occurring	Not occurring	Low [h]	Data needed
Expansion of Grazing	High	Low	High	Not occurring	Not occurring	Not occurring	Not occurring
Burrow Destruction by Feral Pigs	Not occurring	Not occurring	Not occurring	Not occurring	High	Not occurring	Data needed
Fire Damage to Habitat	Low	Low	Low	Low	Low	Medium	Low
Invasive Ferns	Not occurring	Not occurring	Not occurring	Not occurring	Not occurring	Low	Data needed
Wood or NTFP Collection	Low	Low	High	Not occurring	Not occurring	Low (h)	Not occurring

[a] We rated threats for all confirmed and some probable nesting sites on Hispaniola, those where our core planning team had spent considerable time. We also undertook preliminary ratings of threats on other islands (Dominica, Guadeloupe, Cuba and Jamaica) based on more geographically generalized information; confirmation of nest sites on these islands will allow for more informed ratings.

[b] Ratings for Pic de la Selle, and the remainder of the La Visite escarpment are considered to be the same as for the confirmed site at Tet Opak.

[c] Although nests have yet to be located at Macaya, we rated threats at the probable nest site based on team members' strong familiarity with the site.

[d] Ratings for probable nesting site Zapoten are likely the same as for close-by Loma del Toro.

[e] Preliminary ratings for islands other than Hispaniola are based on information about conditions on peaks most likely to host petrels. The probable or suspected sites on Dominica, Guadeloupe, Cuba and Jamaica have protected status, but all of these islands have a host of introduced mammalian predators, may be subject to fires, and host human populations such that light pollution will likely threaten petrels to some extent.

[f] The ratings for Tower Collisions and Mortality are based on the presence of towers in the close vicinity of nesting sites.

[g] Agricultural Expansion is rated as Very High in the absence of interventions; ongoing interventions have apparently reduced the present threat to Low, but these interventions require a sustained and dedicated effort.

[h] Agricultural Expansion in Valle Nuevo has "Low" (rather than "Not occurring") because of past incursions. Rupp believes that nests may have been lost due to impact by fires from land clearing within the last ten years.

Table 4: Threats at Sea to Black-capped Petrels

Threats at sea (Highest to Lowest)	**Rating**	**Suggested impact on BCPE populations** [a]	**Uncertainty level** [b]	**Uncertainty**
Reduced Prey Availability	Medium-High	Reduced life expectancy (all), reduced survival (all), reduced fitness (breeding adults), reduced reproductive success (breeding adults).	High	Diet; Factors contributing to prey availability; Impact of climate change on oceanic regimes; Occurrence and extent of overfishing
Oil spills	Medium	Direct mortality (flying individuals; offspring probably affected by death of parent), reduced survival (all), reduced reproductive success (breeding adults).	Low	Proportion of population affected
Mercury	Medium	Reduced survival (all), reduced life expectancy (all), reduced fitness (breeding adults), reduced reproductive success (breeding adults).	Medium	Extent of contamination; Impacts of contamination on age classes
Plastics	Medium	Direct mortality (all), reduced survival (all), reduced fitness (breeding adults), reduced reproductive success (breeding adults).	Low	Extent of exposure; Impact of exposure
Other contaminants	Medium	Reduced survival (all), reduced life expectancy (all), reduced fitness (breeding adults), reduced reproductive success (breeding adults).	Medium	Types of contaminants; Extent of contamination; Impacts of contamination
Hurricane Fallout	Low-Medium	Direct mortality (non-breeding adults and immatures)	Low	Impact of climate change on frequency of fatal hurricanes
Fisheries Bycatch	Low	Direct mortality (flying individuals; offspring probably affected by death of parent).	Medium	Diet; Level of petrel attraction to fisheries; Types of fisheries affecting petrels; Proportion of population affected
Attraction/Collision with Marine Infrastructure	Low	Direct mortality (flying individuals; offspring probably affected by death of parent).	Low	Proportion of population affected

[a] Target populations include: land-based breeding adults; sea-based non-breeding adults and sub-adults; land-based offspring.

[b] Level of uncertainty associated with how the threat processes affect the Black-capped Petrel population (Low, Medium, High). A baseline for all threats is the extent to which the effects of the threat on the petrel populations can be reversed.

POPULATION AND HABITAT GOALS

Use of Key Ecological Attributes

Goals are defined as formal statements detailing a desired impact of a project on the desired status of conservation targets over the long term (CMP 2020). Goal-setting is an iterative process, and goals should be revised as new information becomes available, new partnerships are established, resources are developed.

The 2012 Black-capped Petrel Conservation Plan (Goetz et al. 2012) proposed the following 10 to 20-year goal: "Ensure the long-term survival of a stable population of Black-capped Petrel whose conservation status has improved from Endangered to Near Threatened on the IUCN Red List[b]". This goal remains valid but it lacks metrics to gauge incremental change.

In this round of planning, our team took the Conservation Standards approach of identifying Key Ecological Attributes (KEAs). KEAs are aspects of a target's biology or ecology that define the health of a target (FOS 2009). Conversely, a missing or diminished KEA would lead to the outright loss or extreme degradation of its associated target over time. Then, using the best available information, we assigned levels of target health (poor, fair, good, very good) to expected ranges of variation for each indicator. There is plenty of uncertainty in setting ranges due to lack of data. For example, if the total population is estimated at up to 1,000 nests; then only 10% have been found and monitored (100 nests). Whenever possible, we drew upon analogous studies with related species.

We identified Black-capped Petrel KEAs (Table 5) that relate to demographic parameters (i.e., population size, productivity, survival) and to its nesting habitat (i.e., distribution, intactness and management). The KEAs are those for which indicator data are already available or that can soon be available. These KEAs comprise the basic elements of a monitoring plan for the species.

For some of the KEAs, baselines are required because the status is a relative, not absolute, measure. For example, the absolute number of birds was not designated as an indicator even though global Black-capped Petrel population was identified as a planning target. This is because of the high level of uncertainty in an absolute population estimate for this species. Rather, relative change in numbers of targets observed in radar surveys at established sites and intervals has been selected as one of the primary means of assessing long-term trends in global petrel populations. See Breakout: Petrel Monitoring with Radar.

Moreover, absolute areal extent of petrel habitat was also not selected as an indicator. Nest density varies greatly from site to site, likely due to site characteristics as well as level of threat. Petrels seem to be flexible regarding habitat quality and it remains uncertain what aspects of habitat are limiting (e.g.,

[b] The Black-capped Petrel's listing as Endangered on the IUCN Red List is due to its very small, fragmented and declining breeding range and population. Criteria B2ab(ii, iii, v) apply. The petrel's geographic range is specifically relevant in the form of Criteria B2: Area of occupancy is:
a) Severely fragmented or known to exist at no more than five locations;
b) There is continuing decline, observed, inferred or projected, in:
(ii) area of occupancy;
(iii) area, extent and/or quality of habitat; and
(v) number of mature individuals.

burrow availability or extent of vegetative cover). Thus, absolute area of petrel habitat (based on modeling or nest-polygons) is not a suitable attribute for conservation planning. It is better to assess the distribution of habitat over discrete sites, and the number of nests this habitat supports.

One KEA refers to the percent of breeding habitat that is cleared. Habitat degradation and loss observed in the past is typically sequential: 1) an area is utilized for wood and forest product collection, 2) underbrush is cleared by grazing, 3) remaining trees are removed, and 4) the ground is tilled. This serial manner of degradation is useful to predict where more damaging activities will follow and it requires vigilance to focus efforts on conservation before forest clearing occurs.

Table 5: Key Ecological Attributes

Key Ecological Attribute	Indicator	Status of Target				Basis of status ranges	Information Needs
		Poor	Fair	Good	Very Good		
Flyway Population Index	Number of radar targets/effort at selected flyways	Any loss	No change	+0-5%	≥10%	IBPCG expertise	Refine sampling and analytic protocols; specifically select drainages/flyways and decide frequency and timing that give power to detect trends. Look to Marbled Murrelet monitoring as an example.
Breeding Vocal Activity	Call rate (calls per minute, during peak activity period) at nesting sites	0.04-0.8	1 to 5	9 to 20	> 20	Based on data from Hawaiian Petrel*	Develop sampling and analytic protocols, considering density and range; intensify ARU deployment for baseline.
Colony Occupancy	Active nests/Total nests at each nesting site	<30%	30-50%	50-70%	>70%	Sister taxa**	Establish study zones (consistent across years) within sites; develop a protocol that is consistent across sites, including dates or period for assessing activity, accepted proofs of activity.
Reproductive Success	Fledged nests/ Active nests at each nesting site	<30%	30-55%	55-75%	>75%	Sister taxa**	Establish study zones (consistent across years) within sites; develop a protocol that is consistent across sites, including dates or period for assessing fledging, accepted proofs of fledging; tools to standardize data.
Breeder Return Rate	Number of individual breeders that return in following year (%)	<25%	25-50%	50-75%	>75%	Sister taxa**	Develop a mark-recapture program.
Habitat Intactness	% of Minimum Suitable Breeding Habitat Cleared	>50%	50% - 10%	10%	No loss, or habitat gain	IBPCG expertise	Establish minimum suitable polygons consistent across years***.
Breeding Distribution	Number of confirmed nesting sites****	<4	4-5	6-7	>7	Number of probable and suspected breeding areas	Continue searches in probable and suspected areas.

* M. Mckown & A. Raine, pers comm. These values need to be calibrated for the Black-capped Petrel.

** Values based on sister taxa
https://docs.google.com/spreadsheets/d/1aylOjkhsk5Jkz4n9UNHSiguT7p5NS4BETDqKASk7WTA
*** The development of minimum convex polygons area encompassing the current petrel nests at each site is a useful tool for registering vegetative changes, but it is a less telling parameter than number of active nests.
**** Immigration/emigration (demographic connectivity) between nesting sites is expected to be low; thus, the number of sites is an important driver of global population viability.

KEA Status and Goals

In three cases, current data are insufficient to assess relative change or absolute values, either because a method needs to be developed or because data need to be analyzed. In these cases, developing and implementing the method serves as the goal. In four cases, data are sufficient to assess status at a baseline level and/or in recent years. The generic goal across all KEAs is to see improvement, or at minimum, stabilization in KEA status in the short-term. Our goals are generally set from one to five years in the future.

Table 6: Tracking and Goals for Key Ecological Attributes

Target	Indicator	Baseline Source	Status [Year]				GOAL
			Poor	Fair	Good	Very Good	
Flyway Population Index (proxy for Population Size)	Number of radar targets/effort at selected flyways	Radar surveys (years)	Any loss	No change	+0-5%	≥10%	Radar surveys to be repeated every 5 years.
Selected Flyways for Haiti/Dominican Republic border area (MV,LdT, Zapoten)		Surveys 2012-2014	[2017]				Fair by 2022 Survey
Selected Flyways for La Visite		Surveys 2012-2014	[2017]				Fair by 2022 Survey
Selected Flyways for Macaya		Surveys 2012-2014	[2017]				Fair by 2022 Survey
Selected Flyways for Valle Nuevo		Surveys 2012-2014	[2017]				Fair by 2022 Survey
Selected Flyways on Dominica		Survey 2015	[2020]				Fair by 2025 Survey
Selected Flyways on Guadeloupe		Survey 2020	To be determined				Conduct 2025 Survey
Breeding Vocal Activity (proxy for Population Size)	Call rate (calls per minute, during peak activity period) at nesting sites	To date, BCPE acoustic activity has only been used to help direct ground searches.	<1	1 to 3	5 to 10	> 10	By 2022, establish and implement a method so vocal activity can provide an index for comparing relative abundance of petrels across sites and through time.
Confirmed nesting sites		To be established.	To be determined				To be determined
Colony Occupancy*	Active nests/Total nests at each nesting site	Nest monitoring, all years.	<30%	30-50%	50-70%	>70%	By 2021, review data to assess whether total nest number is known from early season check.
Confirmed nesting sites		To be established	To be determined				To be determined
Reproductive Success*	Fledged nests/ Active nests at each nesting site	Nest monitoring, all years.	<25%	25-50%	50-80%	>80%	Note: Uncertainty in limited number of visits. May miss early season predation.
Loma del Toro		Monitoring since 2012**		[2018]	[2012] [2013] [2014] [2015] [2017] [2019]	[2016]	Remain Good

Morne Vincent		Monitoring since 2012**			[2013] [2014] [2015]	[2012] [2016] [2017] [2018] [2019] [2020]	Remain Good
Loma Quemada		Monitoring since 2016**		[2016] [2018]	[2019]		Remain Good
Valle Nuevo		Monitoring since 2019**	[2020]	[2019]			Good by 2025
La Visite - Tet Opak		Monitoring since 2018**		[2018] [2019]		[2020]	Good by 2025
Breeder Return Rate	Number of individual breeders that return in following year (%)	Requires mark-recapture	<25%	25-50%	50-75%	>75%	Establish a mark-recapture program by 2025.
Confirmed nesting sites		To be established	To be determined				To be determined
Habitat Intactness	% of Minimum Suitable Breeding Habitat Cleared	Visual observation/opinion from year when nests were first detected	>50%	50% - 10%	10%	No loss, or habitat gain	Improve Baseline and follow-up assessments with method using nesting polygons and habitat surveys
Clearing at Morne Vincent		Observations in 2011 (Rupp)				[2020, all nests vegetated]	Remain Very Good
Clearing at Valle Nuevo		Observations in 2017 (Rupp)				[2020, all nests vegetated]	Remain Very Good
Clearing at La Visite - Tet Opak		Observations in 2018 (Brown)		[2020,10 of 42 nests exposed]			Good by 2025
Clearing on entire La Visite escarpment		Based on observations since 2009 (Goetz), Tet Opak exemplifies greater escarpment.	*Until nests located, cannot establish baseline (unless we use some other polygon as a proxy, e.g., suitable habitat)*				Good by 2025 - same as Tet Opak
Global petrel population	Number of breeding areas	Search results to date	<4	4-5	6-7	>7	
Number of confirmed discrete breeding areas		In 2017, 4 areas: La Visite, Border (Morne Vincent + Loma del Toro), Loma Quemada, Valle Nuevo		[2020]			Good by 2025

* Values based on sister taxa https://docs.google.com/spreadsheets/d/1aylOjkhsk5Jkz4n9UNHSiguT7p5NS4BETDqKASk7WTA
** Where years are missing, data are insufficient to calculate fledging success

CONSERVATION PLAN

DEVELOPMENT OF CONSERVATION STRATEGIES

Once targets and threats are identified, the Conservation Standards recommend that a planning team undertake situational analyses. This process allowed us to describe the context of Black-capped Petrel conservation and it facilitated the identification and rating of strategies (CMP 2020). Specifically, we created conceptual models to depict the links between targets, their direct threats, the factors contributing to these threats, and the possible strategies to ultimately reduce the threats (Figure 4). In theory, any factor in a conceptual model offers an opportunity for intervention. In some cases, the most obvious key intervention point is the direct threat itself (e.g., reducing predation by invasive mammals). In other cases, interventions may be directed towards one of the chain of factors affecting a direct threat (e.g., influencing an ocean-use policy or improving land management practices). Some interventions may directly benefit the target (e.g., colony creation by translocation) or enable conservation activities generally (e.g., raise capacity of local partners). By convention, conceptual models shown strategies to the left or right of the target, depending on their type.

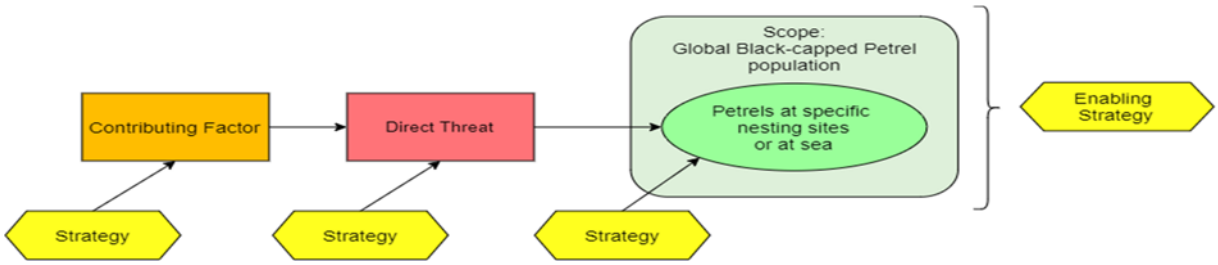


Figure 4: Conceptual model and types of strategies

Our team developed conceptual models for petrels at the five confirmed nest sites; these have had enough recent study and engagement to understand specific contributing factors and strategies that could be undertaken. We also created conceptual models that depicted the factors that contribute to threats at sea. See Appendix 4: Situational Analyses – Conceptual Models.

The Conservation Standards suggest the use of results chains to depict “theory of change”, defined as a series of causally linked assumptions about how strategies lead to the achievement of both intermediate results and longer term conservation goals. A chain of results is used to show how a set of actions tied to a strategy will influence a situation, and explicitly define relationships among actions, impacts of actions, and how they lead to the desired outcomes. Two generic results chains are shown in Figure 5; one shows a strategy to reduce a threat (shown from left to right); while the other is an enabling strategy (shown from right to left). Similar to conceptual models, theory of change models are intended to make assumptions clearer, allow discussion of uncertainty, and entertain varying opinions, concerns, and clarifications (CMP 2020). We developed these models iteratively; they will continue to evolve as strategies are tested, new information becomes available and/or conditions change.

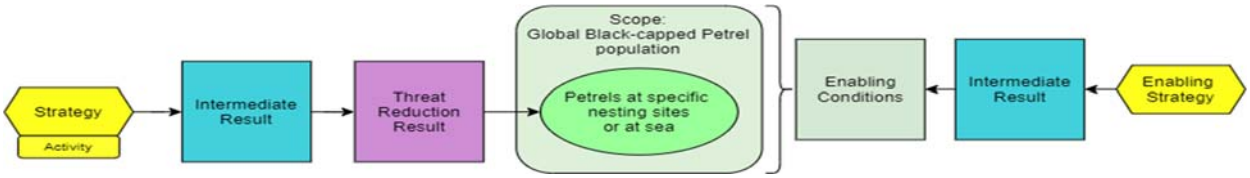


Figure 5: Result chains depicting theory of change

STRATEGY SELECTION

In the face of limited resources, a project team needs to decide which of all possible strategies it will undertake immediately, defer until later, or which it will not undertake (CMP 2020). In building our conceptual models, our team attempted to show the situation with the petrel today and include all the strategies that we think are important and relevant. Implicit in that step was the dismissal of strategies that were felt to be wholly ineffective or infeasible. For example, strategies of government enforcement of Haitian National Parks borders are not viewed as feasible; historic attempts to evict residents and users proved unpopular, inhumane and incited violence. Likewise, there is no known intervention that could be proposed to directly reduce the threat of increasing hurricane fallout due to anthropogenic climate change.

In other cases, potential interventions were identified in conceptual models, but continued development of the strategies was deferred until more information could be acquired. An example of this is the set of potential community interventions identified for La Visite, but not developed further, in favor of a scoping study – an enabling strategy – to better understand the socio-economic drivers within the community.

Finally, in some cases, it was recognized that some outcomes are beyond the manageable interests of the team; for example, reduction in the at-sea threats of depleted prey, marine energy activities, plastics and other contamination. In this case, the strategies included in the theory of change models are limited to those relevant to our team (e.g., communicating to organizations who do advocacy work), rather than the strategies beyond the scope of the team's organizations (e.g., researching at-sea plastic cleanup technologies).

Then, we developed theory of change diagrams for nine strategies. These included enabling strategies to overcome the challenges posed by lack of information and lack of local capacity, as well as to take advantage of colony restoration opportunities. Other strategies are those proposed to address land-based and at-sea threats. (See Appendix 5: Theory of Change – Results Chains). Some of the identified strategies are already well underway; others are in preliminary stages or yet to be commenced.

STRATEGY RATING

Once strategies were developed, we undertook a criteria-based comparison to further differentiate between strategies. Each strategy or sub-strategy was scored on a four-point scale for criteria relating to impact (probability of change, duration of change) and feasibility (financial, technical, organizational, and social/ethical). Scores were averaged across team members involved in the rating, then the averages combined to generate ratings of overall impact and feasibility.

For strategies of threat reduction (that is, interventions directed at threats or at one of the factors contributing to that threat), we developed an additional rating that integrated the level of the threat. Appendix 6: Strategy Rating presents the details of the exercise, along with concerns about strategy limitations and risks.

Table 7 presents the strategies and substrategies recommended for the conservation on the Black-capped Petrel. Those strategies which we believe are paramount or most pressing are in bold. Enabling strategies by definition are paramount (Strategies 1,2,3 and 7), and those with the highest impact and feasibility rating coupled with and highest threat rating were Strategies 4 and 6a,b.

Table 7 – Strategies for the Conservation of the Black-capped Petrel*

Strategy ID		Enabling Strategies	Applicable to which target?
1		**Build in-country capacity**	**Range-wide**
2		**Locate & characterize nesting sites throughout Caribbean**	**Range-wide**
3		**Explore Restoration Methods**	**Range-wide**
		Strategies to Address Threats	
4		**Reduce predator pressure**	**All Land Sites**
5		Reduce flight hazards (collisions and groundings)	All Land Sites
	5a	Voluntary solutions with tower industries	All Land Sites
	5b	Regulatory solutions with government to tower issues	All Land Sites
	5c	Awareness campaign to decrease light pollution	All Land Sites
6		**Support of community development in Boukan Chat**	
	6a	**Sustainable agriculture and reforestation programs**	**Morne Vincent**
	6b	**Environmental awareness and education programs**	**Morne Vincent**
	6c	Economic empowerment - VSLA facilitation	Morne Vincent
	6d	Economic empowerment - livelihood training	Morne Vincent
	6e	Engage with government to clarify and strengthen oversight of forested areas	Morne Vincent
	6f	Stove Program	Morne Vincent
7		**Undertake scoping study of socio-economic drivers of the threats at La Visite****	**La Visite**
8		Engage Dominica Republic government to plan and strengthen oversight of parks	
	8a	Direct engagement	DR Parks
	8b	Public advocacy	DR Parks
	8c	Habitat restoration	Valle Nuevo
9		Address threats at sea through advocacy	
	9a	Better incorporation of pelagic seabirds in fishery management plans	At sea
	9b	Stronger regulation of and mitigation from marine energy	At sea
	9c	Better compliance of marine energy industries to regulations	At sea
	9d	Stronger regulation of contaminant releases	At sea
	9e	Stronger regulations of plastic usage regionally	At sea

*Strategies in bold are those considered paramount, based on consideration of need, impact, feasibility and threat level.

**Initially several strategies to address threats were proposed for La Visite, but these were deferred in favor of undertaking an enabling strategy to fill information gaps.

THE NEED FOR MULTIPLE STRATEGIES

These paramount strategies must be undertaken in combination to achieve the ultimate vision that the Black-capped Petrel is flourishing throughout its range on land and at sea. In fact, we believe no single strategy can result in a population increase, much less a flourishing population. Only by pursuing a number of strategies that synergistically compound the gains from reduced threats and active restoration can we expect to see an upward population trajectory.

PRESENTATION OF STRATEGIES

The following sections detail the strategies identified for Black-capped Petrel conservation. For each, we provide a short introduction to ongoing activities relating to the strategy. We provide a simple diagram (i.e., one condensed from the full diagrams shown in Appendix 5) and a description of the theory of change. Key information needs relevant to the strategies are highlighted. Finally, a table of specific objectives and activities is provided.

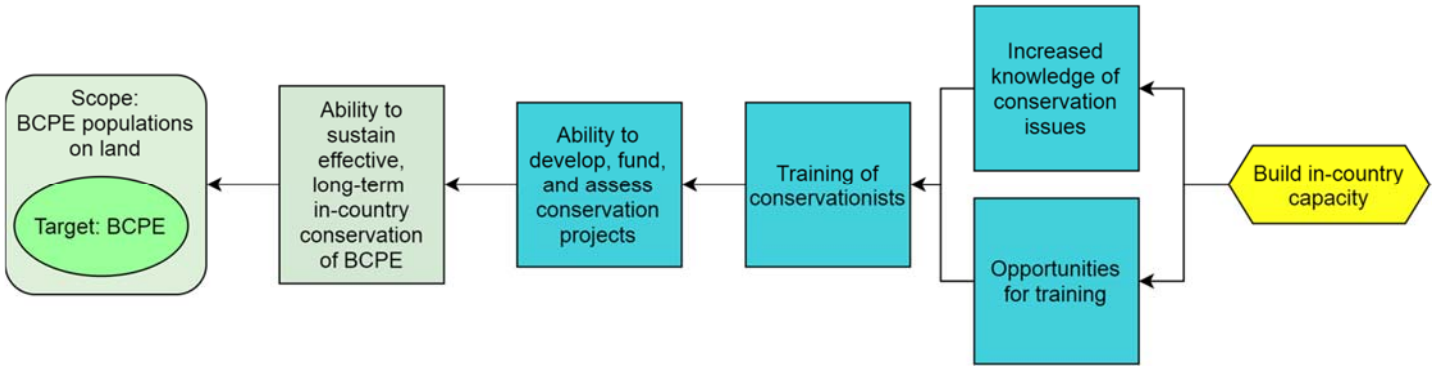
Strategy #1: Build In-Country Capacity

Background:
We recognize that the conservation of Black-capped Petrel relies on engaging individuals and organizations that are "in-country" – that can operate at the local-scale (where many conservation projects operate) to national scale (where much conservation policy is decided). Support for these partners has involved outreach to in-country partners, development and administration of international grant support for institutional strengthening[c] as well as projects, and an emphasis on training and relationship-building[d].

Regarding, current leadership and capacity: the nongovernmental organization Grupo Jaragua has taken the lead in conducting field work in the Dominican Republic in collaboration with international partners. Grupo Jaragua has permanent professional staff and a good capacity for funding-raising, but is challenged by aging field equipment (e.g., vehicles). In Haiti, the recently-formed nongovernmental organization JASCEH is growing into leadership for field efforts in Haiti, for which Société Audubon Haiti and Fondation Seguin have long provided support. The islands of Dominica, Guadeloupe, Cuba and Jamaica have good conservation capacity (professional conservationists in government and nongovernment agencies), but until nests are confirmed there, resources necessary and available for focused study and conservation of the petrel are undetermined.

Ensuring this capacity into the future and for the planning horizon (25-50 years) requires long-term work fostering the practice of conservation in general. Regardless of existing coverage, and especially if more sites are located on or outside Hispaniola, there is an ongoing need for trained conservationists with experience not only in nest searching or monitoring but also in conservation and academic leadership including project management, project funding, and development of research programs.

Strategy Logic:



Strategy Description:

[c] Examples include: MacArthur Foundation and U.S. Forest Service allowed BirdLife to support Société Audubon Haiti biologist positions 2011-2013; MacArthur Foundation and National Fish and Wildlife Foundation provided a capacity grant to BirdLife partner, Grupo Jaragua 2015-2017

[d] Examples include: Vermont Center for Ecostudies international trainings in the northeast U.S.; Grupo Jaragua and J. Goetz have provided trainings for multiple biologists and technicians on Hispaniola; a technical exchange involving teams from the Dominican Republic and Dominica took place in those countries in 2014 and 2017.

Building in-country capacity is central to launching or expanding projects, as well as for the long-term sustainability of current conservation interventions in-country. We believe that if, through a variety of outreach activities, knowledge of conservation issues can become more widespread, then individuals, especially youth, will develop an interest in additional education and training. Opportunities for training and employment must also be made known to these individuals, in order to foster long-term personal and professional commitment to conservation. Supported by the international conservation community, trained in-country conservationists will be in a position to develop, fund, implement and assess petrel conservation projects. Ideally, there should be at least one locally-based partner on every nesting island who is willing and able to implement a petrel-focused project. These petrel "champions" might be students, academics, agency or nongovernmental organization (NGO) biologists; the most important quality is a keeping an ongoing focus on petrel conservation.

Key Information Need: An understanding of the nation-specific conditions that bear on activities to strengthen institutions and grow capacity.

Strategy #1: Build In-Country Capacity		
Objective 1	Build societal awareness and positive attitudes towards petrels and their habitat that fosters engagement and support for conservation activities.	
	Activity 1.1	Highlight the Black-capped Petrel in broad public outreach, awareness and education programs about the importance of conservation.
		Examples: Media coverage of survey expeditions; a "Save the Devil" documentary film series led by filmmaker Aaron Straight, in collaboration with EPIC; Diablotin Festival in Boukan Chat, led by JACSEH and EPIC.
		Indicators: Proximate: Number of festivals; number of media items, number of schools reached, number of people reached. Ultimate: Government and civic engagement in conservation-related activities.
	Activity 1.2	Engage Caribbean biologists from across taxonomic fields who can collaborate on addressing shared threats or habitats (e.g., forest ecologists, herpetologists, etc.).
Objective 2	Students in secondary and undergraduate programs are aware of Black-capped Petrel conservation, and have opportunities to attend internships, fellowships and graduate education programs.	
	Activity 2.1	Identify and promote academic opportunities relevant to petrel conservation and support interested students.
		Examples: *Graduate programs (MS, PhD) supported by Caribbea initiative.* *Grupo Jaragua's environmental education programs for secondary students*
		Indicators: Proximate: Science faculty leads contacted, students reached. Ultimate: Number of secondary students reached; Increased academic engagement in BCPE research (e.g., number of Caribbean universities and students working on BCPE or with communities with BCPE); number of Caribbean graduate students with projects on BCPE.
Objective 3	In-country conservationists (field technicians, resource managers, program leaders) have opportunities for training in programs that will benefit BCPE.	

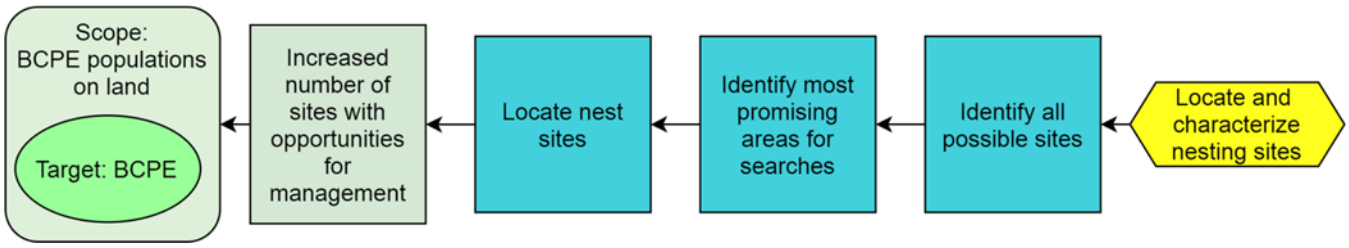
	Activity 3.1	Identify and promote opportunities for field technicians and environmental leadership opportunities relevant to BCPE to in-country conservationists
		Examples: *Field opportunities like* Project Puffin *Fellowships such as* Edge of Existence *or* Conservation Leadership Programme *BirdsCaribbean's periodic trainings in grant-writing, outreach.*
		Indicators: Proximate: Communiques/listings of opportunities. Ultimate: Number of individuals who have taken advantage of training, gaining knowledge of BCPE, the threats to their nesting habitat, management practices to reduce impacts to BCPE, and the means to implement best practices.
Objective 4	Government and non-government organizations have positions that allow nationals to undertake BCPE conservation as paid professionals.	
	Activity 4.1	Encourage governments to fulfill national and international conservation mandates by hiring conservation professionals
	Activity 4.2	Support in-country organizations in building up staff and capacity.
		Indicators: Proximate: Institutional growth government and non-government agencies engaged in species conservation.

Strategy #2: Locate and Characterize Nest Sites

Background:

During the last ten years, the working group has focused on locating and characterizing nest sites. As a result, 100 nests have been identified since the first plan was drafted. A scheme of radar surveys for flying petrels and ground-searches aided by acoustic monitoring were conducted on Hispaniola to determine the extent of nesting petrels at historical and potential petrel activity centers. Despite technology, locating nests has been a laborious process especially since areas are remote and difficult to access, and steep and forested and difficult to survey. Many areas remain to be searched. Successful at-sea capture and tracking of petrels in 2019 offers a method to locating nest areas, especially of targeted light forms (Satgé et al. In prep.). Additionally, habitat suitability modelling provides a tool to direct nest searching efforts to areas of suitable habitat (Satgé et al. 2020).

Strategy Logic:



Strategy Description:

Knowing the location and numbers of petrel nests gives the clearest picture of the species' breeding distribution and success. More impactfully, as more nests are located, there are more options and opportunities for management. If we know where sites are, we can better characterize threats and pursue interventions to reduce threats or enhance populations.

We do note that, although nest confirmation should be a precursor for large-scale investment in conservation actions at any site, some strategies may be worth pursuing at probable and suspected sites. For example, low-cost activities to reduce flyway hazards, increase community awareness, and control invasive mammals can benefit petrels in the absence of nest confirmation and will have benefits for other native species regardless of petrel presence.

Strategy: Locate and Characterize Nest Sites		
Objective 1:	All confirmed, probable and suspected sites on Hispaniola have received comprehensive search effort with all relevant methods and tools by 2025.	
Objective 2:	By 2025, at least one additional island (Dominica, Cuba, Jamaica, Guadeloupe) has been explored more thoroughly for nesting sites.	
	Activity 2.1:	Implement ground searches using all known efficient methods and tools (listening, radar, ARU, optics, habitat suitability modeling) to narrow search areas, prioritizing search areas by strength of evidence of nesting.

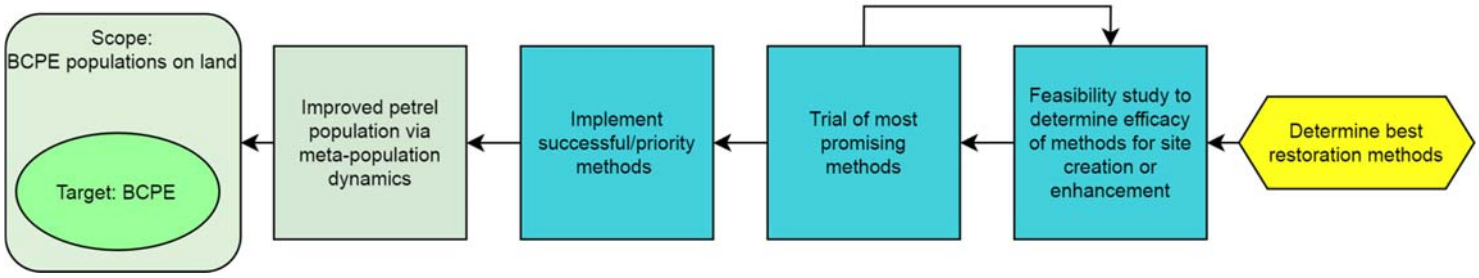
		Indicators: Number of studies/level of search effort at all known, probable and suspected sites; Percentage of suitable habitat searched.
	Activity 2.2:	Explore and integrate additional techniques (sniffer dogs, thermal cameras, community interviews about observations and groundings, at-sea capture and tracking) to direct searches to new nest sites.
		Example: In Cape Verde islands, Militao and colleagues (pers. comm.) conducted interviews with hundreds of local people to gain knowledge of old colonies of Fea's Petrel or Gongon.
	Activity 2.3:	Pursue other clues and techniques (for example, examination of color forms, genetic analysis)to assess whether the located colonies represent the full population (account for the observed variation).
Objective 3:	Threats are characterized at all newly discovered sites through appropriate research and monitoring (e.g., nest visits, camera traps, flight hazard mapping).	

Strategy #3: Explore Restoration Methods

Background:

Seabird restoration can be defined as the "deliberate human-aided movement or attraction of seabirds to establish or enhance a colony" (The Seabird Restoration Database 2020. The two primary restoration methods advanced for imperiled petrel species around the world are (1) Translocation – in which individual near-fledged chicks are physically moved by humans from a source location to a restoration location; and (2) Social Attraction – in which sensory cues (e.g., broadcast vocalizations, deploying decoys, olfactory lures) are used to attract breeding birds to restoration locations (Jones and Kress 2012). Restoration locations may be at sites where the species previously struggled or was extirpated or may be novel to the species, but any site must provide habitat suitable for nesting and be free from significant threats (i.e., predator-free sites; Jacobs et al. 2020).

Seabird restoration methods actively restore seabirds through management rather than allowing seabirds to passively recover following the removal or reduction of threats. Restoration is especially valuable in cases where: seabirds do not readily colonize new breeding sites, risks cannot be eliminated at existing breeding sites, productive restoration sites can accelerate population growth by offsetting losses elsewhere, and/or additional breeding sites reduce extinction risk posed by catastrophic events. Restoration has been implemented for *Pterodroma* species worldwide (e.g. Gould's Petrel *Pterodroma leucoptera*, Priddel et al. 2006; Cahow *Pterodroma cahow*, Madeiros et al. 2012, Carlille et al. 2012) but not been employed for the Black-capped Petrel.



Strategy Logic:

Strategy Description:

Restoration can help to secure and recover the Black-capped Petrel. Exploration of restoration methods starts with undertaking a detailed analysis/feasibility study of translocation and social attraction in respect to the Black-capped Petrel, evaluating efficacy, cost and logistics, and best practice techniques. Methods recommended in the feasibility study must be field tested with the Black-capped Petrel. Although social attraction and translocation have been effective for other imperiled petrel species, these are all novel for the Black-capped Petrel. If the recommended active management methods produce the results anticipated from the pilot studies, we would be successful in improving viability of the species.

The feasibility study should assess:

Long-term Benefit to Species: Explicitly describing the overall project goals and justifications,

and specification of principles (e.g., would restoration outside the species indigenous range be considered? are there justifications beyond species conservation?). Importantly, the desired biological outcomes (the seabird response) should be specified along with a plan to assess these outcomes.

Cost and Logistics: Identifying and assessing source and restoration sites, considering compliance and regulatory considerations (e.g., permits needed); logistics relevant for each method (e.g., timing of attraction tactics or relocations, staff and equipment needs); cost/benefits analysis of methods; and needed long-term commitments and financial resources

Best Practices: Ensuring the welfare of individual birds (e.g., techniques of transporting chicks and during a 2-3 week feeding period; design of nest boxes for the fledging chicks) and the highest likelihood of success (e.g., which forms of social attraction are most effective for the species)?

Limitations: Identify challenges of restoration, which may be ecological (e.g. ecological trap in habitat not suitable for optimal embryo development), logistical (e.g. limited availability of land, resources, and manpower; need for predator control) and socio-political (e.g. reluctance from local communities to have petrels "taken away" from them; reluctance from governments to accept international transfers).

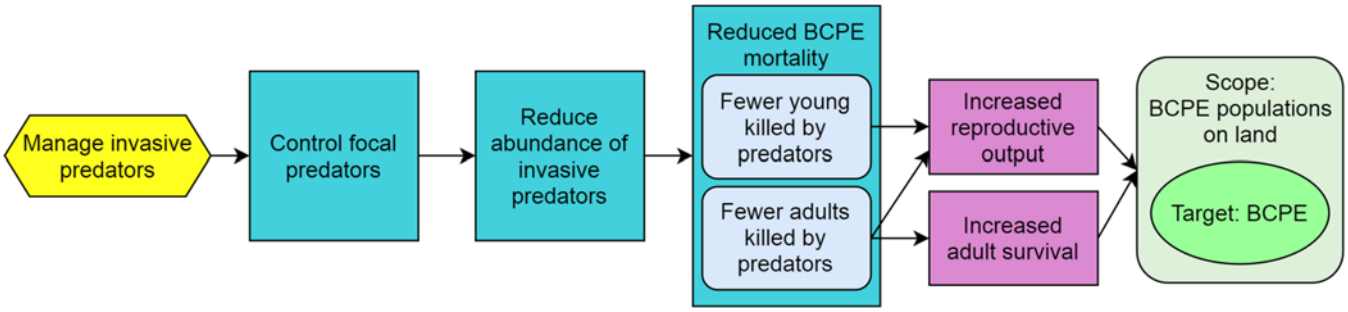
Key Information Needs: We anticipate that the feasibility study will call for research on growth rates, diet composition, quantity, and quality, feeding rates, to support translocation. Additionally, the suitability of the restoration site as breeding habitat is paramount and much is unknown about microhabitat needs. Since current populations of Black-capped Petrels represent relicts of their former distribution, it is also not clear how closely historic populations were tied to current habitats (Simons et al. 2013).

Strategy #3: Explore Restoration Methods		
Objective 1:	By 2025, full feasibility study of restoration methods relevant to Black-capped Petrel is completed with recommendations for pilot projects to test tactics.	
Objective 2:	By 2030, restoration methods undertaken, as informed by pilot studies and models of requirements for resilient and increasing petrel population trajectory.	
	Activity 2.1:	Establish research sub-committee to oversee the progress of the strategy, including 1) the review of the feasibility study, 2) study design of pilot projects, and 3) evaluation of selected tactics.
	Activity 2.2:	Identify experts to conduct the feasibility study and act as advisors on pilot projects

Strategy #4: Reduce Predator Pressure

Background:

Introduced mammalian predators are a critical threat to petrels worldwide (Rodríguez et al. 2019). Since locating nests on Hispaniola, petrel field teams have been collecting information about the presence and effects of introduced mammalian predators. Camera traps are used to document predators in or near burrows, and evidence of predation such as broken eggs and body parts are noted, in order to determine predation effects. To address the threat of predators, field teams on Hispaniola have deployed live traps at the start of laying period at confirmed petrel nest sites, especially where cats and mongoose have been noted. However, field teams can only spend limited time in the remote areas where nests are found, which limits the duration that live traps can be set because they must be checked regularly. The ideal approaches to predator control are those that have lasting effects and require only a low level of effort to maintain. The planning team is currently exploring the use of unattended, automatic-resetting lethal traps that are safe for native wildlife (particularly co-occurring Hispaniolan Solenodon *Solenodon paradoxus* and Hispaniolan Hutia *Plagiodontia aedium*).



Strategy logic:

Strategy Description:

We believe if the most harmful predators can be controlled such that their abundance is reduced, then mortality of adults, chicks, and eggs at nest sites will also decrease. Conversely, both reproductive output and adult survival will increase at these sites. Predator eradication is preferable to predator control, but mainland Hispaniola and the islands with probable and suspected nest sites are vast and densely populated with humans, making eradication impossible. The most effective methods of control (i.e., trapping, poisoning, hunting) will vary among locations and with predator type, its behavior, non-target risk, the conditions at the site, and the experience of the team. Another option might be sub-island predator-proof fencing (exclosures) – although no such approach has yet been used anywhere in the Caribbean.

Data from similar *Pterodroma* species suggest that predator removal and/or long-term control can reverse declines and create long-term stability of nesting populations. For example, after 40 years of predator management in national parks, the Galapagos Petrel (*Pterodroma phaeopygia*) population has stabilized and increased by four-fold (Cruz et al. In prep.) For the closely related Hawaiian Petrel (*Pterodroma sandwichensis*), removing rat predation pressure has resulted in an increase in reproductive rate of 10% for hatching success, and improvement of overall fledgling success (Raine et al. 2020).

Note that predator control activities could be undertaken for some introduced predators even in the absence of confirmed nesting. In Dominica and Guadeloupe, feral pigs are known to occur in the national parks hosting probable or suspected nest sites. Feral pigs damage native vegetation and prey on a number of native species; their reduction or removal would benefit forests regardless of petrel presence.

Key Information Needs: Determining the impacts of predation on Black-capped Petrel, particularly on adult survival, and the techniques that will best control predation

Strategy #4: Reduce Predator Pressure		
Objective 1:	Reduced abundance of introduced predators around nests	
	Activity 1.1:	Activities to control introduced mammals just before and during Black-capped Petrel nesting season
		Indicators: Less frequent presence of predators as evidenced by camera traps; reduced nest losses due to predation, increased productivity.

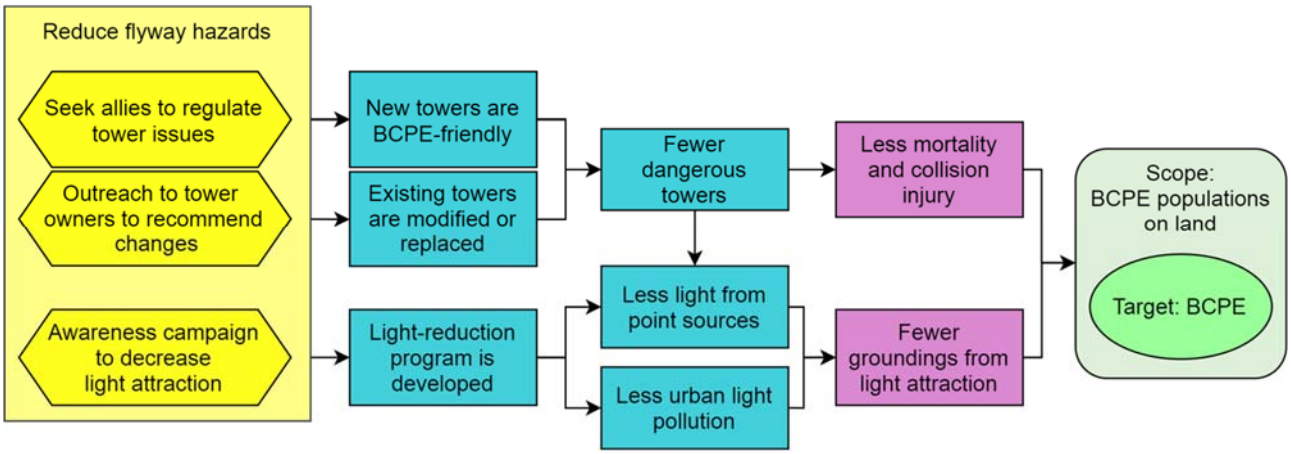
Strategy #5: Reduce Collisions and Groundings

Background:

The first Black-capped Petrel collision injury documented at a tower was in March 2012 at Loma del Toro (Hardesty Norris and Rupp 2012); a grounded fledgling was recovered the same year at the Haiti's Central Bank in Port au Prince (SAH 2012). The working group maintains records of injured and grounded birds reported since 2010 to assist in characterizing the threat. Additionally, locations of high-risk towers – based on location, height, lighting, and cabling – have been compiled. Direct action – removal of a spotlight – was undertaken at a high-risk tower at Tet Kay Jak, Haiti where multiple strikes were observed in real-time in February 2013. Letters and briefings have been developed for private tower owners and government agencies with recommendations to reduce collisions and groundings, many of which may also reduce tower operation costs.

In the Dominican Republic, in an effort to reduce mortality, special instruction has been given to park administrators in both Sierra de Bahoruco and Valle Nuevo national parks of the importance of finding, reporting and saving grounded petrels. Flyers with release protocols in Spanish have been distributed to all park guards in these parks, as well as in different institutions in nearby towns of Pedernales, Puerto Escondido and Duvergé. In Haiti, fliers in Kreyol have been distributed in Anse-a-Pitres and Marigot as well as Seguin, Thiotte and Port-au-Prince. Thanks to this outreach, a small number of downed birds have been successfully recovered and released in recent years.

Strategy Logic:



Strategies description:

3 Substrategies:

- 5a. Seek voluntary solutions with tower industries
- 5b. Seek regulatory solutions with government to tower issues
- 5c. Awareness campaign to decrease light pollution

These substrategies seek to decrease the harm caused by proliferation of lighted structures from infrastructure growth, and light pollution from urbanization through outreach to specific audiences. This is based on the assumption that most owners and communities are currently unaware of the problem, and if given knowledge and recommendations, would be willing to make design and behavior changes if they did not incur significant costs.

The focus of these strategies should be on hazards that pose the highest risk to adult breeders. Special effort should be made at tower hazards near nesting sites, because of proximity and the volume of direct flights to and from nesting areas. Aerial courtship is also known for some *Pterodroma* species and this flight behavior may place pre-breeders as well as breeders at risk.

Unlike with tower hazards, the audiences that need to be reached to reduce the threat of generalized light pollution (e.g., streetlights, home and business lighting, stadium lights) are very broad. We assume that if an awareness campaign is undertaken using effective venues for targeted audiences, then more people will be aware of the phenomenon of light attraction, and open to behavior change. An effective light reduction program is expected to require local leadership andincentives (e.g., demonstrable energy savings, free shielded light bulbs, public recognition) to change behaviors. We can learn from programs around the world.

A light pollution awareness campaign would integrate the current grounded bird outreach effort, which provides information about collection and release of grounded birds. Rescue programs have been set up for 34 other species in 16 locations around the world with thousands of seabirds collected and released by program participants (Rodríguez et al. 2017). It is unlikely that a rescue program for the Black-capped Petrel can replicate the successful release rate achieved for some of these programs that involve rehabilitation of injured birds by trained professionals and dedicated facilities (e.g., Save Our Shearwaters in Kauai). However, rescue programs on Hispaniola and other islands could contribute to conservation knowledge and outcomes by documenting impacts, confirming presence of birds and raising support for other conservation strategies.

Key Information Gap: There is a big data gap in our knowledge of the occurrence and impact of collisions and groundings, especially on adults. Flyways to and from colonies, and fledging corridors also need to be located. Some recommendations to tower owners may need to be piloted on-site (e.g., diverters).

Strategy #5: Reduce Collisions and Groundings in Flyways		
Overarching objective:	The mortalities from collisions and groundings are reduced, especially of adults.	
SubStrategy 5a: Seek voluntary solutions with tower owners to minimize risk to petrels in flyway		
Objective 1:	Owners of existing and planned towers integrate recommendations and tools to minimize collisions and groundings.	
	Activity 1.1	Consultations with tower owners
		Indicators: Proximate: Number of consultations. Ultimate: Alterations to tower design.
SubStrategy 5b: Seek regulatory solutions with government to tower issues		
Objective 2:	Government is aware and in favor of regulating towers for the purposes of environmental protection.	
	Activity 2.1:	Reach out to government bodies with information and recommendations to reduce threat.
		Indicators: Proximate: Allies in government identified. Ultimate: Regulations in place and enforced.
SubStrategy 5c: Awareness campaign to decrease light pollution:		
Objective 3:	Owners (citizens, municipalities, businesses) with high levels of light pollution are aware of wildlife consequences as well as the means and benefits of reducing them.	

	.	
	Activity 3.1:	Identify and work alongside community leaders, business owners, and community groups to address strike and grounding hazards to petrels. Develop local plans to guide efforts to reduce these hazards.
		Indicators: Heightened community awareness, levels of light pollution in targeted areas.
	Activity: 3.2	Continue to systemize and expand the rescue program, working alongside community leaders, business owners, and community groups to educate locals about collection, treatment and release of grounded petrels.
		Indicators: grounded bird reports; number of birds released alive compared to total reported

Strategy #6: Support Community Development in Boukan Chat

Background:

The community of Boukan Chat abuts the confirmed Black-capped Petrel nesting site of Morne Vincent in Haiti. Boukan Chat farmers work the land to within a few hundred meters of petrel burrows. Though located in a National Park, oss and degradation of the nesting site due to expanding agriculture is an imminent threat because park protections are not enforced. As shown in the situational analysis for Morne Vincent, expansion of agriculture results from a lack of alternatives: farmers experience degradation of existing farmland, and without adequate social capital, financial capital, and knowledge, are ill-equipped to pursue change. Moreover, farmers are conditioned by a history of political corruption and social unrest, economic crises, and natural disasters to focus on short-term gains, especially since they have no legal claim to the land.

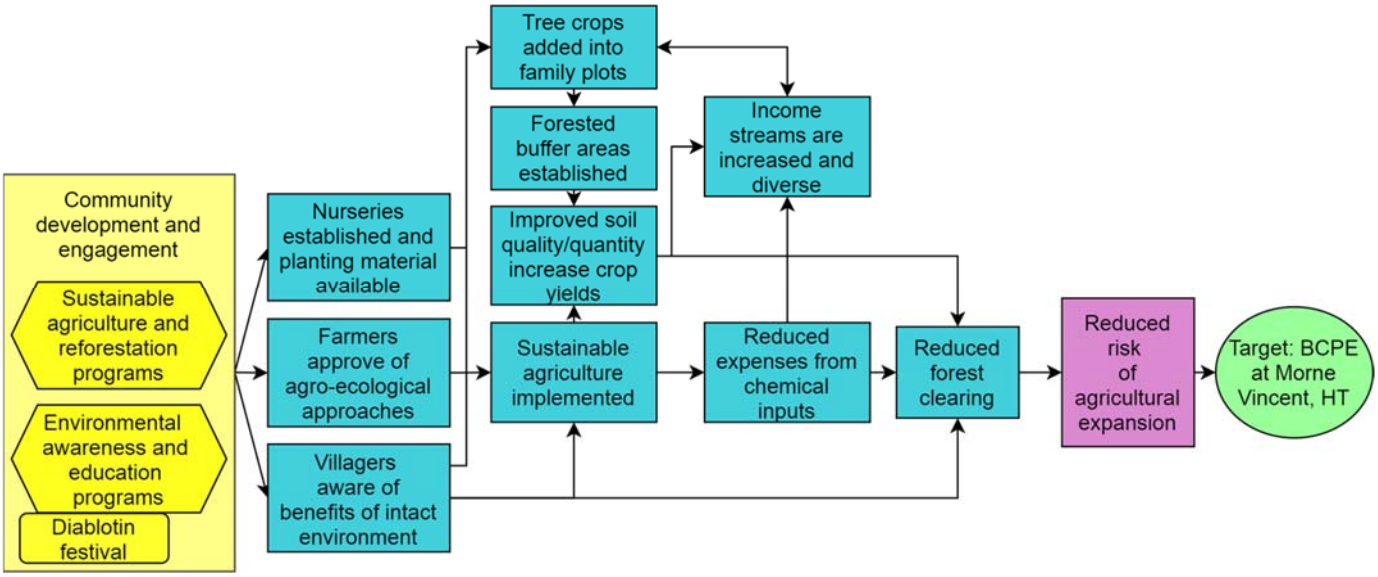
Over the past several years, petrel conservationists working locally – Grupo Jaragua, EPIC and JACSEH – have worked to understand the dynamics of the Boukan Chat community. Early on, teams recognized that community goodwill was necessary to safely and effectively conduct field work, and to explore conservation interventions. By building relationships, undertaking consultations, and supporting humanitarian work (cistern building), conservationists were able to develop a number of strategies to reduce the threat of agricultural expansion. Since forestalling the expansion of agriculture depends on empowering the community to find alternatives to converting and degrading nearby forest, these strategies relate to community development. These work together:

6a Sustainable agriculture and reforestation programs
6b Environmental awareness and education programs
6c Economic empowerment – facilitation of Village Savings and Loans Associations
6d Economic empowerment - livelihood training
6e Engage with government to clarify management of occupied park land forested areas
6f Stove Program

Community development strategies are already ongoing or under development in Boukan Chat. The first two in the above list are most familiar to the organizations represented on the planning team and are described below. All require collaboration with organizations working in the area to improve human health and welfare.

One of the partners in community development is Plant With Purpose (PWP), a private, U.S.-based organization which has operated in nearby Fond Verettes for about a decade and has recently started working in Boukan Chat [See Breakout: Community Development.] Additionally, the IBPCG has engaged with Centro de Estudios y Solidaridad con América Latina (CESAL), an NGO based in Spain, and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), a German development agency. Both of these organizations are currently leading projects to reduce poverty and vulnerability of ecosystems in the La Selle-Jaragua-Bahoruco-Enriquillo Transboundary Biosphere Reserve, which includes Boukan Chat. Grupo Jaragua has been engaged to provide forest restoration training and implementation, and monitoring of priority species, to support these projects.

Strategy Logic:



Strategy Description:

A key assumption of the sustainable agriculture and reforestation programs is that we can reduce pressure on the forests by making the means of livelihood easier to achieve and access outside the forest. Threat of agricultural encroachment into the forested area near Boukan Chat, as well as the harvesting of forest products, is driven by failure of crops on current farming land. By receiving training in sustainable agriculture – methods of soil and water retention, crop rotation, natural fertilizers – farmers will be able increase yields in existing plots at lower expense. If at the same time, planting material, knowledge of agro-ecology principles, and savings to invest were available, farmers would be more able and willing to explore alternatives to short-term annual crops. Fields tilled for cash-crop such as onions, carrots and potatoes, which provide short-term returns at the expense of forest habitat, could be converted to coffee, avocado, and other perennial tree crops. These farms would act as buffers to existing forest, and encourage engagement in reforestation activities.

We believe that if farmers empowered with the means to change their practices also learn the importance of an intact environment to their own welfare, they are more likely to accept that forest preservation should co-exist with crop production. Environmental awareness and education programs will help local citizens, especially youth, to combine a desire for a better life for themselves with a new-found pride in their natural heritage. If there is the belief that a healthy ecosystem really does benefit a farmer – that livelihood is connected to the health of the ecosystem – then farmers are less likely to pursue or allow further forest clearing. Environmental education is built into the agro-ecology curriculum as well as programs for youth.

Strategy #6: Strategies of Community Development in Boukan Chat
Overarching objective: No further loss of petrel nesting habitat at Morne Vincent due to expansion, and bordering farms converted to tree crops.
Sub-Strategy 6a: Sustainable agriculture and reforestation programs

Objective 1:	Improved productivity and decreasing expense in existing fields reduce pressure to encroach on petrel habitat for needed resources.	
	Activity 1.1:	Farmers closest to the Morne Vincent site are included in agro-ecology programs. Trainings address: water retention and stabilization of soil, alternatives to chemical inputs, fencing of livestock, etc.
		Indicators: Number of trainings, number of measures implemented, changes in plots where measures implemented
Objective 2:	Farmers plant trees to produce alternative crops and provide ecological services; thus becoming less likely to encroach on petrel habitat for needed resources.	
	Activity 2.1:	Tree planting for alternative crops and reforestation
		Indicators: row-crop areas converted to tree crops, number of tree crops planted, number of farmers planting trees
Substrategy 6b: Environmental Awareness and Education Programs		
Objective 3:	Farmers and community at large are aware of the importance of forest and biodiversity and the ways their activities can contribute to their conservation while also allowing economic improvement.	
	Activity 3.1:	Farmers receive environmental education along with agroforestry techniques.
		Indicators: Trainings conducted, farmers reached
	Activity 3.2:	Classroom outreach to complement lessons to adults including lessons on soil, water, forest and biodiversity.
		Indicators: School visits; numbers of students reached.
Objective 4:	Community awareness and positive attitudes towards petrels and their habitat foster engagement and support for conservation activities.	
	Activity 4.1:	Continue annual Diablotin Festival – part of a pride campaign that includes a parade, soccer match, film festival, and celebrates the connection between Boukan Chat and the Black-capped Petrel conservation effort.
		Indicators: Festivals conducted, percent of the community reached.

Key Information Need: Precise mapping of land use around petrel habitat (extent of cleared areas converted to trees, extent of buffer to habitat/primary forest patch) to know if agriculture expansion actually stopped or reversed.

Strategy #7: Undertake Scoping Study of Socio-Economic Drivers of Threats at La Visite

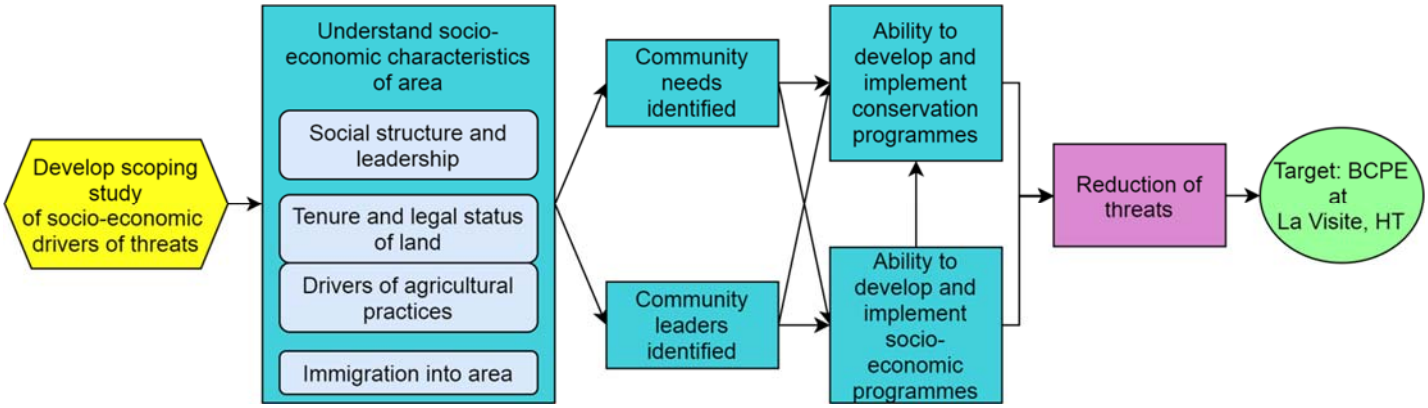
Background:

In many ways, the situational analysis for the confirmed site at La Visite, Tet Opak, resembles that developed for Morne Vincent. Both depict an overarching situation of unsustainable resource use of petrel habitat, driven by institutional, cultural and socio-economic factors in a national park without control or management (i.e., La Visite National Park stewardship has been weak since its creation in 1983 (Woods et al. 1992, Timyan et al. 2012). It's very likely that the situations at Macaya and any other probable or suspected sites in Haiti are similar.

However, interventions in Boukan Chat, the community adjoining Morne Vincent, were enabled by some fortuitous and positive relationships, opportunities for humanitarian aid in a time of drought, and agro-ecology programs already established with farmer cooperatives in nearby valleys. Importantly, in the Boukan Chat community, it appears there is relative stability in the family structure of the community, and claims on land adjoining Morne Vincent are well-established[e].

A member of the planning team (Jim Goetz) has been working in Seguin, in the vicinity of the La Visite ridge for almost two decades. His work in the community managing a Payment for Ecosystem Services project affirms the many social and cultural obstacles to supporting local livelihoods and conserving nearby broadleaf forest. Moreover, despite Goetz's research and experience, and relationship-building in the region, there remain significant unknowns about the communities specifically using the ridge area occupied by petrels.

Strategy Logic:



Strategy Description:

We know that the habitat on the La Visite Ridge is threatened by expansion of agriculture, expansion of grazing and the collection of forest products (tree ferns, bromeliads, firewood). However, unlike at Boukan Chat community in Morne Vincent, key information about the identity, origin and organization

[e] Land occupation and tillage are not legal, but claims are established by working the land and are recognized in the community.

of resource users is lacking. We are not sure exactly who is working or using the petrel habitat: for example, do they reside locally in Seguin or in one of the several surrounding settlements, or do they travel in from several, distant communities? Do these communities have social structures through which conservationists might develop relationships and begin interventions? What community development strategies are in place or have been tried previously? Additionally, we know little about the markets for the extracted forest resources: for example, what are the drivers of demand?

Key Information Need: We need a more in-depth analysis of the situation at La Visite, Haiti, the largest known colony of petrels, in order to move forward on planning and implementing conservation actions to reduce threats to habitat.

Strategy #7: Scoping Study at La Visite		
Objective 1:	With the conservation situation characterized, the planning group can move on to planning and implementing interventions to reduce threats to Black-capped Petrels and petrel habitat in La Visite National Park.	
	Activity 1.1:	Develop and carry out a socio-economic study of the communities living adjacent to the La Visite escarpment.
		Indicators: Study report with recommendations

Strategy #8: Engage Dominican Republic Government to Plan and Strengthen Oversight of Parks

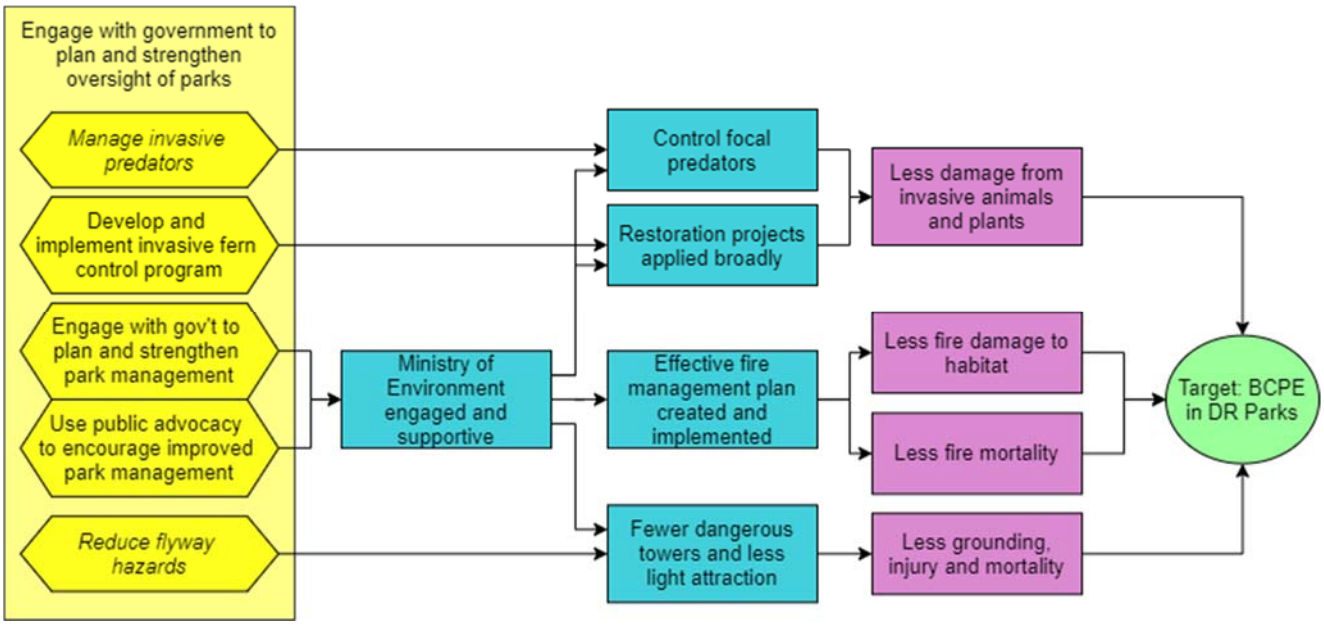
Background:

Confirmed and probable nesting sites in the Dominican Republic fall within the National Parks of Sierra de Bahoruco and Valle Nuevo, and suspected sites fall within other National Parks (Sierra de Neiba, Del Carmen Ramirez, Bermudez). Each park has a different history of protection, degradation, restoration and ongoing management, but all are managed under the same system of policies and authorities. It is the Ministry of Environment (Ministerio de Medio Ambiente y Recursos Naturales) that has the responsibility for the condition of Dominican Republic National Parks and the biodiversity they harbor. National Park management varies with the experience and skills of managers, who are typically political appointees. Elections and political turnover often mean a change in park personnel, which is both a challenge and opportunity for developing relationships within the Ministry.

Grupo Jaragua and other field practitioners regularly engage the Ministry to obtain permits and arrange logistics for field work. In ideal times, government involvement and support in conservation projects is significant, with regular dialogue between organization executives, combined planning exercises, and arrangements in which management projects are viewed as partnerships or collaborations. For example, in February 2016, Grupo Jaragua worked the Ministry to arrange a series of strategic planning workshops for Sierra de Bahoruco using the "Conservation Standards" (Rupp and Garrido 2016).

This strategy also calls for collaboration with other organizations: those that seek strong park oversight to achieve other goals such as water and air quality, carbon sequestration, and conservation of other forms of wildlife.

Strategy logic:



Strategy description:

Substrategies

8a. Direct engagement
8b. Public advocacy
8c. Habitat restoration projects

The Black-capped Petrel occurs on just a small part of the Dominican Republic's very large parks, thus park management to benefit the species must be precisely targeted at the main threats to the petrels and their habitat.

In addition to the threats of predation by introduced mammals and collision and grounding hazards, the greatest threats to Black-capped Petrels in Dominican Parks appear to be damaging fires, the presence of invasive ferns in Valle Nuevo, with only occasional illegal intrusions causing habitat damage (e.g., charcoal production). Ministry approval and support is a necessary component for the implementation of activities to reduce predation and flyway hazards, and these strategies are discussed in other sections (Strategies 4 and 5). In coming years, we believe continued engagement by petrel conservationists should focus on convincing or compelling park administrators to commit to wildfire management plans, including preventative measures (e.g., litter reduction, fire breaks) as well as investment in people and infrastructure to combat harmful fires. Direct engagement involves activities with representatives – meetings, site visits, trainings, etc. – whereas public advocacy is indirect: turning to citizens to bring attention to issues. If engagement with the government is successful, effective management of fire will increase and the threat diminish.

We believe engagement with Ministry on invasive species management in National Parks will also have benefits for the Black-capped Petrel. If officials are made aware of the possibility, means, and benefits of restoration programs – for example, removal of invasive ferns in Valle Nuevo – then they will likely be supportive of these projects in parks. Grupo Jaragua is well positioned to do this: it has organizational experience and capacity for habitat restoration projects; their biologists have first-hand knowledge of habitat conditions that are detrimental to Black-capped Petrels and/or to research and monitoring programs.

Key Information Need: For restoration projects, test feasibility and efficacy of protocols developed to control invasive ferns in the Dominican Republic. Research native species best adapted to recolonize restored habitat.

Strategy #8: Engage with Dominican Republic government to plan and strengthen oversight of parks		
Overarching objective: Grupo Jaragua and national/international partners have a proactive relationship with Ministry of Environment and national park administrators and managers that furthers management of parks important to BCPE.		
Sub-Strategy 8a: Direct Engagement		
Objective 1:	Park administrators and managers look to Grupo Jaragua for expertise on Black-capped Petrel and become directly engaged and supportive of petrel conservation activities.	
	Activity 1.1:	Provide information and opportunities to learn more about petrels and the principal threats at confirmed sites (introduced predators, flight hazards, wild fires and invasive species).
		Indicators: *Number of individual managers and administrators with knowledge of BCPE, the threats to their nesting habitat, and Best Management to reduce impacts to BCPE.*
Substrategy 8b: Public Engagement		
Objective 2:	Grupo Jaragua and partners gain public backing when calling for National Park management of threats to petrels	
	Activity 2.1:	Public outreach and awareness campaigns that bring attention to national park management issues with implications for petrels
		Indicators: articles, interviews in the media
Substrategy 8c: Habitat Restoration		
	Activity 3.1:	Restoration projects (e.g., propagation of native broadleaf species, removal of harmful invasive plants) be showcased for national park administrators and managers.
		Indicators: Invasive fern removal in Valle Nuevo

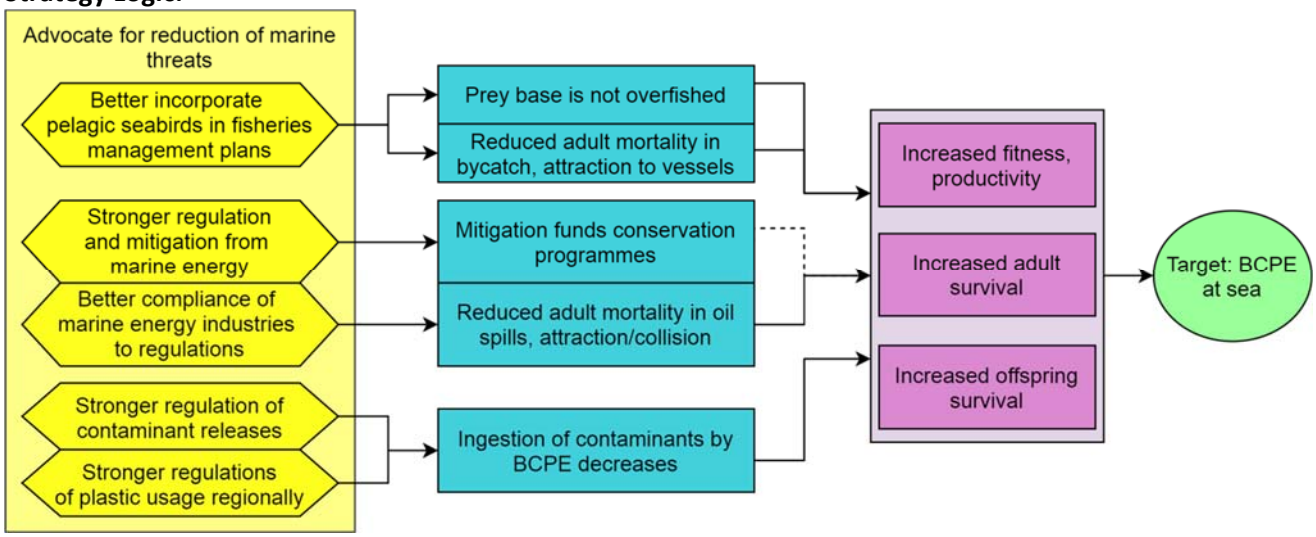
Strategy #9: Address Threats at Sea Through Advocacy

Background:

Although there is significant uncertainty as their population-level effects on Black-capped Petrels, threats at sea are of concern to conservationists. It is likely that marine threats have less impact than do on-land threats, but cumulative threats affect the viability of the species. Moreover, the sectors and society responsible for marine threats may be able to mitigate or offset impacts that occur on land (e.g., restoration funds from an oil spill).

Petrel conservationists have long worked to keep at-sea threats to Black-capped Petrels in the spotlight. Large-scale changes in the marine environment associated with human activity affect all seabirds to some degree. Thus, individuals and organizations involved in petrel work operate in broader networks that concern themselves with seabird research, monitoring, management and advocacy; for example, the World Seabird Union, Atlantic Marine Bird Cooperative, BirdsCaribbean Seabird Working Group, Gulf of Mexico Avian Monitoring Network. Within these networks, research to understand the movements of petrels at sea and potential exposures is conducted, supported and disseminated. Additionally, through our organizations and networks, we work to ensure that petrel information is included as appropriate to assessments that affect policy: e.g., inform regulating authorities about petrel presence in areas slated for energy exploration; inform enforcement authorities of provenance of birds collected in spills.

Strategy Logic:



Strategy Description:

Strategies that directly work on the threat (e.g., develop a technology that harvests plastic debris in oceans) or even on a driver of the threat (e.g., plastic waste reduction) are beyond the manageable interest of the planning group. We believe that our most effective and feasible interventions will be to advocate for the Black-capped Petrel in the realm of marine policy. If we continue to engage with networks that disseminate scientific information and concern themselves with marine environmental health, the interests of the Black-capped Petrel can be part of the development of policies that reduce marine threats where petrels occur.

The multi-scale elements of fisheries, marine energy development, ocean contamination and plastic debris involve local, regional, global-scale levels of management. Moreover, the Black-capped Petrels movements at sea make it subject to the jurisdictions of multiple nations as well as into international waters (Jodice and Suryan 2010, Jodice et al. 2015). Addressing the full scope and scale of related marine policies is infeasible, so effort should be focused on highest threats.

Key Information Need: To better assess marine threats, and to give focus to our advocacy, we need to continue to study the at-sea movements and overlap with risk factors using tracking information, in particular in the Eastern Caribbean Sea and tropical Atlantic.

Strategy #9: Address marine threats through advocacy		
Objective 1:	The interests of the BCPE are included in the development of marine policy relevant to the petrel's highest marine threats.	
	Activity 1.1	Highlight BCPE in appropriate science/conservation forums
		Indicators: Publications, reports, presentations
	Activity 1.2	Contribute data to regulatory and policy documents

CONTINUING THE PROJECT CYCLE

As recommended within the Conservation Standards framework, we envision the conservation of the Black-capped Petrel as a cyclical process of assessment, planning, implementation, adapting and sharing. The IBPCG intends to continue its work in an iterative manner, embracing learning, adapting to emerging information and opportunities, and fostering partnership.

Appendix 1: Planning Process summarizes activities from 2012 to 2020. Going forward from 2021, we take note of some particular intentions:

Assess

We will continue to assess the conservation situation for the petrel, undertaking research to reduce uncertainty and enable strategies. Appendix 7: Information Needs summarizes the information gaps presented throughout this document.

We welcome all interested parties into the IBPCG, and we will seek out partners for information and participation in working groups as needed. Currently there is a need for partnership in the South American countries whose waters host foraging hotspots for petrels (Colombia and Venezuela). Additionally, we will pursue more determinedly synergies with groups undertaking research or conservation on species sharing Black-capped Petrel habitat (e.g., the Bicknell's Thrush International Working Group).

Plan

Additional project- or site-specific planning is required to commence or continue to implement the strategies presented in this Conservation Plan. Many of the strategies are ongoing under the leadership of the organizations represented by the planning team; seem need to be launched, and all would benefit from engaging or re-engaging other stakeholders. This applies particularly for projects on islands where nest sites are yet to be confirmed.

As we plan, we will strike to identify and collaborate with organizations whose mission may focus on other elements (e.g., poverty alleviation or carbon sequestration) but who pursue similar strategies as identified in this plan (e.g. agroecology training or reforestation).

Monitoring is an essential element of planning. We have identified KEAs as the basis of a monitoring plan for the Black-capped Petrel conservation. However, we need to develop defined protocols or established baselines for some.

Implementation

Budgets and timetables are resource-dependent and there is no secured reserve or permanent income-stream established for the project. We will continue to collaborate on fund-raising from agencies, foundations, individuals, seeking growth and diversification of funding streams to support the multi-faceted nature of Black-capped Petrel conservation.

Analyze and Adapt

As data is accrued and assessed, and if and when conditions change, we will revisit our strategies.

Share

We will seek to improve the management and accessibility of the emerging datasets held by IBPCG members, such as of images of color forms and downed birds.

We seek to provide input into policy deliberations as appropriate, for example, listing of the species under national and international conventions. Black-capped Petrels have many protections, but there are gaps. Appendix 8: National and International Instruments details the legal status of the species (updated since the 2012 Plan).

We aspire to have more research shared in peer-reviewed journals and will continue to spread the story of the species in lay publications.

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BREAKOUTS

BREAKOUT: HABITAT MODELLING

Our understanding of the breeding distribution of the Black-capped Petrel in Caribbean is limited by the difficulties of locating nesting sites in remote and rugged mountains. This information is critical to assess threats, and to prioritize conservation actions and research needs. We developed a statistical model to predict suitable habitat to better estimate the extent of available breeding habitat, and to direct future priorities (see Satgé et al. 2020 for further details). We first estimated large-scale habitat characteristics of all known nesting sites, using a set of environmental variables which included, among others, altitude, distance to coast, slope direction, and vegetation indices such as productivity, percent tree cover or wood biomass. We then selected those environmental variables that were most significantly associated with nesting activity (altitude, distance to coast, and a composite of percent tree cover and evapotranspiration index) to output a map of predicted habitat suitability for Hispaniola and the wider

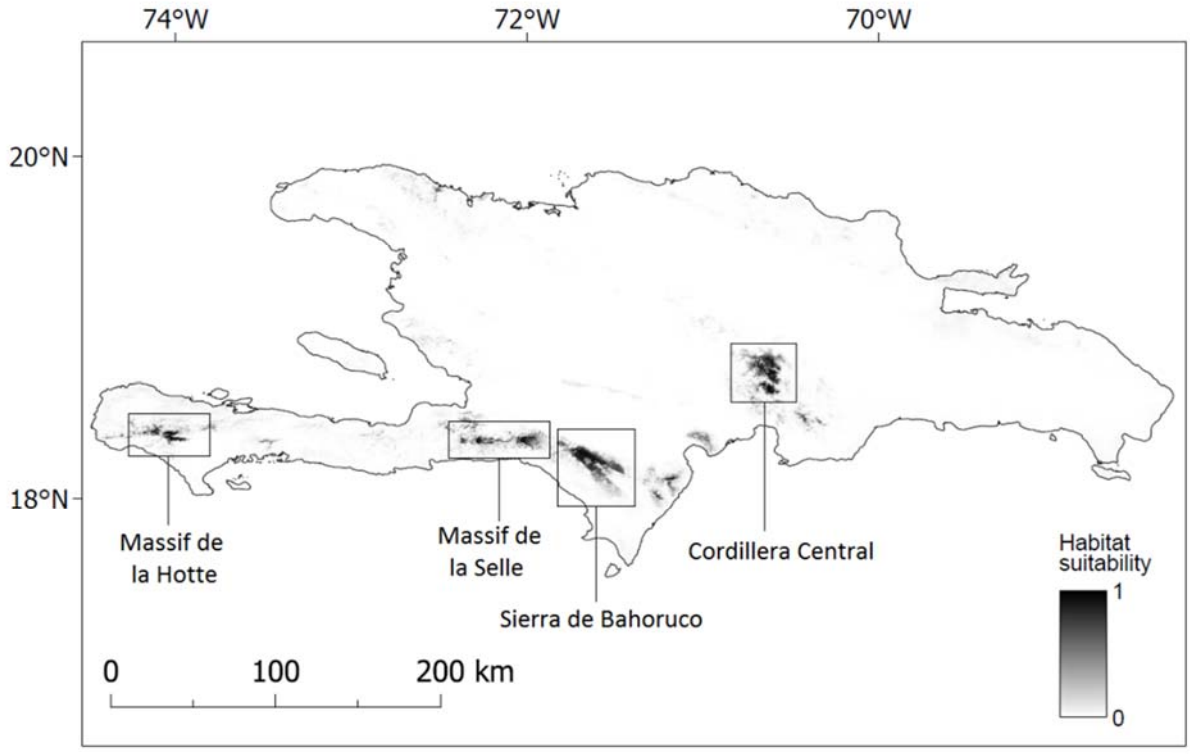

Figure A. Map of predicted nesting habitat suitability for Black-capped Petrel on Hispaniola. From Satgé et al. (2020).

Caribbean region (Figures A and B).

On Hispaniola, highly suitable habitat is predicted in all four elevated areas where the species is currently known to nest in Haiti (Massif de la Hotte, Massif de la Selle) and the Dominican Republic (Sierra de Bahoruco, and southern Cordillera Central). Lower areas near Sierra de Bahoruco are also predicted as suitable, whereas suitable habitat is not predicted in the occidental Cordillera Central. In total, the model estimated that 167–563 km^2 are suitable for petrel nesting on Hispaniola, 75% in the Dominican Republic and 25% in Haiti. Between 2000 and 2018, 15–17% of nesting habitat predicted on

Hispaniola was affected by forest loss, likely due to hurricanes, forest fires, and deforestation for agriculture.

In the Caribbean, our analysis predicts that suitable nesting habitat is available in Cuba, Jamaica, Dominica and Guadeloupe (Figure B). In Cuba, suitable habitat is limited to montane forests surrounding Pico Turquino and Pico de la Bayamesa, in the southeastern region. In Jamaica, the highest elevations of the Blue Mountains ridge host suitable habitat. In Guadeloupe, suitable habitat is limited to the top of La Soufrière Volcano. Finally, in Dominica, suitable habitat is concentrated on both main peaks, Morne Diablotin and Morne Trois Pitons. In Guadeloupe and Dominica, these results confirm the choice of the areas selected for recent nest search efforts (see Appendix 2: Site Profiles for more details).

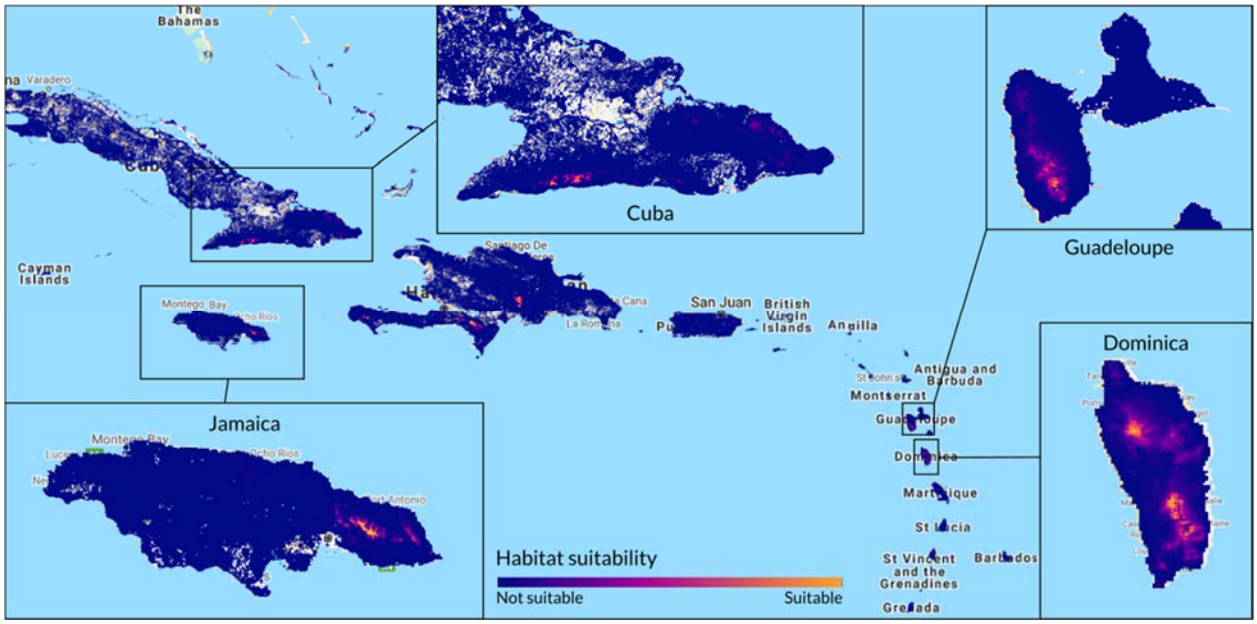

Figure B. Map of predicted nesting habitat suitability for Black-capped Petrel in the Caribbean (Satgé et al. In prep).

BREAKOUT: SEABIRD POPULATION VIABILITY ANALYSIS MODEL

Population Viability Analysis (PVA) has long been a tool for conservation; it is a species-specific method of risk assessment that combines life history characteristics and environmental variability to forecast population trends and extinction risk. Meta- or multiple-population PVA (mPVA) integrates models that account for fluctuations in spatiotemporal abundance[f]. To inform the 2020 planning process for Black-capped Petrels, we employed an mPVA program specifically designed for seabirds of high conservation concern, developed in the Coastal Conservation Lab, University of California at Santa Cruz (Seabird mPVA)[g]. The Seabird mPVA takes into account biological and ecological particularities of seabirds, such as their high foraging and migratory mobility, as well as their philopatry and demographic connectivity. The program focuses on threatened, island-breeding seabird species and integrates data from multiple sources of information relevant to seabirds, including IUCN Red List of Threatened Species, the Threatened Island Biodiversity database, literature-reported values of seabird vital rates, and solicited expert opinion.

Demographic information for the Black-capped Petrel is lacking, but the Seabird mPVA model allows a "sister taxa" approach using data from 35 closely-related Pterodroma species to generate vital rates and associated estimates of variability. These vital rates, along with estimates about breeding sites (number of sites, number of birds per site, invasive species present), can be varied to explore how various assumptions (impact of threats over time, or effects of management) affect predictions of viability. We explored scenarios such as *status quo*, deteriorating/improving conditions, and strategies to reduce key threats, using the Seabird mPVA model to project future population trajectories and quasi-extinction risk[h] over the next 100 years.

Modeling involved making assumptions about changes in vital rates and/or varying the number of birds/nesting sites. To assess strategies designed to counteract threats of habitat degradation, we translated the loss/gain of habitat into population parameters as was done for strategies to address direct mortality. Results of the model should not be interpreted as estimates of absolute abundance. Rather, the results should be used as clues into how conservation actions could slow and buffer the rate of decline and decrease quasi-extinction risk, and what combinations of actions might be necessary to see an increase in population trends. Additionally, the model was helpful in identifying key information gaps about the relative benefits of alternate conservation actions.

Seabird mPVA results

An analysis of *status quo* conditions for the Black-capped Petrel affirms that the population is likely in a long-term trajectory of decline (Figure 1). The model suggests a high probability (73%) of quasi-extinction within the next 100 years (confidence interval 47%- 90%) without active management to reduce threats and improve the vital rates.

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[f] Wenger, Seth J., Douglas R. Leasure, Daniel C. Dauwalter, Mary M. Peacock, Jason B. Dunham, Nathan D. Chelgren, Helen M. Neville. Viability analysis for multiple populations. Biological Conservation, Volume 216, 2017, Pages 69-77, ISSN 0006-3207, https://doi.org/10.1016/j.biocon.2017.10.006.

[g] Seabird mPVA. 2020. Seabird mPVA Online Tool developed by the UC Santa Cruz Conservation Action Lab. https://nhydra.shinyapps.io/mPVA1/

[h] Quasi-extinction, a threshold value reflecting the point at which a population is functionally extinct, was set at 50 female petrels.

As is the case for long-lived, slow-to-reproduce seabirds, population trends for the Black-capped Petrel are most sensitive to changes in adult survival. The model confirms that this vital rate underpins trends and conservation urgency. For example, a reduction of adult survival from 0.95 to 0.85 hastens functional extinction of the species to within 25 years. Thus, understanding adult survival is a key research need.

New Nests Discovered: To examine the implications of locating additional nest sites of the Black-capped Petrel, we modeled scenarios in which 200 additional nesting birds were added to one of the islands included in the *status quo* scenario. Regardless of which island was assigned the additional birds, the modeling results were similar: the population viability is not greatly increased. The scenarios show a short term increase in the numbers of petrels into the target population (<25 yr time frame), but over long-term, the overall trend of the population continues to decrease, with a similar risk of extinction at 100 years. In short, while the re-discovery of nesting sites would be gratifying, it does not reflect long-term security for the petrel population, unless threats are addressed.

Colony Creation: We modeled a successful restoration project by including a new hypothetical island or site (2 km^2, Lat 16, Long -68) free from invasive species, and allocating some number of birds to it. Across multiple scenarios (placing 25, 50, 100, or 200 birds at the hypothetical predator-free site), the overall Black-capped Petrel population is shown likely to persist at low numbers beyond 100 years. This long-term outcome is less pronounced with scenarios involving fewer translocated birds and it assumes that the population at the restoration location can grow and expand (i.e. is not site-limited). Finally, since the population trend is still predicted to decline, colony creation should thus be used in association with other strategies focused on reducing threats at existing locations.

Reduced Predation:

To model the effects of reduced predation, we reduced the number of invasive species on Hispaniola to zero in the Seabird mPVA. This was done to explore the optimal outcome of the strategy; it is unrealistic to expect complete control or protection at all sites in the Dominican Republic and Haiti. The absence of predation on the Hispaniola population reduces the modelled rate of population decline and essentially eliminates extinction risk over 100 years. Even so, this scenario does not result in a population increase/recovery trajectory. For this, other strategies are required to increase the number of birds or nest sites in the population or reduce predation on other islands.

Other Mortality Threats:

We modelled the outcome of birds “saved” from collisions and light attraction by adding some number of birds per year into the model. The rate of decline slowed and risk of extinction decreased, but obviously, the lower the number of saves, the smaller the impact. Moreover, the effect on the decline is mainly in the early years (10-20yr). Conversely, repeated high mortality events (e.g., large fire event, collision in fog event) modeled by removing 50 birds per year results in quasi-extinction within 100 years.

Population Recovery:

The model was used to examine the effects of multiple strategies together. The results from a variety of scenarios included:

- A population that gained stability through translocation of 100 birds to a threat-free nest site plus discovery of another site with 200 birds.
- A population that gained stability through translocation of 50 birds plus removal of threats on

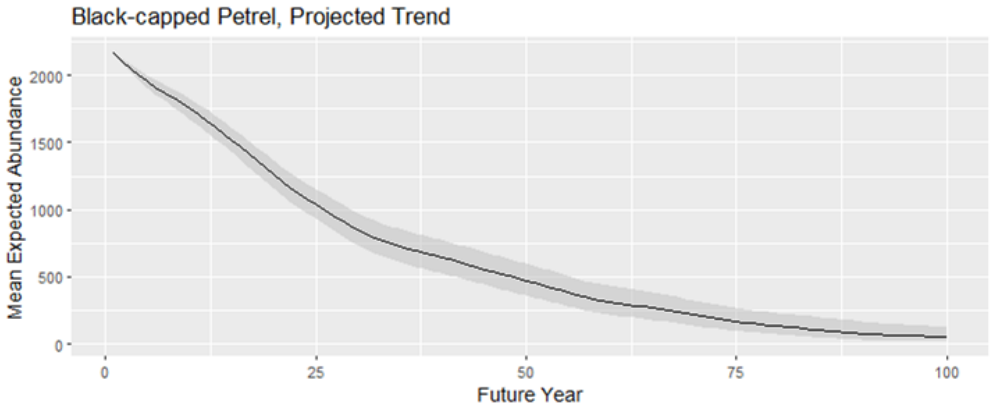
Hispaniola (no loss due to encroachment, predation, or collisions/groundings).

- A positive population trajectory required an optimistic scenario such as discovery of another site with 200 birds, translocation of 50 birds to a new site, and reduction of threats at all nest sites.

The Seabird mPVA helps us to appreciate the level and length of effort that will be needed to secure a resilient Black-capped Petrel population.

Figure 1. An analysis of *status quo* conditions for the Black-capped Petrel

Parameter	Value
Age_Repro	6.36
Prob_Breed	0.85
N_eggs	1.00
Hatch_Prob	0.68
Fledge_Prob	0.75
Juv_Sv	0.68
SubAd_Sv	0.94
Adult_Sv	0.95
N_Islands	6.00
N_Invasive_sp	100.00



BREAKOUT: PETREL MONITORING WITH RADAR

Since 2012, we have used marine radar technology to survey for Black-capped Petrels in flyways, to locate nesting areas, and to determine trends at sites with multiple years of data. This work is being led by EPIC in tandem with local partners.

Reaching the remote, rugged nesting sites of Black-capped Petrels is fraught with logistical challenges. Further, audio and visual methods typically used to assess nesting activity are extremely limited when used for species which visit breeding areas only at night. Ordinarily used at sea to avoid collision with other boats, marine radar can also be used to locate small flying objects on land, including birds and bats. This method thus extends our ability to observe and monitor petrels, by enabling accurate, consistent counts. In 2012-2014, EPIC conducted radar surveys in parallel with conventional audio/visual surveys on Hispaniola, demonstrating that radar is indeed an effective observation and monitoring tool for Black-capped Petrels.

In 2012-2014 and 2017, we monitored several sites on Hispaniola (Figure C); we used the same sites each time to allow for comparisons. Each monitoring night, we started radar surveys at sunset, when petrels become active at flight corridors and nesting areas, and ended them three hours later, when petrel activity slows[i]. We set up the radar within 1.5 km of sites of interest, allowing for the detection of flying targets at a substantial distance while still recording a clear radar signal. Using these methods developed on Hispaniola, we identified petrel flyways and potential nesting areas on Dominica (2015 and 2020), Jamaica (2016) and Guadeloupe (2020). In all places, we conducted surveys with the assistance of local conservation partners, both for the necessary logistical support and to train local biologists in radar techniques. Once baseline population indexes for petrel activity centers have been established, we seek to repeat surveys every five years at each site. While surveys have been completed at all suspected high activity flyways and centers on Hispaniola, surveys with radar for new flight corridors and new nest colonies is not complete; some additional areas should be visited to rule out activity.

Results of repeated surveys on selected flyways on Hispaniola (2012-2014, 2017) and Dominica (2015, 2020) indicate that Black-capped Petrel population numbers are declining[j]. On Hispaniola, the total number of radar targets on re-surveyed flyways decreased. In the Dominican Republic, downward trends were seen in the Cordillera Central with more pronounced downward trends in both the eastern and western Sierra de Bahoruco. In Haiti, opposite trends were detected between the eastern area where there was a significant decrease, and western Massif de la Selle where there was a robust increase. On Dominica, the total number of detected targets in 2020 was concerningly lower than the number detected in 2015.

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[i] Brown, A. 2012. Towards Black-capped Petrel Conservation; Report to the Disney Conservation Fund. Unpublished Report. 6 pp. Green Cove Spring, Florida, USA: Environmental Protection in the Caribbean.
Brown, A. 2014. Radar Surveys for Black-capped Petrels on Hispaniola: January – March 2014. 11 pp. Green Cove Spring, Florida, USA: Environmental Protection in the Caribbean.

[j] Brown, A. 2017. Radar Surveys, Nest Monitoring and Conservation of the Black-capped Petrel on Hispaniola: February 2017. Unpublished Report. 7 pp. Green Cove Spring, Florida, USA: Environmental Protection in the Caribbean.
Brown, A. 2020. Radar Surveys for Black-capped Petrels on Dominica: Results from an Expedition During January and February 2020. Unpublished Report. 12 pp. Green Cove Spring, Florida, USA: Environmental Protection in the Caribbean.

We continue to recommend radar as a critical tool for locating Black-capped Petrel terrestrial flyways and nesting areas (Strategy #3). Furthermore, use of radar at established sites at intervals has been selected as one of the primary means of assessing long-term trends in the petrel populations (see main text discussion of Key Ecological Attributes), and has been demonstrated for Hawaiian Petrel[k].

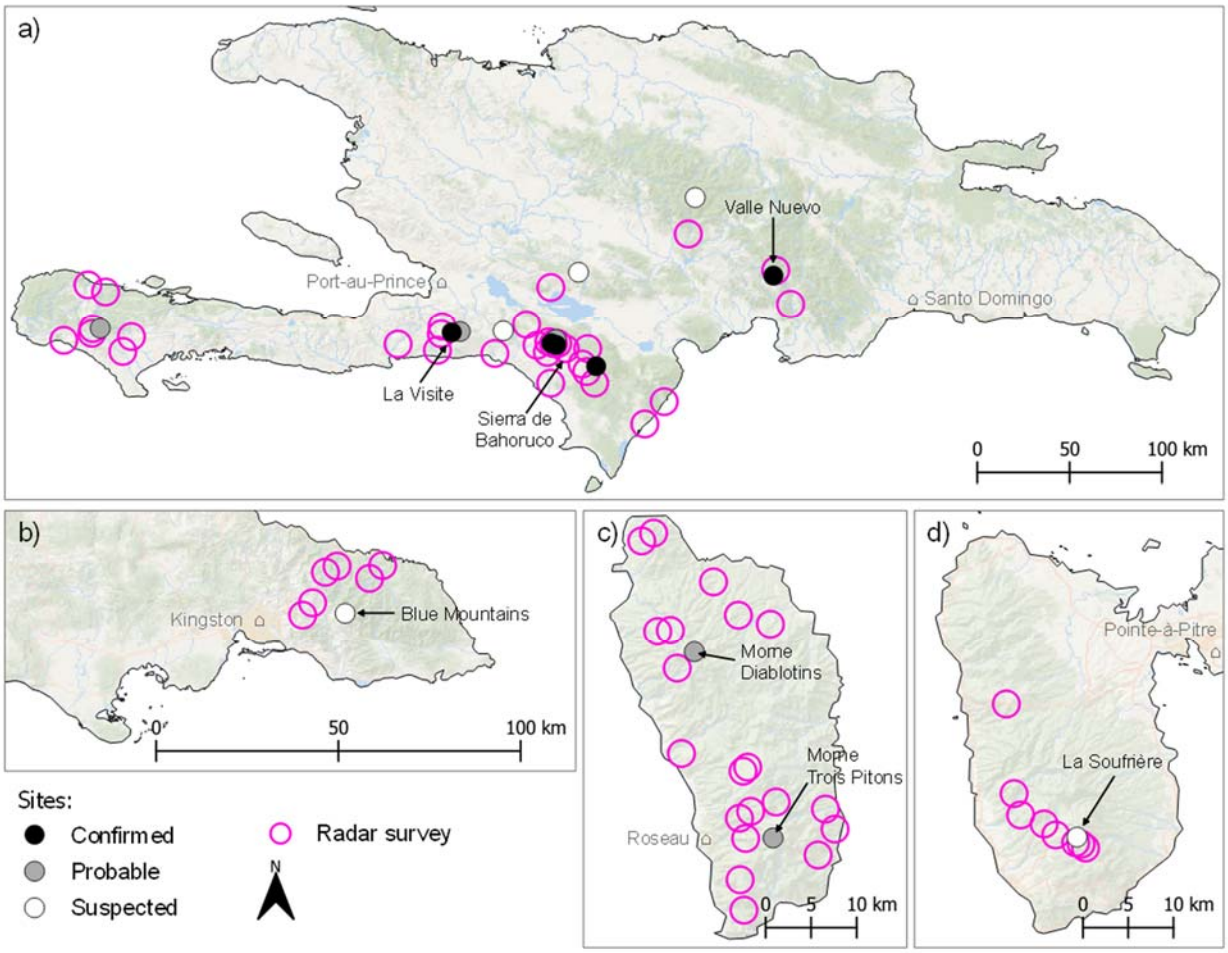

Figure C: Location of radar surveys for Black-capped Petrels in the Caribbean, 2012-2020. a) Hispaniola, b) Jamaica, c) Dominica, and d) Guadeloupe.

[k] Raine et al. 2017.

BREAKOUT: COMMUNITY DEVELOPMENT

Human benefits in the service of conservation

The conservation of Black-capped Petrels in Haiti – where the largest population is assumed to exist – requires interventions that focus on people. The threats of habitat loss and degradation stem from socio-economic needs of local communities therefore, development of these communities – empowering them socially and economically to make change – is the only feasible way we can hope to protect habitat.

Humanitarian organizations often recognize that improving the natural environment benefits of human welfare; thus, these organizations can be natural partners on a joint goal of habitat conservation. One example for Haiti is Plant With Purpose (PWP) is a US-based nonprofit, non-governmental organization (NGO) whose organizational goal is to improve the quality of the lives of people living in extreme rural poverty, using an approach that brings together environmental restoration and economic empowerment. PWP has worked in the Haitian border for about a decade, orienting their activities around watershed-level socioeconomic and environmental goals. The NGO broadened its program to include Boukan Chat after learning about petrels and petrel habitat needs from EPIC. PWP is seeking to go beyond re-vegetation to address ecosystem function and components, and was open to adding a biodiversity target (petrel) to its work.

PWP already collaborates with the IBPCG on the Boukan Chat community development strategies of **Sustainable agriculture and reforestation** (Strategy #6a), and **Environmental awareness and education** (Strategy #6b). In addition, they are implementing or developing community development strategies, including:

- **Economic empowerment - Facilitation of Village Savings and Loan Associations (VSLAs): ongoing.** If VSLAs are in place to assist farmers with micro-savings, micro-credit and micro-insurance, then farmers are less vulnerable to income fluctuations and have reduced reliance on environmentally unsustainable "desperation" practices. VSLAs are also effective venues for the sustainable agriculture training programs.
- **Economic empowerment - Livelihood training: ongoing.** If citizens have access to guidance and technical assistance, as well as economic tools, they are better able to pursue new ventures and innovative ideas. The development of nurseries for perennial or tree crops would support reforestation programs; another venture might be the production of efficient cooking stoves.
- **Engagement with government to clarify management of occupied park land: in development.** The community of Boukan Chat is illegally living and farming on national park land. A return to the past practice of Haitian government-forced evictions is undesirable, but an absence of management is also detrimental to the community. If farmers have confidence in their ability to remain on the land, they are more incentivized to act as stewards of that land. If the government officially embraces the model of sustainable agriculture and tree crop buffers that benefit the community, then the community is more likely to be supportive of re-forestation activities.
- **Stove Program: in development**. If firewood demand is decreased by the availability of more efficient stoves, then there will be less pressure to cut forest. The first step is a scoping study: stove programs require understanding of supply and demand, effective systems of distribution and maintenance, and acceptance in the community.

These strategies focus on human welfare and are measured by social benefits, but they are "in the service of conservation" (CMP 2020) in that they ultimately improve the status of a conservation target, the Black-capped Petrel. These strategies must complement and build upon one other and are likely to take many years to come to fruition. Additionally, development activities need to be conducted in a way that empowers citizens to be partners and leaders in change. The methods of fostering and working through community groups, such as farmer associations, schools or churches are intended to strengthen social cohesion and shared commitment. Building skills and experience in group moderation, decision-making, and mobilization is critically important in Haitian communities where concerted action, transparent and democratic decision-making, and security have been lacking. The interventions are designed to foster a culture of thinking long-term, and to give citizens increased confidence, self-worth, faith, and trust in others.

The complexity and challenge of community development in Boukan Chat cannot be overstated; improvement in social and economic condition requires an evolution in mindsets and culture, which takes many years, and can be swept by a single crisis. Throughout, the value of healthy environment must made visible to the community: the value of not only increased, sustainable agricultural production, but services associated with the forest, including a more regulated water supply, erosion control, carbon sequestration and biodiversity beneficial to humans. The latter can include the Black-capped Petrels as a symbol of the community, its resilience and pride.