National Fish and Wildlife Foundation

Business Plan for Pacific Seabirds (Update)

August 2022

Purpose of a Business Plan

The purpose of a NFWF business plan is to provide a concise blueprint of the strategies and resources required to achieve the desired conservation outcomes. The strategies discussed in this plan do not represent solely the Foundation's view of the actions necessary to achieve the identified conservation goals, but instead reflect the majority view of the many federal, state, academic, and organizational experts that consulted during plan development. This plan is not meant to duplicate ongoing efforts but rather to guide investments to areas where gaps might exist so as to support the efforts of the larger conservation community.

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Cover photo credit: Humboldt penguin – Uku Paal (Macauley Library); Polynesian storm-petrel – Eric Vanderwerf (Macauley Library); Waved albatross – David Marques (Macauley Library)

Conservation Need

Globally, there are more than 430 species of seabirds, across 18 bird families (Harrison *et al.* 2021). The earliest "proto-seabird", *Ichthyornis* (fish bird) and their relatives, date from the late-Cretaceous period. These early seabirds had teeth, were robin to crow sized and are believed to have been powerful flyers like modern terns and gulls (Harrison 1990). Today's seabirds represent a diverse group whose life history is intricately linked to marine and coastal resources. Some species range across entire ocean basins and travel more than 500 miles in a day, while other species are flightless and, in extreme cases use their wings to "fly" through the water at speeds up to 15mph. The largest seabird, the wandering albatross, has a wingspan exceeding 11.5ft and weighs more than 25lbs, while the diminutive least storm-petrel's wings barely stretch 1ft and they only weigh ½ an ounce. As expected, with so many species and adaptations to life over, in, and around the sea, there is great variation in life history across the 18 families; however, in very general terms seabirds tend to be characterized by delayed maturity (often 3–8 years before attempting to breed), low reproductive output (1–2 eggs), high parental care (young are dependent upon parents for 3–12 months), long-lived, and high adult survival. Seabirds forage at sea—often far from breeding colonies, many disperse over vast distances, and species include colonial and solitary breeders.

The overlap of seabirds and humans on oceanic islands and in the marine environment has driven many species to the brink of extinction. Consequently, a major challenge to effective seabird conservation is to mitigate human-induced threats at multiple temporal and spatial scales; in other words, to protect and restore habitats utilized by seabirds throughout their entire life cycle (on both land and at sea).

More than a hundred species of seabirds are regularly found in the Pacific (Harrison 1990, Hatch and Piatt 1995, Birdlife International 2012, WBSJ 2017). At minimum, 40 are listed on the IUCN Red List of Threatened Species (IUCN 2021) as Critically Endangered, Endangered, or Vulnerable; 17 species are listed under the United States Endangered Species Act (ESA); 27 are listed as "Red or Yellow" on the 2014 State of the Birds report; 35 are listed as species that are "highly imperiled or high concern" in the Waterbird Conservation Plan for the Americas; 50 species are listed in the 2021 U.S. Fish and Wildlife Service (USFWS) Birds of Conservation Concern update, and 22 are listed in the three billion birds Road to Recovery list as either very high urgency, high urgency or data deficient. Without immediate action, risk of extinction for several species is high (Ruiz *et al.* 2021).

Seabirds are among the most threatened groups of birds globally (Croxall *et al.* 2012, BirdLife International 2018, Dias *et al.* 2019). They are widely regarded as good indicators of the health of marine ecosystems (Cairns 1998, Piatt and Sydeman 2007, Parsons *et al*. 2008), and play a key role in the regulation of marine ecosystems, with an overall consumption of biomass on the same order of magnitude as global fisheries landings (Cury *et al*. 2011). A global assessment of seabird populations suggested a 70% decline of monitored populations from 1950-2010, with the greatest declines noted for wide ranging pelagic species (Paleczny *et al.* 2015).

Consider the following facts:

- 110 of 359 seabird species evaluated (31%) are globally threatened (IUCN – Critically Endangered, Endangered or Vulnerable) and an additional 11% (40 species) are listed as Near Threatened.[1]

- Nearly half (47%) of all seabird species have declining populations.[2]

- Approximately 70% of all seabird species, especially globally threatened species, face multiple threats including both terrestrial and marine threats[3].

For others, more than a century of predation by non-native invasive predators, destruction of nesting habitat, incidental capture in fisheries and human disturbance have drastically reduced populations. The top threats for seabirds in terms of number of species affected and average impact are: non-native invasive alien species, affecting 165 species; incidental bycatch in fisheries operations, affecting fewer species (100) but with the greatest average impact; and climate change/severe weather, affecting 96 species (Dias *et al.* 2019). Additional threats include hunting/trapping, human disturbance, marine pollution, overfishing (reduced forage), problematic native predators, energy production and mining, and light pollution (Dias *et al.* 2019).

Pelagic seabirds (the ocean "wanderers") are more threatened than coastal seabird species. Most of these species are contained within the families and genera facing the highest levels of risk: albatrosses, gadfly petrels, penguins, large petrels, shearwaters, and storm-petrels (Dias *et al* 2019). Mitigating the top threats would benefit two-thirds of all seabird species. As the negative effects of climate change are difficult to solve directly, it is vital to build population resilience through addressing other major threats that affect the same species, such as removal of non-native invasive alien species, reducing seabird bycatch, and reversing habitat degradation and disturbance.

Overall, a continuing challenge to our understanding of seabirds is that most of the information about seabirds are derived from breeding colony monitoring and research studies where most birds spend less than half of their lives. To achieve effective seabird conservation, actions are necessary that integrate the needs of species at the breeding colonies and at appropriate ocean scales. A full life cycle conservation approach is critical for simultaneously addressing marine and terrestrial threats. For some species, especially data deficient species, an essential first step for conservation is to understand the suite of threats, to evaluate the population constraints, the population trajectory, and to learn more about movements and distribution of individuals throughout the annual lifecycle.

Background on NFWF Seabird Investments

The Seabird Keystone Initiative was one of more than a dozen initiatives approved for implementation by the NFWF Board of Directors in 2009. The original Seabird Keystone Initiative Business Plan identified eight focal species across five main geographies, including the both the Pacific and the Caribbean. In

[1] Dias, M. P., Martin, R., Pearmain, E. J., Burfield, I. J., Small, C., Phillips, R. A., et al. (2019). Threats to seabirds: a global assessment. *Biol. Conserv.* 237, 525–537.
[2] BirdLife International, 2019. IUCN Red List for Birds [WWW Document]. URL. http://www.birdlife.org
[3] Dias, M. P., Martin, R., Pearmain, E. J., Burfield, I. J., Small, C., Phillips, R. A., et al. (2019). Threats to seabirds: a global assessment. *Biol. Conserv.* 237, 525–537.

2011, NFWF made a major expanded commitment to the Pacific portion of the Foundation's seabird initiative which became the Pacific Seabird Program. The first business plan for the Pacific Seabird Program was developed in 2011/12; this $20M program was established with 5 years of funding invested over 6 years. In 2016, an additional $25M was secured as continuing support for seabird conservation in the Pacific and an updated business plan was developed which outlined a 6-year implementation strategy for nine focal species (seven focal species were carryovers from the 2012-2016 Pacific seabird program business plan).

The overarching goals of these two Pacific Seabird business plans was to improve the survival and reproduction of focal species across four broad geographic regions – Alaska, the California Current, Chile, and Hawaii, with additional strategic investments in American Samoa and the Commonwealth of the Northern Mariana Islands. The business plans identified five primary strategies for mitigating threats to seabirds during the breeding and non-breeding periods. This full life cycle approach aimed to achieve measurable gains for the focal species.

A 3rd party evaluation (2014) noted that a key strength of NFWF's approach to seabird conservation is the diverse portfolio of strategies. Specifically, NFWF's willingness to support community and organizational capacity and projects that fill scientific information gaps differentiates this program from other efforts focused on invasive animals and bycatch reduction.

In 2021, the Foundation commissioned a conservation impact assessment to evaluate investments made through the Pacific Seabird Program since 2011. The assessment examined several themes, including the intended and broader impacts, ancillary benefits, sustainability, and emerging opportunities. The assessment found that NFWF investments: 1) **increased reproductive success** for black-footed albatross, Hawaiian petrel, Laysan albatross, Newell's shearwater, pink-footed shearwater, and Scripps's murrelet; 2) **increased populations** of black-footed albatross, Laysan albatross, and pink-footed shearwater and, further, modeled predictions of population abundance also demonstrate increases for six additional focal species; and 3) NFWF investments **reduced predicted seabird extinction risk** by an average of 30% for seven focal seabird species. Townsend's shearwater extinction risk was reduced by 90%.

Program investments contributed to:

- **9 successful invasive species eradications** (several pending projects are awaiting confirmation and/or completion) reduced or eliminated invasive species threats to nine populations of seven focal seabird species and 65 populations of 45 non-focal seabird species across over 81,000 acres of seabird breeding habitat.

- **10 predator and/or ungulate proof fencing projects** protected 2,953 acres of breeding habitat for 13 populations of 5 focal seabird species.

- **7 seabird translocations** totaling 519 eggs or chicks from six focal seabird species were successful with a 97% post-translocation fledging success rate.

- **10 social attraction projects** led to the establishment of successful nesting for three populations of three focal seabird species.

- **8 habitat restoration projects** covering 1,744 acres resulted in increased reproductive success of five populations of four focal seabird species.

- **5 fisheries bycatch reduction projects** documented reductions in seabird bycatch of three focal seabird species across five fisheries.

Program funding benefitted an additional 75 seabird species and more than 50 invertebrate and vertebrate species that co-occur with focal seabird species. NFWF support has also increased overall seabird conservation capacity for 16 partner organizations, including increased staffing capacity to plan, implement, and assess the efficacy of interventions. Funding provided through this program also contributed to more than 100 peer-reviewed publications and developed important decision support tools designed to enhance the effectiveness of seabird conservation towards reducing risks for imperiled species. This impact also developed recommendations for future programmatic planning—including the following suggestions:

- Expand the list of priority seabirds across a broader range of species and geographic scope to increase the impact of NFWF's Pacific Seabird Program and recover threatened seabird populations.
- Use the population viability analysis tool in project selection and planning to facilitate quantitative analysis of the relative cost / benefit of potential conservation actions.
- Support emerging technologies and technique improvement such as drones, new toxicants, CRISPR/gene drive, and new translocation techniques that will provide new opportunities for more impactful and cost-effective projects.

This updated business plan leverages the results of the impact assessment and 10 years of programmatic investment and experience to develop a framework for advancing conservation of at risk seabirds with a renewed 5-year/$25M investment, to be implemented over 6 years. The business plan sets species and strategy goals to be reached by the conclusion of this program, in 2027.

Current Conservation Context

Global data sharing and new prioritization efforts are guiding seabird conservation activities in the 21st century (Lewison *et al.* 2012, Dawson *et al.* 2014, Borrelle *et al.* 2015, Holmes *et al.* 2019, Rodriguez *et al.* 2019, Beal *et al.* 2021). Further, recently developed seabird decision support tools provide a platform for developing decision scenarios and portfolio level planning exercises. These scenarios are useful for initial review and targeting of interventions for species with the greatest risk of extinction (Ruiz *et al.* 2021).

In 2021, CEA consulting completed an assessment of primarily U.S.-based marine bird funders for the 2010-2019 period[4]. Although the study had some limitations, its findings provide important context, including:

- Annual funding for marine birds/seabirds is approximately $8M/year; NFWF is the top funder (>$3.6M/annually) followed by the David and Lucille Packard Foundation ($2.5M/annually) and Mava Foundation ($1.5M/annually).

[4] Commissioned by the David and Lucille Packard Foundation

- A total of 47 marine bird/seabird funders were identified; however, the sum of investments of the bottom 44 is less than the total invested by the David and Lucille Packard Foundation.
- Most funding originates in North America and remains in North America. Other regions receiving support are Africa, South America, Oceania, Europe, Atlantic islands, and the high seas.
- Top NGOs include NFWF partner organizations, such as Island Conservation, Birdlife International, National Audubon Society, American Bird Conservancy, Grupo de Ecología y Conservación de Islas and the U.S. Fish and Wildlife Service.

Beyond the philanthropic sector, the seabird community is populated with extraordinary organizations and programs that fill critical leadership roles (e.g., Agreement for the Conservation of Albatross and Petrels, BirdLife International's Global Seabird Program), funding roles (e.g., the Global Environmental Facility, U.S. Fish and Wildlife Service), and demonstrate implementation competency (e.g., Island Conservation, Grupo de Ecologia y Conservacion de Islas, Pacific Rim Conservation, and Oikonos). Multilateral efforts, such as the Commission for Environmental Cooperation (CEC) are also important forums that continue to raise awareness about the importance of island restoration and bycatch continentally. Through each successive business plan, the Pacific Seabird Program continues to play an important role in the community, connecting science and conservation with dedicated funding focused on delivery of on-the-ground impact for species and habitats.

Conservation Outcomes

The overarching vision of the Pacific Seabird Program Business Plan is to **diminish the impact of terrestrial and marine threats for focal seabird species (a full lifecycle conservation approach) and to reduce extinction risk and sustain resilient populations**. Specifically, the goal of the plan is to **enhance the viability of target seabirds by increasing population size through improved survival and reproduction.** Building on NFWF's experience and 10 years of investments in support of Pacific seabird conservation, this plan outlines goals for focal seabirds that it aims to achieve over the next 6 years (Table 1). The plan also identifies prospective species that will be considered for NFWF investment following further examination of available data (Table 2) and presents a strategy for the long-term sustainability of a former focal species (Table 3).

To be selected as a business plan focal species, a species must meet multiple criteria. One criterion is that the species is imperiled, either threatened or endangered, of conservation concern (i.e., declining population) and/or is an indicator of habitat quality. All focal species in the Pacific Seabird Program Business Plan are either listed (IUCN red list, ACAP Annex 1 or U.S. Endangered Species Act) or otherwise of conservation concern. Several species also serve as good indicators of quality predator free nesting habitat.

Another criterion for a focal species is that the geographic footprint of the business plan plays a key role in the species lifecycle. The geographic footprint of this business plan encompasses four very broad geographic regions (the California Current, the Hawaiian Archipelago, the Humboldt Current and Galapagos, and the central/western Tropical Pacific; Figure 1). These regions were selected because they support the focal species as well as significant concentrations of seabirds generally. Focal areas (islands) within these geographies have been identified where conservation investments are likely to impact one or more business plan focal species (orange points in Figure 1). In addition, there is potential for some investment in high seas (international) bycatch assessment and mitigation actions.

Additional criteria used in the selection of focal species include that: the necessary management strategies are understood and can be successfully implemented, the species will measurably respond to those actions, and species outcomes are likely to be sustained beyond the period of investment.

For this updated business plan NFWF will advance conservation for three broad categories of focal seabird species:

1) Species that were focal seabirds in earlier business plans and for which initial threat reduction has been accomplished but require additional support towards building self-sustaining populations.

2) Species that are at imminent risk of continued population decline and extinction and for which NFWF has no previous history of investments.

3) Species that are only known from at-sea detections or for which there are little or no data on breeding locations such that basic threat assessment and population trend information is lacking, and thus hindering any effective conservation interventions for these species.

Seabird conservation

The anticipated changes in productivity and survival will result in increased long-term resilience of populations to anthropogenic threats described previously. By directly addressing the principal threats, filling scientific knowledge gaps, and focusing on building resilience to climate change—specifically habitat loss and degradation due to sea level rise and storm surge events through translocation and social attraction—this business plan aims to slow or reverse population declines for at risk seabird species. NFWF is leveraging the seabird mPVA tool (Ruiz *et al.* 2021) to develop population abundance projections for focal seabird species and will report the predicted percent change in population for a focal species 5 years following confirmation of eradication success. Overall, six of 12 focal species are at risk of extinction in the next 100 years; strategies and actions in this plan aim to reduce extinction risk for these species.

Table 1. Business Plan Goals for Focal Bird Species

Focal Birds	Business Plan Goals
Ainley's storm-petrel	Establish one new population through translocation (Guadalupe).
Black-footed albatross	Maintain a reproductive success rate of 0.5 chicks/pair at Midway Atoll NWR. Increase nesting population at Midway Atoll NWR and Kure Atoll by 2.5% above the 2022 baseline of 29,055 pairs. Establish 2 new populations through translocation (MX, CA and/or Kauai).
Galapagos petrel	Eradicate multiple invasive species from Floreana Island resulting in an increase of 14% in the global population, 5 years after confirmation of success. Increase reproductive success from 0.23 chicks per pair to a minimum of 0.5 chicks/pair at managed sites.
Hawaiian petrel	Maintain a reproductive success rate of 0.7 chicks/pair at managed sites. Establish one new population through translocation (Maui).
Henderson's petrel	Eradicate rats from Henderson Island resulting in an increase of 9% in the global population, 5 years after confirmation of success.
Humboldt penguin	Eradicate multiple invasive species from 3-5 Peruvian and Chilean sites resulting in an increase of 24% in the local populations, 5 years after confirmation of success.
Newell's shearwater	Establish one new population through translocation (Lanai).
Phoenix petrel	Eradicate rodents from 3 islands in the Marquesas resulting in an increase of 29% in the local population, 5 years after confirmation of success. Establish one new population through translocation (Palmyra/TBD).

Focal Birds	Business Plan Goals
Polynesian storm-petrel	Establish one new population through translocation (TBD) and another new population through social attraction (Kamaka).
Rapa shearwater	Eradicate rodents from 3 islands in Rapa resulting in an increase of 17% in the global population, 5 years after confirmation of success.
Townsend's shearwater	Maintain a reproductive success rate of 0.6 chicks/pair at managed sites.
Waved albatross	Maintain the 2021 baseline interior nesting population of 21,150 (+/- 4,300 individuals) on Espanola through habitat management and bycatch reduction[5].

Prospective Species and Sites

The following prospective focal species and sites require additional information and/or investment before NFWF can include them as species with measurable conservation goals in the business plan.

Table 2. Planned Actions for Prospective Seabird Species

Prospective seabird species	Planned Actions
Band-rumped storm-petrel	The Hawaiian band-rumped storm-petrel is listed as endangered under the U.S. ESA. Basic information species data are lacking. To date, most conservation has been coupled with work for Hawaiian petrel and Newell's shearwater. Establishing a protected population through fencing and social attraction would provide valuable information on life history essential to conservation planning as well as securing a breeding population.
Bryan's shearwater	Bryan's shearwater are only confirmed nesting on a single island in the Oswagara Islands of Japan. Basic information and capacity to address species threats are lacking. Black rats and invasive plants are known threats. First steps should include building capacity and relationships with appropriate teams in Japan – species data gaps to be addressed include breeding distribution, population assessment and a threat assessment.
Craveri's murrelet	Beyond an eradication of house mice on Alcatraz Island, more work is needed to address data gaps including a threat review (bycatch, marine pollution, forage depletion, predation/disturbance) and the completion of an assessment of current distribution using standardized methods.

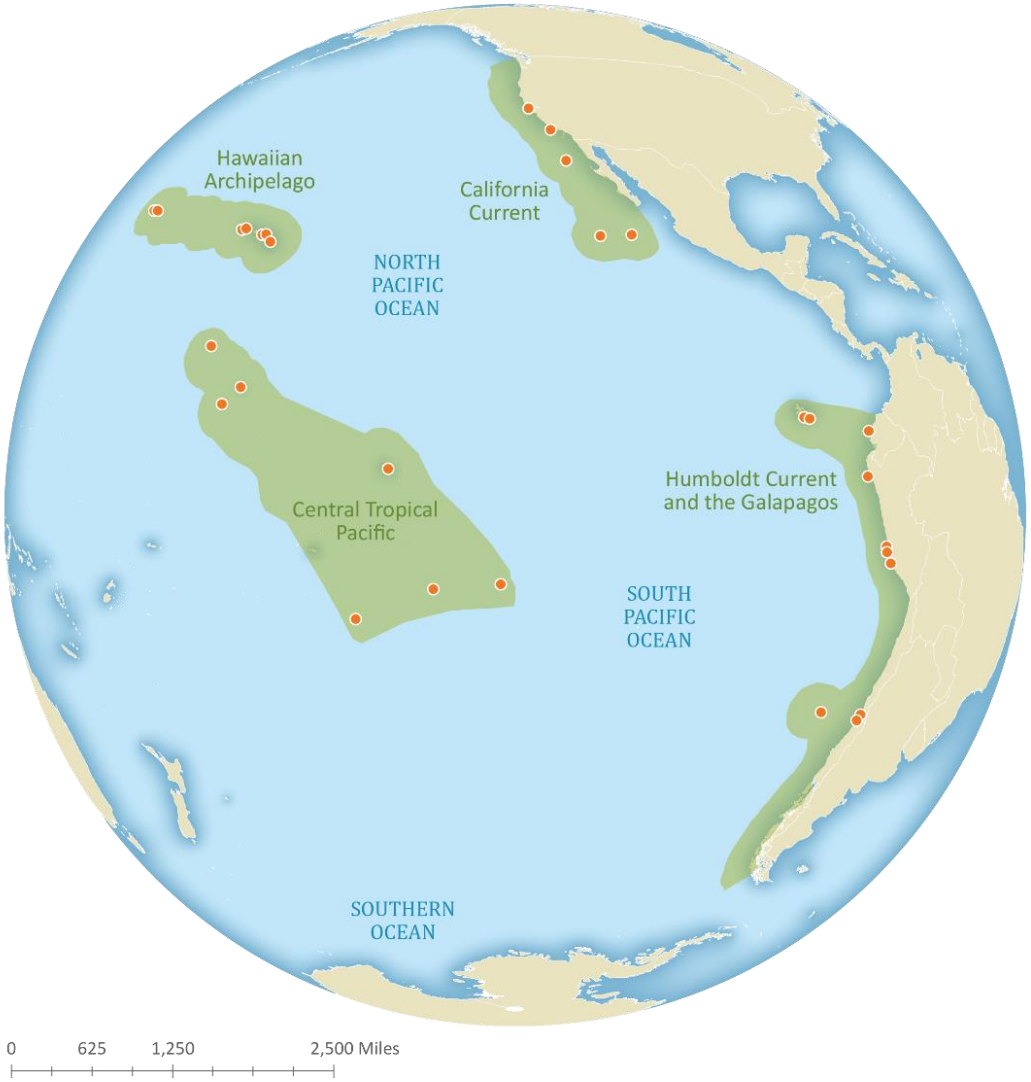
Table 3. Planned Legacy Actions for Prior Business Plan Seabird Species

Prior focal seabird species	Planned Actions
Ashy storm-petrel	NFWF has supported 10 years of investment in ASSP conservation. The one priority action to be completed is the mouse eradication on SE Farallon

[5] As an additional measure of waved albatross population stability, we will track coastal breeding pairs in the Punta Ceballos colony. Data are collected using different methods than the interior population – the goal is to maintain 3,340 +/- 650 nesting pairs.

	Island. Pending resolution of details around timing, funding gaps, planning gaps, and regulatory and legal hurdles – NFWF will consider support for this intervention. SE Farallon Island is home to roughly %50 of the global breeding population.
Pink-footed shearwater	NFWF has supported 10 years of investment in PFSH conservation. Measurable gains have been made to reduce poaching, grow community support, initiate eradications, complete a colony fencing project, facilitate bycatch reduction, and monitor the species. Several current actions are ongoing and require additional monitoring support and intervention to ensure longer-term species sustainability. NFWF will provide 1-3 "capstone" awards over the next 2-3 years to ensure that partners are able to transition to alternate funding to sustain conservation for this species.

Figure 1. Business Plan Geographies and Focal Areas



Implementation Plan

NFWF will principally focus investments on four strategies to increase survival and improve reproductive success of 12 focal species (see Appendix 1 for species/strategy table). To ensure the sustainability of viable seabird populations, it is critical to take a full life cycle approach to addressing threats during the breeding and non-breeding periods. The principal threats to seabirds are known and types of conservation actions necessary to secure seabird populations are well understood. Strategy level results chains for the management of non-native, invasive animals, and bycatch reduction strategies (Figures 2 & 3) are included in the implementation plan to highlight the relationships among threats, risks, and the sequence of strategies-to-outcomes by which we intend to reach business plan goals. In addition to these strategies, we will support restoration actions, investments in organizational and community capacity, filling information gaps for data deficient species, and monitoring.

Strategy 1: Management of non-native, invasive animals

NFWF will support strategies to address introduced and invasive animals which alter fragile island ecosystems and can have a multitude of direct and indirect negative effects on seabirds (Burger and Gochfeld 1994).

1.1 Eradication of non-native invasive animals – NFWF will support eradications of non-native invasive animals on breeding islands where they overlap with focal species and sufficient capacity exists. Removal of invasive animals typically offers a rapid and impressive return on seabird conservation investments. In more than 200 eradications of invasive predators worldwide where seabirds were the principal beneficiary, approximately 75% resulted in a rapid increase in reproductive success, increased survival of adults, or re-colonization by seabirds (Nogales *et al.* 2004, Howald *et al*. 2007, Jones *et al.* 2016). NFWF will leverage recent prioritization efforts (Dawson *et al.* 2014, Holmes *et al.* 2019, Young and VanderWerf 2023) and the seabird mPVA decision support tool (Ruiz *et al.* 2021) to select a subset of highly impactful island eradication projects.

1.1.1 Prioritization and Project development: Support project development including 1) project scoping; 2) completing a feasibility assessment; 3) securing partnership agreements; 4) development of a communication strategy; 5) outreach and capacity building with stakeholders; 6) completion of environmental compliance review; 7) completion of operational plans including mitigation, monitoring, waste management, and development of biosecurity plans.

1.1.2 Project implementation: Implement operational, mitigation, and biosecurity plans which follow established best practices.

1.1.3 Monitoring: Conduct baseline ecological monitoring; complete pre-implementation bait trials and research to inform the development of operational plans; complete post-implementation efficacy monitoring and absence detection to assess success of the intervention following established best practices; develop and implement post-implementation ecological monitoring to evaluate change for impacted species and systems.

1.2 Fencing (predator proof and ungulate): NFWF will invest in predator-proof and ungulate fencing for focal seabirds to increase in situ protection of breeding colonies when eradication and control are

impractical solutions. The use of predator-proof fencing is the best alternative in landscapes too large and complex to attempt an eradication; fences thus increase management efficiency by shifting the focus from control to local eradication. In Hawaii, the use of predator-proof fencing is especially promising because of the potential to protect an entire ecosystem, including native vegetation (Young *et al.* 2012).

1.2.1 Install and maintain predator and ungulate-proof fences: Priority actions include all phases of project development such as scoping, feasibility assessment, securing partnership agreements, community outreach, completion of environmental compliance review, pre-implementation ecological monitoring and research, project implementation, post-implementation monitoring, and fence maintenance.

1.3 Predator/animal control: NFWF will support in situ predator control to protect breeding colonies of focal species where eradication and fencing are not feasible, removal of predators (primarily rats/cats and pigs) through trapping and monitoring can be effective for improving seabird reproductive success and survival.

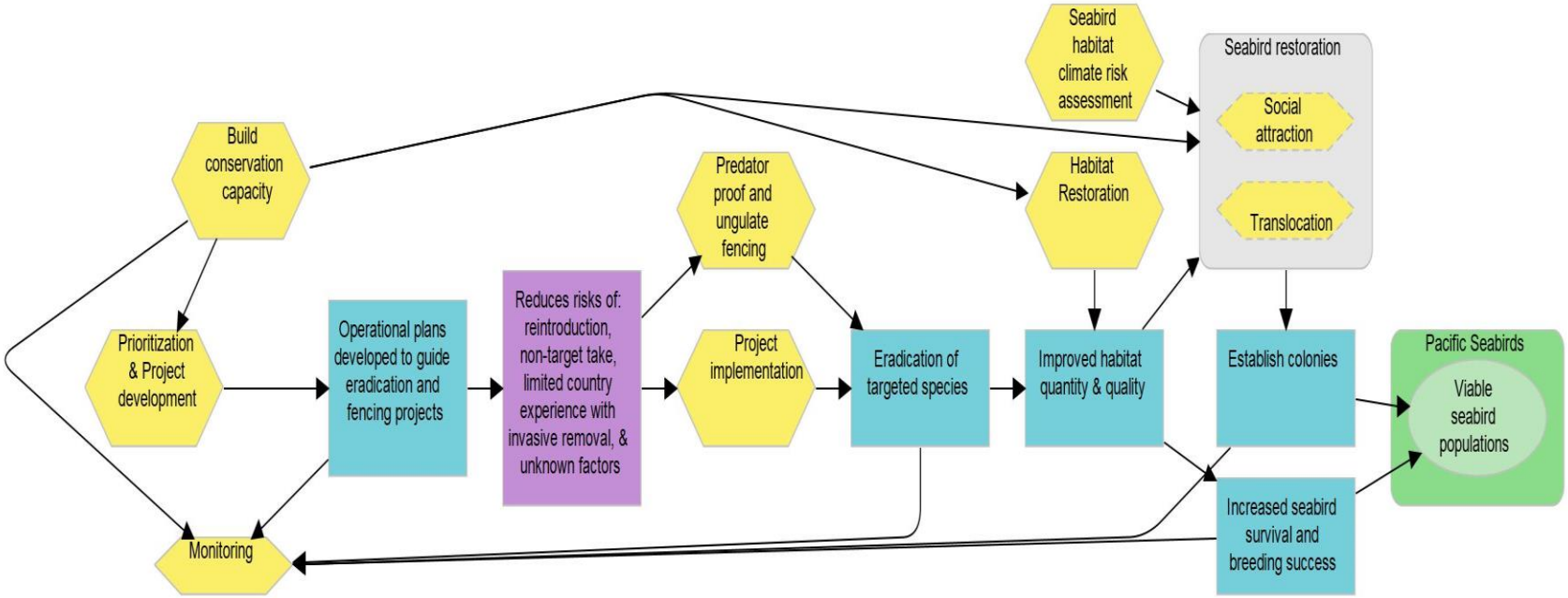


Figure 2. Results chain depicting the sequence of strategies-to-outcomes for invasive management, habitat restoration, and seabird restoration. Yellow hexagons are strategies; blue rectangles are the intermediate outcomes and purple rectangles show the risk factor that has been addressed/reduced.

Strategy 2: Restoration & conservation capacity

NFWF will support restoration actions that enhance degraded habitat and improve population resilience by increasing the number and distribution of colonies for focal species. Restoration actions are often conducted in conjunction with or following the eradication of non-native invasive animals (Strategy 1). Further, seabird restoration and assisted colonization (including social attraction and translocation) will be critical for several seabird species in the tropical Pacific that nest on low lying atolls and are threatened by habitat loss driven by sea level rise (Young and VanderWerf 2023). NFWF will also support capacity building to improve effectiveness of seabird conservation.

2.1 Habitat restoration – NFWF will support actions that improve seabird breeding habitat and resiliency by systematically removing invasive plants and weeds to promote growth of native species. Monotypic stands of invasive species create an acute disruption of ecosystem structure and function. For seabirds, such stands of invasive plants degrade breeding habitat and can reduce reproductive success. Priority actions may include invasive weed control, invasive plant removal through herbicide treatment and physical removal, native seeds/plant propagation, out planting, community engagement, post-removal/planting monitoring and implementation of biosecurity to prevent re-establishment and introduction of invasive plant species.

2.2 Seabird restoration – NFWF will support actions to establish new colonies of seabirds. Colony formation in seabirds is expedited by social attraction, in that the presence, density, and success of breeders play a role in attraction of recruits (Kildaw *et al.* 2005). Managers have successfully used decoys, audio lures, and translocations to facilitate the establishment of colonies (Jones and Kress 2012, VanderWerf *et al.* 2022). Support includes - development of a site-specific seabird restoration plan including but not limited to review of historical site use of target species, current site conditions (predators, habitat quality, sea level rise vulnerability), species life history, distance to nearest colony, availability of source colonies for translocation, cost/benefit of passive vs active restoration, and restoration logistics. **Note**: It is important to recognize that time lags exist for establishing new populations of focal seabirds through social attraction and translocation – for larger species like albatross, the delay from fledging of translocated chicks to first breeding is on average, 5-7 years, for mid-sized petrels and shearwaters the delay is 3-5 years and for storm-petrels it is ~2 years.

2.2.1 Translocation: Support translocation efforts including development of a translocation plan – with specific details on source colony identification, recipient site, eggs vs chick translocations, husbandry plan, artificial burrows designs/installation (for burrowing species), annual cohort size, # of translocation years, habitat management.

2.2.2 Social attraction: Support social attraction efforts including site identification, artificial burrow designs/installation (for burrowing species), decoy development, audio lures, habitat management.

2.2.3 Monitoring: Support monitoring programs to assess seabird returns, site use, behavior and nesting using passive acoustic recorders (ARUs), camera traps, drone surveys and direct counts, band resights and listening surveys.

2.3 Conservation capacity - Building community support and local and organizational capacity is a critical conservation step for protecting seabird resources where they overlap with human communities and where capacity gaps exist. NFWF's strategy emphasizes support to conservation

partners that have an on-the-ground presence in communities are building communication with private landowners, fostering pride, and implementing conservation actions for species and habitats. NFWF will support capacity development and training for individuals in regions lacking technical expertise and monitoring/ assessment capacity. Further NFWF will support building a community of diverse early career scientists pursuing marine bird conservation.

Strategy 3: Reduce seabird bycatch - The incidental capture of seabirds by fisheries is a global issue (Clay *et al.* 2019). However, quantifying the scale of the problem is often a challenge due to the lack of fisheries observers at sea, the number of fisheries involved, the difficulty of assessing artisanal fisheries impacts, the difficulty of assessing distant-water high seas fleets, the geographic scale of fisheries, and the lack of widespread industry standards or government regulation for quantifying bycatch.

3.1 **Bycatch assessment:** NFWF will support strategic assessment of seabird fisheries overlap and seabird bycatch for at risk species, activities will include seabird tracking, seabird movement analyses, assessment of global fishing watch data, dock side surveys and engagement with fleet captains and fishers.

3.2 **Bycatch mitigation gear development and implement proven mitigation strategies:** Support research and innovation to develop effective seabird deterrents that work with current fishing practice. In fisheries with documented impact support, support use of current Best Management Practice (BMP) mitigation where appropriate and/or invest in research to modify current gear towards reducing bycatch: actions include, working with captains and crew to set-up mitigation gear on vessels, conducting gear trials, and conducting trainings on use and effectiveness of tools.

3.3 **Observer coverage/ monitoring:** Support observer training and increased observer coverage including the use and evaluation of electronic monitoring and collection of seabird bycatch data.

3.4 **Outreach:** Outreach is integral to the success of any bycatch reduction efforts and need to be initiated early in the process. Outreach efforts will include engaging with industry for assessment, gear trials, gear use, and monitoring. Outreach and engagement to fisheries regulatory agencies and exploration of market-based solutions will be integral to developing a chain of custody around implementation of BMP mitigation, compliance, and reduction of risk for imperiled seabirds.

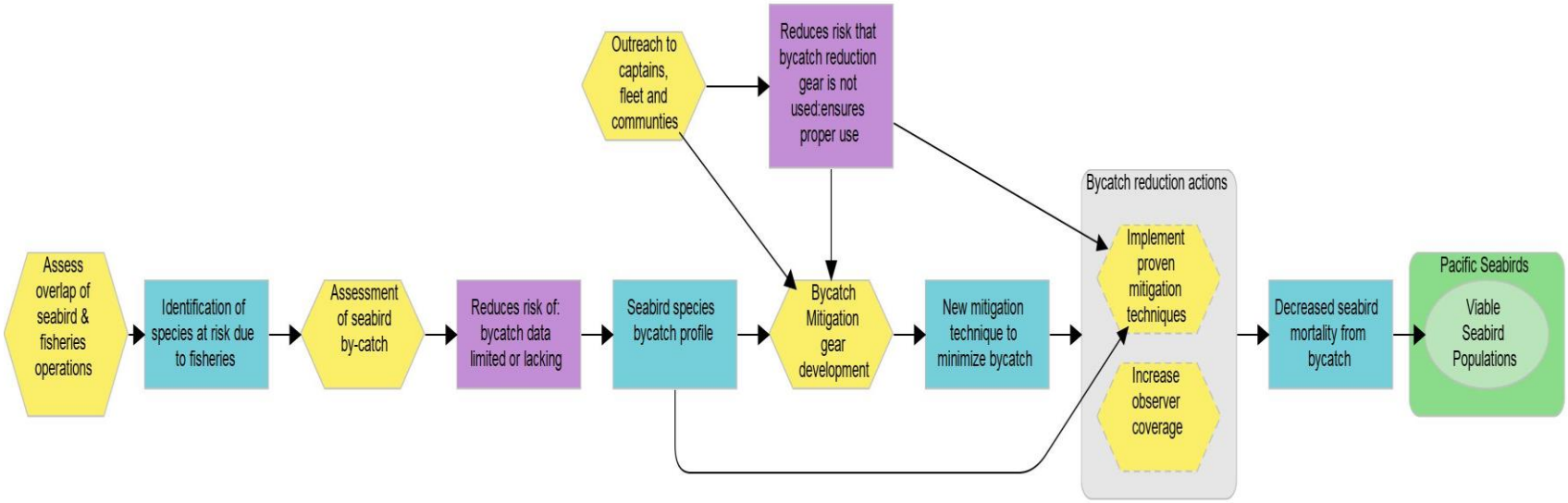


Figure 3. Results chain depicting the sequence of strategies-to-outcomes for bycatch reduction. Yellow hexagons are strategies; blue rectangles are the intermediate outcomes and purple rectangles show the risk factor that has been addressed/reduced.

Strategy 4: **Research and monitoring** - NFWF will invest in research, monitoring, and assessment actions to improve the effectiveness of species conservation, strategies, and the delivery and reporting of conservation actions over the life of this business plan.

4.1. **Information gaps/research**: For several seabird species, lack of information is the primary obstacle to effective conservation; these information gaps can hinder initiation of effective and justifiable action. Species of interest (due to observed declines and/or current listing review) are identified as prospective species in this plan. In addition, there are regional gaps with respect to the distribution and abundance of priority species as well as threats (e.g., unknown population impact of plastic ingestion); thus, filling specific information gaps with targeted research will allow for more effective, directed conservation actions in the future.

4.2. **Prioritization (tool development), assessment and monitoring -** To effectively implement, measure, and report project and programmatic level outcomes, dedicated resources are needed to capture project and programmatic level data. Recently completed prioritization exercises, population viability analyses, and return on investment tables are yielding significant planning data. New tools are also in development and are needed to further extend portfolio-style planning for seabird conservation. Support for development of monitoring tools is also critical for species and locations that would be difficult to survey using traditional techniques (e.g., cryptic, nocturnal species and for remote uninhabited islands).

Risk Assessment

Risk is an uncertain event or condition which, if it occurs, could negatively affect a plan's outcomes. NFWF assessed seven risk categories to determine the extent to which they could impede progress towards goals over the duration of this plan. Below, we identify primary risks to success and describe strategies that NFWF will implement to minimize or avoid those risks, where applicable (Table 4). NFWF also considers how these risks might affect the long-term sustainability of the outcomes achieved (i.e., up to 10 years after closure of the plan).

NFWF also considers how these risks might affect the long-term sustainability of the outcomes achieved (i.e., up to 10 years after closure of the business plan). Potential concerns include identifying long-term funding for conservation dependent species and monitoring. Accidental or intentional introductions of non-native species pose risk to eradication and habitat management interventions. Lastly, environmental risks will likely intensify and impact the sustainability of restoration projects. To support long-term sustainability, NFWF will engage in the following best practices:

- NFWF will support biosecurity planning as an integral aspect to grant making for eradication, fencing and habitat restoration projects to ensure that potential introductions of invasive species are reduced.
- Overall, strategies in this business plan are designed to build population resilience for at risk seabirds including translocating species vulnerable to sea level rise to alternate high island locations – we anticipate that actions to build resilience will offset short-term (10 year) climate impacts by increasing annual reproductive performance.

Table 4: Risk Assessment Summary

RISK CATEGORY	RATING	RISK DESCRIPTION	MITIGATING STRATEGIES
Economic Risks	Low	If bycatch reduction gear is perceived to be more expensive, harder to use, or negatively impacts fishing success, use will be limited.	Tied to Social Risks below. Adoption of bycatch mitigation measures is increased through direct engagement with fishing communities. Development of mitigation using local communities that design and manufacture fishing gear for local fleets further increases likelihood of successful use.
Environ-mental Risks	Moderate	Sea level rise, increased storm surges, ocean acidification, ocean warming and changing fish distributions could all be detrimental.	Short-term environmental risks are low. Over the longer term, changing oceanic conditions and climate are likely to impact some populations. Creating high island predator-free colonies through social attraction and translocation is one strategy for building long-term population resilience to projected changes.
Financial Risks	Low	Invasive animal eradication projects tend to be expensive and require sustained investment throughout all phases of a project. Match and long-term funding may be challenging to raise for some projects.	Communicating with partners about financial benchmarks for eradication efforts will be helpful for evaluating grantees' fundraising progress. Developing co-funding relationships with other marine funders will alleviate match and cost concerns.

Institutional Risks	Moderate	Landowners/managers, regulating agencies, and jurisdictions may be reluctant to engage in eradication programs or restoration activities.	NFWF program managers are, in part, managing risk by investing in organizations with a proven track record of success. For new partners, a deeper review of a project's ability to implement and deliver outputs is conducted. Outreach and engagement are important activities for building capacity in communities without previous implementation experience.
Regulatory Risks	Low	Specific, preferred toxicants, not currently authorized for intended use, may have to proceed through environmental review and a registration process, which could delay or prohibit use.	Thorough project planning combined with a communication strategy will alleviate most concerns. The use of pesticides and lethal control could trigger challenges. Overall, the risk is likely to result in delays and not prevent a project from proceeding.
Scientific Risks	Low	Population size and distribution of some species is largely unknown. There is also lack of knowledge about potential ocean stressors (e.g., plastics, bycatch risk).	There is an extensive body of science underlying this business plan. In those cases where scientific knowledge is low, however, the business plan outlines a plan for obtaining information prior to implementation of conservation actions.
Social Risks	Low	Resolution of actual and/or perceived human–wildlife conflicts usually require human behavioral change.	Social risks revolve around securing and maintaining behavioral change. Developing up-front strategies to advance local community engagement throughout all stages of a project is critical. Risk associated with human behavioral change is difficult to predict.

Monitoring & Evaluating Performance

Performance of the Pacific Seabird Business Plan will be assessed at both project and program scales. At the project scale, individual grantees will be required to track relevant metrics from Table 5 for demonstrating progress on project activities and outcomes, and to report out on them in their interim and final programmatic reports. At the program scale, broader habitat and species outcomes will be monitored through targeted grants, existing external data sources, and/or aggregated data from relevant grant projects, as appropriate. In addition, NFWF will conduct an internal assessment within 3-years of business plan inception to assess progress and adaptively manage.

Because several focal species select remote oceanic islands for breeding sites that were historically free of predators, routine monitoring programs to assess a species population status and trend are constrained by cost, access, and logistics. For these species, we will assess response to conservation interventions in a minimum of two ways.

First, implementing partners will be required to monitor the efficacy of the conservation action. For island eradications, near-term post-project implementation monitoring will be required to evaluate the success of the eradication attempt using best practices for monitoring detections of the target invasive species. Ideally, these projects will also include pre- and post implementation plans for monitoring the population response of focal species. Where these monitoring programs exist, NFWF will leverage species data to understand the full effect of removal on focal seabird species.

Second, absent site level monitoring, following confirmation of eradication success, NFWF will leverage the seabird mPVA tool (Ruiz *et al.* 2021) to develop population abundance projections for focal seabird species and will report the predicted percent change in population for a focal species 5 years following confirmation of eradication success.

For a minimum of four focal species, direct monitoring data (reproductive success and population counts) will be available to assess species response. While long-term population scale responses are expected for several focal species, these outcomes will not be realized until well after the 6-year time frame covered by this plan.[6] Reproductive success data expressed as the number of chicks fledged per pair provides an accurate indicator of within season breeding performance and an index of potential future recruitment class strength (Cairns 1992). Many of the species' outcomes will be tracked using data from existing third-party sources. Key data sources include the following:

- **United States Fish and Wildlife Service** – annual nest counts and reproductive success for black-footed albatross at Midway Atoll NWR.
- **Hawaii Department of Land and Natural Resources** – annual nest counts for black-footed albatross at Kure Atoll.
- **Grupo de Ecología y Conservación de Islas** – annual Townsend's shearwater reproductive success data.

[6] Collecting species specific population data for focal seabirds in a 6-year business plan (investment strategy) is not feasible due to life history constraints (delayed age of first breeding) and lag times between treatment and response for restoration activities.

- **Pulama Lanai, Maui Nui Seabird Recovery Project, Kauai Endangered Seabird Recovery Project** – annual reproductive success monitoring for Hawaiian petrel and Newell's shearwater.
- **Oikonos** – annual reproductive success monitoring, burrow counts, and burrow occupancy data for pink-footed shearwater. Periodic population estimates are also available.

In addition, the Foundation will support collection of data reporting on intermediate outcomes of threat reduction activities (Table 5). At the finest scale, individual projects will be required to develop metrics and monitoring plans to assess implementation of the work and whether the goals were achieved. Monitoring will be conducted by grantees and, where appropriate, will follow published best practice guidelines or standardized methods. Contracting to independent (third-party) monitoring programs or review of monitoring plans is an option for specific projects. Independent verification of absence confirmation (following an invasive animal eradication) and ecosystem response to invasive removal are potentially important audit functions for large, expensive eradication projects.

Table 5. Core Metrics for Measuring Progress on Program Strategies

Category	Outcomes	Metrics	Baseline	2027	Data source(s)
Management of non-native, invasive animals	*Remove non-native invasive animals from 126,000 acres of seabird breeding habitat*	*# of sites with predation reduction goals met*	0	15	Grantees
		# of acres w/ invasive reduction goals	0	126,000	Grantees
	Protect breeding populations	*# of fences completed*	0	4	Grantees
	Ensure long-term site security	*# of biosecurity plans developed*	0	8	Grantees
Restoration	*Remove invasive weeds from 1,900 acres of seabird breeding habitat*	*# of acres of seabird breeding habitat restored*	0	1,850	Grantees
	Establish new breeding colonies	*# of translocation and social attraction projects initiated for focal and non-focal seabirds*	0	10	Grantees
	Capacity building	*# of people with improved knowledge of seabird conservation*	0	20	Grantees
Reduce seabird bycatch	*Reduced seabird bycatch*	*# of fisheries with reduced seabird bycatch*	0	5	Grantees
	Improved mitigation and understanding of seabird bycatch	*# of bycatch assessment projects completed*	0	5	Grantees
		# of fisheries with gear modifications completed to reduce seabird bycatch	0	5	Grantees
Research and Monitoring	*Focal species and strategy research*	*# of research projects completed resulting in improved species conservation*	0	30	Grantees
	Prioritization / Monitoring/ Assessment	*# monitoring programs established or underway*	0	20	Grantees
		# studies completed whose findings are used to adapt management/ inform mgmt decisions (DST/Assessments)	0	3	Grantees

Budget

The following budget shows the estimated costs to implement the business plan activities. NFWF will have to raise funds to meet these costs; therefore, this budget reflects NFWF's anticipated engagement over the business plan period of performance and it is *not* an annual or even cumulative commitment by NFWF to invest. This budget assumes that current activities funded by others will, at a minimum, continue.

Table 7. Pacific Seabird Program 2022-2027 Budget

BUDGET CATEGORY		TOTAL
Strategy 1: Management of non-native, invasive animals		**$11.0M**
1.1 Eradication of invasive animals	$8.5M	
1.2 Fencing (predator proof/ungulate)	$2.25M	
1.3 Predator control	$0.25M	
Strategy 2: Restoration		**$6.15M**
2.1 Habitat restoration	$1.8M	
2.2 Seabird restoration	$4.05M	
2.3 Capacity building	$0.3M	
Strategy 3: Reduce seabird bycatch		**$5.0M**
3.1 Bycatch assessment	$1.0M	
3.2 Bycatch gear development and deployment	$3.0M	
3.3 Observer coverage/monitoring	$0.5M	
3.4 Outreach	$0.5M	
Strategy 4: Fill information Gaps/Monitoring/Assessment		**$3.35M**
4.1 Information gaps/ research	$1.5M	
4.2 Prioritization / Monitoring/ Assessment	$1.85M	
TOTAL BUDGET		**$25.5M**

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