NĀ PUA MAKANI WIND ENERGY PROJECT

Habitat Conservation Plan

FY 2024 Annual Report

(July 1, 2023 – June 30, 2024)

Prepared for:

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Incidental Take License: ITL-21/Incidental Take Permit: TE63452B-0

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1.0 Introduction

Nā Pua Makani Power Partners, LLC (NPMPP) developed a Habitat Conservation Plan (HCP; Tetra Tech 2016) for the Nā Pua Makani Wind Energy Project (Project) and received a U.S. Fish and Wildlife Service (USFWS) incidental take permit on September 7, 2018 (ITP; TE63452B-0) and the Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) incidental take license on April 30, 2019 (ITL; ITL-21). Covered Species include:

- Hawaiian hoary bat (*Lasiurus cinereus semotus*) or ʻōpeʻapeʻa;
- Newell's shearwater (*Puffinus newelli*) or ʻaʻo;
- Hawaiian goose (*Branta sandvicensis*) or nēnē;
- Hawaiian duck (*Anas wyvilliana*) or koloa maoli;
- Hawaiian coot (*Fulica alai*) or ʻalae keʻokeʻo;
- Hawaiian gallinule (*Gallinula chloropus sandvicensis*) or ʻalae ʻula;
- Hawaiian stilt (*Himantopus mexicanus knudseni*) or aeʻo; and
- Hawaiian short-eared owl (*Asio flammeus sandwichensis*) or pueo.

Project construction began in FY 2019 and continued into FY 2021. Concrete pouring for the first turbine foundation began on April 30, 2019, and coincides with the effective start date of the ITL. Project commissioning began on August 16, 2020, and commercial operations began on December 11, 2020. During commissioning Project components and the interconnection and transmission capabilities of the system are tested before the initiation of full commercial operation.

On behalf of NPMPP, Tetra Tech, Inc. (Tetra Tech) has prepared this report to describe activities relating to the Project HCP for the State of Hawaii fiscal year (FY) 2024[1] (July 1, 2023 – June 30, 2024) pursuant to the terms and obligations of the approved HCP, ITL, and ITP. The Project has previously submitted annual HCP progress reports to DOFAW and USFWS for FY 2019 through FY 2023 (Tetra Tech 2019a, Tetra Tech 2020, Tetra Tech 2021, Tetra Tech 2022, Tetra Tech 2023a).

2.0 On-Site HCP-Related Management

2.1 Avoidance and Minimization

NPMPP has worked to minimize risk to wildlife through avoidance and minimization measures outlined in the HCP. In addition, NPMPP has implemented monitoring approaches to document potential impacts to wildlife.

[1] Fiscal year references in this report refer to the State of Hawaii fiscal year, which begins every July 1st and ends every June 30th.

To minimize potential impacts to wildlife, on-site lighting at the operations and maintenance building and substation is directed downward and fitted with non-white light bulbs. Lighting in the vicinity of the turbines is only used when workers are at the site at night. No night work requiring lights that could attract wildlife occurred in FY 2024.

NPMPP implements low wind speed curtailment to reduce potential impacts to Hawaiian hoary bats. Implementation included increasing manufacturer's recommended cut-in speeds to 5 meter per second (m/s) and feathering turbine blades into the wind below 5 m/s. Low wind speed curtailment is instituted annually March – November between sunset and sunrise; in FY 2024 this included implementation July – November 2023 and March – June 2024. In addition to the intended benefit of reducing bat fatalities, low wind speed curtailment reduced risk to Covered Species such as the Newell's shearwaters and Hawaiian short-eared owl, which could transit the Project at night.

NPMPP installed an NRG ultrasonic acoustic bat deterrent system on Turbines 2, 3, 4, and 6 prior to the initiation of commercial operations to further reduce the collision risk to the Hawaiian hoary bat. These turbines were selected due to their proximity to forest edge and gulch habitat, which have been correlated with increased bat activity.

2.2 Downed Wildlife Monitoring

On August 26, 2020, the Project initiated standardized carcass searches according to the Project's Post-construction Mortality Monitoring (PCMM) Implementation Plan (Tetra Tech 2023b), concurrent with the beginning of periodic turbine testing during the Project commissioning phase (August 16, 2020). While input had not yet been received from USFWS or DOFAW on the PCMM Implementation Plan, there was a need to implement a standardized monitoring approach suitable for yielding robust statistical estimates of take.

Based on input on the PCMM Implementation Plan from USFWS and DOFAW, NPMPP and Tetra Tech have updated the document incorporating additional information and commitments to address agency questions and concerns through three revisions. Two significant changes to implementation were made because of these updates. In FY 2022, searches in supplemental (agricultural areas) and associated bias correction testing were incorporated into the analysis. In FY 2023, carcass persistence testing protocols were modified to test carcass persistence in the searched agricultural areas rather than similar, but unsearched, surrogate agricultural areas.[2]

Throughout FY 2024 downed wildlife monitoring at the Project consisted of standardized fatality monitoring according to the Project's PCMM Implementation Plan (Tetra Tech 2023b). A final revision of the plan was submitted in December 2023 addressing a few minor clarifying edits requested by DOFAW (Tetra Tech 2023b). The PCMM Implementation Plan describes how the

[2] Testing of carcass persistence trials in searched agricultural areas demonstrated that when the number of trial carcasses was low, search dogs were unlikely to cause damage to tender crops. Therefore, carcass persistence could be measured accurately within the searched agricultural areas. This approach was used throughout FY 2024.

Project implements the PCMM program provided in the HCP based on the Project construction footprint, current land use patterns, and topography. The elements of the PCMM program used to estimate fatality rates of Covered Species include:

- The specific delineation of:
    - systematic search areas;
    - supplemental (agricultural) search areas within active agricultural areas in the vicinity of turbines 6 – 9, where canine search teams can at least periodically safely perform searches;
- Search frequency;
- Bias correction testing protocols (see Sections 2.3 – 2.4); and
- Methods and results for the calculation of the proportion of the carcass distributions searched within individual agricultural plots and systematic search areas.

In FY 2022, based on recommendations from DOFAW and USFWS to increase the search areas around the turbines, NPMPP and Tetra Tech incorporated protocols to augment the systematic search area results with search results from supplemental (agricultural) search areas where consistent and effective searching can take place. This process included extensive outreach to the farmers working adjacent to the Project turbines[3], hiring of an additional canine handler, and significant logistical and methodological adjustments to ensure that health and safety requirements are met, landowner and farmer relationships are maintained, and quality data can be collected.

Under the PCMM Implementation Plan as performed in FY 2024, NPMPP conducted weekly searches with trained canine search teams within systematic search areas (Figure 1). These systematic search areas consist of areas that were cleared and graded during Project construction at each of the Project's eight turbines and can be practicably maintained in low-growing vegetation through mowing due to the low to moderate slopes. In addition, as site conditions allowed, a canine search team performed supplemental searches within active agricultural areas; all such areas that were searched consistently[4] during any fiscal quarter were incorporated into fatality estimate(s). We performed associated bias correction trials (see sections 2.3 and 2.4) and searches throughout

[3] To facilitate reporting by farmers of incidental observation of carcasses in the agricultural areas, NPM created and printed an informational flier in Lao language which included photos of HCP-covered and other protected species (i.e., MBTA), messaging to report any carcasses found, and NPM's contact information for reporting found carcasses. Copies of the flier were both posted in the areas where the tenant agricultural workers work and live and distributed as laminated copies to each individual tenant for reference. In addition, the operations manager of the agricultural area who speaks Lao verbally conveyed the same information to each tenant and emphasized the importance of notifying NPM of any carcasses they find.

[4] Some supplemental search areas regularly or occasionally have loose dogs which threaten the safety of the canine search team. Similarly, other conditions, such as the periodic application of herbicide or other chemicals, may make searching a supplemental search area unsafe or impractical during a particular week.

FY 2024 and incorporated consistently searched supplemental search area data into the analysis of the take estimate (Section 2.7).

Supplemental areas are not always searchable (see footnote 4), can be highly variable in terms of the vegetative growth, evolve quickly, and are relatively small. These challenges meant that not all delineated supplemental search areas were used in the statistical analyses. Nevertheless, all delineated supplemental search areas are regularly evaluated and considered for incorporation in future analyses based on their search history. Ultimately, these additional areas provide opportunities for an improved understanding of the carcass distribution at the site and may facilitate the establishment of more robust fatality estimates.

2.3 Carcass Persistence Trials

Eighty, 28-day carcass persistence trials were conducted within the systematic search areas in FY 2024, using black rats (*Rattus rattus*) for Hawaiian hoary bat surrogates and wedge-tailed shearwater (*Ardenna pacifica*) carcasses collected or procured under the Project's Special Purpose Utility Permit (MB79835D-0) and Hawaii Protected Wildlife Permit (WL20-18) as surrogates for the avian Covered Species.

Within supplemental agricultural search areas, an additional 40, 28-day carcass persistence trials were conducted in FY 2024. The probability that a carcass persisted until the next search used in the fatality analysis is reported in Table 1.

2.4 Searcher Efficiency Trials

Within systematic search areas, a total of 156 searcher efficiency trial carcasses were placed over 12 trial days during FY 2024. Similar to the carcass persistence trials, black rats were used as surrogates for bats, and chukars (*Alectoris chukar*), wedge-tailed shearwaters, Bulwer's petrels (*Bulweria bulwerii*), or cattle egrets (*Bulbulcus ibis*) were used as surrogates for avian Covered Species. Searcher efficiency trials occurred approximately monthly throughout the year. Most trials tested canine search teams in FY 2024; however, un-aided human searches occurred during 49 searches to cover a small area adjacent to a warehouse near Turbine 7 due to searcher safety concerns. This warehouse area routinely had aggressive, loose dogs in the vicinity, making it unsafe to perform searches with the search dog. Therefore, 62 of these 156 searcher efficiency trials were administered to test human-only searcher efficiency. Of the 156 trials placed, 18 bat surrogates and five bird carcasses were not available for detection.[5] Within supplemental search areas, an additional 95 searcher efficiency trial carcasses were placed over 12 trial days. Of these, 11 bat surrogates and four bird carcasses were not available for detection. The probability that an available carcass would be detected is reported in Table 1.

[5] Carcasses not available for detection are those that were not detected by the search team, and upon investigation by the testing proctor, could not be found, indicating the carcass had likely been scavenged prior to the search.

Figure 1. Project Infrastructure and HCP Implementation Components

Table 1. Cumulative Searcher Efficiency and Carcass Persistence Trial Results FY 2024

Size	Search Area	Total Trials		Mean (95% Confidence Interval)	
		Searcher Efficiency[1]	Carcass Persistence	Searcher Efficiency (Proportion Detected)[2]	Probability of Persistence to the Next Search (r)[3]
Bat Surrogate	Systematic (canine)	45	39	0.93 (0.83 – 0.98)	0.72 (0.60 – 0.81)
	Systematic (human only) [4]	21		0.91 (0.73 – 0.98)	0.71 (0.59 – 0.81)
Medium Bird	Systematic (canine)	43	41	1.00 (0.94 – 1.00)	0.91 (0.79 – 0.97)
	Systematic (human only) [4]	24		0.96 (0.82 – 1.00)	0.91 (0.78 – 0.97)
Bat Surrogate	Supplemental canine (analysis)	41	20	0.81 (0.67 – 0.90)	0.63 (0.47 – 0.78)
Medium Bird	Supplemental canine (analysis)	39	20	0.97 (0.89 – 1.00)	0.96 (0.90 – 0.98)

1. Available for detection.
2. Estimates and 95 percent confidence interval calculated using Dalthorp et al. (2017) single year module.
3. The estimate of *r* is reported in lieu of carcass persistence time, as *r* provides a more informative portrayal of the effect of carcass persistence on fatality estimates, incorporating information from the carcass persistence distribution and the search interval in a single variable. Estimates and confidence interval for *r* calculated using Dalthorp et al. (2017) single year module. We report the probability of persistence based on a 7-day search interval for the supplemental agricultural search areas, but the actual measure varies based on the frequency of searches.
4. Throughout FY 2024 small area around a warehouse in the vicinty of Turbine 7 routinely had loose dogs in the vicinity. The canine handler could not safely search this small discrete area. Testing of searcher efficiency performed by the canine handler without their dog was performed to incorporate this information into the analysis.

2.5 Vegetation Management

Mowing within each of the eight search plots currently occurs every other week, on average; On a weekly basis, NPMPP staff and search contractors evaluate the condition of search plot vegetation, and contractors perform necessary vegetation management around turbines following the completion of scheduled fatality monitoring searches. This effort maintains vegetation at heights below approximately 8 inches within the systematic search areas at each turbine.

2.6 Scavenger Trapping

NPMPP has contracted scavenger control for the site. Traps are checked approximately every two weeks. Active trapping occurred at all eight turbines and connecting roadways throughout the Project area using 90 DOC250 and 10 Steve Allan traps[6]. Trap distribution has remained consistent throughout the implementation of this program. The scavenger control program documented the

[6] Scavenger control traps are not deployed in the searchable agricultural areas for safety reasons due to the presence of tenant farmer's children and pets.

removal of 195 mongooses (*Herpestes auropunctatus*), 148 rats (*Rattus* spp.), 13 feral cats (*Felis cattus*), three house mice (*Mus musculus*), and 51 non-target species (28 spotted doves [*Spilopelia chinensis*], nine common mynas [*Acridotheres tristis*], seven giant African snails [*Lissachatina fulica*], five cane toads [*Rhinella marina*], and two unrecorded species) in FY 2024. Based on bi-weekly trapping data capture rates were relatively stable over time and are reported in Table 2.

Table 2. Scavenger Trapping Results at the Project in FY 2024

Trap Check Date	Mongooses per Trap	Rats per Trap	Cats per Trap	Mice per Trap	Non-Target Species per Trap	Active Traps per Check[1]
07/08/2023	0.10	0.03	0.01	0.00	0.01	93
07/22/2023	0.14	0.05	0.03	0.00	0.03	94
08/06/2023	0.11	0.06	0.01	0.00	0.00	95
08/12/2023	0.50	0.00	0.00	0.00	0.00	2
08/20/2023	0.11	0.02	0.00	0.00	0.00	95
09/02/2023	0.14	0.05	0.00	0.00	0.01	92
09/16/2023	0.09	0.08	0.02	0.00	0.02	93
10/01/2023	0.08	0.15	0.02	0.00	0.02	95
10/15/2023	0.08	0.03	0.01	0.00	0.00	96
10/27/2023	0.08	0.02	0.00	0.00	0.00	99
11/12/2023	0.09	0.08	0.00	0.00	0.00	96
11/25/2023	0.07	0.09	0.00	0.01	0.01	92
12/10/2023	0.03	0.10	0.01	0.01	0.01	96
12/23/2023	0.03	0.09	0.00	0.00	0.00	95
01/07/2024	0.08	0.06	0.00	0.00	0.02	106
01/09/2024	1.00	0.00	0.00	0.00	0.00	1
01/21/2024	0.09	0.05	0.01	0.00	0.02	87
01/25/2024	0.50	0.00	0.00	0.00	0.00	2
01/27/2024	0.00	0.00	0.00	0.00	0.50	2
02/04/2024	0.07	0.06	0.00	0.00	0.04	98
02/18/2024	0.04	0.04	0.01	0.00	0.01	96
03/02/2024	0.07	0.11	0.00	0.00	0.00	89
03/16/2024	0.12	0.12	0.00	0.00	0.09	92
03/31/2024	0.15	0.13	0.00	0.00	0.11	95
04/14/2024	0.15	0.06	0.00	0.00	0.00	89
04/26/2024	0.16	0.02	0.00	0.00	0.01	83
05/13/2024	0.11	0.04	0.02	0.00	0.02	93
05/27/2024	0.12	0.05	0.00	0.00	0.03	94
06/09/2024	0.14	0.04	0.00	0.00	0.02	93

Trap Check Date	Mongooses per Trap	Rats per Trap	Cats per Trap	Mice per Trap	Non-Target Species per Trap	Active Traps per Check[1]
06/22/2024	0.00	0.00	0.00	0.00	0.00	1
06/23/2024	0.09	0.10	0.03	0.01	0.02	94
Mean (SD)	0.14 (0.19)	0.06 (0.04)	0.01 (0.01)	0.00 (0.00)	0.04 (0.10)	79.6 (33.5)

1. "Active Traps per Check" represents the number of active traps checked on a given trap check date. Traps were less than 100 when trap(s) were damaged, lost, or malfunctioned. On some trap check days, only 1 – 2 traps were checked due to logistical issues (see trap check dates 8/12/23, 1/9/24, etc). This resulted in a low mean trap rate with a high standard deviation.

2.7 Documented Fatalities and Monitoring Results

All observed downed wildlife were handled and reported in accordance with the USFWS and DOFAW Downed Wildlife Protocol (DOFAW and USFWS 2020). NPMPP documented 27 wildlife incidents in FY 2024 (Appendix 1). No Covered Species injuries or fatalities were found in FY 2024. Six fatalities of species covered by the Migratory Bird Treaty Act (MBTA) were documented: four wedge-tailed shearwaters, one Pacific golden-plover (*Pluvialis fulva*), and one Bulwer's petrel (*Bulweria bulwerii*). The other wildlife incidents included 13 spotted doves, four common waxbills (*Estrilda astrild*), one warbling white-eye (Zosterops japonicus), one Java sparrow (*Lonchura oryzivora*), one scaly-breasted munia (*Lonchura punctulata*), and one chestnut munia (*Lonchura atricapilla*).

Various factors affect how the number of observed fatalities is scaled to estimate the direct take of Covered Species at the Project. Unobserved fatalities are due to three primary factors:

- Carcasses may be scavenged before searchers can find them;
- Carcasses may be present and not detected by searchers; and
- Carcasses may fall outside of the search area.

Sections 2.3 and 2.4 describe methods that are used to estimate the effect of the first two factors. To evaluate the contribution of the proportion of the search area searched to the estimate, we used an agency recommended ballistics model (Hull and Muir 2010) and GIS-delineated search area spatial data to estimate the proportion of the carcass distribution searched. In Quarter (Q) 4 FY 2024, DOFAW requested that NPMPP update the fall distribution estimate based on information from more recent peer-reviewed publications. Tetra Tech is evaluating relevant data and publications for NPMPP, and NPMPP anticipates additional discussion on the topic in FY 2025.

2.7.1 Hawaiian Hoary Bat

2.7.1.1 Estimated Take

One Hawaiian hoary bat fatality has been observed at the Project since the Project began testing turbine operations (commissioning) in August 2020. The single documented Hawaiian hoary bat

fatality was found on September 22, 2021, during a regular search. The carcass was detected 14 meters from the base of Turbine 6 and was collected and transferred to the U.S. Geological Survey (USGS) for genetic sexing. The results of the testing identified the individual as a female (Pinzari and Bonaccorso 2018). The observed Hawaiian hoary bat fatalities by fiscal year are listed in Table 3.

Table 3. Observed Hawaiian Hoary Bat Fatalities at the Project through FY 2024

Fiscal Year	Hawaiian Hoary Bat Observed Direct Take	Hawaiian Hoary Bat Incidental Fatality Observations	Total
2021	0	0	0
2022	1	0	1
2023	0	0	0
2024	0	0	0
Total	**1**	**0**	**1**

On an annual basis, observed take and bias correction factors are applied to estimate the probability of having detected a fatality over the previous year using the Evidence of Absence software program (EoA; Dalthorp et al. 2017), an agency approved analysis tool. This process for the Project is complex, combining systematic search areas searched by canines with the small systematic search area searched by humans only and multiple groups of agricultural search plots with unique search schedules through a multi-class analysis in EoA. This analysis process is illustrated in Appendix 2.

Cumulative take is estimated from three components: (1) observed direct take (ODT) during protocol (standardized) fatality monitoring, (2) unobserved direct take (UDT), and (3) indirect take. EoA is used to assess direct take, using results from bias correction and ODT to generate an upper credible limit (UCL) of direct take (i.e., ODT + UDT). USFWS and DOFAW have requested that estimates of direct take be reported at the 80 percent UCL. Direct take values from this analysis can be interpreted as: there is an 80 percent probability that actual direct take at the Project over the analysis period was less than or equal to the 80 percent UCL. Associated indirect take is estimated based on the sex and age characteristics of bat fatalities found at the Project, and the life history characteristics of (assumed to be representative of) the Hawaiian hoary bat, as described in the Project's approved HCP and current agency guidance (USFWS 2016).

The total cumulative estimated bat take (including indirect take) from the start of Project commissioning (when periodic turbine operation began) through FY 2024 is summarized in Table 4. Input values used in the EoA multi-year analysis are provided in Table 5.

Table 4. Cumulative Take Estimation for Hawaiian Hoary Bat through FY 2024

A: Observed Direct Take Used in Analysis	B: Incidental Observed Take	C: 80% Upper Credible Limit of Estimated Direct Take[1]	D: UDT (C – A – B)	E: Estimated Indirect Take (Adult Equivalents)[2,]	Total Estimated Adult Take (C + E)
1	0	3	2	1	4

1. Multi-year EoA analysis (Dalthorp et al. 2017) based on FY 2021 –FY 2024 data.
2. Overall indirect take for the Project is the rounded-up value calculated using the USFWS (2016) methodology as described in the text.

Table 5. Input Values for Multi-Year Analysis of Hawaiian Hoary Bat Take

Modelling Period	Weight	Search Fatalities	Ba[1]	Bb[1]	$\hat{g}$	$\hat{g}$ 95% CI
FY 2021	0.87	0	81.18	74.92	0.520	0.442 – 0.598
FY 2022[2]	1.00	1	144.3	115.2	0.556	0.492 – 0.616
FY 2023[2]	1.00	0	152.9	134.2	0.533	0.475 – 0.590
FY 2024[2]	1.00	0	91.06	97.79	0.482	0.411 – 0.553

1. EoA stores the parameters of the beta distribution to four significant digits; however, model imprecision suggests these results should be reported to a maximum of three digits (Dan Dalthorp, USGS, pers. comm. January 2020).
2. Results from FY 2022 – FY 2024 include results from searches within the systematic search areas and consistently searched supplemental search areas combined into a single estimate through the multi-class module in EoA (Dalthorp et al. 2017).

The estimated direct take (ODT + UDT) for the one Hawaiian hoary bat fatality found between the start of operation and end of FY 2024 (June 30, 2024) is less than or equal to 3 bats (80 percent UCL). Details of the estimated direct take parameters are in Appendix 3.

Indirect take is estimated to account for the potential loss of future individuals (offspring) that may occur as the result of the loss of an adult female through direct take during the breeding period when females may be pregnant or supporting dependent young. Indirect take for the Project is calculated using the USFWS (2016) guidance as follows:

- **Total Juvenile Take Calculated from Observed Female Take (April 1 – September 15)**
    - 0 (observed females) * 1.8 (pups per female) = 0 juveniles[7]
- **Total Juvenile Take Calculated from Observed Unknown Sex Take (April 1 – September 15)**

[7] As the observed fatality in FY 2022 occurred outside the period when females have dependent young, no indirect take is associated with that individual.

  - 0 (observed unknown sex) * 0.5 (assumed sex ratio) * 1.8 (pups per female) = 0 juveniles

- **Total Juvenile Take Calculated from Unobserved Take**
  - 2 (unobserved direct take) * 0.5 (assumed sex ratio) * 0.25 (proportion of calendar year females could be pregnant or have dependent pups) * 1.8 (pups per female) = 0.45 juveniles
- **Total Calculated Juvenile Indirect Take** = 0.45
- **Total Adult Equivalent Indirect Take =** 0.3 (juvenile to adult conversion factor) * 0.45 = 0.135

The UCL for cumulative Project take of the Hawaiian hoary bat at the 80 percent credibility level is 4 adult bats (3 [estimated direct take] + 1 [estimated indirect take]). That is, there is an approximately 80 percent probability that actual take at the Project at the end of FY 2024 is less than or equal to four bats.

2.7.1.2 Projected Take

Evidence of Absence (EoA) includes a module that allows users to project future estimates of mortality based on results of past fatality monitoring. Due to the inherent uncertainty of these projections (including the potential future contribution of indirect take) and the amplification of this uncertainty resulting from the use of the 80 percent UCL as the estimate of take for regulatory compliance, long term projections have limited utility. Nevertheless, they do help gauge the likelihood of permitted take exceedance, and may help operators in their mitigation planning, assuming future management and monitoring conditions can be reasonably estimated.

NPMPP projected take through the end of the permit term using the fatality monitoring data collected through FY 2024. The objective of this analysis was to evaluate the potential for the Project to exceed the permitted take limit at the 80 percent UCL prior to the end of the permit term (Appendix 3). For this analysis, the detection probability for future years is assumed to be constant at 0.482 (95 percent CI = [0.411, 0.553]). As future indirect take is unknown and will potentially vary based on the timing of ODT, we assumed total indirect take for the Project over the permit term would be a maximum of three adult equivalents (10 juveniles based on assumed Hawaiian hoary bat survival rates; USFWS 2016), or 5.8 percent of the permitted take. Currently, the proportion of total take that is attributable to indirect take is 4.3 percent (0.135 [adult indirect take]/3.135 [adult direct and indirect take] = 0.043). Assuming three adult bat equivalents are attributed to the Project as indirect take, the permitted direct take under the Project's ITP and ITL would be 48 bats (i.e., 51 permitted take – 3 indirect take = 48 direct take). Based on the analysis described above and presented in Appendix 3, there is a 97.5 percent chance that the 80 percent UCL of cumulative take will not be exceeded during the permit term.

2.7.2 Other Covered Species

There has been no observed take of the seven other Covered Species (i.e., excluding Hawaiian hoary bat) at the Project. The yearly take for these species by fiscal year is listed in Table 6.

Table 6. Observed Fatalities of Other Covered Species at the Project through FY 2024

	FY 2021		FY2022		FY 2023		FY 2024	
Covered Species	**Direct**	**Incidental**	**Direct**	**Incidental**	**Direct**	**Incidental**	**Direct**	**Incidental**
Newell's shearwater	0	0	0	0	0	0	0	0
Hawaiian goose	0	0	0	0	0	0	0	0
Hawaiian duck	0	0	0	0	0	0	0	0
Hawaiian stilt	0	0	0	0	0	0	0	0
Hawaiian coot	0	0	0	0	0	0	0	0
Hawaiian gallinule	0	0	0	0	0	0	0	0
Hawaiian short-eared owl	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

2.8 Invasive Species Management Surveys

In FY 2019 NPMPP developed an invasive species management plan to limit the potential impacts of invasive species (Tetra Tech 2019b). Consistent with HCP requirements, NPMPP coordinated with the Oʻahu Invasive Species Committee (OISC) to identify and implement measures to minimize the risk of introducing devil weed (*Chromolaena odorata*) to the Project area. Approaches to minimize risk include periodic site inspections by qualified personnel to search for the presence of plants and cleaning of equipment used in the Project area. Surveys covering the Project's disturbance footprint are conducted annually in the fall.

During an invasive plant species survey of the Project in Q2 FY 2024, biologists detected devil weed in the approximately the same distribution as the Q2 FY 2022 surveys (Turbines 3, 4, and 6, as well as along the road between the Mālaekahana and Department of Land and Natural Resources-owned portions of the Project, and on the road between turbines 6 and 7). No new detection areas were documented in FY 2024. Following initial detection of devil weed at the site, NPMPP coordinated with the OISC to verify appropriate control measures for this species within the Project's disturbance footprint and has continued to implement this approach in FY 2024.

Field observations suggest devil weed is established beyond the Project's disturbance footprint. The OISC has reported the presence of a known infestation in the vicinity of the Project prior to Project construction. Based on current data, OISC does not believe eradication of devil weed is possible and requested that NPMPP manage the species to the extent practicable, using best practices identified in the Project's invasive species management plan. NPMPP manages the devil weed within the

Project footprint through a combination of hand removal, herbicide, and mowing. Herbicide cannot be used within the systematic search areas to protect the health and safety of the canine search team. Hand pulled specimens are bagged and incinerated. NPMPP continues to monitor and manage known infestations and monitor for the presence of devil weed in new locations. The canine search team and project biologist follow decontamination protocols to clean field gear following potential exposure to devil weed seed sources. This approach should reduce the risk of further expansion of the colony. To date regular mowing of affected areas within the systematic search areas have kept the plants from forming flowers or seeds.

2.9 Wildlife Education and Incidental Reporting System

NPMPP implemented a Wildlife Education and Incidental Reporting Program for Project staff working at the Project. This training enables staff to identify the Covered Species that may occur at the Project site by providing staff with printed reference materials that include photographs of each of the Covered Species, information on their biology and habitat requirements, threats to the species onsite, and avoidance and minimization measures of the HCP. Project staff are responsible for awareness of wildlife activity onsite, responding to and treating wildlife appropriately, documenting any Project-related wildlife incidents, and reporting any downed wildlife to the on-site manager.

Forty-five Project personnel, subcontractors, and visitors were trained through this program in FY 2024. Downed wildlife observations found during standardized searches were supplemented by 15 incidental downed wildlife observations reported in FY 2024 by Project personnel trained through the Wildlife Education and Incidental Reporting Program (Appendix 1).

3.0 Mitigation and Related Activities

The Project's mitigation requirements are described in Section 6.0 of the HCP (Tetra Tech 2016).

3.1 Hawaiian Hoary Bat

3.1.1 Poamoho Management Area Research and Management Plans

The mitigation plan for the Hawaiian hoary bat in the HCP includes preparation and implementation of research and management plans targeting actions that will improve and protect bat habitat in the Poamoho Management Area and study the effectiveness of habitat restoration activities on improving the availability of bat food resources, increasing bat activity, or other appropriate variables. Several revisions to the associated research and management plans were submitted and reviewed by DOFAW and USFWS in FY 2024. In Q3, revised versions of the plans were submitted for review by the Endangered Species Recovery Committee (ESRC). The Q4, the ESRC recommended revisions to the plans including close coordination with all stakeholders involved in the management of the Poamoho Management Area. Through the close of Quarter 4,

NPMPP met with stakeholders and worked on revisions to the mitigation plan. NPMPP anticipates submittal of a revised mitigation plan in Q1 FY 2025.

3.1.2 Bat Deterrent Research Plan

The ITL includes a special condition requiring NPMPP to perform research focused on bat deterrence measures with the goal of reducing the bat take at wind turbines. NPMPP and Tetra Tech have consulted with DOFAW on their priorities for this research, potential challenges, and possible research approaches over several years. In Q2 FY 2024, NPMPP and Tetra Tech submitted a revised research plan for review. In Q4, Tetra Tech presented the plan for review by the ESRC. The ESRC recommended the development of a further revised plan that more directly evaluates the efficacy of deterrents. Upon receiving additional input from DOFAW on potential research sites, NPMPP will further revise the plan and submit for ESRC review. Ultimately, results of the research plan will be reported in the HCP annual reports for the duration of the approved research project.

3.1.3 On-Site Acoustic Surveys

The Project commenced commercial operation on December 11, 2020. As part of the HCP the Project commits to performing acoustic monitoring for Hawaiian hoary bat activity for an undefined period during operation (Section 4.2.2 of the HCP [Tetra Tech 2016]). Post construction monitoring for bat activity began in September 2020 and is currently in the 4th monitoring year. Monitoring was conducted at four locations (Turbines 1, 4, 6, and 9; Figure 1) using ground-based recording units. Recording units consisted of a Song Meter SM4BAT-FS ultrasonic acoustic recorder equipped with high frequency microphones (SMM-U2; Wildlife Acoustics, Inc., Maynard, Massachusetts), elevated 3 meters above the ground on poles and powered by 12 v/18 amp-h batteries connected to 10 w/12 v solar panels (ACOPower, Walnut, California). All units were set to record nightly bat activity beginning 1 hour before sunset and end 1 hour after sunrise. Monitoring site locations were selected to provide the best spatial distribution across the Project and representation of the habitats (e.g., mature forest, agriculture, and gulch).

The objective of acoustic monitoring is to better understand the annual, seasonal, and site variation in bat activity at the Project. Analysis of variance (ANOVA) and Tukey's honest significance difference (Tukey's HSD) were used to test for differences in annual detection rates between the FY 2021 and FY 2024 monitoring years. A linear model (LM) was used to test for a change in detection rates across all monitoring years and for differences in mean detection rates between sites. Data were normalized with an Ordered Quantile Normalization transformation using the 'bestNormalize' package in R (Peterson 2021). The distribution of residuals from the LM were examined to check for violations of model assumptions. All tests were two-tailed, employed an alpha value of 0.05, and were conducted in R version 4.3.1 (R Core Team 2023). The characterization of Hawaiian hoary bat seasons corresponds approximately to Gorresen et al. (2013).

Bat activity at the Project was generally low. Across the four turbines monitored during FY 2024 (June 2023 – May 2024), Hawaiian hoary bats were detected on 138 nights out of the 1,334 (10.3 percent) detector-nights sampled. Detection rates were highest from July through October during

the lactation and post-lactation reproductive periods, with a peak (0.23) occurring in the month of August and September (Figure 2). Following September, bat activity continued to decline throughout the post-lactation reproductive period and remained low through the pre-pregnancy reproductive period. Detection rates increased again in April and May of the pregnancy reproductive period (Figure 2).

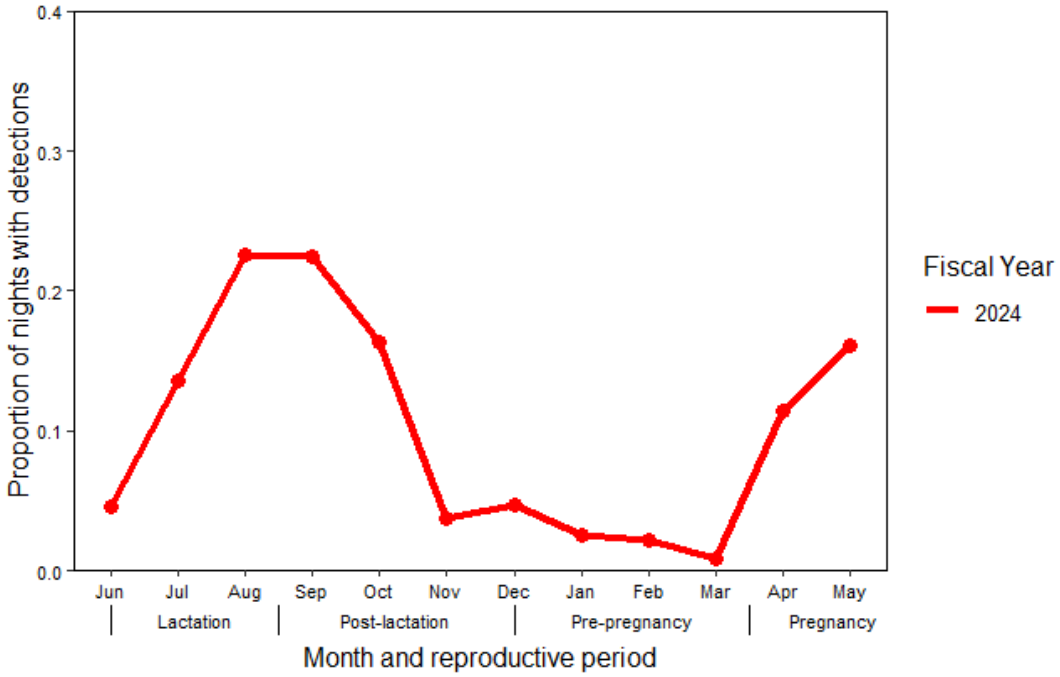

Figure 2. Monthly Bat Acoustic Activity at Nā Pua Makani for FY 2024 with Corresponding Reproductive Periods

The annual detection rate during the FY 2024 monitoring period (10.3 percent) was similar to the observed annual detection rate (9.6 percent) for the previous FY 2023 monitoring period (Tukey's HSD: $P = 1$; Table 7). A significant difference in the annual detection rate between the four sampling years was only observed between 2021 and 2024 (ANOVA: $F_{3,41} = 2.94$, $P < 0.044$; Tukey's HSD: $P < 0.059$). The seasonal trend observed in FY 2024 was similar to the seasonal trend observed in previous sampling years (Figure 3) and across the four monitoring years there is a significant increase in the annual detection rates (LM: $R^2 = 15.72$ percent; $F_{1,43} = 8.02$, $P < 0.007$; Figure 4).

Table 7. Number of Nights Sampled, Number of Nights with Detections, and Proportion of Nights with Bat Detections at Four Ground-based Detectors Sampled from FY 2021 through FY 2024

Sampling Period	No. of Nights Sampled	No. of Nights with Detections	Proportion of Nights with Detections
FY 2021 (September 2020 – May 2021)	969	26	0.027
FY2022 (June 2021 – May 2022)	1,357	83	0.061
FY 2023 (June 2022 – May 2023)	1,351	130	0.096
FY 2024 (June 2023 – May 2024)	1,334	138	0.103

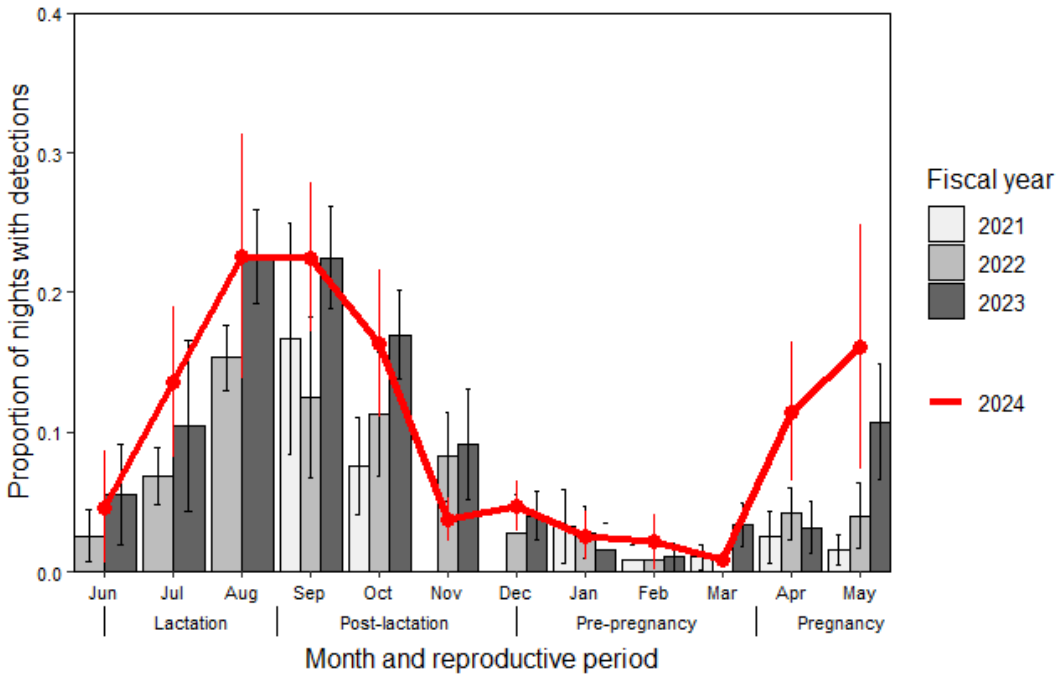

Figure 3. Monthly Bat Acoustic Activity at Nā Pua Makani for FY 2021 and FY 2024 with Corresponding Reproductive Periods

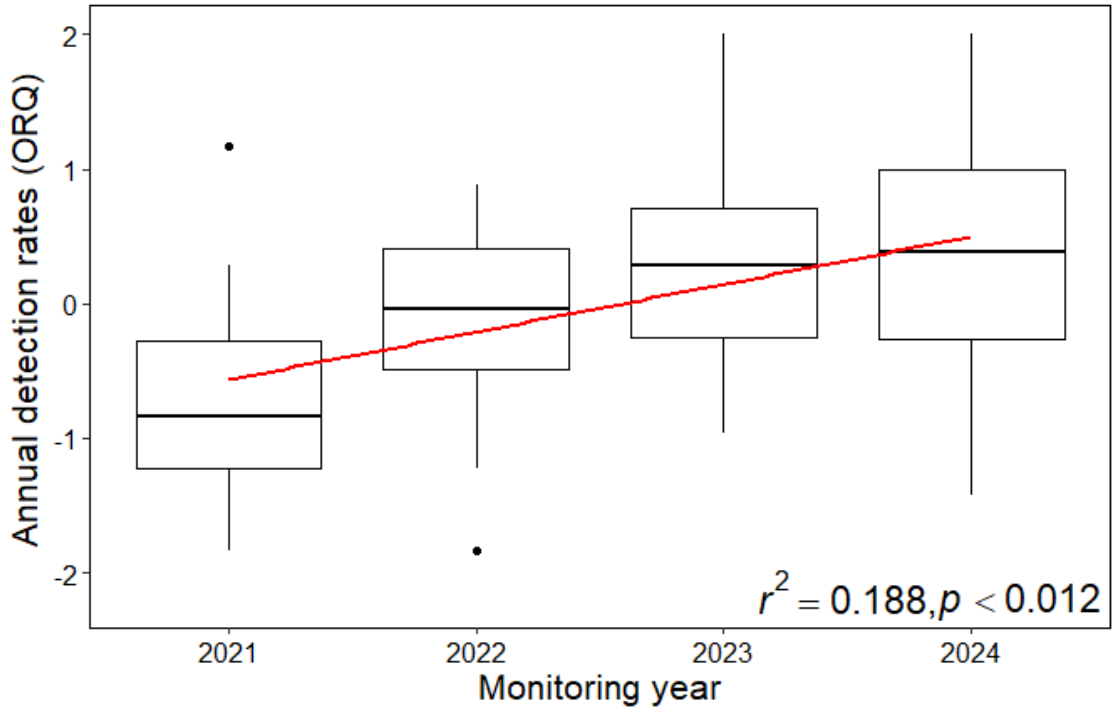

Figure 4. Box-plot with Linear Regression Showing the Increasing Trend in the Annual Detection Rate at the Project between FY 2021 and FY 2024

The seasonal pattern in mean detection rates was similar across all monitoring locations. Significant site level differences in detection rates occurred during the lactation and post-lactation reproductive periods (July through October) when bat activity was higher (LM: R^2 = 63.9 percent; $F_{47,131}$ = 4.93, P < 0; Figure 5). During the lactation reproductive period, detection rates were significantly higher in July at WTG-6 (LM: t = 2.10, P < 0.038), and in August at WTG-1 (LM: t = 2.80, P < 0.006), WTG-4 (LM: t = 2.82, P < 0.006) and WTG-6 (LM: t = 4.06, P < 0.001). During the post lactation reproductive period detection rates were significantly higher in September at WTG-1 (LM: t = 3.42, P < 0.001) and WTG-6 (LM: t = 3.7, P < 0.001) and in October at WTG-4 (LM: t = 2.9, P < 0.005; Figure 5).

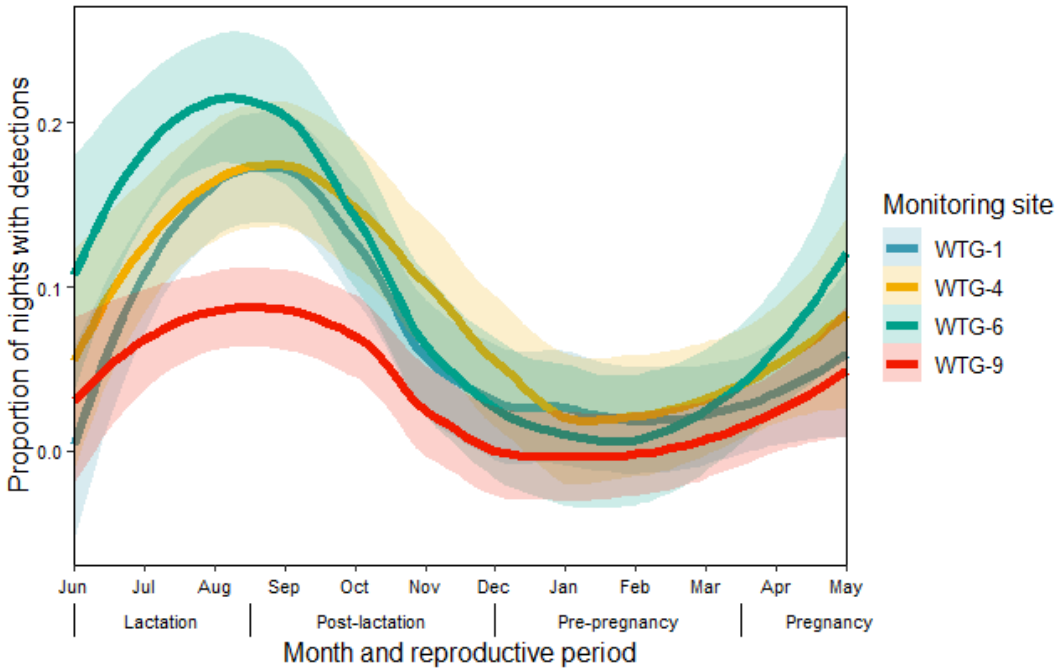

Figure 5. Site-Specific Variation in Mean Detection Rates for Each Month with Corresponding Reproductive Periods.

Note: Trend Lines are fitted with Loess smoothing curve; see Figure 1 for spatial context.

3.2 Newell's Shearwater

NPMPP provided required mitigation funds to the National Fish and Wildlife Foundation (NFWF) on September 22, 2020. USFWS will share updates on the status of the NFWF program when available (Jonah Dedrick, pers. comm. June 2024). At the end of FY 2024 USFWS reported that NFWF had not yet funded programs using the NPMPP funds. USFWS and DOFAW are coordinating on mitigation project selection. NPMPP will report results from the Newell's shearwater mitigation efforts once NFWF identifies and funds an appropriate mitigation project.

3.3 Hawaiian Goose

Based on NPMPP's consultation with DOFAW and USFWS regarding the loss of the Hawaiian goose population on Oʻahu prior to the construction and operation of the Project, NPMPP will address new information associated with this species in the HCP major amendment (see Section 4.0).

3.4 Hawaiian Waterbirds

Adaptive management of the Hawaiian waterbird mitigation program is required (see Section 4.0). After several rounds of review and discussion, NPMPP has received USFWS and DOFAW approval of an updated Hawaiian waterbird mitigation plan. NPMPP and DOFAW signed a memorandum of understanding (MOU) to allow DOFAW to perform habitat management, predator control, and monitoring associated with the mitigation plan was signed in FY 2024, and NPMPP made a payment

to DOFAW to fund the first year of management on June 28, 2024. Per the MOU management and monitoring efforts is expected to start in November 2024.

3.5 Hawaiian Short-eared Owl

NPMPP provided required mitigation funds to the Endangered Species Trust Fund on September 18, 2020, and an MOU for use of the funds and reporting requirements was finalized with DOFAW on February 18, 2021. DOFAW used the funds provided by NPMPP to fund a graduate research project on Hawaiian short-eared owl breeding ecology. Appendix 3 in the FY 2023 annual report (Tetra Tech 2023a) is the final report from that study (Price and Wang 2023).

4.0 Adaptive Management

NPMPP has identified several adaptive management actions for the Project and has coordinated closely with USFWS and DOFAW to document needs and ensure agency support for the identified actions. Adaptive management actions identified by NPMPP include:

- Limited deployment of ultrasonic acoustic bat deterrents to test their efficacy at the Project;
- Modifications to the waterbird mitigation plan described in the HCP to address changed conditions at Hāmākua Marsh (the proposed mitigation site); and
- Addressing changed conditions relating to the status of the Hawaiian goose on Oʻahu.

In consultation with USFWS and DOFAW, NPMPP installed ultrasonic acoustic bat deterrents on four Project turbines based on available scientific research and preliminary results from the Kawailoa Wind Farm on Oʻahu (Tetra Tech 2019c, Weaver et al. 2019). Deterrents became operational between September 17 and 28, 2020.

The deterrent system is monitored to ensure components are operating according to the manufacturer's recommendations. The effective area covered by each of the 6 deterrent units overlap, ensuring redundancy in the system in the event of a component failure. Components are replaced as soon as practicable after they fall below the manufacturer's standards, and replacement components are stored on site to ensure availability. During FY 2024, the deterrent units operated within manufacturer's recommendations 90.3 percent of the time.

USFWS and DOFAW have agreed that a modified waterbird mitigation program implemented at Hāmākua Marsh that reduces fatalities and/or increases productivity of the resident waterbird species is appropriate, as the fencing, public outreach, and staffing program identified in the HCP is no longer viable due to changed site conditions and development plans (see Section 3.4).

USFWS, DOFAW, and NPMPP have agreed that because the Hawaiian goose was extirpated from Oʻahu prior to the construction and operation of the Project, the Project currently poses no risk to the Hawaiian goose. NPMPP continues to work with USFWS and DOFAW to address this changed circumstance in the Project's HCP major amendment.

5.0 Agency Meetings, Consultations, and Site Visits

NPMPP and Tetra Tech communicated actively with USFWS, and DOFAW throughout FY 2024 through in-person meetings, conference calls, and e-mail communications related to the Project's HCP. The purposes of these communications included required semi-annual meetings, and planning associated with avoidance and minimization measures, monitoring, and mitigation. A summary of agency coordination is provided in Table 8.

Table 8. Summary of Key Agency Coordination and Communication in FY 2024

Date	Description	Participants/Recipients
07/07/2023	HCP amendment review meeting	NPMPP, Tetra Tech, DOFAW, USFWS
08/01/2023	FY 2023 annual report submittal	NPMPP, Tetra Tech, DOFAW, USFWS
08/10/2023	Deterrent study review meeting	NPMPP, Tetra Tech, DOFAW, USFWS
08/12/2023	HCP amendment input request submitted by Tetra Tech	NPMPP, Tetra Tech, DOFAW, USFWS
08/23/2023	USFWS reply to HCP amendment input request	NPMPP, Tetra Tech, DOFAW, USFWS
09/01/2023	Waterbird mitigation plan revision and MOU revision submittal	NPMPP, Tetra Tech, DOFAW, USFWS
09/06/2023	DOFAW comments on waterbird mitigation plan MOU received	NPMPP, Tetra Tech, DOFAW, USFWS
09/11/2023	HCP amendment input followup call	Tetra Tech, USFWS
09/13/2023	USFWS FY2023 annual report comments received	NPMPP, Tetra Tech, DOFAW, USFWS
09/18/2023	DOFAW Post-construction monitoring plan comments received	NPMPP, Tetra Tech, DOFAW, USFWS
09/22/2023	DOFAW reply to HCP amendment input request	NPMPP, Tetra Tech, DOFAW, USFWS
09/25/2023	USFWS signed approval of waterbird mitigation plan received	NPMPP, Tetra Tech, DOFAW, USFWS
09/29/2023	DOFAW FY2023 annual report comments received	NPMPP, Tetra Tech, DOFAW, USFWS
11/04/2023	Bat deterrent plan revision submittal	NPMPP, Tetra Tech, DOFAW, USFWS
11/07/2023	DOFAW waterbird mitigation MOU comments received	NPMPP, Tetra Tech, DOFAW, USFWS
11/08/2023	DOFAW/USFWS fall HCP implementation meeting	NPMPP, Tetra Tech, DOFAW, USFWS
11/10/2023	USFWS request for Project raw EoA data for FY 2023	NPMPP, Tetra Tech, DOFAW, USFWS
11/17/2023	NPMPP submittal re PCMM approval process memo	NPMPP, Tetra Tech, DOFAW, USFWS
11/30/2023	NPMPP revised annual report submittal	NPMPP, Tetra Tech, DOFAW, USFWS
11/30/2023	USFWS follow-up regarding input on bat mitigation plans	NPMPP, Tetra Tech, DOFAW, USFWS
12/01/2023	NPMPP revised comment matrix on bat mitigation plans submittal	NPMPP, Tetra Tech, DOFAW, USFWS

Date	Description	Participants/Recipients
12/12/2023	Call with DOFAW/USFWS regarding bat mitigation plans	NPMPP, Tetra Tech, DOFAW, USFWS
12/14/2023	DOFAW bat mitigation and research plan comments received	NPMPP, Tetra Tech, DOFAW, USFWS
12/28/2023	Project EoA data submittal	NPMPP, Tetra Tech, DOFAW, USFWS
12/29/2023	PCMM Implementation Plan update submittal	NPMPP, Tetra Tech, DOFAW, USFWS
01/19/2024	Annual report submittal for Protected Wildlife Permit	NPMPP, Tetra Tech, DOFAW
01/23/2024	Annual report submitted for MBTA permit	NPMPP, Tetra Tech, USFWS
02/01/2024	ESRC Annual Review Meeting	NPMPP, Tetra Tech, DOFAW
03/04/2024	PCMM discussion with DOFAW regarding intent to take the plan to ESRC	NPMPP, Tetra Tech, DOFAW
03/12/2024	Habitat management and research plan revision submittal	NPMPP, Tetra Tech, DOFAW, USFWS
03/13/2024	Agency site visit focused on PCMM	NPMPP, Tetra Tech, DOFAW, USFWS
03/19/2024	DOFAW/USFWS provided potential sites for Hawaiian petrel mitigation projects	NPMPP, Tetra Tech, DOFAW, USFWS
03/19/2024	Fully executed waterbird mitigation MOU	NPMPP, Tetra Tech, DOFAW, USFWS
04/23/2024	Meeting with DOFAW to discuss bat plans and ESRC presentation	NPMPP, Tetra Tech, DOFAW
04/30/2024	E-mail request from DOFAW to consider newer research in estimate of carcass fall distribution	NPMPP, Tetra Tech, DOFAW, USFWS
05/07/2024	Partial set of agency comments received related to NPMPP bat mitigation plans	NPMPP, Tetra Tech, DOFAW, USFWS
05/10/2024	Bat mitigation plan discussion with agencies	NPMPP, Tetra Tech, DOFAW, USFWS
05/15/2024	Meeting with DOFAW HCP and Oʻahu Branch staff regarding Poamoho mitigation area	NPMPP, Tetra Tech, DOFAW (HCP and Oʻahu Branch staff)
05/17/2024	ESRC presentations on bat mitigation plans, PCMM, and bat deterrent study	NPMPP, Tetra Tech, DOFAW
05/20/2024	DOFAW e-mail summarizing ESRC recommendations	NPMPP, Tetra Tech, DOFAW
06/05/2024	Spring agency HCP implementation meeting	NPMPP, Tetra Tech, DOFAW, USFWS
06/10/2024	Poamoho mitigation area discussion with stakeholders	NPMPP, Tetra Tech, Koʻolau Mountain Watershed Partnership, DOFAW Oʻahu Branch staff

6.0 Expenditures

Total HCP-related expenditures for the Project in FY 2024 were $367,658. A summary of expenditures by category is provided in Table 9.

Table 9. HCP-related Expenditures at the Project in FY 2024

Category	Amount
Permit Compliance	$78,583
Fatality Monitoring	$102,398
Acoustic Monitoring for Bats	$16,502
Vegetation Management	$75,000
Scavenger Trapping	$22,335
Bat Mitigation Planning	$39,953
Other Mitigation Planning and Coordination	$11,386
HCP Amendment Planning	$17,686
Miscellaneous Costs	$3,815
Total Cost for FY 2023	**$367,658**

7.0 FY 2024 HCP Implementation Work Plan

NPMPP's FY 2024 HCP implementation work plan is provided as Table 10.

Table 10. FY 2025 HCP Implementation Work Plan

Program	Component	FY 2025			
		Quarter 1	Quarter 2	Quarter 3	Quarter 4
PCMM	Fatality Searches	Weekly searches throughout FY			
	Bias Correction Trials	Searcher efficiency and carcass persistence trials	Searcher efficiency and carcass persistence trials	Searcher efficiency and carcass persistence trials	Searcher efficiency and carcass persistence trials
	Scavenger Control	Trap checks every ~2 weeks, quarterly evaluation to assess changes in schedule			
	Vegetation Management	Occurs shortly after completion of searches, search areas evaluated weekly and managed as needed			
	Invasive Species Surveys		Survey Project area		
		Manage devil weed consistent with protocols			
Bat Acoustic Monitoring	Data downloads and Equipment Checks	Download data and equipment check monthly			
Bat Deterrents	Maintenance	Maintain operational deterrents on 4 turbines			
	Research Study	Revise and submit research plan for ESRC review and DOFAW approval		Implementation	
Mitigation	Hawaiian Goose	To be addressed in HCP major amendment			
	Waterbirds	Implementation			
	Newell's Shearwater	Coordinate with USFWS regarding mitigation progress and reporting			
	Hawaiian Hoary Bat	Revise and submit research and management plans for ESRC review and USFWS and DOFAW approval	Implementation		
	Hawaiian Short-eared Owl	Complete			
Reporting	Wildlife Incidents	As required per DOFAW and USFWS 2020 protocol			
	Regular Reporting	FY 2024 annual report	Semi-annual agency meeting; ESRC annual review		Semi-annual agency meeting

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APPENDIX 1. OBSERVED FATALITIES, LOCATIONS, AND DETECTION METHOD IN FY 2024 AT THE PROJECT

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Species	Date	Turbine Number or Location[1]	Distance to the Turbine (meters)	Detection Method[2]
Spilopelia chinensis (spotted dove)	07/02/2023	4	1	Incidental
Bulweria bulwerii (Bulwer's petrel)	07/05/2023	7	95	Search
Lonchura atricapilla (chestnut munia)	07/06/2023	2	1	Incidental
Estrilda astrild (common waxbill)	08/02/2023	8	9	Search
Spilopelia chinensis (spotted dove)	08/03/2023	6	3	Incidental
Spilopelia chinensis (spotted dove)	08/29/2023	9	1	Incidental
Lonchura punctulata (scaly-breasted munia)	09/06/2023	3	46	Search
Spilopelia chinensis (spotted dove)	09/09/2023	4	1	Incidental
Estrilda astrild (common waxbill)	09/24/2023	2	0	Incidental
Estrilda astrild (common waxbill)	09/27/2023	3	1	Search
Ardenna pacifica (wedge-tailed shearwater)	11/18/2023	7	31	Incidental
Ardenna pacifica (wedge-tailed shearwater)	11/22/2023	9	41	Search
Ardenna pacifica (wedge-tailed shearwater)	11/22/2023	7	77	Search
Ardenna pacifica (wedge-tailed shearwater)	11/28/2023	7	52	Search
Lonchura oryzivora (Java sparrow)	11/29/2023	1	2	Search
Pluvalis fulva (Pacific golden-plover)	11/29/2023	6	61	Search
Zosterops japonicus (warbling white-eye)	01/10/2024	8	73	Search
Spilopelia chinensis (spotted dove)	02/02/2024	6	2	Incidental
Spilopelia chinensis (spotted dove)	02/03/2024	7	6	Incidental
Estrilda astrild (common waxbill)	02/07/2024	1	4	Search
Spilopelia chinensis (spotted dove)	02/13/2024	2	1	Incidental
Spilopelia chinensis (spotted dove)	02/20/2024	7	1	Incidental
Spilopelia chinensis (spotted dove)	02/26/2024	9	2	Incidental
Spilopelia chinensis (spotted dove)	03/20/2024	3	54	Search
Spilopelia chinensis (spotted dove)	04/05/2024	8	2	Incidental

Species	Date	Turbine Number or Location[1]	Distance to the Turbine (meters)	Detection Method[2]
Spilopelia chinensis (spotted dove)	04/06/2024	2	2	Incidental
Spilopelia chinensis (spotted dove)	04/09/2024	6	6	Incidental

1. Incidental detections are downed wildlife incidents detected outside of the systematic search effort, including detections outside of the defined systematic search areas but found during a search effort as well as detections of fatalities within search areas by non-searchers.

APPENDIX 2. EVIDENCE OF ABSENCE ANALYSIS FLOWCHART FOR THE PROJECT

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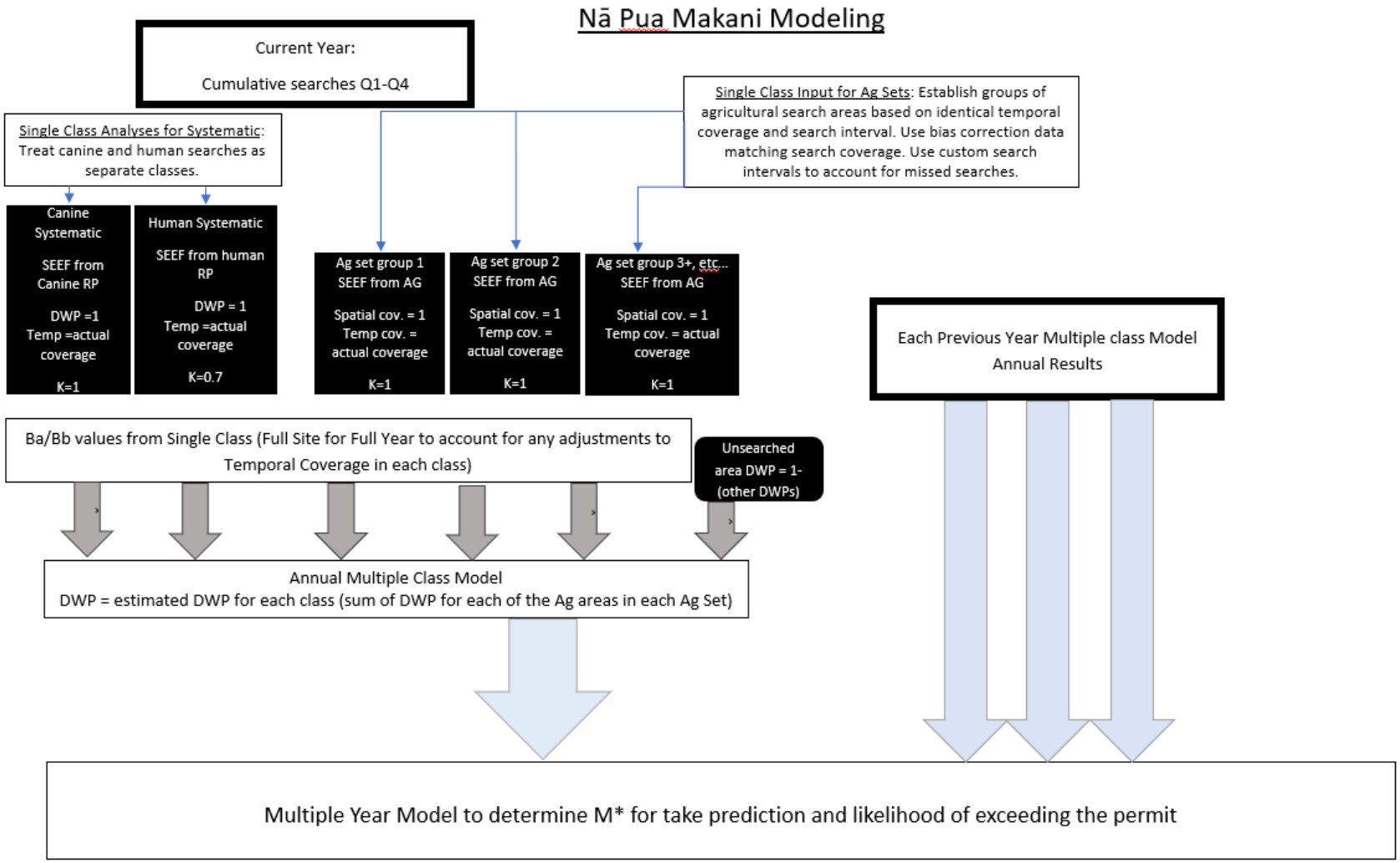
Nā Pua Makani Modeling
Current Year:
Cumulative searches Q1-Q4
Single Class Analyses for Systematic: Treat canine and human searches as separate classes.
Single Class Input for Ag Sets: Establish groups of agricultural search areas based on identical temporal coverage and search interval. Use bias correction data matching search coverage. Use custom search intervals to account for missed searches.
Canine Systematic
SEEF from Canine RP
DWP =1
Temp =actual coverage
K=1
Human Systematic
SEEF from human RP
DWP = 1
Temp =actual coverage
K=0.7
Ag set group 1
SEEF from AG
Spatial cov. = 1
Temp cov. = actual coverage
K=1
Ag set group 2
SEEF from AG
Spatial cov. = 1
Temp cov. = actual coverage
K=1
Ag set group 3+, etc..
SEEF from AG
Spatial cov. = 1
Temp cov. = actual coverage
K=1
Each Previous Year Multiple class Model Annual Results
Ba/Bb values from Single Class (Full Site for Full Year to account for any adjustments to Temporal Coverage in each class)
Unsearched area DWP = 1- (other DWPs)
Annual Multiple Class Model
DWP = estimated DWP for each class (sum of DWP for each of the Ag areas in each Ag Set)
Multiple Year Model to determine M* for take prediction and likelihood of exceeding the permit

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APPENDIX 3. DALTHORP ET AL. (2017) FATALITY ESTIMATION DATA FOR HAWAIIAN HOARY BATS THROUGH FY 2024 AT THE PROJECT

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Figure 1. Dalthorp et al. (2017) Multi-year Analysis Input

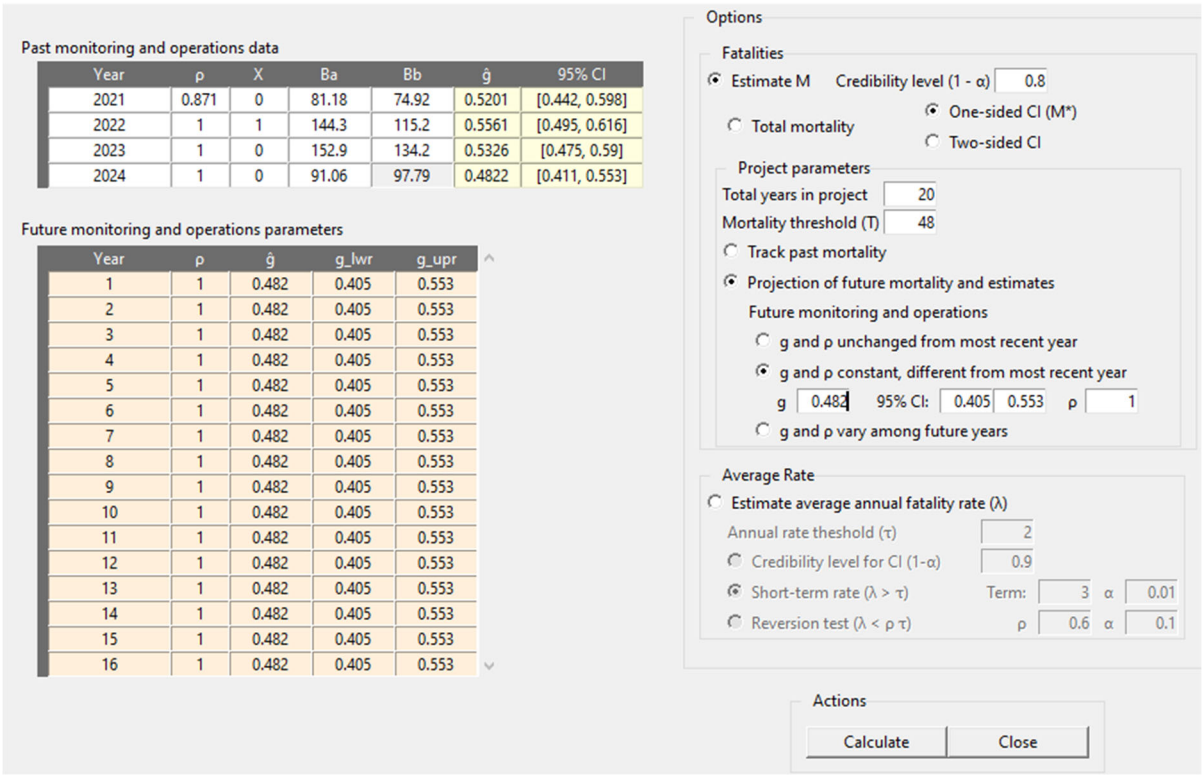

Figure 2. Dalthorp et al. (2017) Projection Results Figure Output

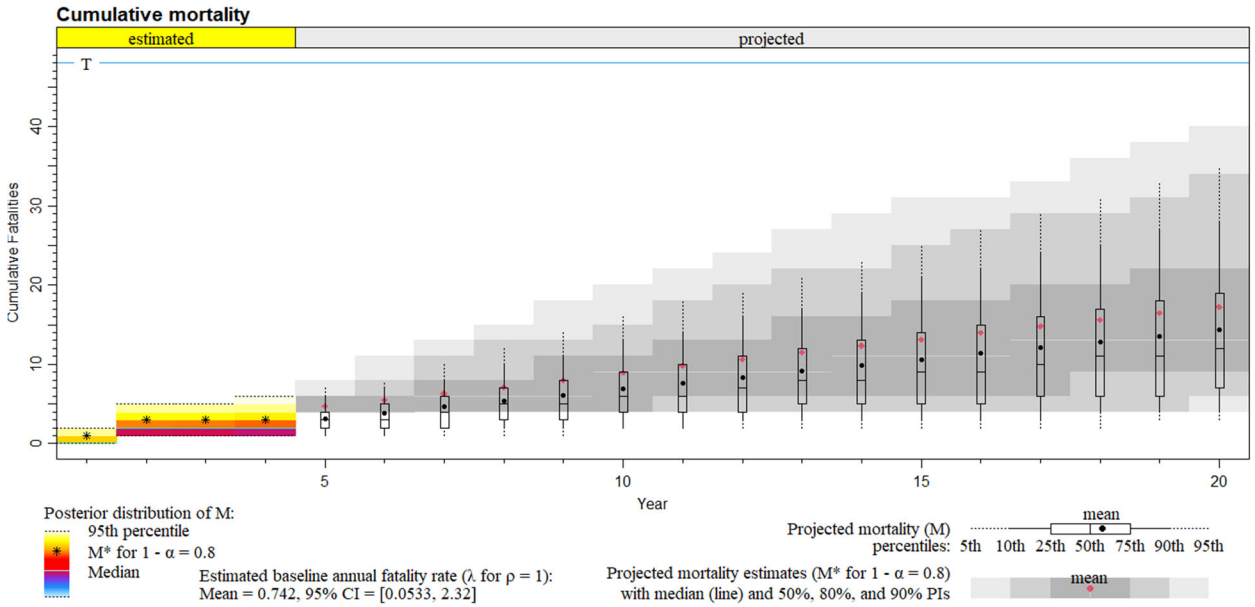

Figure 3. Dalthorp et al. (2017) Projection Text Results Output Page 1 of 2

```
================================================================================
Summary statistics from posterior predictive distributions for 10000 simulated projects
-----------------------------------
Estimated annual baseline fatality rate (lambda for rho = 1): mean = 0.742, 95% CI = [0.0533, 2.32]

Projected fatalities and fatality estimates...
p(M > Tau within 20 years) = 0.012  [exceedance]
p(M* > Tau within 20 years) = 0.0266  [triggering]
M* based on credibility level 1 - alpha = 0.8

Among projects with triggering (2.66%), mean(M) = 40.99 at time of triggering, with median = 41 and IQR = [36, 45]
Among projects with no triggering (97.34%), mean(M) = 13.38 at end of 20 years, with median = 11 and IQR = [7, 18]

Years of operations without triggering:
 Mean = 19.93, with median =  20 and IQR = [20, 20]

----------------------------------------
Summary statistics for projection years
-------------------------------------------------------------------------------------------------------------
Yr   Mean            quantiles of M                          | quantiles of M*
       M       M*  0.05  0.10  0.25  0.50  0.75  0.90  0.95 |  0.05  0.10  0.25  0.50  0.75  0.90  0.95
-------------------------------------------------------------------------------------------------------------
1       3.1    4.7     1     1     2     3     4     6     7 |     4     4     4     4     6     6     8
2       3.9    5.5     1     1     2     3     5     7     8 |     4     4     4     4     6     8    11
3       4.6    6.3     1     2     2     4     6     8    10 |     4     4     4     6     8    11    13
4       5.4    7.1     1     2     3     5     7    10    12 |     4     4     4     6     8    13    15
5       6.1    8.0     1     2     3     5     8    11    14 |     4     4     4     6    11    13    18
6       6.9    8.9     2     2     4     6     9    13    16 |     4     4     4     9    11    15    20
7       7.6    9.8     2     2     4     6    10    14    18 |     4     4     6     9    13    18    22
8       8.4   10.6     2     3     4     7    11    16    19 |     4     4     6     9    13    20    24
9       9.1   11.5     2     3     5     8    12    17    21 |     4     4     6     9    16    22    27
10      9.9   12.3     2     3     5     8    13    19    23 |     4     4     6    11    16    22    29
11     10.6   13.1     2     3     5     9    14    21    25 |     4     4     6    11    18    25    31
12     11.3   14.0     2     3     5     9    15    22    27 |     4     4     6    11    18    27    31
13     12.1   14.8     2     3     6    10    16    24    29 |     4     4     6    13    20    29    33
14     12.8   15.6     2     4     6    11    17    25    31 |     4     4     9    13    20    29    36
15     13.6   16.4     3     4     6    11    18    27    33 |     4     4     9    13    22    31    38
16     14.3   17.2     3     4     7    12    19    28    35 |     4     6     9    13    22    34    40

================================================================================

Governing parameters: Tau = 48, alpha = 0.2

Data for 4 years of monitoring:
           yr    x     g    glwr   gupr  rho  M*
         2021    0 0.5201 0.4403 0.5998  0.871   1
         2022    1 0.5561 0.4945 0.6176  1    3
         2023    0 0.5326 0.4738 0.5914  1    3
         2024    0 0.4822 0.4097 0.5547  1    3

Parameters for future monitoring and operations:
  Number of years:  16
  g = 0.482, 95% CI  [0.405, 0.553]
  Relative weight (rho): 1
```

Figure 3 (continued). Dalthorp et al. (2017) Projection Text Results Output Page 2 of 2

```
**************************************************************************************
Summary statistics for mortality estimates through 4 years
-----------------------------------
Results
Totals through 4 years

M* = 3 for 1 - alpha = 0.8, i.e., P(M <= 3) >= 80%
Estimated overall detection probability: g = 0.523, 95% CI = [0.489, 0.556]
    Ba = 450.62, Bb = 411.31
Estimated baseline fatality rate (for rho = 1): lambda = 0.7423, 95% CI = [0.0533, 2.32]

Cumulative Mortality Estimates
Year         M*   median   95% CI   mean(lambda) 95% CI
2021          1     0      [0, 2]  0.9699   [0.0009283,  4.888]
2022          3     2      [1, 5]  2.7900   [0.2002,  8.714]
2023          3     2      [1, 5]  2.7990   [ 0.201,  8.733]
2024          3     2      [1, 6]  2.8730   [0.2064,  8.964]

Annual Mortality Estimates
Year         M*   median   95% CI   mean(lambda) 95% CI
2021          1     0      [0, 2]  0.9699   [0.0009283,  4.888]
2022          3     2      [1, 5]  2.7100   [0.1942,  8.473]
2023          1     0      [0, 2]  0.9430   [0.0009389,  4.745]
2024          1     0      [0, 3]  1.0460   [0.00104,  5.269]


Test of assumed relative weights (rho) and potential bias             Fitted rho
Assumed rho     95% CI
  0.871     [0.004, 2.771]
      1     [0.213, 3.618]
      1     [0.004, 2.561]
      1     [0.005, 2.682]

p = 0.46079 for likelihood ratio test of H0: assumed rho = true rho
Quick test of relative bias: 1.017

==========================================================================
Input
Year (or period) rel_wt  X    Ba     Bb   ghat    95% CI
2021             0.871   0  81.18  74.92 0.520 [0.442, 0.598]
2022             1.000   1  144.3  115.2 0.556 [0.495, 0.616]
2023             1.000   0  152.9  134.2 0.533 [0.475, 0.590]
2024             1.000   0  91.06  97.79 0.482 [0.411, 0.553]
```