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Tesoro Hawaii SPM Spill NRDA

Dear Mr. McKinley:

Enclosed is a draft report reflecting the discussion of Adrian del Nevo during our meetings in Honolulu in May; wherein conditional settlement was reached on restoration projects for potential loss of seabirds as result of the Tesoro Hawaii SPM spill.

These materials are provided with the same understanding as to confidentiality as the settlement negotiations. More specifically, that all communications are to be treated as confidential settlement discussions as provided under applicable federal and state laws.

The draft report represents a scientifically estimated restoration benefit for the restoration projects agreed upon during our meetings. Please advise if you have any questions regarding the report.

Very truly yours,

Barry R. Ogilby

Enclosure

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A METHOD FOR ESTIMATING 'VALUE' FROM AGENCY PROPOSED RESTORATION PROJECTS ASSOCIATED WITH THE TESORO SPM HOSE SPILL.

INTRODUCTION

Restoration projects (hereafter, Projects) have been proposed by Government Agencies that are intended to compensate for the potential loss of seabirds associated with the Tesoro Spill. Independent of an assessment of the estimated number of seabirds implicated with the spill it is important to estimate the potential 'value' that may be gained from the restoration projects. The Agencies have identified Projects that are intended to reduce or remove predators to nesting seabirds. The Agencies have further identified target seabird species, specific locations and the predators that are thought to threaten seabird populations. From the list of proposed Projects provided by the Agencies Tesoro has identified three Projects which it believes will provide substantial value to the seabird populations. These are (1) anti-predator (dog) fencing at Kilauea Point, Kauai, (2) predator (rat) removal on three Ohau offshore islets, and (3) anti-predator (rat) program within the interior of Kauai. These three Projects involve different seabird species that may have been implicated with the Tesoro Spill. The following description provides a rationale for estimating the potential 'value' of these projects.

SPECIES COMPOSITION

Two of the three projects, Kilauea Point and Ohau offshore islets, involve a number of seabird species. These species include wedge-tailed shearwater, Newell's shearwater, red-tailed tropicbird, white-tailed tropicbird, Bulwer's petrel, red-footed booby, brown booby, masked booby and great frigatebird. The third project was intended to target the predators of one species, the Newell's shearwater Agency personnel provided current population estimates for each of the locations.

RATIONALE FOR ESTIMATING 'VALUE' TO TARGET SPECIES

We recognize that numerous factors may influence the productivity, survival and population of seabird species. These factors may be natural (e.g., weather) or artificial (e.g., disturbance). Within the Hawaiian Islands introduced predators have been identified has a significant threat to the viability of several animal species, particularly seabirds (Harrison et al. 1984). Given the suggested scale of threat and subsequent impact upon seabird populations relatively few data exist to document the rate or amount of loss due to introduced predators. Similarly relatively few data exist to estimate the benefit or value of predator removal. Point Reyes Bird Observatory (PRBO) have attempted to quantify the predation rate to Newell's shearwater (PRBO, 1995) and suggest an annual predation rate of 2.5%. PRBO recognize that 2.5% is probably an underestimate and would probably be as high as 5% for some age classes. However, for the purposes of this evaluation we will assume a predation rate of 2.5%. This paper proposes a method to estimate the benefit or value of predator removal.

If we assume that other population determining factors are held constant we can model the effect of predator removal upon seabird populations. We recognize that the factors influencing seabird population change are complex and variable within and between species, colonies and years. However, we propose a Simplified Population Productivity Model (SPPM) that demonstrates how seabirds might benefit from anti-predator activities. In order to simplify the model and use it for several species we have assumed a surrogate 'hybrid seabird' with average population parameters and values. Table 1. provides a synopsis of the population variables for seabird species nesting within Hawaii. The inclusion of all Hawaiian seabird species does not necessarily indicate that we believe that these species may have been impacted by the Tesoro spill. To simplify the model further we have assumed a 'hybrid seabird' exhibiting biological characteristics listed in Table 2. In most cases we have assigned an average value or a weighted value (from Table 1) which take into account the relative number of individuals in the estimated population. For example, we have used 6 years as the age of first breeding as this is the age of first breeding for Newell's and wedge-tailed shearwaters which when combined are the most common species. We recognize that sooty terns, with an estimated first breeding age of four years (Table 1), are also numerous. However, this species may attempt breeding at four years but is not usually successful until at least five or six years of age. Also, sooty terns may initiate breeding more than once in a given calendar year.

We are aware that the model is not completely appropriate for all species. We further acknowledge that there may need to be some changes in values that might more accurately reflect our intended 'hybrid seabird'. Despite the potential limitations and compromises of the model we believe that the input parameters and the 'hybrid' values represent a reasonable representation for a surrogate Hawaiian seabird population.

MODEL OUTCOME: WITH PREDATION

We present a model-run that includes the effect of predation in Table 3. The model was run for a 20-year period as we assumed that this would be an appropriate period for fence longevity at Kilauea Point. In Table 3 we assumed an initial 100 pairs (Pairs 1) of 'hybrid seabirds', which underwent a predation loss of 2.5% (Table 2). In many cases loss from predation is only likely to include one of the pair. However, in all years we assumed both were lost to the breeding season as the remaining bird may be unable to find another mate for one or more seasons. The remaining pairs (Pairs 2) were assumed to produce one chick per pair. We also assumed predation loss to chicks and subtracted this percentage (2.5%) from the available chicks. Typically hatching success is high in most seabirds and thus any loss from other causes (thereby reducing hatching success) is accounted for in the overall productivity value. The remaining chicks were multiplied by 0.7 (productivity) to obtain the number of young fledging from the colony. The total population was estimated to be the sum of the breeding individuals and the number of young produced. Even with this very simplified model the graph at the bottom of Table 3 demonstrates that a constant predation rate will have a serious negative affect upon the population. In the first few years our theoretical (enclosed) population will experience a population decline and will only start to increase after the young produced during the first year have recruited to the breeding population. After recruitment takes place (year 7) the population starts to rise but after twenty years is less than at the end of the first year. Continued predation at the modeled rate is likely to result in substantial population declines. The total population (adults and young) at year 20 would be 242 individuals.

MODEL OUTCOME: WITHOUT PREDATION

The same approach was used to model the potential outcome with predation removed (Table 4). The graph associated with Table 4 demonstrates how the removal of predation will positively effect the seabird population. At year 14 the total population would be higher than at year 1 and would then increase steadily over time. After twenty years, and keeping everything constant, the total estimated population would be 329 individuals.

ANTICIPATED BENEFIT OF PREDATION REMOVAL

The estimated difference between 100 pairs of predated and non-predated 'hybrid seabirds' would be 44 and 87 individuals for 10 and 20 years of restoration respectively (Table 5).

APPLICATION OF THE MODEL RESULTS

Applying the differential between the current (predation) scenario (Table 3) and the potential (post-predation) scenario (Table 4) we are able to estimate the benefit to seabird populations from anti-predation restoration work (Table 5). In Table 6 we present the current population estimates provided by Agency personnel for each Project Area. Note that the Moku Manu Project only includes one island as data were not available to incorporate into this assessment. Consequently the estimated benefit for this Project is an underestimate.

Kilcuca Point: For the Kileuea Point Project we have assumed that only 60% of the seabird community would benefit from the fencing. The remaining 40% of the population are situated along steep cliffs and in areas where it is unlikely that dogs or cats can gain access. Consequently we have only applied the benefit to 60% of the population. To estimate the potential population gain we d[illegible]ed each population estimate by 100 and multiplied the resulting number by 87. We have assumed that the fence will last for twenty years and calculate a total population benefit of 12,705 individuals over this time period (Table 6a).

Moku Manu: For the Moku Manu Project we have assumed that the proposed three years of anti-predator activities will have a negative effect upon predators for ten years. Consequently we have used the population gain over ten years (44 individuals from 100 pairs, Tables 4 and 5) to estimate the potential benefit. We divided each of the existing population pairs by 100 and multiplied the result by 44. The anticipated benefit would involve an increase of 644 individuals over ten years (Table 6b).

Kauai Interior Project: The Interior Project is only focussed on Newell's shearwater. However, we did not know what proportion of the estimated total population (14,000 pairs) were included in the Project. We have assumed that the Interior Project will involve 50% (7,000 pairs) of the population. We have also assumed that the benefits associated with the anti-predator activities will last for ten years. Dividing the existing population by 100 we then multiplied the result by 44 to obtain an increase of 3,080 individuals over ten years (Table 6c).

Combining the anticipated benefit for each of the three Projects (Tables 6a,b,c) we estimate a total gain of 16,429 individuals to the seabird community.

Table 1: Population variables for Hawaiian seabirds.

Species	Clutch Size	Productivity (%)	Breeds Annually	Estimated # Years Breeding within 10 year period	Age (years) at First Breeding	Adult (>4 years) Survivorship (%)	Juvenile (1-4 years) Survivorship (%)	Source
Laysan Albatross	1	90	Mostly	9	8	92	81	Harrison 1990, Warham 1990
Black-footed Albatross	1	90	Mostly	9	5	92	81	Berger 1972, Harrison 1990, Warham 1991
Hawaiian Petrel	1	85	Mostly	8	5	90	33	Berger 1972, Harrison 1990, Warham 1992
Bonin Petrel	1	85	Mostly	8	5	90	33	Berger 1972, Harrison 1990, Warham 1993
Bulwer's Petrel	1	85	Mostly	8	6	90	33	Croxall & Rothery 1991, Warham 1993
Newell's Shearwater	1	85	No	8	6	90	33	Berger 1972, Harrison 1990, Warham 1992, PRBO 1995
Christmas Shearwater	1	85	No	8	6	90	33	Berger 1972, Harrison 1990, Warham 1992, PRBO 1995
Wedge-tailed Shearwater	1	85	No	8	6	90	33	Berger 1972, Harrison 1990, Warham 1992, PRBO 1995
Red-tailed Tropicbird	1	60	?	10 (?)	4	90 (?)	33 (?)	Berger 1972, Harrison 1990,
White-tailed Tropicbird	1	60	?	10 (?)	4	90 (?)	33 (?)	Berger 1972, Harrison 1990,
Masked Booby	1 - 2	63	No	7	4	91	40	Nelson 1978,
Brown Booby	1 - 2	75	Mostly	8	4	93	33	Nelson 1978,
Red-footed Booby	1	70-80	Mostly	8	4	90	50	Nelson 1978,
Greater Frigatebird	1	30	Yes	10	5	90 (?)	33 (?)	Croxall & Rothery 1991,
Sooty Tern	1	60	Yes	10	6	90	30	Cramp 1985, A.J. del Nevo (unpbl. data)
White Tern	1	60	Yes	10	4	90	30	Cramp 1985
Black Noddy	1	60	Yes	10	4	90	30	A.J. del Nevo (unpbl. data)
Brown Noddy	1	60	Yes	10	4	90	30	Cramp 1985, A.J. del Nevo (unpbl. data)
Blue-grey Noddy	1	60	Yes	10	4	90	30	Estimated
Gray-backed Tern	1	60	Yes	10	4	90	30	Estimated

Table 2: Simplified Population Values for a Hybrid Seabird (Based on Table 1.)

Population Variable	Value
Adult survivorship (>4 years)	90%
Adult survivorship constant within and between years	Yes
Juvenile post-fledging survivorship (1-4 years)	50%
Juvenile post-fledging survivorship constant	Yes
Age of first breeding	6
No immigration or emmigration	Yes
Adults breed in all years	Yes
Clutch size	1
Productivity	70%
Predation rate	2.50%
Predation rate is constant within and between age classes and years	Yes
Annual variation in occupancy rate not considered	Yes

Table 3: Simplified Population Productivity Model with Predation

Year	Pairs 1	Predation	Pairs 2	Chicks	Predation	Chicks after Predation	Productivity	Adults and Young	Year
1	100	2.5	97.5	97.5	2.4	95.1	66.5	261.5	1
2	87.8	2.2	85.6	85.6	2.1	83.4	58.4	229.5	2
3	77.0	1.9	75.1	75.1	1.9	73.2	51.2	201.4	3
4	67.6	1.7	65.9	65.9	1.6	64.2	45.0	176.7	4
5	59.3	1.5	57.8	57.8	1.4	56.4	39.5	155.1	5
6	52.0	1.3	50.7	50.7	1.3	49.5	34.6	136.1	6
7	62.3	1.6	60.7	60.7	1.5	59.2	41.5	162.9	7
8	69.3	1.7	67.5	67.5	1.7	65.8	46.1	181.1	8
9	73.6	1.8	71.7	71.7	1.8	70.0	49.0	192.5	9
10	75.8	1.9	73.9	73.9	1.8	72.1	50.4	198.3	10
11	76.4	1.9	74.5	74.5	1.9	72.6	50.8	199.8	11
12	75.7	1.9	73.8	73.8	1.8	71.9	50.4	197.9	12
13	76.8	1.9	74.9	74.9	1.9	73.0	51.1	200.8	13
14	78.9	2.0	76.9	76.9	1.9	75.0	52.5	206.3	14
15	81.5	2.0	79.4	79.4	2.0	77.4	54.2	213.1	15
16	84.1	2.1	82.0	82.0	2.0	79.9	56.0	220.0	16
17	86.5	2.2	84.3	84.3	2.1	82.2	57.6	226.3	17
18	88.5	2.2	86.3	86.3	2.2	84.1	58.9	231.5	18
19	90.4	2.3	88.2	88.2	2.2	86.0	60.2	236.5	19
20	92.5	2.3	90.2	90.2	2.3	87.9	61.5	241.9	20

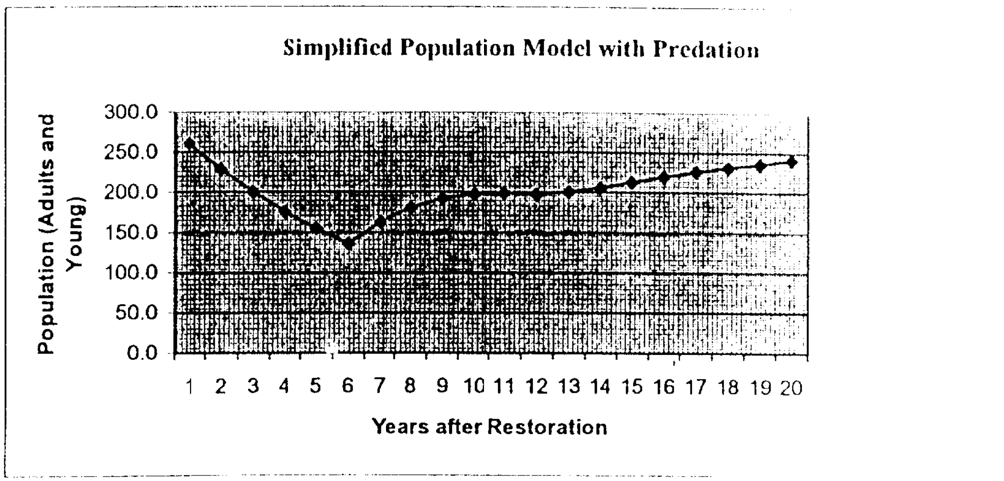

Table 4: Simplified Population Productivity Model without Predation

Year	Pairs	Predation	Pairs	Chicks	Predation	Young	Productivity	Adults and Young	Year
1	100	0	100	100	0	100.0	70.0	270.0	1
2	90	0	90	90	0	90.0	63.0	243.0	2
3	81	0	81	81	0	81.0	56.7	218.7	3
4	72.9	0.0	72.9	72.9	0.0	72.9	51.0	196.8	4
5	65.6	0.0	65.6	65.6	0.0	65.6	45.9	177.1	5
6	59.0	0.0	59.0	59.0	0.0	59.0	41.3	159.4	6
7	70.6	0.0	70.6	70.6	0.0	70.6	49.5	190.7	7
8	79.3	0.0	79.3	79.3	0.0	79.3	55.5	214.2	8
9	85.6	0.0	85.6	85.6	0.0	85.6	59.9	231.0	9
10	89.8	0.0	89.8	89.8	0.0	89.8	62.8	242.4	10
11	92.3	0.0	92.3	92.3	0.0	92.3	64.6	249.1	11
12	93.4	0.0	93.4	93.4	0.0	93.4	65.4	252.1	12
13	96.4	0.0	96.4	96.4	0.0	96.4	67.5	260.3	13
14	100.6	0.0	100.6	100.6	0.0	100.6	70.5	271.8	14
15	105.6	0.0	105.6	105.6	0.0	105.6	73.9	285.0	15
16	110.7	0.0	110.7	110.7	0.0	110.7	77.5	298.9	16
17	115.8	0.0	115.8	115.8	0.0	115.8	81.1	312.6	17
18	116.0	0.0	116.0	116.0	0.0	116.0	81.2	313.2	18
19	121.1	0.0	121.1	121.1	0.0	121.1	84.8	326.9	19
20	122.0	0.0	122.0	122.0	0.0	122.0	85.4	329.4	20

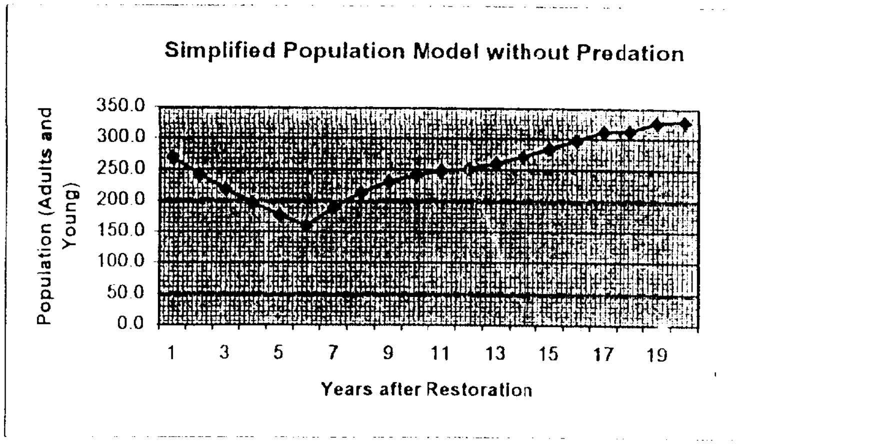

Table 5: Estimated Total Population of 'Hybrid Seabirds' 10 and 20 years after restoration with and without Predation.

Years After Restoration	Estimated Total Population (Adults+Young)		Difference
	With Predation	Predation Removed	
10	198	242	44
20	242	329	87

Note: 1. Information taken from Tables 3 and 4.
2. Total population at 10 years with Predation removed is the same as the total population after 20 years with predation.

Table 6: Estimated Benefit to Seabirds from Anti-Predator Activities at Three Locations (Moku Manu Project only includes data from one island).

6a

Kileuea Point	Species	Estimated Population	Assumed Target Population (60% of Total)	Estimated Benefit After 20 Years (Individuals)
	Wedge-tailed shearwater	16,000	9600	8352
	Red-tailed tropicbird	200	120	104
	White-tailed tropicbird	60	36	31
	Bulwer's petrel	80	48	42
	Red-footed booby	8,000	4800	4176
			Total	12,705

6b

Moku Manu	Species	Estimated Population	Assumed Target Population	Estimated Benefit After Ten Years (Individuals)
	Wedge-tailed shearwater	312	312	137
	Brown booby	92	92	40
	Red-footed booby	317	317	139
	Masked booby	13	13	6
	Great Frigatebird	729	729	321
			Total	644

6c

Interior Project	Species	Estimated Population	Assumed Target Population (50% of Total)	Estimated Benefit After Ten Years (Individuals)
	Newell's shearwater	14,000	7,000	3080
			Total	3,080

Note: Population Estimates provided by USFWS