are about equally represented in the panel. We will ask for specific information on how the harvests are organised on the different islands, the methods now used, and how these have changed over the years, trends in the number of participants, perceived issues for the future of the harvests etc. Some of the questions asked have been identified for their potential importance for management and ecological understanding. For instance, we will pay particular attention to which clues are used by the muttonbirders to form an opinion about whether the population is declining or increasing. This will then lay the foundation for the eventual evaluation of differences and congruencies between a traditional Māori-styled conservation approach to natural resource use and the Euro-centric approach.

The importance of history and historical records

TEK and kaitiakitanga rely heavily on historical customary use experience. The TEK approach is most often diachronic (long runs of data from a small "local" place), whereas science is often synchronic (short runs of data from a variety of widely spaced places; Johnson 1992, Moller 1996). TEK is ideally suited to study of seabirds, because their long generation time makes population dynamics slow. Even study for 30 or 40 years is insufficient to understand population trends (Serventy & Curry 1984, Wooller *et al.* 1992). Accordingly our study has placed considerable emphasis on understanding past population patterns as noticed by the muttonbirders and recorded in informal sources like newspapers and natural history books. We have been given records by one birder on the condition and relative number of chicks in each year stretching back to 1958, and will try to negotiate access to similar records we know to have been gathered on other manu. Searches of an old Riverton newspaper, the *Western Star* have revealed detailed reports of the number and condition of tītī harvested between 1880 - 1940 (Russell & Gaw 1998), and there are fragmentary records of kiaka and good chick years in various books (Beattie 1994, Sansom 1982), unpublished manuscripts (Willa 1993), and scientific papers (Richdale 1945). The last 25 years of OSNZ Beach Patrol records of dead birds washed-up also identify clear catastrophic events (Hamilton & Moller 1993, 1995). A detailed 20 year diary of a birder from Poutama Island has been gifted to the research team and already provided a wealth of information on inter-annual variation in harvest success (Lyver & Moller 1999; Lyver *et al.* in press, Lyver subm. b).

We seek historical records in part to estimate past population abundance, but also to discover how harvest intensity has changed over the past century. This may allow us to compare the predictions of a "backward computer simulation" of past tītī abundance and the oral testimony of the long-standing muttonbirders. This represents a useful evaluation of the comparative reliability of TEK and science to monitor the fundamentally important variable, the trend in resource abundance (Objective 4). A comparison of past with present harvest practices and consequent harvest rates also allows us to evaluate what sets the limit on current catch rates (Objective 3).

Scientific examination of TEK

Major contrasts between Mātauranga Māori and science understandings of tītī ecology and behaviour will be distilled from the two sets of interviews and the hui to help focus the remaining 5 years of the *Kia Mau te Tītī Mo Ake Tōnu Atu* research program. In particular, a short list of important Mātauranga Māori and ecological hypotheses will be nominated for detailed further study. In some cases the Mātauranga Māori constructs will be treated as hypotheses to be tested by science methods. In other cases predictions of the science will be evaluated by Māori assisting the research to see if they are viewed as complementary or contradictory to Mātauranga Māori.

The first study to compare TEK with scientific research of muttonbird harvesting has just been completed (Lyver 1999). This involved two years study of harvesting by 5 whānau (7 working groups) on common ground on Poutama Island. Jane Kitson's research augments those descriptions by

repeating similar investigations on Putauhinu Island. It is important to replicate and extend the findings from Poutama because each island differs in several respects, and each whānau tends to perpetuate traditions learned from each other on the same island. On Putauhinu Island the ground is divided into 5 distinct manu, each worked and managed differently by each whānau. This provides an ideal basis for Jane Kitson's testing of the generality of the observations begun by Phil Lyver.

STUDY DURATION & STAGING OF RESEARCH EMPHASES

Study Duration

A study of tītī population changes and harvesting will take many years to complete fully. We envisage that the preliminary full-scale research will take 10 years and involve several successive students. Our main population ecology work re-started in earnest on Putauhinu Island during the 1997 season after a false start on Poutama Island in 1994. Major scientific contributions on tītī population ecology from Putauhinu will not be available until 2000. The research team will ask for a 3 year extension to the initial 10 year study timetable (from 1994) only if it is needed to catch up the time lost on Poutama Island. The University research team is committed to withdraw from the study as soon as Rakiura Māori take on the main scientific study and monitoring (Taiepa *et al.* 1997).

It is unlikely that we could recognise a fixed end point where absolute certainty about harvest impacts is achieved. Rather it is more realistic to expect a steady but gradual improvement in our ecological knowledge. Confidence in our predictions about harvest impacts will emerge as error limits on parameter estimates are narrowed. Calculation of the error limits on preliminary predictions will be essential to guard against premature conclusions. In the meantime we will stage research emphases in a logical priority order to speed the attainment of our research goal.

Changing research emphases

Our research strategy has been and is to:

- test previous methods of surveying tītī and other Procellariids (Hamilton 1993, 1998, in press; Hamilton *et al.* 1997a,b)
- test and develop new methods as far as practicable on the mainland before transferring them to the island colonies (Lyver *et al.* 1998, Uren 1999).
- shift emphasis from mainland to island research as trust between muttonbirders and the research team has grown
- develop and test methods of estimating harvests on Poutama and Putauhinu before extending research to shorter-term study on several other islands
- choose final survey methodologies and sample designs by the end of 3 years, and then stick to them (so that changes in methodology do not confound trend analyses)
- band a large number of chicks in the first years so that large samples of known-age breeders can be monitored in the last half of the study; emphasis will thus shift from banding chicks to detecting, banding and measuring breeding adults as the study progresses
- establish base-lines for the monitoring part of the study in the first 3 years at intensive study sites before branching out to the extensive phase of the study in the middle years; a return to the monitoring at the intensive sites will happen in the last 3 of the 10 years of the foundation study
- shift emphasis to monitoring frequency of breeding, age at first breeding, probability of staying at the breeding colony and adult survival in years 4 - 10 of the study (by when several known-aged recruits should be establishing pair bonds and attempting to breed).

- prioritise research themes from highest (first) to lowest as: (1) develop methods and obtain baseline measures of abundance, breeding success, survival (2) investigate chick quality and their differential susceptibility to harvest, (3) measure the strength and mechanisms of density dependence, (4) measure rate of migration between islands, (5) estimate the effects of tītī on other ecological processes on the bird islands.
- assess the potential impacts of climate fluctuations, climate change, and fishery bycatch before either intensifying or de-intensifying research of each of these areas according to their perceived importance
- move from a research to an adaptive management framework after the 10 year study is complete.

These changes of emphasis and critical milestones for main project themes are depicted in Fig. 9.

Publishing

The team's written outputs have aimed to obtain peer review of our research methodology in these first years of the study (see Appendix 5 for a list of all outputs so far). The first papers on Sooty Shearwater ecology are mainly from the mainland studies where predation threats are a predominant theme. This reflects the early emphasis on these study areas for testing methods while negotiations with Rakiura Māori were developing to commence work on the harvest on islands. With the completion of the first detailed studies of harvesting on Poutama Island in February 1999 by Phil Lyver, the first quantitative studies of harvesting itself are about to be published. Reports of seasonal progress and significant events (such as the potential detection of a stoat on Solomon Island) are lodged within the University of Otāgo's Wildlife Management Report series. These function rapidly to inform the kaitiaki and DoC of the research progress and to help their assessment of permitting requirements. We expect more rapid production of formal publications in peer reviewed scientific journals from now on as the initial stages of establishing the research program are behind us.

SYNTHESIS OF FINDINGS

Mathematical modelling in year 2005 will synthesise all our findings (demographic parameters, potential chick quality effects, climate, bycatch, proportions harvested, etc.) to predict population trajectories and the efficacy of potential mitigation responses. Sensitivity analyses will test the uncertainties in the models, and we will validate the models by testing whether predicted trends actually occurred at our monitored sites, and by whether burrow density and occupancy are predicted and observed to be lower on harvested than on unharvested islands.

If validated, the models and estimates of harvest intensities and understanding of what determines harvest levels will be used to:

(a) predict population trajectories from all threats,

(b) simulate influence of current harvest levels on those trajectories,

(c) predict effects of changing population abundance on harvest success rates and likely response in harvesters behaviour, and

(d) predict the degree and time for population responses to various management options.

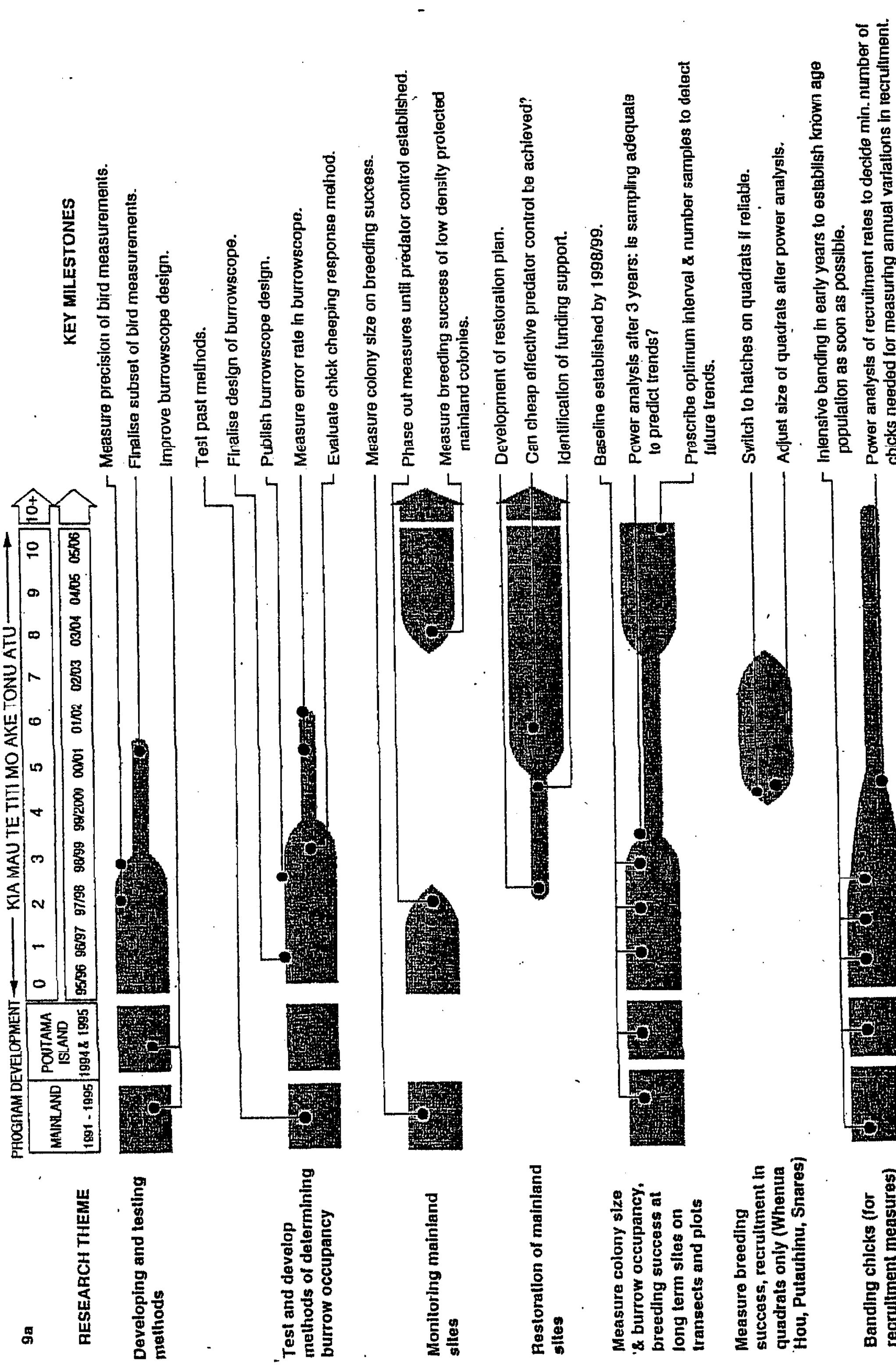


Fig. 9. Staging of the main research themes of the *Kia Mau Te Tītī Mo Ake Tōnu Atu* project and critical milestones in the first 10 years of research.

Fig. 9 continued

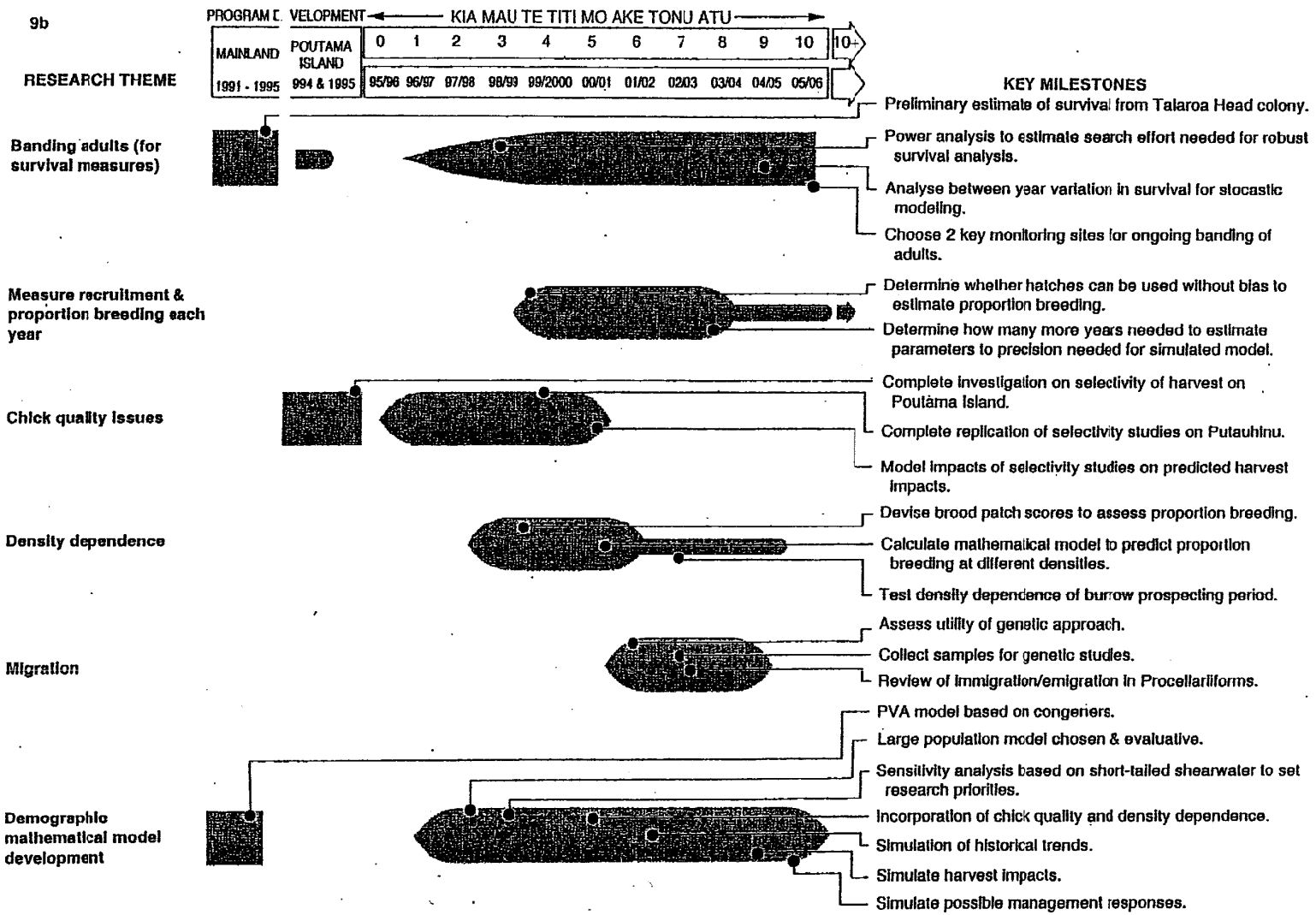
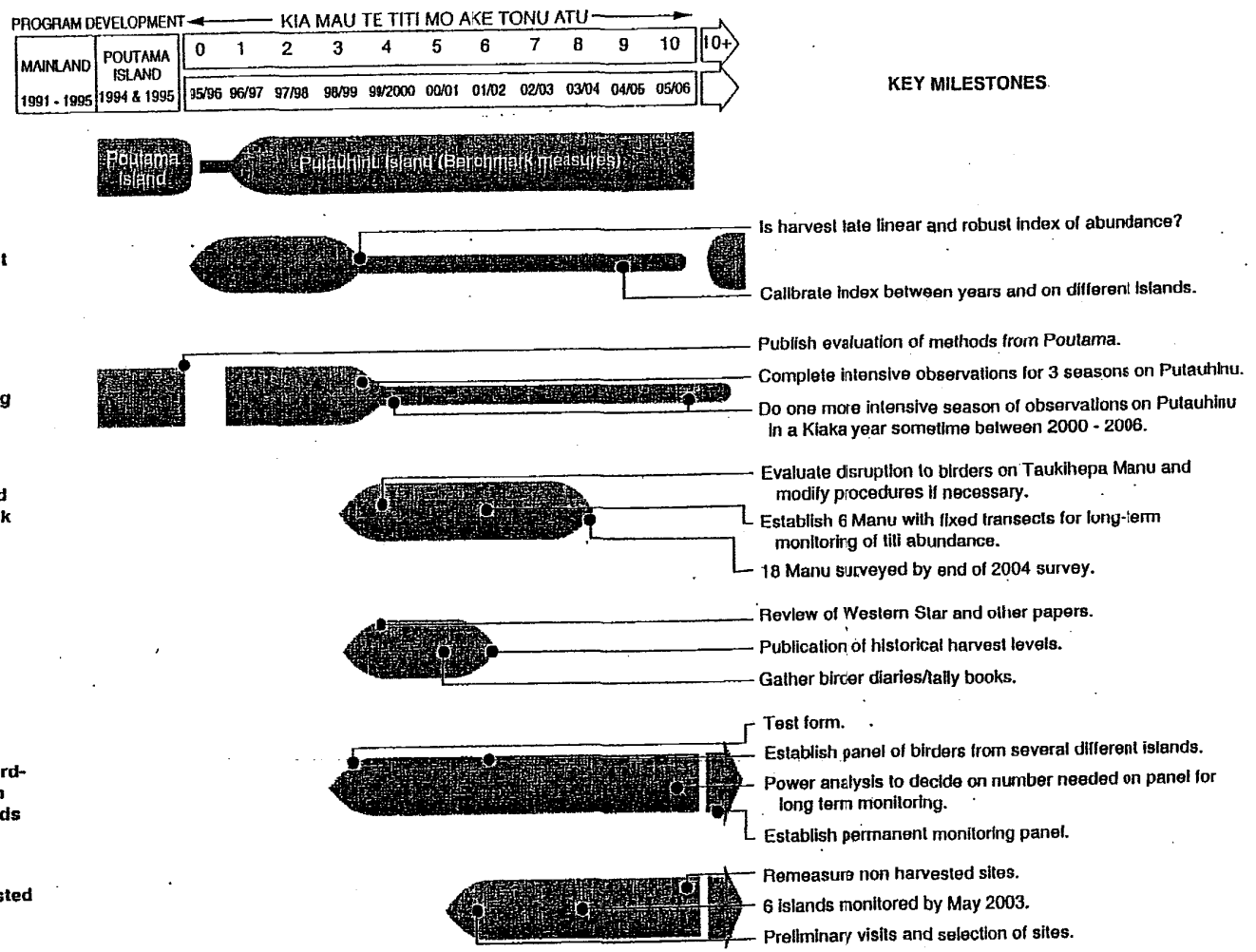


Fig. 9. continued.

9c



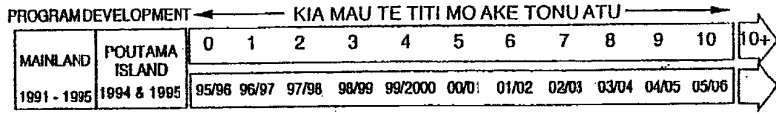
We plan to complete this synthesis by December 2005 to allow Rakiura Māori to seek an independent scientific peer review of our findings and to consider any management responses in 2006. A series of hui may well be needed to discuss options and to transfer the knowledge from the research team to the Rakiura Māori community. Prof. Lynn Maguire (Duke University, North Carolina, USA) has agreed to participate in any workshops and hui near the end of our research project to assist in evaluating management options and suggesting ways of brokering differences between their wishes and wider community conservation interests. Prof. Maguire has pioneered the use of value-focused thinking and interest-based negotiation to help resolve environmental decisions characterised by multiple parties with differing goals and by disagreement about the underlying science (e.g. Maguire & Sondak 1998).

If the kaitiaki decide that changes in harvesting practices are needed to safeguard the resource and harvesting, there will be a need to consider the economics of various potential management scenarios.

An adaptive management strategy and monitoring protocol will be designed to guide the ongoing harvest of the tītī if requested, but its adoption would be solely at the discretion of the kaitiaki for the tītī and their islands.

Fig. 9. concluded

9e



RESEARCH THEME

KEY MILESTONES

Remeasure fixed quadrats on islands other than Putauhinu

- Simulation to predict optimal interval between surveys to detect population trends.
- Compare population trends on harvested and unharvested islands; check whether model accurately predicted trends.

Impacts of changing density on island ecology

- Commence soil sample.
- Analyse difference in vegetation / regeneration in relation to colony density.
- Commence exclosure experiment.

Record TEK, Matauranga and Kaitiakitanga.

- Hui at Murihiku.
- Complete 20 oral histories.
- Complete 20 interviews with questionnaires.
- Publish proceedings of Murihiku hui.

TEK c.f. science field studies

- Develop TEK/Science merger/model to guide ongoing management.

Synthesis

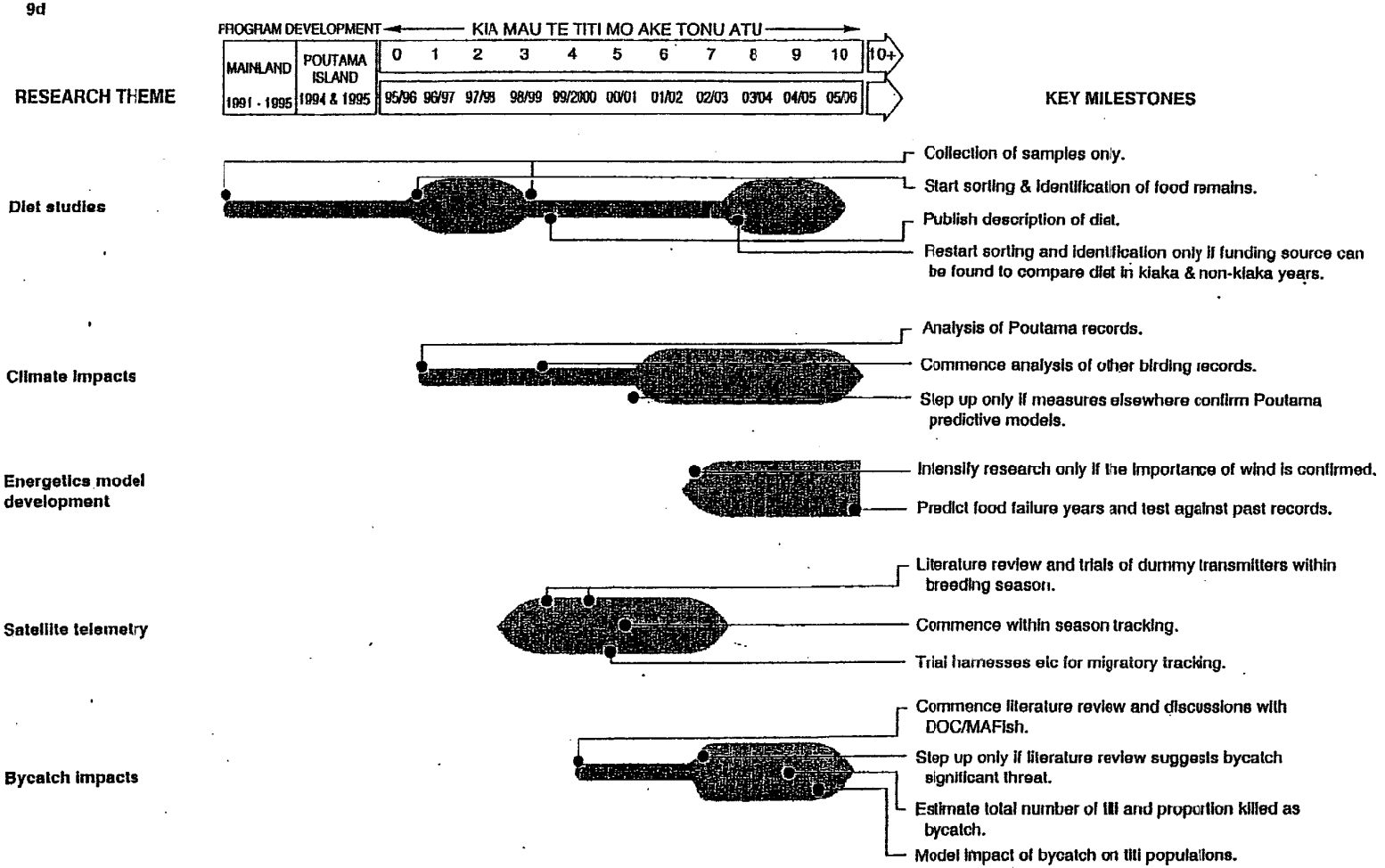
- Hui for reporting to community.
- Reworking according to community guidance.
- Formulation of management options & plan if needed.

Adaptive management

- Design Adaptive Management Strategy.
- Commence adaptive management.

Fig. 9. continued.

9d



APPENDIX 2:
POTENTIAL FUTURE RESEARCH DIRECTIONS

Inter-island recruitment

Populations on harvested islands and the South Island mainland may be buoyed by high rates of immigration by adolescent birds. Spatial refuges from harvest within manu or islands may act as nursery areas to counteract the impacts of intensely harvested ground, especially if recruitment to the breeding population is in some way density dependent.

Obtaining reliable estimates of immigration rates is notoriously difficult for Procellariids. Mass banding of chicks should allow us to draw a coarse picture of flow between breeding colonies, but a more detailed measure of immigration rate is needed for modelling. The number of non-natal chicks entering the breeding population on intensively studied plots on the Snares, Whenua Hou and Putauhinu should allow a crude estimate of migration rates. However, "micro-satellite" DNA techniques have better potential to indirectly measure migration rates. It will be comparatively easy to obtain flesh samples from a large sample of harvested chicks to build up a baseline of genetic variation at different parts of the species range from which migration rates can be estimated. We will shift emphasis to measuring migration rates indirectly from these detailed genetic studies once the priority of discerning density dependence has nearly been completed. This is likely to involve a PhD study from 2001 onwards.

Step-down to banding all the chicks on small sub-plots within the main monitoring quadrats on Whenua Hou, Snares and Putauhinu are envisioned for the 2000/01 seasons, primarily to measure skipping rates of breeding adults. It is conceivable that monitoring on the subplots can be run on to measure long-term recruitment rates more accurately, but we would need to carry this study on for another 10 years to measure return rates of the natal chicks and learn how many non-natal chicks settle on the subplots. If this latter approach proves impracticable and genetics studies were unable to estimate immigration rates sufficiently accurately, we will have to estimate immigration/emigration rates indirectly by comparing the outcomes from the 3 major approaches of the overall study (monitoring, modelling, spatial comparisons). We can consider them as complementary rather than replicated tests of one another i.e. they can be solved as simultaneous equations to independently estimate migration rates. For instance, if harvested and unharvested islands have similar density, yet the model predicts from the observed harvest intensity and demographic measures that harvested populations should have lowered density, the difference can be inferred to result from immigration between the two groups. We can simulate to infer the immigration rate that would explain the lack of difference. Similarly, if the model without immigration predicts 50% lowered density on harvested sites and this is observed, we can infer that migration is zero.

Obviously it would be much better to gain independent measures of emigration and immigration so the 3 approaches of the overall study genuinely test each other, rather than being forced to infer migration rates to explain away differences between the three approaches. The latter outcome would only leave the adaptive management approach to check the validity of the model, and that would take 10 years after our initial brief and depends on the tītī harvesters being willing to experimentally restrict take on some areas but not others.

We will also have a series of population monitoring comparisons on small c.f. large islands. Modelling variation amongst these could also potentially be used to estimate absolute migration rates if we can first get a handle on how it varies relatively between: (i) small large islands, (ii) shallow/deeps soils (nearly all small islands will have shallow soils) and (iii) with density itself. Relative variation in immigration/emigration should be measurable at least even if absolute migration rates will be difficult.

Satellite telemetry to learn where tītī feed

Much can be learned about the movements of Procellariids by collating information on sightings, fishery bycatch and band returns (e.g. Stahl *et al.* 1998). We are currently drawing together such data for sooty shearwaters as a prelude to designing a more focused study of movements using satellite telemetry.

Satellite telemetry of Short-tailed Shearwaters in Australia has shown that they travel as far as the Antarctic icesheet (ca. 2,000 km) to feed (Nicholls *et al.* 1998; Dr. Eric Woehler, Australian Antarctic Division, *pers. comm.*). Our diet study confirms that some sooty shearwaters at northern colonies do the same, at least occasionally. Weimerskirch (1998) inferred the same from foraging trip lengths. However, digestive breakdown may have obliterated most sign of foods gathered in Antarctica by the time they return to the northern breeding colonies, so we are unsure how much reliance can be placed on the comparative rarity of Antarctic foods in the samples to infer frequency of visits to Antarctica. Counts show that sooty shearwaters predominate amongst seabirds in the Ross Sea Antarctic waters (Ryan & Cooper 1989) but the identification used may not have been reliable (many may have been short-tailed shearwaters). A large colony of sooty shearwaters occurs on the Auckland Islands (C.J. Robertson, pers. comm.) so sooty shearwaters seen in Antarctica may have come from there rather than from the harvested colonies around Rakiura.

The main breeding concentrations are at the Snares and Foveaux Strait region (Hamilton *et al.* 1997b). If tītī are indeed regularly feeding near this sea-ice, they are probably eating Antarctic krill and may then be affected by the Antarctic Circumpolar Wave. This anomaly is thought to have a 4-5 year periodicity, probably associated with ENSO activity in the equatorial Pacific (White & Peterson 1996). Like a "wave-train", southern ocean climate patterns are linked to periodic fluctuations emanating from other parts of the global climate system (Fouhy *et al.* 1992).

Oceanic seabirds often assemble in areas of particular water temperature, boundaries between water masses and around currents (Ainley & Jacobs 1981, Ribic & Ainley 1988/89, Wahl *et al.* 1989, Ainley *et al.* 1995). We will use satellite tracking to search for association of adult feeding with ocean currents (e.g. the Southland Current that passes near Rakiura) and water masses associated with El Niño weather patterns so that we can better focus our inquiry about long-term climate change impacts on tītī populations. Although El Niño weather patterns are associated with warm water in the equatorial Pacific, this is not necessarily true in New Zealand waters.

In order to model the effects of food availability on the tītī population better, we need to determine such crucial factors as the position of ocean currents and depth of thermoclines that influence the abundance, location, and depth of some of the tītī's primary prey species (e.g. arrow squid, Somerville 1994). These conditions are influenced in turn by physical mechanisms such as sea surface temperatures and surface pressure fluctuations that drive linked ocean-atmospheric processes (Fouhy *et al.* 1992).

If we can radio-track breeding tītī during their breeding season for 4 - 5 years we will be able to relate foraging ranges to (i) annual variations in sea surface temperatures (measured by very high resolution radiometry available through NIWA), (ii) proximity of feeding to currents and circumpolar waves, (iii) ENSO effects, (iv) kiaka events (assuming one is recorded between 1999 and 2004), (v) an index of provisioning rates (obtained from transect counts of number of adults ashore), (vi) prevailing wind and oceanic conditions (available from meteorological data), (vii) diet, and (viii) our own measures of chick growth and survival.

Satellite telemetry to learn where El Niño weather fluctuations develop

Tītī are in some way affected by the precursor conditions for El Niño and La Niña weather systems (Lyver *et al.* in press), and these are not well understood (Minobe 1997; Zang *et al.* 1997, 1998). Therefore satellite tracking of tītī during their northern migration may prove invaluable to climatologists to pin-point where and when incipient weather fluctuations develop. Several studies have identified impacts of climate fluctuations on the abundance and distribution of seabirds and/or their foods (eg. Cruz & Cruz 1985, 1990b; Ainley *et al.* 1986; Valle *et al.* 1987; Ribic *et al.* 1992; Ingraham *et al.* 1996; Renwick *et al.* 1998). The El Niño/La Niña fluctuation also has enormous impacts on people and their livelihoods. It would be of considerable practical and basic research interest if tītī can lead climatologists to where and when the El Niño fluctuation first develops.

Computer simulations to predict the arrival of El Niño or La Niña for New Zealand are not reliable until late April or May of any year (B. Mullan and J. Kidson, pers. comms.). If the main effect observed by Lyver *et al.* in press is confirmed to result from poor survival of adult tītī during incipient El Niño conditions, we may be able to forecast the event by December of the preceding year from the number of breeders that return to New Zealand colonies.

Proposed radio-tracking protocols

We will probably use the tracking protocols employed with albatrosses (Prince *et al.* 1992, Weimerskirch *et al.* 1993, 1997; Weimerskirch & Robertson 1994, Sagar 1995) and perfected by Australian research teams for use on Short-tailed Shearwaters (Nicholls *et al.* 1998). There Pico platform terminal transmitters (weighing 24 g or about 3% of adult tītī body mass) are pressure-proofed to 70 m below sea surface and have a very fine antennae that should not disrupt the burrowing activities of breeding adults (Nicholls *et al.* 1998).

Trials using 24 dummy transmitters (either taped to feathers or glued to a piece of cloth which in turn is glued to an adult's back) are currently being conducted at Taiaroa Head in the 1998/99 season by Ilka Sōhle, a Postgraduate Diploma in Wildlife Management student. Weight change, body condition, frequency of visits to the colony, breeding success and the fledging weight of the chicks reared by telemetered birds will be compared with those of non-telemetered birds. Re-appearance of telemetered cf. non-telemetered birds will be compared in spring 1999 to see whether the packages affected their ability to migrate and survive overwinter. We expect that the dummy transmitter will fall off during the annual moult, which occurs mainly in the northern hemisphere.

If transmitters do not imperil tītī and we can demonstrate an ability to keep the dummy transmitters on the birds, we will attach at least four real satellite transmitters to breeding adults in the 1999/2000 season. Because satellite transmitters are expensive, we propose to use only a few during any one season, but we will be obtaining as many as 8 locations on each bird per day throughout the breeding season using the ARGOS tracking facilities (more if they venture into Antarctic waters where satellite coverage is better). We will shift the transmitter to a new breeding bird intermittently from November until mid-March so that several different birds are monitored per unit per season (12 - 16 different birds in the first year assuming that we can buy 4 units and that we do not lose any transmitters at sea).

If we succeed in radio-tracking tītī during their breeding season, we will next consider attaching some transmitters to cover trans-equatorial migration and moult. Development of a harness, suturing to the outside of the bird, or surgery to implant transmitters will all be investigated as potential ways around this problem. Weight of the battery may impose severe limits on the length of life of the transmitter during this trans-equatorial migration, so further development and field trials are needed before the optimum design can be determined.

A data-logger recording approximate position (from light intervals), times of immersion in sea-water and sea surface water temperature is under development by Chris Robertson *et al.* for use on Northern Royal albatrosses (*Diomedea epomophora sanfordi*). These units are much cheaper than satellite transmitters and potentially offer better sample sizes for our proposed study, but it may be several more seasons before a perfected unit is available for our use.

Colony attendance by adults

Adult tītī exhibit a pattern of cyclical colony attendance that has been observed by many people. Richdale (1963) thought that the pattern might be linked with lunar rhythm but found no correlation with wind or weather conditions. Oka *et al.* (1987) suggested that it is a semi-lunar rhythm linked to swarming of a main prey, *Nyctiphanes* krill. Weimerskirch (1998) suggested that the pattern is an accidental result of a bimodal feeding strategy whereby the adults take a few short trips to provision the chick and then a long one to the Antarctic Polar Front to replenish their own diminished body reserves. The cyclical pattern is a result of the regular periodicity of the foraging trips initialised by a fairly synchronised hatching period.

Because the team wants to incorporate flight energetics into the modelling efforts, we are interested to see how weather fronts might affect the attendance pattern. To this end we devised a simple index to reflect the number of tītī attending the colony and took weather data on wind speed and cloud conditions every night at the same time. We assumed that all tītī we saw were going to land. The index consists of the number of tītī we counted in a well defined patch of sky, every night at the same time and same place for a 10 minute period. This gives us a rough estimate of change from evening to evening of the numbers flying over the colony just before the time when adults begin to land.

We have also modified an electronic surveillance system that normally records the time and direction of swing doors opening within buildings. A data logger can simultaneously monitor times of entries and exits from 16 tītī burrows with chicks (Uren 1999). The method was trialed in the 1997/98 seasons on Tuhawaiki Island (throughout chick rearing) and used to monitor chick emergence on Putauhinu Island (1997/98 and 1998/99 seasons). It is now working well and will monitor provisioning rates on the Snares in the 1998/99 and 1999/2000 seasons and assess the relative frequency of social interactions amongst breeding pairs in high and low density colonies (a potential density dependent influence on breeding success).

The potential importance of wind

The rate of provisioning chicks by adults will be a key determinant of chick growth rate, fledging dates and sizes, and probably their chance of subsequent recruitment to the population (Sagar & Horning 1997). Therefore we hope to research factors affecting provisioning. It has been suggested that adults alternate short and long trips when provisioning their chicks, to replenish their own depleted body condition and to feed their growing young (Weimerskirch 1998). The location and distance of food together with wind direction and strength are also probably key determinants of whether the adult returns to the colony to feed the chick. Energetic costs of gliding flight are much less than for flapping flight and travel is much less energetically costly in windy conditions (Furness & Bryant 1996). Therefore, the energetic and time costs of returning to provision chicks will be much less in windy conditions, provided it is flowing in a suitable direction to assist passage back to the colony. Prevailing winds in El Niño and La Niña weather fluctuations may also be important determinants of adult survival of the trans-equatorial migration during the non-breeding season (Lyver *et al.* in press).

TEK of the muttonbirders emphasises the importance of wind in the harvest (Lyver & Moller 1999, Lyver, subm. b). More adults ("motherbirds") arrive back at the breeding colonies just before and during windy weather (P. Davis, pers. comm.). More chicks emerge on windy nights and harvesting is concentrated in windy parts of the island (Lyver, subm. b). Scientific study of the importance of wind is therefore proposed as one of the main themes to compare the common ground, methods and utility of TEK and ecology for understanding the bird and guiding the harvest.

Energetics modelling
We hope to build a model of flight energetics of tītī and use it to predict impacts of El Niños, provisioning behaviour, and the frequency and intensity of kiaka years. Such a model could be calibrated against historical records of annual adult survival and chick quality in relation to weather records for those years. This model helps understand the mechanisms behind some of the inter-annual variation in tītī population parameters. Issues of mechanism for the observed patterns are of secondary importance than establishing that the link exists, so building this energetics model will be scheduled for the end of the 10 year study period if the putative importance of wind is confirmed in the interim. The model will follow that developed by Dr John Ollason and co-workers from Aberdeen University to predict the distribution and movements of seabirds in the North Sea (Ollason *et al.* 1997).

Stoats: a new threat to tītī harvests?
There have been recent sightings of a mustelid species, probably stoats, on Rakiura (Moller & Lyver 1997). If present on the main Rakiura Island, stoats will soon reach many of the Tītī Islands (Appendix 1). If the presence of this new threat is confirmed, research and management of stoats will become a new priority.

Vegetation cycles and their inter-relationship with tītī abundance
Muttonbirders have shared much of their TEK on the way vegetation has changed dramatically within their life-time on particular parts of their manu (J. Kitson, pers. comm.). A vegetation cycle is recognised. Burrowing seabirds may alter vegetation cycles (Campbell 1967, Towns *et al.* 1990, Furness 1991), so the density of the birds may in the long-run have profound influences on the vegetative community and related aspects of island ecology.

Muttonbirders use of bottled gas, coal and generators has increased throughout this century, and probably especially since helicopters have been employed for transport and heavy lifting from boats to shore. This has led to a much reduced use of firewood on the islands, which in turn may have changed habitats and regeneration.

The inter-relationship between bird abundance, harvesting and vegetation is a fruitful area of research that is suggested as a final priority of the 10 year research program.

APPENDIX 3:
MEASURES OF BREEDING SUCCESS AT EACH STUDY AREA

Testing techniques for measuring burrow-occupancy, development of improved burrowscopes, burrowscope equipment failure, and expulsion from Poutama Island all contributed to incomplete early egg, early chick and late chick phase surveys in some years and places. Reduction in funding and heavy predation of mainland colonies forced abandonment of some of the colonies in recent years. The result is a sporadic coverage of breeding success measures in the earlier years followed by establishment of a regular set of breeding success and burrow occupancy measures on long-term study sites from the 1996/97 season onwards (Table 4).

Table 4: Measures of breeding success at different tītī colonies on South Island and offshore islands until 1997/98. Sampling planned for the remaining years of the 10 years of intensive study are given in brackets. Australian harriers *(Circus approximans)* may prey on Tītī on some mainland sites and Tuhawaiki Island.

Breeding Area	Treatment	Introduced Predators	Early egg survey	Early chick survey	Late chick survey
Snares - A	Unharvested	None	1996/97 - 1998/99 (2004/05- 2006/07)	1996/97 - 1998/99 (1999/00- 2006/07)	1996/97 - 1998/99 (1999/00- 2006/07)
Snares - B	Unharvested	None	1996/97 & 1998/99 (2004/05-2006/07)	1996/97 & 1998/99 (1999/00- 2006/07)	1996/97 & 1998/99 (1999/00- 2006/07)
Snares - C	Unharvested	None	1996/97 & 1998/99 (2004/05-2006/07)	1996/97 & 1998/99 (1999/00- 2006/07)	1996/97 & 1998/99 (1999/00- 2006/07)
Snares - D	Unharvested	None	1997/98 - 1998/99 (2004/05-2006/07)	1997/98 - 1998/99 (1999/00- 2006/07)	1997/98 - 1998/99 (1999/00- 2006/07)
Snares - transects	Unharvested	None	1996/97 - 1998/99 (2004/05 - 2006/07)†	1996/97 - 1998/99 (2004/05 - 2006/07)†	1996/97 - 1998/99 (2004/05 - 2006/07)†
Whenua Hou A	Unharvested	kiore	1996/97 - 1998/99 (1999/00- 2006/07)	1996/97 - 1998/99 (1999/00- 2006/07)	1996/97 - 1998/99 (1999/00- 2006/07)
Whenua Hou B	Unharvested	kiore	1996/97 - 1998/99 (1999/00- 2006/07)	1996/97 - 1998/99 (1999/00- 2006/07)	1996/97 - 1998/99 (1999/00- 2006/07)
Whenua Hou C	Unharvested	kiore	1996/97 - 1998/99 (1999/00- 2006/07)	1996/97 - 1998/99 (1999/00- 2006/07)	1996/97 - 1998/99 (1999/00- 2006/07)
Whenua Hou transects	Unharvested	kiore	1996/97 - 1998/99 (2004/05 - 2006/07)	1996/97 & 1997/98 (2004/05 - 2006/07)	1996/97 - 1998/99 (2004/05 - 2006/07)
Putauhinu - transects	Harvested	kiore	Access forbidden	Access forbidden	1996/97 - 1998/99 (1999/00- 2006/07)
Putauhinu - Kitson Rahui	Unharvested	kiore	Access forbidden	Access forbidden	1996/97 - 1998/99 (1999/00- 2006/07)

Putauhinu - Davis rahui	Harvested	kiore	Access forbidden	Access forbidden	1996/97 - 1998/99 (1999/00- 2006/07)
Taiaroa Head (Private)	Unharvested	stoats, ferrets, Norway rats, cats	1994/95 - 1997/98 (2004/05 - 2006/07)	1992/93 -- 1997/98 (2004/05 - 2006/07)	1996/97 & 1997/98 (2004/05 - 2006/07)
Taiaroa Head (colony)	Unharvested	Norway rats, stoats, ferrets	1994/95 - 1997/98 (2004/05 - 2006/07)	1992/93 - 1997/98 (2004/05 - 2006/07)	1996/97 & 1997/98 (2004/05 - 2006/07)
Nuggets (4 colonies)	Unharvested	Stoats, ferrets, cats	1994/95 - 1997/98 (2004/05 - 2006/07)	1992/93 - 1997/98 (2004/05 - 2006/07)	1996/97 (2004/05 - 2006/07)
Kakanui	Unharvested	Stoats, ferrets, cats	1994/95 - 1997/98 (2004/05 - 2006/07)	1994/95 - 1997/98 (2004/05 - 2006/07)	1996/97 (2004/05 - 2006/07)
Long Point	Unharvested	Stoats	1993/94 - 1997/98 (2004/05 - 2006/07)	1993/94 - 1997/98 (2004/05 - 2006/07)	(2004/05 - 2006/07)
Tuhawaiki A	Unharvested	None	1994/95 - 1997/98 (2004/05 - 2006/07)	1992/93 - 1997/98 (2004/05 - 2006/07)	1996/97 & 1997/98 (2004/05 - 2006/07)
Tuhawaiki B	Unharvested	None	1994/95 - 1997/98 (2004/05 - 2006/07)	1992/93 - 1997/98 (2004/05 - 2006/07)	1996/97& 1997/98 (2004/05 - 2006/07)
Tunnel Rocks	Unharvested	Stoats, ferrets, cats, rats	1993/94 (2004/05 - 2006/07)	1993/94 (2004/05 - 2006/07)	(2004/05 - 2006/07)

† All transects except those in *Poa*

APPENDIX 4: STUDY PERSONNEL & PEER REVIEW

The overall research project is under the research direction of Dr Henrik Moller (mainly in matters of ecology) and Dr David Fletcher (mainly in matters of biostatistics). Dr Moller is a population ecologist and wildlife manager with particular experience in conservation management, invasive species impacts and island ecology (e.g. Moller & Craig 1987; Alterio *et al.* 1997; Moller & Raffaelli 1997). Since 1995 he has worked for the International Union for the Conservation of Nature expert panels on Collaborative Management and for Sustainable Use of Wildlife (Moller 1996, 1998b; Taiepa *et al.* 1997). This has brought him into direct involvement with Indigenous People's environmental philosophies and management. Dr Fletcher has expertise in environmental risk assessment, fishery bycatch and modelling (Fletcher *et al.* 1998, Manly *et al.* 1998) and mark and recapture survival estimation.

Dr Justine de Cruz joined the team as post-doctoral fellow in November 1997. She brought her previous experience on conservation of seabirds and seabird diet studies (Coulter *et al.* 1985; Valle *et al.* 1987; Imber *et al.* 1992; Cepeda & Cruz 1993; Cruz & Cruz 1990a, 1990b, 1996) to bear on our project. Dr de Cruz took over the main field research planning roles leading the Snares part of the program in particular, evaluating the diet samples and establishing an overall database for the project. Regrettably, shortage of funds has forced non-renewal of her employment contract from January 1999.

Development of study methods and scoping of research possibilities was mainly the work of Ms Sheryl Hamilton's MSc research on mainland and near-shore islets, and Phil Lyver's PhD study working on both the mainland and Poutama, a harvested island. We hired Sheryl Hamilton to establish our field research on Whenua Hou and The Snares (1997), and to prepare peer reviewed scientific papers on her earlier work.

Kim Garret has led the team's banding of birds on Te Wai Pounamu in the 1996/97 to the 1997/98 seasons.

The project has been well served by Phil Lyver (1994 - 1998), Christine Hunter (1996 - present) and Jane Kitson (1997 - present) as PhD students. Paul Scofield has most recently joined as a PhD student (July 1998 - present). Chris Jones completed an extensive survey of headlands on the mainland coast from Oamaru to Dunedin city in the hope of finding more colonies for restoration work (Jones, in prep.). Very few new colonies were found, so he has redirected his PhD study to other areas to research interactions between the mammalian predators.

Individual participating students are charged with the responsibility of designing and executing the detail of their own research module. Each student is encouraged to dedicate part of their research efforts to meet the existing overall research program and specific objectives contracted to FRST, but also to test and develop new areas of enquiry that, if fruitful and relevant to the main research project, will be subsumed and enlarged later by the team. MSc and Postgraduate Diploma in Wildlife Management students will be involved in mainland work, literature reviews and more short-term projects designed to check methods.

Detta Russell was chosen as the Rakiura field assistant for these initial years of study. Observations of muttonbirders at work have only been done by Detta and Jane Kitson so as to minimise disruption of the muttonbirders. Both Jane Kitson and Detta Russell are related to the harvesting whānau on Putauhinu. We will continue to minimise the number of different people observing muttonbirders in action (only one PhD student will be involved in such research at any one time), and whenever possible we will use

Rakiura Māori for this close-up work. Muttonbird harvesting is exhausting, dirty and often uncomfortable work involving long hours, disrupted sleep rhythms, and cramped living conditions. It is extremely important that culturally and personally sensitive researchers do the work, and that disruption of the birder's work routines are minimised.

Christopher Robertson, an experienced seabird biologist from DoC's Science and Research group, guides students in the program, either as a formal supervisor, or as a member of their PhD committee. Dr John Fairweather (a sociologist from Lincoln University) and Ms Helen Frizzell (an Oral Historian from Presbyterian Support Services, Dunedin) have assisted interview design and interpretation for the recording and research of Mātauranga. Dr Fairweather has worked with Māori groups on issues of sustainable land management and with farmers on issues concerning their TEK.

The project has gained considerably from peer reviewers of FRST proposals in 1996 and 1998. There were 5 anonymous scientific reviews and 4 reviewers that identified themselves. Amongst the latter, Mike Imber and Dr Irynej Skira are both seabird ecologists; and Assoc. Professor Mick Clout and Dr Mike Walker are population ecologists without seabird research experience. The Māori and sociological dimension of the research also benefited from comments from an anonymous reviewer and Marj Gelling, Anake Goodall, Haami Piripi and Dr Mike Walker. With the exception of one anonymous reviewer, all have been broadly supportive of the research and offered useful constructive criticisms that we have taken on board. Commenting on grant applications is a painstaking and unpleasant task that risks conflict when the reviewer criticises, so we would especially like to thank all the above for their honest and detailed assistance.

Appendix C: Costs of eradication of rats from Taukihepa, Pukeweka, Rerewhakaupoko and Mokonui islands.

Calculation of cost of rat eradication

Area requiring coverage by poisons:

Taukihepa - 939ha
Solomon (Rerewhakaupoko) - 30 ha
Pukeweka - 3ha
Mokonui – 86 ha

This is a total area of 1058 ha, and gives a working area to be covered of approximately 1400ha including double runs on cliffs etc.

Bait cost (21 tonne) includes 20% contingency, transport and storage, this is calculated at 2 drops by helicopter, 1 of 8 kg/ha and 1 at 4kg/ha (this is standard to make sure there are no gaps and in case of bad weather). .....NZ$128,000[80]

Bait deployment costs	
Helicopter hire for bait drops	NZ$ 98,000[81]
Boat to transport bait	NZ $ 15,000
Helicopter ferrying bait	NZ$ 23,000
Boat and Helicopter ferrying people[82]	NZ$ 32,000
Boat and helicopter for reconnecting water systems after drop	NZ$ 20,000[83]
Consents, forecasts, bait testing, safety gear etc.	NZ$ 12,000[84]
Post drop monitoring	NZ$ 20,000
Total eradication cost:	NZ $ 348,000

This calculation does not include "help in kind" to the project from the Department of Conservation from supervising the application of poisons. We estimate this contribution to be around 125 people-days (assuming lengthy preparations for Environment Court hearings are avoided). At a standard DoC charge out rate of NZ$52 per hour, this equates to US$101,000 in-kind assistance to the Rakiura Tītī Islands Restoration project.

[80] All the costs are listed in this Appendix are in New Zealand Dollars unless otherwise stated. At the time of writing this proposal the local currency exchange rate was 1 NZ Dollar = 0.517 US$.
[81] This is a minimum estimate that assumes that Peter Garden is available. Otherwise we must add another $15000 to bring in another suitable pilot.
[82] A dedicated team is needed to put bait around all the houses on the islands on the day of the drop.
[83] This is based on taking down a limited number of people on a catameran and ferrying them to the sites to do the work – if each whānau wanted someone to go down this would increase substantially.
[84] This will increase if the proposal must go to the New Zealand Environment Court.

APPENDIX 5:
WRITTEN OUTPUTS OF THE RESEARCH PROGRAM
(TO MID 1999)

Published or "in press" papers in peer reviewed scientific journals

Hamilton, S. 1998. A test of burrow occupancy of sooty shearwaters (*Puffinus griseus*) using chick response to sound. *Notornis*. 45: 64 - 66.

Hamilton, S.A. 1998. Determining burrow occupancy, fledging success and land-based threats to mainland and near-shore island sooty shearwater (*Puffinus griseus*) colonies. *New Zealand Journal of Zoology*. 25: 443 - 453.

Hamilton, S.A. In press. How precise and accurate are data obtained using an infra-red scope for burrow-nesting birds? *Journal of Marine Ornithology*

Hamilton, S.; de Cruz, J.; Hunter, C.; Moller, H. 1998. An infrared scope for assessing sooty shearwater burrow occupancy. *Conservancy Advisory Science Notes: 187*. 19 + 2 p. colour plates.

Hamilton, S.A.; Moller, H. 1993. Population viability analysis of sooty shearwaters (*Puffinus griseus*) for efficient management of predator control, harvesting and long-term population monitoring. Pp 621-626. In: McAleer, M.; Jakeman, A. (Eds.). *International congress on Modelling and Simulation Proceedings, University of Western Australia, Perth, December 6-10, 1993*.

Hamilton, S.A.; Moller, H. 1995. Can PVA models using computer packages offer useful conservation advice? Sooty shearwaters in New Zealand as a case study. *Biological Conservation*. 73: 107 - 117.

Hamilton, S.A.; Moller, H.; Robertson, C.J.R. 1997. A review of the distribution and abundance of sooty shearwaters (*Puffinus griseus*) in New Zealand. *Notornis*. 44: 15 - 25.

Lyver, P.O'B. 1999. *Predation and harvest impacts on Sooty shearwaters (Puffinus griseus) in New Zealand*. PhD thesis, University of Otago.

Lyver, P.O'B. In press. Identifying mammalian predators from bite marks: a tool for focusing wildlife protection *Mamm. Review*.

Lyver, P. O.; Hamilton, S.; McKenzie, M.; Dickson, I.; Dooher, T.; Broad, T.; Moller, H. 1998. A burrowscope for examining petrel nests in burrows. *Conservation Advisory Science Notes*. 209: 21 pp.

Lyver, P.O'B.; Moller, H. 1999. Tītī harvest by Rakiura Māori: a case study of the use of Māori Traditional Environmental Knowledge for sustainable natural resource management. *Proceedings of Landcare Conference*, Wellington 21 -23 April, 1999. Published on Landcare Research Web page: http://www.landcare.cri.nz/conferences/manaakiwhenua/papers/index.shtml?lyver

Lyver, P.; Moller, H.; Thompson, C. In press. Changes in sooty shearwater (*Puffinus griseus*) harvests and their relationship to climatic perturbations. *Marine Ecology Progress Series*.

Moller, H. 1996. Customary use of indigenous wildlife: Towards a bicultural approach to conserving New Zealand's biodiversity. Pp 89 - 125. In: McFagen, B.; Simpson, P. (comp.). *Biodiversity*. Papers from a seminar series on biodiversity, hosted by Science Research Division, Dept. of Conservation, Wellington 14 June - 26 July 1994.

Taiepa, T.; Lyver, P.; Horsley, P.; Davis, J.; Bragg, M.; Moller, H. 1997. Co-management of New Zealand's Conservation Estate by Māori and Pakeha: a review. *Environmental Conservation*. 24: 236 - 250.

Manuscripts in review by scientific journals

Lyver, P. Subm. a. Sooty shearwater (*Puffinus griseus)* harvest intensity and selectivity on Poutama Island, New Zealand. *New Zealand Journal of Ecology*.

Lyver, P. Subm. b. The use of Traditional Environmental Knowledge to guide sooty shearwater (*Puffinus griseus*) harvests by Rakiura Māori. *Wildlife Society Bulletin*

Cost of Rakiura Māori scientist/manager for monitoring and quarantine programme

An annual salary of NZ $ 35,000 is required and ca NZ$ 15,000 in expenses (transport, bait stations and poison baits) for years when both monitoring and quarantine tasks are being completed (2003-2006; 2012 & 2013). More than one Rakiura Māori community member will be employed for part of the year so that support peaks at the time of fledging. $10,000 of this allocation will be dedicated to quarantine issues every year throughout the programme.

University of Otago science studies to monitor and report outcomes and predict long-term restoration.

Around NZ$ 11,000 is needed in each of the first two years to establish new benchmark plots on impact islands to assess the effect of rat eradication. This involves a team of 4 people monitoring working in the field for 3-4 weeks each year. An intensive study of rat predation for 4 years (two before impact, two after) will require NZ$ 15,000 per year and an additional NZ$ 20,000 in 2006 to synthesise, model and report the predicted rate of recovery of the oils spill injury from all these preliminary studies. NZ$ 20,000 has been allocated for the last year of the RTRP (2013) to re-survey the impact and control plots and check whether model predictions have been realised and publish the outcomes in a peer reviewed journal.

Collaboration between New Zealand and USA scientists and educationalist

We have scheduled visits of Hannah Nevins and Josh Adams to New Zealand (visits in 2003, 2004, 2005, 2012 and 2013 (@ NZ$ 11,000 per visit) to participate in fieldwork, study design, synthesis and publication. Similar visits by Dr Dick Veit are scheduled for 2004 and 2006 (@ NZ$ 5,000 each). Reciprocal visits by Drs Moller or Newman from the tītī research team to USA are scheduled for 2005 and 2013 (budgeted @ NZ$ 5,000 each).

Production of Tītī Times, Films and Educational packages for quarantine and outreach

A special issue of *Tītī Times* on quarantine issues will be prepared and distributed in 2004 (cost NZ$ 4,500) and a fifth of issues in all other years (@ NZ$ 1800 per year) to build awareness and dedication to quarantine efforts.

A provisional budget for NZ$ 22,000 has been allocated to preparing the natural History film about the restoration project. This will be used for both general public outreach and educational packages for schools and quarantine education and workshops, so half of its cost was allocated to the quarantine budget and half to the educational outreach in Table 2.

Preparation of educational material, websites etc, by *Oikonos* is costed as USA$ 5,000 in each of 2004, 2005 and 2013.

Support by the kaitiaki

Rakiura Māori kaitiaki will help in eradication operation, planning, resource consent application, negotiation and monitoring of the overall project, reporting and filmmaking. NZ$ 17,500 has been allocated per year for the first 3 years (2003 – 2005) for this role, followed by NZ$ 9,000 in the last year (2013) for final synthesis, reporting and closure issues. At least one visit to the *Command* Trustee Council in California will be requested and funded out of this allocation.

Appendix D: Letter of support from the New Zealand Department of Conservation

Department of Conservation
Te Papa Atawhai

28 November 2002

Command Trustee Council

Dear Trustees

Support for Rat eradication on Taukihepa and nearby islands.

The Department of Conservation is the government agency responsible for protecting and enhancing New Zealand's native flora and fauna and works closely with a wide range of private organisations and individuals to achieve this.

The Department has a long history of eradicating introduced species from islands in order to protect the natural ecosystems and to allow the introduction of indigenous species. In the last 10 years this work has been focused at removing rats from increasingly larger islands culminating in 11,200 ha Campbell Island last year. While it is too early to confirm the success of that project the eradications on 1896 ha Whenua Hou and several other smaller islands in the area show that the techniques used do work, are safe and can give cost-effective conservation returns if applied professionally.

The Rakiura Titi Islands Administering Body has approached the Department about assisting with the removal of rats from the Taukihepa group and the two parties are currently working towards that end. Unfortunately the Department's financial rules do not allow it to contribute financially to the project but we can provide the technical expertise required. The eradication project will be under the direction of Peter McClelland, a senior conservation manager in our team whom also directed the earlier eradication operations in our Conservancy.

The removal of rats from Taukihepa, Pukeweka, Rerewhakaupoko and Mokonui islands will benefit a range of species including land and seabirds. One of the most important of these is the Titi (*Puffinus griseus*) which is a keystone species for the ecology of the islands. Rats are undoubtedly having an affect on the titi productivity so rat eradication is one way that the Command Trustee Council can mitigate the injury sustained by the titi population and to Rakiura Maori from the oil spill.

Yours sincerely

Greg Lind
Area Manager Southern Islands.

souco-38023 - taukihpa funding (oil spill) leter of support

Southland Conservancy
State Insurance Building, 33 Don Street, P.O. Box 743, Invercargill, New Zealand
Telephone 03-214 4589. Fax 03-214 4486

FOUNDATION
BENEFITING COUNTY PARKS

- Coyote Point Marina
- Coyote Point Recreation Area
- Crystal Springs Trails
- Edgewood Park & Preserve
- Fitzgerald Marine Reserve
- Flood Park
- Heritage Grove
- Huddart Park
- Junipero Serra Park
- Memorial Park
- Pescadero Creek Park
- Pillar Point Marsh
- Sam McDonald Park
- San Bruno Mountain Park
- Sanchez Adobe
- San Pedro Valley Park
- Sawyer Camp Trail
- Woodside Store
- Wunderlich Park

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Nicole Goldstein
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Susan H. Russell
Sarah Swinerton

Advisory Board

Melvin Lane
Jo Schreck

Executive Director

Julia Bott

215 Bay Road
Menlo Park, CA 94025
650-321-5812 voice
321-5813 fax
@supportparks.org
www.supportparks.org

January 9, 2003

Charlene Hall
Command Oil Spill Trustee Council
C/O Fish and Wildlife Service
2800 Cottage Way, Suite 2605
Sacramento CA 95825

RE: Mirada Surf Acquisition

Dear Ms. Hall:

The Foundation appreciates the Council's continued interest in funding the acquisition of the Mirada Surf Oceanside parcel. This letter is to answer the question in your correspondence of January 3, 2003.

Proposed Improvements
The Mirada Surf Oceanside parcel is being acquired specifically so that the missing link of the coastal trail and coastal access improvements can be completed.

The acquisition of the Oceanside parcel is the second phase of a two phased effort to acquire parcels on both sides of Highway 1. The planning for the entire site, especially facilities and activities on the east side are complex and will require a community based planning effort, as well as rigorous environmental review as there are wetlands on the east side. Providing coastal access and completion of the missing segment of the Coastal Trail is one of the expressed reasons for purchasing the Oceanside parcel. Given that the access and trail is a regional amenity, with no opposition and limited environmental constraints (in fact an improved trail will reduce impacts), it is anticipated that this activity would be segmented from the planning for the eastern parcel to expedite its completion.

A conceptual plan for the trail and access was done in 1997. I am unable to provide this via email. A development budget, based on figures from a 2002 project, has been developed. It is attached. While funding sources for the actual development have been identified, the funding for this development has not been secured as we are first focused on the acquisition effort.

The County recognizes that there are parking issues to be resolved in the area. The Mirada Surf Oceanside parcel does not include the parcel that had been previously used for parking. That land is a separate parcel and under the jurisdiction of the City of Half Moon Bay. The County was not responsible for the closure of the bluff top parking area. Further, local coastal planning rules encourage parking away from sensitive bluffs and view corridors.

There are no immediate, easy answers but the County is interested in looking for interim and long-term solutions. Our development proposals anticipate that there will be limited parking on the west side, primarily for disabled parking and staging (pick up and drop off). It is expected that additional parking will be developed in appropriate locations east of Highway 1. The controlled intersection at Coronado and State Highway 1 provides safe access from parking on the east to the bluff and beach on the west.

Restriction of Funds
The San Mateo County Parks and Recreation Foundation is willing to have the restoration funds restricted to a certain purpose. However, I'm not sure if this is relevant as we are seeking the funds to assist with our acquisition effort, not the development effort. There is only one activity -acquisition - associated with our request. The restoration funds would be directly solely at this.

If we do not acquire the property, development of the coastal access and completion of the coastal trail will not occur until there is an easement granted by the owners. This will only occur as a condition of a development permit. It is likely to be a minimum of 5 years before the process would be complete and the permits granted. By providing funds for the acquisition, you will be supporting efforts which will result in completing the proposed improvements sooner.

Sincerely,

Julia Bott

Julia Bott
Executive Director
San Mateo County Parks and Recreation Foundation

SAN MATEO COUNTY RESOURCE CONSERVATION DISTRICT
www.sanmateorcd.org

625 Miramontes St., Ste. 103
Half Moon Bay, CA 94019-1942
(650) 712-7765 * Fax 726-0494
info@sanmateorcd.org

January 14, 2003

David Harlow, Field Supervisor
Fish and Wildlife Service
Sacramento Fish and Wildlife Office
2800 Cottage Way, Rm. 2605
Sacramento, CA 95825

RE: Command Oil Spill Fund Restoration Projects

Dear Mr. Harlow,

Thank you for the opportunity to provide additional information on restoration projects for the Command Oil Spill Fund. I have enclosed a document describing projects for Command Oil Spill funding. It responds to your request for project information in the San Vicente Creek watershed that impacts Fitzgerald Marine Reserve. It also outlines two additional projects. The first concerns completing the stewardship process resulting in a coordinated restoration plan for the Pescadero-Butano watershed and Pescadero Marsh, the largest watershed and marsh in San Mateo County having the single greatest impact on our marine and coastal resources. The second project proposes to develop recreational opportunities and educational materials for the portion of the California Coastal National Monument located in our area. The previous projects proposed to the Trustees also remain viable and important to our resources.

I have enclosed lists of some of the organizations that you requested to include in your outreach efforts and a partial list of resources and publications contained in the SMC RCD office. The latter is also available on our web site www.sanmateorcd.org and is in the process of being updated so that the list is electronically available (Mircosoft Access). In general, the SMC RCD maintains copies of reports and studies undertaken in the district as well as more general studies and recovery plans concerning species, habitat and restoration. The majority of these reports have yet to be added to our electronic list, but are available to the public.

Finally, the San Mateo County Resource Conservation District would like to reiterate two comments from our initial response last June:

1. All Command Oil Spill funds should be spent in coastal San Mateo County as this is where the spill occurred and the resource was impacted; and
2. The Trustees should expand their definition of "resource" to include the entire western side of San Mateo County from the crest of the mountains to the ocean as this entire area drains into and impacts the Monterey Bay National Marine Sanctuary where the oil was spilled.

Once again, thank you for the opportunity to help shape restoration plans benefiting the people and resources in coastal San Mateo County. Please contact me if we can be of further assistance.

Sincerely,
Mike Ednoff
Mike Ednoff
Executive Director

Partnering to Implement Conservation Practices and Promote Environmental Stewardship on Public and Private Lands Since 1939

Potential Command Oil Spill Projects Proposed by the San Mateo County Resource Conservation District

Project 1: San Vicente Creek Watershed Restoration Plan

Status of the Watershed: San Vicente Creek watershed encompasses an approximate area of 5 square miles, originating on Montara Mountain and entering the Monterey Bay National Marine Sanctuary (Pacific Ocean) at the San Mateo County Fitzgerald Marine Reserve. Uses for the watershed include a large rural area, known as Corral de Tierra, designated for open space, equestrian trails and stables, agriculture and recreation; other private lands including farm and ranch; the Moss Beach urban area; and the Fitzgerald Marine Reserve, an important and unique marine resource. There are approximately 200 property owners within the watershed, most of which are located within the Moss Beach urban area.

Approximately 4,200 acres of the upper watershed is in the process of being transferred from private to public trust ownership with a long term likelihood of becoming part of the Golden Gate National Recreation Area. The two largest owners of the upper watershed are supportive of a stewardship and watershed restoration process. An informal group of local citizens and interested organizations and businesses operating in the watershed exists and would logically become part of a more formal watershed group. Local organizations and agencies including Save Our Shores, Surfriders, Peninsula Open Space Trust, San Mateo County Parks (Fitzgerald Reserve) and Environmental Health (Clean Beaches Initiative), and the San Mateo County Resource Conservation District have expressed an interest in working with or directly participating in the proposed project. Information and publications that currently exist on the watershed include: Fitzgerald Marine Reserve Master Plan; San Vicente Creek, A Watershed With New Friends (university student project), Montara-Moss Beach EIR, and various investigations on water and aquifers in and adjacent to the watershed. In addition, the County Environmental Health has been monitoring water quality (primarily coliforms) in the watershed and the RCD has been actively demonstrating management practices for horses along with manure composting. The latter is part of a larger project that produced the publication entitled Horse Keeping: A Guide to Land Management for Clean Water.

Major concerns and preliminary problems identified in the watershed presently include nonpoint source water quality problems from sedimentation, microbial sources, and urban uses; invasive species especially those impacting the riparian zone of the creek; erosion including repair of gullies and rural dirt roads; loss of freshwater in the system; and barriers to fish passage, especially state and federally threatened anadromous steelhead trout.

The Fitzgerald Marine Reserve has its own Master Plan and implementation process that must be respected. This proposal will coordinate, compliment and integrate all processes and activities that lead to restoration and improvement of the health of the watershed, that includes the marine reserve, with the Fitzgerald Master Plan. Improving the health of the watershed will improve the health of the marine reserve. All components of this proposal will be coordinated closely with San Mateo County Parks to ensure an integrated process.

Project Overview: The overall goal of this proposal is to develop a coordinated and integrated watershed management process to address problems in the watershed that result in improving the overall water quality and health of this resource for its many diverse users, land owners, and community members. A framework that helps control nonpoint source pollution through monitoring, rehabilitation, and best management practices will be encouraged and facilitated. The process will accommodate diverse interests and participation. The framework will also address land management, species and habitat enhancement, and long term watershed improvement. One major focus will be on obtaining results from restoration activities implemented that improve habitat and water quality for species living in the marine reserve at the mouth of the watershed. The latter will also benefit those who enjoy visiting the marine reserve. Another focus will be on improving the resource and management practices that accommodate expanded recreational uses, especially equestrian, in the upper portion of the watershed. In addition, preservation of prime agricultural lands along with the management of adjacent watersheds will be addressed in the stewardship plan. The proposal will span a two year period, at which time, full implementation of restoration projects will be underway.

Specific Project Components:

1. **Watershed Advisory Committee**. People support what they help create. This component will focus on outreach and communication with all landowners and residents located in the watershed as well as be inclusive of other interested organizations and agencies outside the watershed in order to establish a watershed advisory committee. Established practices and approaches will be used to build a consensus based stewardship group and process. Once established, the advisory committee will oversee the entire process, evaluate and make recommendations concerning any studies, restoration projects, program alterations, and activities related to the watershed and stewardship process. Estimated costs for this component are $96,000 over two years covering staff time and expenses.

2. **Watershed Plan and Restoration Project Development**. One or more consultants will be subcontracted to develop a watershed plan that identifies restoration projects and includes an implementation schedule. The plan will minimally incorporate:

   a. Sedimentation study and inventory of sediment restoration projects including stream flow monitoring, management of gullies and repair of upper watershed roads (estimated $70,000);
   b. Invasive species management and restoration of the creek riparian zone (est. $30,000);
   c. Design options followed by engineering and design specifications for restoration of the creek to allow fish passage especially for migration of ESA listed steelhead (est. $80,000);
   d. Extensive sampling and analysis of coliform using genomic techniques to determine origin and source of coliforms and recommended corrective actions (est. $90,000);
   e. Identification of best management practices for land uses, expanded recreation, and maintenance of existing uses including continued equestrian use of open space and integration with the Fitzgerald Master Plan (est. $100,000).

3. **Plan Implementation**. Restoration projects identified in the watershed plan will be packaged and actual costs determined through an RFP or bid solicitation process. The resulting

projects with costs will then either be implemented directly or additional funds sought (state bond, state and federal grants, etc) for project implementation. Permitting will be a part of this component (est. $300,000 or more, if available).

4. **Education**. An comprehensive education component will be developed that complements educational programs of the Fitzgerald Marine Reserve to be inclusive of the entire resource from the crest of the mountain down through the valley crossing many habitats, uses, and users, all the way into the marine reserve. The resulting curriculum and educational materials will be integrated into the Fitzgerald programs providing greater use for marine reserve facilities (est. $160,000).

5. **Project Administration and Fiscal Management**. $130,000 over 24 months includes all fiscal and programmatic management, coordination and RCD Board administration. Roughly 14% of total project costs. Includes all reporting.

TOTAL ESTIMATED PROJECT BUDGET: $ 1,056,000

Additional Information that addresses Scoping Document:

Nexus: The Fitzgerald Marine Reserve is one of the most important marine resources on the San Mateo coast. It was right in the path of the Command Oil Spill. The health of estuarine and rocky intertidal habitats are closely dependent upon the health of the watershed emptying into such an important resource. The two are intricately tied functioning as one integrated marvel of mother nature.

Feasibility: Most of the components proposed in this request have been successfully carried out in nearby watersheds, such as the Pilarcitos Creek Watershed, a much larger watershed with more users and uses and sources of pollution impacting the coastal area. The challenges in this proposal are in the integration of restoration outcomes with the Fitzgerald Master Plan and the expanded recreational uses in the upper watershed. All proposed components are technically and procedurally sound.

Duplicate/Replacement Funding: This project and watershed are unique in that they focus on a marine reserve at the mouth of the watershed and restoration geared towards increased recreational use in the upper watershed. However, the small size of the watershed would typically not qualify for significant federal watershed funders due to cost, and although Californians have generously voted to issue bonds for watershed restoration, these funds are geared toward in-the-ground projects and not so much for planning and coordination. Due to concern over the health of the marine reserve, the existing urban area impacts, and the opportunity for increased recreation and open space held in perpetuity, there is a critical need for a coordinated planning process, a stewardship group, and ultimately a restoration plan based on sound science and information. In addition, once the planning is in place, any additional funding to implement individual restoration projects will be easier to obtain.

Legality: There have not been any legal problems identified. All permits will be obtained as cognizant agencies will be involved from the beginning and throughout the process. In addition,

the SMC RCD is a California special district organized and governed under Division 9 of the Public Resource Code, and as such, must be compliant with all state and federal laws.

Likelihood of Success. A Watershed Advisory Group created through an inclusive process that achieves consensus to develop and complete a restoration plan is always successful. People support what they help create.

Cost Effectiveness. Watershed restoration is a costly process and San Mateo County, where the Command Oil Spill came ashore, has a high cost of living. If the watershed is restored, water quality improved, and marine organisms in the reserve sustained, then the cost will be effective.

Multiple Benefits. This proposal will incorporate a diverse group of people, organizations and agencies into the process. Anticipated outcomes include a healthy marine resource, improved habitat throughout the watershed and especially along the riparian corridor of the stream, and expanded recreational opportunities in the upper portion of the watershed. The proposal will also include and benefit those already living and operating businesses in the watershed.

Duration of Benefits. Restoration "fixes", once fully implemented, are anticipated to last for 20 years or more. The stewardship process will be continuous and as such, will continually evolve, reflect and improve.

Heath and Safety. The microbial component of this proposal directly addresses health issues especially those that have resulted in beach closings and human health warnings. The overall plan, especially the recreational component, must address safety and safe use of the resource.

Adverse Impacts. There is nothing proposed in this request that will adversely impact the resource. All components should result in balance, improved management practices, and overall improved health of the resource, especially the marine reserve.

Collaboration. This project request has extensive interest in collaboration that will only be expanded. A primary duty of RCDs is coordination and collaboration for the benefit of the resource and all those who live within the district.

Project 2: Pescadero-Butano Watershed and Pescadero Marsh Restoration

The Pescadero-Butano watershed is the largest watershed in San Mateo County, encompassing 84 square miles, draining the crest of the Santa Cruz mountains down through redwood forests, open space, agricultural lands, the community of Pescadero, into the Pescadero Marsh and then emptying into the Monterey Bay National Marine Sanctuary (Pacific Ocean). The Pescadero Marsh is the largest and most important marsh in San Mateo County. The entire system is intricately linked to the marine ecosystem.

A number of projects in the watershed are currently underway or nearing completion including two studies in the marsh (State Parks), an oral history project (RCD and EPA), a water study and

a second sediment study (County Parks), and a sediment and fishery study (Sanctuary and State Water Board). However, there is no overall watershed plan and process in place. These separate projects need to be linked together into an overall watershed plan that addresses upstream resource management issues of the entire watershed that impact the marsh and result in the habitual flooding of Pescadero.

$400,000 is requested from the Trustees to hire a full time, independent staff person or watershed coordinator for two years to work with: All the people living and owning land within the watershed, local, state and federal agencies, and other private organizations and individuals to complete the stewardship process; link all ongoing and recently completed studies into a coordinated and integrated watershed process, undertake and collect any additional data, science and studies needed, and complete an overall watershed plan. An outside facilitator or process, such as the BLM stewardship course, would be incorporated to help engage a stewardship group and get the process back underway. The resulting group would drive the overall process and restoration effort. All regulatory agencies would also be involved in the process form the beginning and updated routinely to ensure that data and information is sufficient to obtain permits for all restoration work identified in the overall plan.

Support for this concept is high. Potential partners and participants include: San Mateo County (Parks, Public Works, and Board of Supervisors), State Parks, Monterey Bay Sanctuary, Committee for Green Foothills, Pescadero Municipal Advisory Council, Coastal Conservancy, California Department of Forestry (Fire Dept), State and Regional Water Quality Control Board, Agricultural Water Quality Alliance, Farm Bureau, RCD and others.

This project request easily meets or exceeds all selection criteria listed in the scoping document as the Pescadero Marsh is the county's largest marsh and a very important marine resource. Additional details can be provided upon request.

Project 3: California Coastal National Monument Education and Use Project

$100,000 is requested from the Trustees to develop outreach materials and information to increase recreational use of the BLM rocks off the coast of San Mateo. This is a joint proposal from the SMC RCD and Recreational and Educational Access (Robert Burco), a BLM consultant and volunteer. A comprehensive investigation would be undertaken along the San Mateo coast to identify access points for viewing and kayaking along the National Monument rocks, performing an assessment and identifying partners who might benefit through the incorporation of promotion materials to increase local tourism tied into rock viewing and use, and developing educational materials that would inform visitors of the rocks, develop protocols for use such as kayaking around the rocks, safety, and preparing for a waterborne excursion. A report, promotional materials, educational brochures, and individuals and businesses interested in this concept would be produced. Currently there is no funding to develop the recreational use of this resource. The Command Oil Spill passed through the rocks on its way to the beach. Additional Information (Project 3 only): Robert Burco, 213-509-8844 or rburco@aol.com.

Additional Contact information for the above projects may be obtained from:

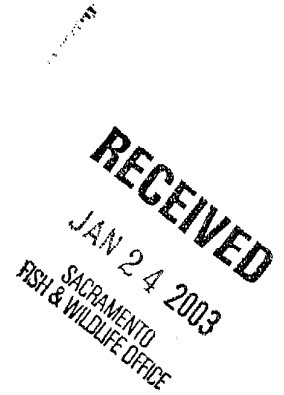
Mike Ednoff
San Mateo County RCD
650-712-7765
650-726-0494
Mike.Ednoff@sanmateorcd.org
www.sanmateorcd.org

The SMC RCD Board of Directors will maintain full administrative and fiscal oversight of this project. The RCD Board is currently appointed by the County Board of Supervisors, however, California law encourages election and once appointed RCD Board members serve as if elected with a single purpose of resource conservation using a non-regulatory approach. The SMC RCD currently covers all of coastal San Mateo County (157,000 acres) representing approximately 46,380 registered voters.

#13

January 15, 2003

Mr. David L. Harlow
Acting Field Supervisor
Command Oil Spill Trustee Council
c/o U. S. Fish and Wildlife Service
2800 Cottage Way, Suite 2605
Sacramento, CA 95825



ENVIRONMENTAL SERVICES AGENCY

Agricultural Commissioner/ Sealer of Weights & Measures

Animal Control

Cooperative Extension

Fire Protection

LAFCo

Library

Parks & Recreation

Planning & Building

Dear Mr. Harlow:

This is in response to your letter of January 3, 2003 requesting additional information on our proposed Fitzgerald Marine Reserve Seal Cove Trail Improvements and Interpretive Signs Project.

Parks Superintendent David Moore has spoken with Ms. Charlene Hall of your office regarding the additional information requested. To recap, the funding of $110,000 is being requested for the preparation costs of detailed plans and engineered drawings, which would include a budget breakdown and the construction phase of the project. There is an interpretive signage portion within the project that addresses the necessity for visitors to stay on the trails due to the sensitive vegetation and eroding ocean bluffs.

Thank you for the continued interest shown in our proposed project. Please contact Parks Superintendent David Moore at (650) 599-1906, or e-mail him at dmoore@co.sanmateo.ca.us, if you need further information.

Sincerely,

Mary E. Burns
Director

c: David Moore
Julia Bott

PARKS AND RECREATION DIVISION
455 County Center, 4th Floor • Redwood City CA 94063 • Phone (650) 363-4020 • Fax (650) 599-1721

Island Conservation & Ecology Group
Long Marine Lab, University of California
100 Shaffer Rd
Santa Cruz, CA 95060 USA
Telephone: (831) 459-1476
Fax: (831)-459-3383
http://www.islandconservation.org

Feb 7 2003

Dear Command Trustee Council,

It is my pleasure to submit this short proposal to the council for your consideration. The Island Conservation and Ecology Group is committed to the protection of seabirds in the US and Mexico and feel the activities outlined in this proposal will greatly benefit the Black-vented Shearwater and other breeding seabirds on Natividad Island. Please feel free to contact me with any questions.

Sincerely,

Bernie Tershy
Director
Island Conservation and Ecology Group
831.459.1461
tershy@islandconservation.org

A PROPOSAL TO THE COMMAND SPILL TRUSTEES

Seabirds in the Order Procellariformes have low fecundity and are long lived (Warham, 1990). This reproductive strategy makes their populations especially susceptible to adult mortality such as that which occurs while adults are at sea (Russell, 1999). Adult mortality of Procellariforms from oil pollution can cause permutations in a species' population structure that lasts for tens of years (Russell, 1999). Because of a seabird's ability to disperse long distances they are at risk over large areas and mortality can occur far from their centralized breeding locations.

The Command Spill in late September 1998 occurred during an unusual period of warm water off the San Mateo and Santa Cruz coast. As a result, the seabird fauna included a greater number of southern species. Black-vented Shearwaters (*Puffinus opisthomelas*) are a California endemic species and breed on only three islands, all off the Pacific coast of Baja California (Keitt et al., 2000b). This species disperses northward to southern California during the non-breeding season (August through December) and in warm water years can become common off the coasts of San Mateo and Santa Cruz counties (Keitt et al., 2000b). Black-vented Shearwaters are a coastal species, rarely seen greater than 25 km offshore, that dive to 20m for small fish and invertebrates (Keitt et al., 2000a). In October of 1998 Black-vented Shearwaters were noted as the most common shearwater in the Monterey bay (S. Benson unp. data). Additionally, in the fall of 1998, Black-vented Shearwaters were reported as common as far north as the Marin and Sonoma coasts (Keitt et al., 2000b). Because of the direct temporal overlap of large numbers of this species in the waters off the San Mateo and Santa Cruz county coastlines and the Command spill incident, it is highly likely a significant number of Black-vented Shearwaters were impacted.

The greatest causes of extinction and endangerment to seabird populations are nesting habitat destruction and introduced predators at the breeding colony (King, 1985). Therefore, it is most effective to mitigate impacts to seabirds occurring at sea by protecting breeding habitat from destruction and introduced predators.

Over 95% of the worlds' population of Black-vented Shearwaters breed on Natividad Island (Keitt et al., in press). This species shares its breeding habitat with a community of about 500 human residents, primarily fishermen and their families. The town is essentially unregulated and the shearwater breeding colony is threatened by habitat destruction and introduced predators (Keitt, 1998). A population model developed by Keitt et. al (Keitt et al., 2002) showed that feral cats could drive the shearwater population to extinction in less than 30 years. Mapping of the island demonstrated that almost 15% of the colony has been destroyed by the development of the town and roads, with more habitat lost each year (Keitt, 1998).

The Island Conservation and Ecology Group has already undertaken several important conservation projects on Natividad Island to conserve the Black-vented Shearwater and other species. In 1998 goats and sheep were removed (Keitt, 1998) and in 2000 feral cats were eradicated (Keitt et al., 2002). Dogs, which are known to destroy shearwater burrows and kill adult birds, still occur on the island (B. Keitt pers. obs.). Concurrent environmental education programs with island residents were conducted during this period. However, these programs are

no longer active. Ongoing education efforts combined with monitoring and quarantine programs to stop the introduction of cats and rats are desperately needed.

In order to protect the 95% of the world's population of Black-vented Shearwaters on Natividad Island the Island Conservation and Ecology Group proposes to:

1) Conduct environmental education in the town.

ICEG will use proven environmental education programs to work with fishermen and their families. Programs will be conducted in the local school, at fishermen's houses, and at public meetings. Education will concentrate on the effects of introduced predators and habitat destruction on the Black-vented Shearwater and other seabird species.

2) Map areas of town and roads to help with monitoring and enforcement of no construction rules.

It is critical to establish an accurate map of the town footprint, outbuildings, and roads to monitor future development in these areas. Island will be mapped using GPS and a monitoring program will be implemented.

3) Develop quarantine plan to keep island free of cats, rats, and other introduced species.

The introduction of cats, rats, or other species is the greatest threat to the Black-vented Shearwater colony on Natividad Island. We will work with the community to develop a plan that will help eliminate the possible introduction of these species.

4) Implement quarantine plan.

We have requested money to implement the quarantine plan. It is our goal to work with the community to have them continue the program into the future. Because a rat introduction is a threat to the island's fish processing facility island residents have already indicated interest in maintaining a program if we can develop a cost efficient system.

5) Work with management agency responsible for islands to make these efforts long lasting.

This work will be carried out over a period of one year.

Natividad Island is part of the Vizcaino Biosphere Reserve. Unfortunately, this does not mean the island is actively managed. However, with the imminent creation of the new Baja California Pacific Islands Biosphere Reserve, Natividad will soon be managed appropriately. All of the conservation actions outlined in this proposal will become policies for the new reserve, thereby ensuring the long term protection of the island.

These conservation actions will also benefit all of the other breeding seabird species on Natividad Island, including: Brown Pelican, Double-crested and Brandt's Cormorant, and Western Gull.

The Island Conservation and Ecology Group already has an established track record working in this region and on these islands.

Organization's History & Goals: Island Conservation is a science-driven, bi-national organization dedicated to preventing extinctions and protecting natural ecological and evolutionary processes. Island Conservation started as an association in 1994, and gained 501 (c) (3) status in 1997.

To prevent extinctions and protect natural ecosystems we:

1) Conduct applied research and set conservation priorities
2) Build local capacity to undertake long-term management of protected islands
3) Work with governmental agencies to develop island conservation policy
4) Remove introduced species from island ecosystems

In the last seven years we:

- Developed an internationally acclaimed island conservation database
- Facilitated six MS theses and published 20 technical papers
- Made significant contributions to Mexican and US policy on island conservation
- Collaborated with local and national organizations to remove introduced mammals from 24 islands
- Protected 22 seabird species and 48 endemic vertebrate species and subspecies from the threat of extinction

Please see our website www.IslandConservation.org for more information.

BUDGET

ITEM		Amount
Personnel-salary	Education director	15,000
	Biologist	20,000
Supplies	Education materials	3,000
	Signs on island	800
	Quarantine supplies	5,000
Travel	10 trips Ensenada to INA	4,000
	5 trips SC- Ensenada	1,200
Total		$49,000

Literature Cited

Keitt, B. S., (1998). Ecology and conservation biology of the Black-vented Shearwater (*Puffinus opisthomelas*) on Natividad Island, Vizcaino Biosphere Reserve, Baja California Sur, Mexico (Master of Science). Santa Cruz: University of California.

Keitt, B. S., D. A. Croll and B. R. Tershy. (2000a). Dive depth and diet of the Black-vented Shearwater. Auk 117: 507-510.

Keitt, B. S., B. R. Tershy and D. A. Croll, (2000b). Black-vented Shearwater (*Puffinus opisthomelas*). In The Birds of North America (A. Poole and F. Gill, Eds). Philadelphia, PA: Academy of Natural Sciences, Philadelphia, PA, and American Ornithologists' Union, Washington D.C.

Keitt, B. S., B. R. Tershy and D. A. Croll. (in press). Breeding biology and Conservation of the Black-vented Shearwater. Ibis.

Keitt, B. S., C. Wilcox, B. R.Tershy, D. A. Croll and C. J. Donlan. (2002). The Effect of Feral Cats on the Population Viability of Black-vented Shearwaters (*Puffinus opisthomelas*) on Natividad Island, Mexico. Animal Conservation 5: 217-223.

King, W. B. (1985). Island birds: Will the future repeat the past? Pages 3-15 in P. J. Moors, Ed. Conservation of Island Birds: Case studies for the management of threatened island species. ICBP, Cambridge, England: ICBP.

Russell, R. W. (1999). Comparative demography and life history tactics of seabirds: implications for conservation and marine monitoring. Amer. Fish. Soc. Sym. 23: 51-76.

Warham, J. (1990). The petrels: Their ecology and breeding systems. San Diego: Academic Press.

"Steve Hampton"
<SHAMPTON@OSPR.DFG.CA.GOV>

02/13/2003 12:21 PM

To: <Charlene_Hall@fws.gov>, <jennifer.boyce@noaa.gov>, <kolleen.bannon@noaa.gov>, "Kathy Verrue-Slater" <Kvslater@OSPR.DFG.CA.GOV>, <JKERB@parks.ca.gov>, <yorks@slc.ca.gov>

cc:

Subject: Command human disturbance reduction project

Command Trustees,

Attached is a rough description of a human disturbance reduction project to benefit seabird colonies. I have pulled this from the Torch case and modified it slightly. I have not touched the budget. Paul Kelly develcped this during the Torch case and the budget details come largely from experience in Oregon (Roy Lowe) and monitoring from Devil's Slide (Mike Parker).

As we get into the details, we'd need to figure out what elements are relevant and what is most important. I've heard that overflight and nearshore commericial fishery issues are the most important. (Charlene, can you pass this on to Joelle?).

all for now,

Steve Hampton

Resource Economist
Office of Spill Prevention and Response
California Dept of Fish and Game
PO Box 944209
Sacramento, CA 94244-2090
---
(916) 323-4724 phone
(916) 324-8829 fax

HDR Project from Torch

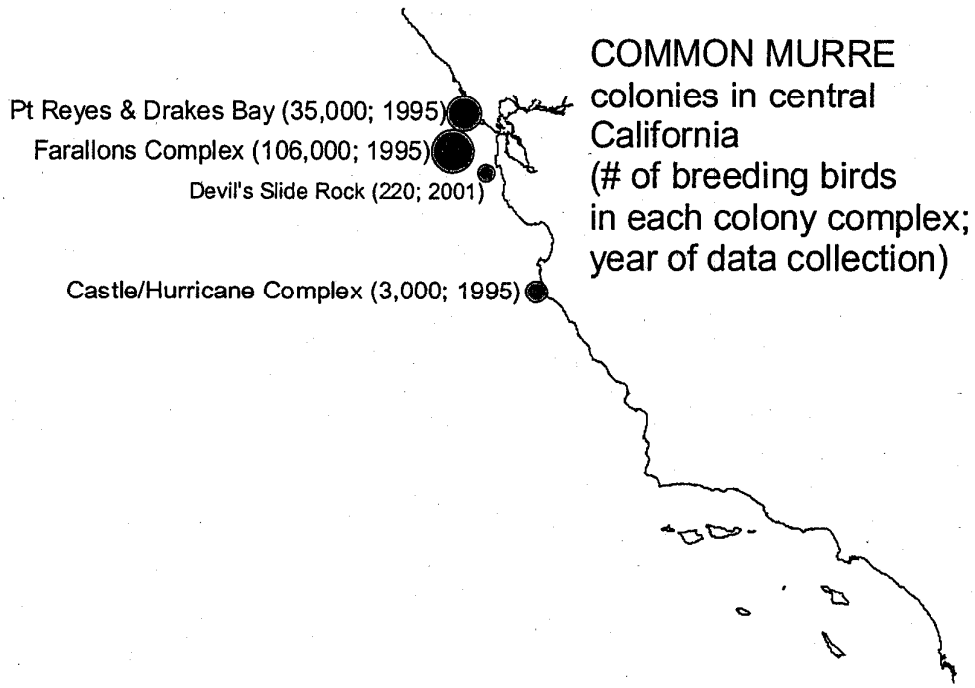
ex. from Torch.

Seabird Colony Enhancement Project: Detailed Project Description

Restoration Category
Seabirds

Objective
Restore injured seabird resources to prespill or baseline condition and compensate for interim ecological losses pending full restoration to baseline conditions

Project Location
By design, the project may have both a regional focus and some colony-specific components. The map below outlines the locations of Common Murre colonies in the region. More detailed maps are available.



Nexus to Injured Resources
The Command Oil Spill (the Spill) is estimated to have impacted approximately xxx Common Murres. Other species that may also benefit from the project are…

Project Description

Human Disturbance Reduction at Seabird Colonies

Unauthorized visitor entries into seabird colonies during the nesting season can cause abandonment by adult birds leaving nests vulnerable to predation and exposure to weather. Other potential impacts include premature fledging and seasonal or even long-term colony abandonment. Low altitude overflights by aircraft can cause similar types of impacts.

Human disturbance of seabird colonies and roosts in the target area would be reduced by developing, implementing, and educating the public about new protective measures for seabird colonies and roosts. New measures would address disturbance from aerial overflights, unauthorized landings on islands and rocks, close approach of sensitive coastal areas by unauthorized boats, and close approach on foot or by vehicle on land. Such measures would include seasonal positioning of buoys around breeding rocks, as well as informing kayakers, commercial and sport fishermen and others to maintain specified distances from colonies during the breeding season. These new measures would be integrated with other multiple uses of the coastal environment to prevent or minimize disturbance to seabirds on a site-by-site basis. At the conclusion of this restoration project, the disturbance reduction efforts would be assimilated into state or federal agency seabird management programs.

Objectives: This element of the project has five objectives:

1. Identify and collate available data for all seabird colonies and roosts in the restoration area;

2. Document the types and degree of human disturbance throughout the restoration area and identify specific colonies that require specialized efforts and protection;

3. Develop, implement, and enforce appropriate protective measures to reduce disturbance at specific colonies and throughout the restoration area; monitor compliance by the public and make appropriate modifications if necessary. Signs would be erected at coastal launching ramps in the two counties to educate sport and commercial fishermen, kayakers and others about the sensitivity of nearby seabird colonies. Specially produced pamphlets would be distributed through marine supply stores and sporting goods stores would contain similar information. A video depicting the threats to seabird colonies, highlighting the importance of the regional seabird fauna and its conservation problems, and describing applicable state and federal laws, would be produced and distributed through tourist

information services, tourist lodging facilities and local school districts. Sea kayak sales and rental companies would be asked to show the video to customers. The video could function as a public service announcement on local television.

Anchored buoys with warning would be placed around key colonies seasonally to establish protection zones and signs would be placed on offshore rocks and sensitive coastal trails.

Public outreach to promote awareness of seabird conservation needs would be accomplished through seasonal presentations to community groups and schools.

Presentations would be developed for U.S. Coast Guard pilots, military pilots and general aviation pilots to promote conformance with Department of Fish and Game Code Sections prohibiting low altitude flights over State Ecological Reserves and increase agency awareness. These presentations would be repeated twice annually for all agencies because of staffing turnovers.

The technical feasibility of video surveillance at key colonies will be explored. Social attraction techniques using decoys and other tools will be considered to promote colony establishment at abandoned rocks.

Wildlife interpretive programs and materials would be developed to promote public awareness and used to provide seabird viewing opportunities at selected coastal vantage points.

Improved surveillance at all colonies would identify unauthorized actions. Coordination between the project staff and DFG wardens would promote more effective enforcement of state and federal regulations.

4. Monitor seabird population size, breeding success, and attendance patterns at colonies and roosts before, during, and after implementation of protective measures to evaluate effectiveness.

5. Develop public viewing areas and education programs about seabirds to increase public appreciation and awareness of these resources.

Seabird Colony Enhancement Project: Detailed Project Breakdown (Optimum Project)

OPTIMAL PROJECT SIZE

CONFIDENTIAL
DO NOT DISCLOSE
*** DRAFT ***

SEABIRD COLONY ENHANCEMENT PROJECT

Colony Disturbance Element

FIELD EQUIPMENT

Zodiac Boat (2) 14 ft.	$7,900.00
Boat Trailers (2)	$1,450.00
Outboard Motors 40hp. (2)	$8,000.00
Questar Spotting Scopes (2)	$5,990.00
Spotting Scopes (3)	$1,050.00
Tripods (3)	$510.00
Binoculars 8X42 (4)	$1,400.00
Mustang Float Coats (4)	$720.00
Observation Blinds (2)	$250.00
Journals/Notebooks (20)	$330.00
24 ft. Boston Whaler w/ Trailer and Electronics	$110,000.00
1 ton Tow Vehicle	$40,000.00
1/2 ton Pickup Truck	$24,000.00
Misc. Equipment	$1,000.00
Subtotal	$202,600.00

PHOTOGRAPHIC EQUIPMENT

Nikon 6000 Camera Bodies (2)	$800.00
24mm-50mm Lenses (2)	$700.00
300mm Lenses (2)	$2,000.00
Camera Protective Cases (2)	$300.00
Film/Development (500 rolls)	$7,500.00
Caramate Slide Projectors (2)	$1,600.00
Subtotal	$12,900.00

SAFETY EQUIPMENT & SITE ACCESS

Boat Ramp – VAFB	$25,000.00
Cellular Phones (3)	$1,200.00
Bendix/King Radios (3)	$1,350.00
Climbing Ropes (3--150mX11mm)	$525.00
Helmets (4)	$600.00
Harnesses (4)	$300.00
Belay Station Equipment (2)	$225.00
Caribiners (20)	$300.00

Locking Caribiners (20)	$400.00
Belay/Rapel Devices (10)	$200.00
nuts/camelots/friends (2 sets)	$1,000.00
Ladders (2)	$1,200.00
Subtotal	$32,300.00

OFFICE EQUIPMENT

Desk top Computer	$4,000.00
Software	$1,000.00
Laser Printer (1)	$2,000.00

OFFICE EQUIPMENT (continued)

Plain Paper Facsimile	$1,500.00
Photocopier	$1,500.00
Furniture (desks, cabinets, etc.)	$3,000.00
Office Supplies (pens, paper, etc.)	$2,500.00
Telephone (purchase and installation costs)	$200.00
Lap top Computers (2)	$6,000.00
Software	$2,000.00
Subtotal	$23,700.00

SIGNS, BUOYS, HARDWARE, ED. MATERIALS

Buoys, anchors, hardware (24)	$36,000.00
Signs 4ft.X 8ft. (8)	$16,000.00
Signs 24in.X 24in. (40) and posts	$4,000.00
Production of a Video	$10,000.00
Pamphlets and fliers	$3,500.00
Subtotal	$69,500.00

OPERATING EXPENSES

Gas/oil (boats and autos)	$5,000.00
Flights-- fix wing @ $275/hr for 20 hrs and helo's @ $750/hr for 8 hrs	$11,500.00
Travel to rocks (per diem 200 biologist days @$100/day)	$20,000.00
Workboat Charter (2/yr) - place anchors	$3,000.00
Agency Admin. Support	$35,000.00
office rent	$11,400.00
equipment maintenance	$7,500.00
Subtotal (annual expense)	$93,400.00

SALARIES/BENEFITS

GS-11 or equivalent (full time) incl. health and benefits		$60,000.00
GS-7 or equivalent (1/2 time) incl. health and benefits (3)		$63,000.00
Subtotal (annual expense)		$123,000.00

Colony Nesting Enhancement Element

SANDPIPER PIER ENHANCEMENT

Construction Costs ($1999 – not incl. ARCO share)		$580,000.00
Maintenance Costs ($1999 for years:2000 to 2003)	$10,000 per year	$35,875.00
Total Cost for Year 1		$1,137,400
Total Cost Years 2 through 5 Includes salaries, operating expenses, and $28,000 for replacement of buoys, signs, educational materials and $10,000 for pier maint. (present value used)		$912,667
Optimal Project Budget: ($1999)		*$2,050,067*

MINIMUM PROJECT SIZE

CONFIDENTIAL
DO NOT DISCLOSE
*** DRAFT ***

SEABIRD COLONY ENHANCEMENT PROJECT

Colony Disturbance Element

FIELD EQUIPMENT

Zodiac Boat 14 ft.	$3,950.00
Boat Trailers	$725.00
Outboard Motors 40hp. (2)	$8,000.00
Questar Spotting Scopes (2)	$5,990.00
Spotting Scopes (3)	$1,050.00
Tripods (3)	$510.00
Binoculars 8X42 (4)	$1,400.00
Mustang Float Coats (4)	$720.00
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Journals/Notebooks (20)	$330.00
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1 ton Tow Vehicle	$40,000.00
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Boat Ramp – VAFB	$25,000.00
Cellular Phones (3)	$1,200.00
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Helmets (4)	$600.00
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Ladders (2)	$1,200.00
Subtotal	$32,300.00

OFFICE EQUIPMENT

Desk top Computer	$3,000.00
Software	$1,000.00
Laser Printer	$2,000.00

OFFICE EQUIPMENT (continued)

CONFIDENTIAL
DO NOT DISCLOSE

Plain Paper Facsimile	$1,500.00
Photocopier	$1,500.00
Furniture (desks, cabinets, etc.)	$3,000.00
Office Supplies (pens, paper, etc.)	$2,500.00
Telephone (purchase and installation costs)	$200.00
Lap top Computers	$3,000.00
Software	$2,000.00
Subtotal	$19,700.00

SIGNS, BUOYS, HARDWARE, ED. MATERIALS

Buoys, anchors, hardware (24)	$36,000.00
Signs 4ft.X 8ft. (8)	$16,000.00
Signs 24in.X 24in. (40) and posts	$4,000.00
Production of a Video	$10,000.00
Pamphlets and fliers	$3,500.00
Subtotal	$69,500.00

OPERATING EXPENSES

Gas/oil (boats and autos)	$5,000.00
Flights-- fix wing @ $275/hr for 20 hrs and helo's @ $750/hr for 8 hrs	$11,500.00
Travel to rocks (per diem 200 biologist days @$100/day)	$20,000.00
Workboat Charter (2/yr) - place anchors	$3,000.00
Agency Admin. Support	$25,000.00
office rent	$11,400.00
equipment maintenance	$7,500.00
Subtotal (annual expense)	$83,400.00

SALARIES/BENEFITS

GS-11 or equivalent (full time) incl. health and benefits		$60,000.00
GS-7 or equivalent (1/2 time) incl. health and benefits (2)		$42,000.00
Subtotal (annual expense)		$102,000.00

Colony Nesting Enhancement Element

SANDPIPER PIER ENHANCEMENT

Construction Costs ($1999)		$200,000.00
Maintenance Costs ($1999 for years:2000 to 2003)	$10,000 per year	$35,875.00
Total Cost for Year 1		$693,725
Total Cost Years 2 through 5 Includes salaries, operating expenses, and $28,000 for replacement of buoys, signs, educational materials and $10,000 for pier maint. (present value used)		$801,474
Minimum Project Budget: ($1999)		*$1,495,199*

6C

rcvd 2/24/13

Individual Volunteer Services Agreement

Name of Volunteer: Robert Burco

Job Description:

Incumbent services as an interpretive advisor and outreach opportunities coordinator to the California Coastal National Monument (CCNM) Manager by assisting with the following activities:

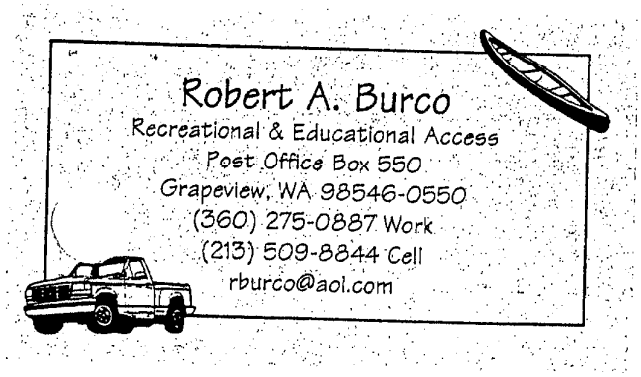
- Identification and planning of potential interpretive opportunities between the various CCNM partners and with other possible partners, funding sources, and resource providers.

- Development and implementation of a variety of interpretive and outreach opportunities that address the goals of the CCNM.

- Development of specific long-term partnerships to leverage resources to address critical joint issues within the CCNM region with federal, state and local agencies, and/or with public and private groups.

- Meet with federal, state and local agencies, businesses, scientists, and environmental and public groups in identifying, developing, and implementing opportunities related to interpretation and outreach of the various coastal and marine resources along the California coast.

- Attend meetings and workshops related to interpretation or outreach issues and opportunities sponsored by other organizations and tracking local, regional, and national opportunities for expanded partnerships, funding, and joint interpretation.



OIKONOS
Ecosystem Knowledge

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PRBO
Conservation Science

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Command Oil Spill Restoration Project

Subject: Response to Command Trustee request for additional information on Año Nuevo Island Seabird Habitat Restoration

20 February 2003

Dear Command Trustees,

Thank you for the opportunity to provide further information regarding the project proposal "Año Nuevo Island Seabird Habitat Restoration". This letter addresses specific information requested by the council.

1. Description and explanation of how the proposed project would specifically meet selection criteria listed in the Command Public Scoping Document.

Project Selection Criteria:

Nexus to injured resources *- Restoration efforts must be directed at projects that restore, rehabilitate, replace, enhance, or acquire the equivalent of the resources and services impacted by the spill.*

Año Nuevo Island lies approximately 1 km offshore of Año Nuevo State Reserve in San Mateo County and supports the largest seabird breeding and roosting populations in the Command spill area. Seven marine bird species regularly use the island refuge for rearing young and over fourteen bird species use the island for stopover and roosting habitat during the non-breeding seasons. The main goal of this restoration project is to revegetate the central marine terrace, the main habitat for burrowing seabirds, with a diversity of native shrub and grass assemblages. We predict this can be accomplished with 3 years of intensive restoration, followed by 4 years of secondary adaptive maintenance and studies to quantify the success of restoration efforts. Restoring the marine terrace habitat on the central portion of Año Nuevo Island (Figure 1) will directly benefit the following seabird resources that were impacted during the Command oil spill: Rhinoceros Auklets, Cassin's Auklets, and Western Gulls. In addition, this project has wide reaching benefits for the entire island ecosystem, including other breeding seabird species vulnerable to injury from oil spills.

Rhinoceros and Cassin's Auklet

No estimate of damage was modeled for Rhinoceros or Cassin's Auklets, however, individuals of both species were likely impacted by the Command oil spill. Rhinoceros and Cassin's Auklets were observed in the spill area during OSPR aerial surveys; although no abundance data was reported (Boyce and Hampton 2002). No auklets were found dead during OSPR/OWCN beach surveys. The effect of oil spills on Rhinoceros Auklets has been studied at numerous locations (Smail et al. 1972, Page et al. 1990, Helm et al. 1997, Nur et al. 1997, Sato 1999, Oka and Masaki 2000) and the species vulnerability and characteristically low rates of deposition on beaches upon death or injury is known. Cassin's Auklet potential for beach deposition after contamination is even less given their smaller size and this species generally does not frequent waters close to shore. The only alcid recovered on beaches during the Command spill was the Common Murre, which is not representative of the species diversity in the area.

Colony studies on Año Nuevo Island document Rhinoceros Auklets in the area in mid September (Thayer/PRBO unpublished data). The number of Rhinoceros Auklets breeding on Año Nuevo Island in 1998 was approximately 175 birds (Figure 2). In 1998, the last monitored Rhinoceros Auklet chicks fledged from burrows between 14 and 21 September, therefore, in addition to adults, hatch-year birds were potentially in the contaminated area. Most years there is evidence of fresh digging by adults on the island as late as September (Hester 1998). This post-breeding digging is suspected to be activity by prospecting adults and/or breeders maintaining territories and pair bonds.

In the fall and winter, the Rhinoceros Auklets in waters off central California are a mixture of birds that reside in the region year round and northern populations that migrate south after the breeding season, although no studies have been conducted to evaluate colony or age-specific migration patterns. In late September and early October 1998, it is likely that individuals from both the resident California population and northern populations were in the spill area between San Francisco and Año Nuevo Island

Cassin's Auklets are declining throughout the California Current region (Veit et al. 1997, Pyle et al. 2001), although a small population colonized Año Nuevo Island in 1995 and has increased annually to 24 breeding birds in 2002 (Thayer/PRBO unpublished data). Cassin's Auklets initiate breeding in most years between March and April, but in 1998 eggs were not laid until mid June, resulting in chick rearing extending into late August at least.

How project will directly replace, enhance, restore the resource?

This project will directly benefit the Rhinoceros and Cassin's Auklet populations on Año Nuevo Island by enhancing and increasing the habitat available for breeding, thereby potentially increasing the number of chicks fledged and reducing mortality of adults and juveniles.

Throughout their range, both species are capable of nesting in rock crevices (e.g. cracks in cliffs, caves, rubble piles) and burrows dug in soil. Suitable crevice habitat on Año Nuevo Island is very limited, and the sites that do exist are mainly occupied by Pigeon Guillemots, which are able to out compete auklets for crevice sites (Wallace et al. 1990). On Año Nuevo Island, the majority of Rhinoceros and Cassin's Auklets nest in burrows dug in the soil around the margins of the central marine terrace (small numbers also nest under the old lighthouse residence on the southeast corner of the island; Figure 1).

When Rhinoceros Auklets began colonizing Año Nuevo Island in the early 1980s, the central marine terrace was dense with vegetation, mainly exotic species (Lewis and Tyler 1987). Heavy use of the island for government facilities for over a century changed the ecological community, including plants. After evaluating the condition of island natural resources, the Año Nuevo State Reserve management plan recommended revegetation to provide additional bird habitat and slow topsoil erosion (Lewis and Tyler 1987). However, no habitat restoration or direct erosion control has occurred to date. By the mid 1990's, the density of vegetation began to thin and be dominated by exotic *Malva* and *Tetragonia* species in areas used by burrowing auklets (Hester 1998).

After the 1998 El Nino, there was a rapid increase in erosion and almost complete disappearance of vegetation in auklet breeding areas (Figure 3). The rapid plant die off is speculated to have been caused by dry summer conditions followed by heavy winter rains that washed away the remaining seed bank. In addition, numbers of roosting Brown Pelicans increased on the island, as is typical in ENSO warm water periods when breeding attempts are abandoned in southern California, and the remaining exotic seed cover was likely not adapted to intense sporadic seasonal trampling. Pinnipeds are often the first to be blamed for the loss of vegetation, as is certainly the case in the northern and southern most portions of the island which are easily accessible to sea lions. However, revegetation feasibility studies conducted by PRBO and pinniped census data from University of California Santa Cruz (UCSC) indicate the central portion of the marine terrace is not used regularly by seals or sea lions (Figure 4). This central portion is the main area for burrowing seabirds and the only area planned for erosion control and planting. In exposed habitat away from buildings and fences, currently, only sparse patches of native salt grass (*Distichlis spicata*; less than one square meter) exist.

The number of Rhinoceros Auklet burrows that collapsed due to soil erosion during the nesting season have increased from 11% in 1997 to 56% in 2001 (Thayer/PRBO unpublished data). Some collapses caused adults and chicks to be trapped underground resulting in death (between 1998 and 2002, 3 adults were found crushed in burrows, 6 chicks were found crushed or injured, 8 chicks disappeared after severe burrow damage, and at least 34 eggs were crushed or abandoned after erosion to burrows). The amount of effort currently expended by researchers repairing and stabilizing collapsing burrows during the breeding season is not sustainable. It is clear that the Rhinoceros Auklet colony will decline due to loss of habitat if action is not taken promptly. We have an opportunity to conserve these populations during a period of natural colonization before declines in breeding numbers are evident. The continued population increase despite degrading habitat can be attributed to increases in the availability and occupancy of artificial nest boxes (Figure 2). The breeding population in natural burrows has not increased since 1996. Unfortunately, no other predator-free habitat exists in the San Mateo region to support the density of burrowing seabirds on Año Nuevo Island if current natural nesting areas become uninhabitable.

Establishing an island marine terrace plant community will improve soil stability, reduce erosion and potentially increase protective cover from predators. This should decrease adult and juvenile mortality due to burrow collapse in areas currently occupied and increase the amount of suitable habitat for additional colony growth. Both outcomes should result in an increased number of chicks fledged from the island. The areas not currently used for nesting in the central portion of the island are eroding rapidly and may not be suitable for burrows in the current degraded condition. Upon establishment of a plant community in these areas, Rhinoceros and Cassin's Auklets may expand and potentially double in size (224 breeding Rhinoceros Auklets and 24 breeding Cassin's Auklets in the central marine terrace region in 2002; Thayer and Sydeman 2002). At-sea surveys suggest nesting habitat may be limited for Rhinoceros Auklets, as the pool of birds in the area offshore during spring is higher than can be accounted for at breeding colonies (Ainley and Spear unpublished data). In northern populations, it has

been shown that local habitat constraints explain most of the spatial distribution of Rhinoceros Auklet colonies (Forbes et al. 2000). This pool of potential breeders may contribute to the continued increase in nest box occupancy despite deteriorating natural habitat.

Survival of adult Rhinoceros Auklets is low on Año Nuevo Island compared with other colonies (Southeast Farallon Island) and other related alcid species (Thayer/PRBO unpublished data). Adult survival is a very important factor in population dynamics of long-lived species such as auklets. Predation by raptors (Peregrine Falcons and owl species) likely plays a role in reduced adult survival, as documented by the high percentage of auklet carcasses recovered each year on the island (up to 10% of the breeding population per year). Vegetation may reduce predation risk by providing visual and physical cover for adults traveling to and from nest sites, and also for chicks venturing outside burrows at night or during fledging (Nelson 1989, Miyazaki 1996). In addition to enhancing productivity and improving survivorship, this project has other benefits to auklets and the whole island ecosystem (discussed further in sections below).

Western Gull

Western Gulls were potentially impacted during the Command spill as evidenced by five carcasses recovered on beach surveys. Data from aerial and boat surveys were not reported with enough detail to evaluate occurrence by gull species (Boyce and Hampton 2002). Western Gulls breed on Año Nuevo Island and other near shore islets and artificial structures (e.g. piers, jetties) in the spill vicinity. After breeding, Western Gulls distribute to roosting areas within range of reliable food, often in near shore areas. Gulls are capable of tolerating higher concentrations of oiling on their feathers than alcids for example. It is likely some birds that encountered oil on beaches or at sea potentially flew out of the area before detection.

How project will directly replace, enhance, restore the resource?

Restoring island vegetation will improve habitat for nesting Western Gulls by providing protected territories and potentially increasing productivity. On Año Nuevo Island, the density of Western Gull nests is higher in vegetated areas (most vegetation is in protected areas near buildings and behind fences). In areas with visual cover and a diversity of structure, it is presumed there are fewer aggressive interactions among conspecific neighbors and chicks have more places to hide, resulting in increased reproductive performance in some studies (Brown 1967, Davis and Dunn 1976). The enhancement of gull populations is not often viewed as a desired outcome. Regardless of perceptions, Western Gulls are endemic to the California Current, population levels have stabilized in the last decade (at least in part due to better waste management region-wide and multiple years of reduced prey availability; Warzybok et al. 2002), and individuals were injured during the spill.

Improved gull habitat translates into a reduced need for aggressive territoriality that results in death of near-fledging auklet chicks and adult Cassin's Auklets entering gull territories on their excursions outside burrows and transits to and from sea. In addition, certainly aggressive encounters with adults during mate bonding, burrow maintenance and chick-feeding would be reduced. Given the current condition of a denuded marine terrace, almost every board and/or piece of debris on the island attracts auklets and nesting gulls by providing some structure to dig under for auklets and protection from wind and neighbors for gulls. Often gulls build nests in auklet tunnel entrances due to the lack of any other habitat structure. On Año Nuevo Island, we have witnessed close to 80% of Rhinoceros Auklets arriving with bill-loads full of fish being chased and/or kleptoparasitized by gulls on bright evenings (Hester pers. obs.) On other islands, differences in kleptoparasitism rates, auklet chick growth, timing of

breeding, and attendance patterns have been found between vegetated and denuded plots demonstrating that ground-nesting gulls and burrowing auklets can coexist with limited negative interactions in vegetated habitats (Watanuki 1990, Wilson 1993, Miyazaki 1996, Finney et al. 2001).

Feasibility *- Based on past experience or studies, the restoration projects must be technically and procedurally sound.*

Islands pose different challenges for habitat restoration than most coastal areas near highways. In addition to logistic difficulties with access and transport, the weather and ocean elements are more variable and extreme. The plant assemblage on the island prior to the building of the lighthouse facility probably resembled that on windward Año Nuevo Point, to which it was connected by land above high tide at least during the 18th century (Le Boeuf and Kaza 1981). A natural progression towards more salt, wind and guano tolerant species likely occurred as the island became more exposed and separated from the mainland point. Among coastal restoration experts, there is acknowledgement that a period of trial and error is needed for success in any habitat. The small size of the area to be restored (0.94 acres) increases the feasibility of revegetation, although it also complicates the approach. There is little space to experiment and little space for the dynamics of plant succession and distribution to occur. Much of the habitat is near the margins where exposure to wind and salt is high (and where auklets prefer). Therefore, many factors (ground-nesting gulls, roosting pelicans, variable rainfall, heavy winds) lead to the recommendation that an aggressive approach with grown plants in dense concentrations is likely the best way to succeed at establishing a plant community on this portion of the island.

Actions taken to ensure the restoration plan is technically and procedurally sound include collaboration with experts, conducting feasibility studies and gathering data on island use by wildlife, testing plant species and erosion control techniques on the island, and assembling a restoration review committee.

In addition to Thayer, Sydeman and Hester who have over 10 years of experience conducting seabird population studies on Año Nuevo Island, collaborators and other experts who have contributed to the development of this project and will be involved throughout the process include:

Moss Landing Marine Laboratories, Coastal Restoration Group
John Oliver - Director; Peter Slattery and Kristy Uschyk - Research Associates

Go Natives Nursery
Dave Sands - Coastal Restoration and former Año Docent

University of California, Natural Reserve System
Pat Morris - Assistant Manager, Año UC Reserve, pinniped researcher for over 25 years
Steve Davenport - Manager, Año UC Reserve

University of California, Santa Cruz
Breck Tyler - Began seabird monitoring on Año and Management Plan author
Michael Weise - Ph.D. Candidate in Marine Science

Año Nuevo State Reserve
Gary Strachan - Supervising Ranger

State of California, Department of Parks and Recreation
Joanne Kerbavaz - Botanist and Lead Resource Ecologist for Bay Area District
Victoria Seidman - Assistant Resource Ecologist

PRBO, Conservation Science
Sue Abbott - Education Specialist
David Gardner - Seabird researcher

Oikonos
Hannah Nevins - Seabird/Marine ecosystem expertise
Carol Keiper - GIS spatial mapping

The timing and methods of planting will be crucial to the success of this project. The main factors affecting the success of plant survival during initial stages include the degree of trampling and plant-pulling by ground-nesting and roosting seabirds and the harsh and variable environmental conditions. Spring and summer is an active period for nest building gulls and rainfall is minimal. During winter, gull numbers decline significantly, Brown Pelicans roost in the area sporadically, cormorants roost in consistent low numbers, and despite the peak in total sea lion attendance, the restoration area is not occupied by pinnipeds (Figure 4). The preferred roosting sites for these species are on the rocky margins, islets, and beaches. Therefore, we predict the appropriate timing for planting is in late fall, after the gull nesting season, prior to peak attendance by pelicans, and near the start of annual rains.

Initial testing has begun for appropriate plant species and erosion control methods taking into account the variable winds, salt influence, resiliency to periodic trampling, growth season, water requirements, and logistical constraints of transportation. Two plots were installed in June 2002 and eight in November 2002. From our most recent island visit in January 2003 we have learned that 1) the burlap ground cover works well to retain topsoil and is brittle enough to allow auklets to burrow into (two complete burrows and two scrapes have been dug in the test plots), 2) all *Distichlis spicata*, native salt grass, plants installed in November 2002 survived the winter and are growing, mostly spreading horizontally, and 3) no growth from the native seeds was visible; it appears most seed blew away before sprouting. These results support the opinion that conditions are too windy and dynamic for seed alone to take hold in bare soil while larger plants can survive if they take root before winter storms begin. Based on the success of our test plots thus far, we predict significant habitat improvements can be accomplished with 3 years of intensive planting and erosion control, followed by 4 years of secondary studies and adaptive upkeep.

Further action will involve the establishment of a restoration review committee with a panel of botanists, restoration ecologists, marine ornithologists, and managers.

Given the lack of restoration efforts such as this on offshore islands, it is our hope that knowledge gained during this project can be applied to other islands that have degraded habitat from human use and/or introduced species and are in need of restoration to conserve wildlife populations.

No Duplicate or Replacement Funding *- The Trustees will not fund projects that are already going to be funded or accomplished by other means or should be funded by more appropriate sources.*

No direct funding exists for restoration action (planting and erosion control) or studies to directly evaluate the effects of habitat improvements to impacted species. Some inkind support has already been provided for feasibility studies and plan development. In addition, limited funding exists for mutually beneficial seabird demographic studies to augment the ability to determine success of restoration efforts (see Cost Effectiveness and Project Cost sections below).

Legality *- The projects must comply with all applicable laws.*

Oikonos, PRBO, and all collaborating organizations doing field work on Año Nuevo Island have research permits issued by the State of California Department of Parks and Recreation, Bay Area District. This project will not involve the take of any wildlife or the noncompliance with any laws.

Likelihood of Success *- Projects will be evaluated by considering the relationship of expected project costs to the expected return of resources and resource services. Performance criteria of projects will have to be clear and measurable.*

Success of this project will be evaluated by determining the following parameters:

1) proportion of occupied auklet burrows that collapse (and resulting injury) will be measured annually and compared with proportions from 1993 to present,
2) auklet burrows and gull nests will be mapped to determine distribution and density of breeding birds relative to habitat characteristics, and
3) proportion of auklet burrows occupied by breeding pairs will be determined with a burrow camera to quantify breeding population size and prospecting activity.

Other parameters measured to document habitat changes and wildlife response will include:

1) density and distribution of plant species,
2) changes in top-soil measured in standardized locations,
3) the occurrence of predation on auklets by owls and peregrines, and
4) auklet chick growth rates in relation to proximity to gulls and habitat structures.

Cost Effectiveness *- The projects will be evaluated by considering the relationship of expected project costs to the expected resource/service benefits from each project alternative.*

There are many significant factors that make this an ideal time to proceed with restoration efforts. Project costs will be reduced by inkind support from Año Nuevo State Reserve, PRBO Conservation Science, UC Santa Cruz, and the UC Natural Reserve System that logistically supports mutually beneficial work on the island ecosystem (see matching contributions below). The proposed project funding from Command is for direct restoration actions and data collection to determine the success of the project. Costs for small boat operations and storage/research facilities are provided by these other sources with this project only augmenting gas, some safety equipment, and water catchment improvements for the restoration.

Substantial inkind donations from Go Natives Nursery will reduce the cost of plan development and the time, space and materials needed to propagate and grow appropriate native plants in the needed quantity. Go Natives currently has gallon-size native plants from the "San Mateo County coastside region" for large-scale coastal restoration. The value of this cannot be overemphasized considering that dense installation of grown plants is likely the key to establishing a plant community on Año Nuevo Island (as discussed above). The costs for plants in the proposed budget ($4.00 gallon) does not include local seed collection, propagation, or labor - these costs have been donated. In addition, the development of this project has depended on Go Natives donations to test plant resiliency to harsh island conditions and

Watanuki, Yutaka. 1990. Daily activity pattern of Rhinoceros Auklets and kleptoparasitism by Black-tailed Gulls. Ornis Scandinavica 21(1): 28-36.

Wilson, Ulrich W. 1993. Rhinoceros Auklet burrow use, breeding success, and chick growth: gull-free vs. gull-occupied habitat. Journal of Field Ornithology, 64(2): 256-261.

Long-term conservation of the seabird populations and island biodiversity in general is the overarching goal. This project involves maintenance and upkeep during initial establishment, after which time natural processes and dynamics of community succession, erosion, and plant distribution will occur without human manipulation.

What we know is that since 1982 Rhinoceros Auklets began naturally colonizing Año Nuevo Island (LeValley and Evens 982) and have continued to increase in next boxes but are reaching the limit of suitable natural habitat and negative impacts of rapidly degrading soil quality are evident. We also know that the island ecosystem has been significantly altered by human use and resident seabirds have been further affected by oil contamination during the Command spill and others.

Since 1986, the Rhinoceros Auklet colony has been enhanced and protected through the use of nest boxes and changes in island use practices (Thayer et al. 2000). Nest boxes serve as an invaluable monitoring tool and aid in enhancing nesting habitat immediately, however, boxes turn into traps if not monitored frequently and maintained, and are therefore best to augment population studies and conservation, not be the sole means by which a species exists in an area. Improving the natural habitat for burrow nesting species will hopefully give these populations more space to expand and shrink as they will through time. Importantly, long-term benefits reach beyond San Mateo County as this Rhinoceros Auklet colony may contribute to the expansion of the species breeding range in the Channel Islands (McChesney et al. 1995), as immigrants likely facilitate southward colonization.

2. Estimated project costs and a description of the financial and regulatory feasibility of the project.

The estimated total 7-year budget for this project is $1,199,534. Annual budgets itemized below vary depending on extent of restoration activities. Year 1 costs are highest due to initial expenses such as water catchment improvements, planting and experimentation, and methods development and review process. Years 2 and 3 will support intensive planting and erosion control and studies to document wildlife response. We anticipate ending intensive restoration work after three years, therefore, costs for years 4 through 7 are reduced and include adaptive efforts to enhance plant community establishment and studies to determine success of the project.

Year 1 (2003)
$281,418 estimated first year budget

Years 2-3 (2004-2005)
$237,748 estimated annual budget

Years 4-7 (2006-2009)
$110,655 estimated annual budget

Salary and expenses are itemized in the draft budget submitted with this document.

Matching Contributions for restoration and mutually beneficial seabird studies:
Year 1 - 2003
Total Matching Contribution secured = $ 52,000
Total Matching Contribution pending = $ 48,000

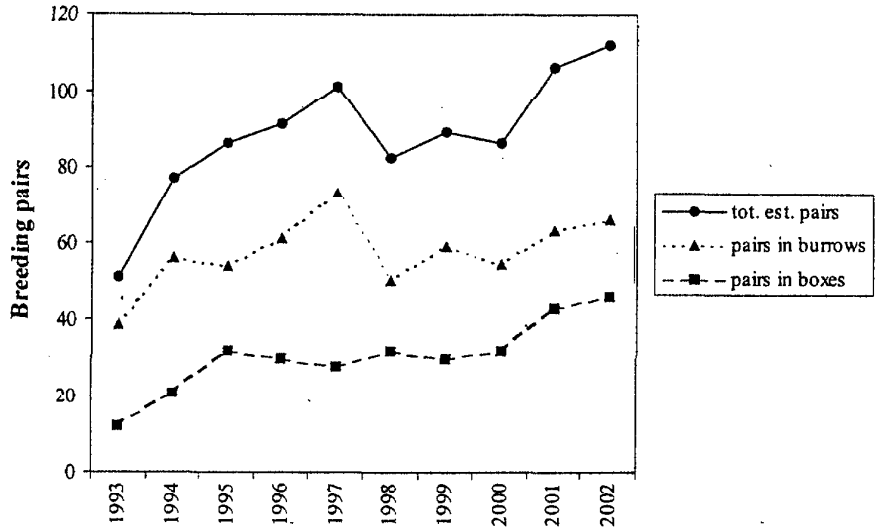

Figure 2. Breeding pairs of Rhinoceros Auklet on Año Nuevo Island from 1993 to 2002 (from Thayer et al. 2002).

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Le Boeuf, B.L. and S. Kaza. 1981. *The Natural History of Año Nuevo*. The Boxwood Press, Pacific Grove, CA.

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Oracle Corporation
National Fish and Wildlife Foundation
Monterey Bay National Marine Sanctuary SIMoN
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State of California Department of Parks and Recreation
Go Native Nursery
Peninsula Community Foundation
University of California, Santa Cruz
Moss Landing Marine Laboratories - Coastal Habitat Restoration Group

Continued sources of matching contributions secured through 2009:
Go Natives
University of California Santa Cruz
State of California Department of Parks and Recreation

3. Contact information identifying personnel who can answer questions about your proposed projects.

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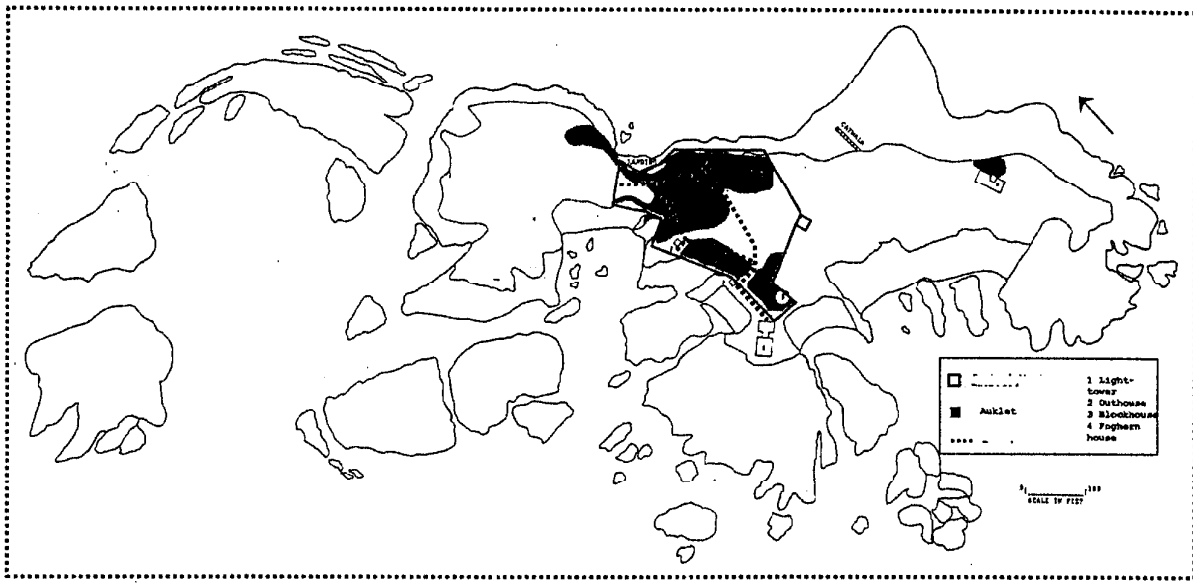

Figure 1. Map of Año Nuevo Island (137° 06.30' N, 122° 20.09' W) showing Rhinoceros and Cassin's Auklet nesting/burrowing areas (grey shading) and the central marine terrace area (outlined in green) proposed for habitat restoration.

erosion control methods on the island and assist with developing restoration plans prior to receiving any funding.

An extensive volunteer network already established will reduce costs when more people are required (e.g. installing plants, collecting seed). Although, due to the high sensitivity of wildlife on this refuge and dangerous transport across the channel, only experienced volunteers in limited numbers will be utilized regularly. Based on ten years of collective experience managing research on Año Nuevo Island, we have learned that the effort expended on coordinating volunteers and assuring their safety is a position in itself. Therefore, instead of hiring a volunteer coordinator, this project will employ an intern that will become experienced in working on the island and reduce time needed to train new volunteers every trip. Transportation costs to the island are further reduced by trip coordination with collaborators from UCSC who also regularly conduct studies on the island; we attempt to combine resources and plan trips to limit the number of "landings" on the island.

Long-term cost effectiveness will hopefully be the result for agencies responsible for conserving marine wildlife on the island. Once the plant community is established, it reduces energy required to protect burrowing auklets and other wildlife.

Multiple resource benefits *- Benefits can be increased if proposed projects benefit more than one natural resource or resource service.*

Restoring the plant community on a portion of Año Nuevo Island has numerous benefits beyond stabilizing the soil for burrowing seabirds injured by the Command spill. Vegetation may also provide visual cover and increased habitat diversity for other island species, including Pigeon Guillemots, Brandt's and Pelagic Cormorants, Brown Pelicans, Black Oystercatchers, Ashy and Fork-tailed Storm-petrels, Peregrine Falcon, Barn Owls, Herrmann's Gull and numerous other migratory marine bird species. In particular, Brandt's Cormorants, which were injured in the Command spill, will likely benefit from this project as vegetation will provide more suitable nesting space protected from disturbance and a source of nesting material (approximately 320 breeders have colonized an area on the central marine terrace near large cement blocks).

The restored area may also provide songbirds, shorebirds, and other species nesting and migratory stop-over habitat free from exotic predators. White-crowned Sparrows and Killdeer (Le Boeuf and Kaza 1981) once bred on the island before vegetation disappeared. Other benefits to this island refuge not mentioned above include increasing habitat for amphibians, pollinators and other terrestrial invertebrates that once inhabited the island. The evidence of past use of the island by indigenous cultures has literally blown away and soil stabilization will enable the investigation of remaining artifacts (Mark Hylkema, State of California Cultural Resources Manager, pers. comm.). There will also be numerous opportunities to educate the public about the consequences of oil transport and raise awareness of seabird sensitivity by collaborating with programs already in place at Monterey Bay and Gulf of the Farallones National Marine Sanctuaries, Año Nuevo Docent Program, PRBO Education Program, and others.

Duration of benefits *- Long-term benefits are the objective of the restoration projects, and the Trustees will evaluate project alternatives according to their expected duration of benefits.*

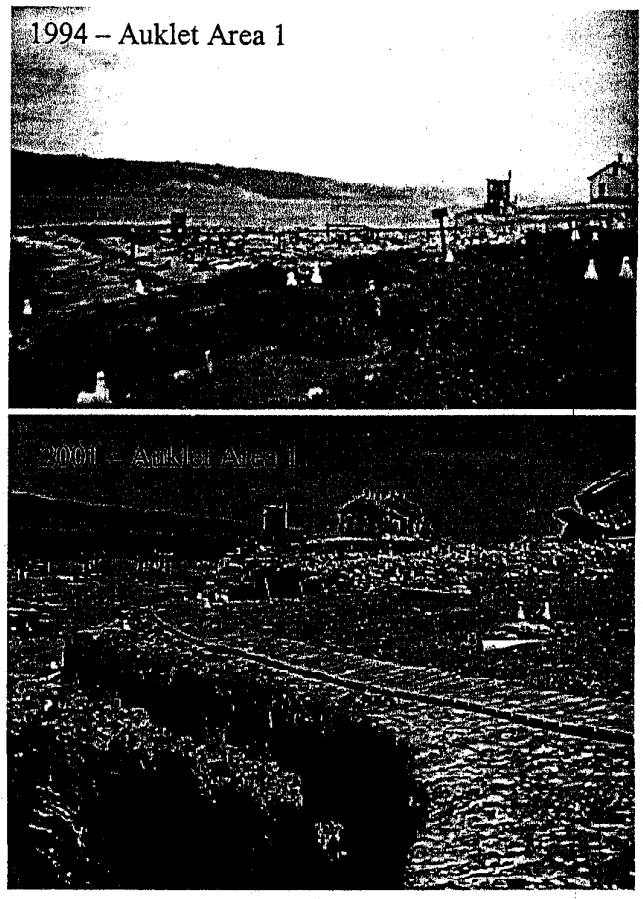

Figure 3. Photos showing the change in vegetation cover from 1994 (top) to 2001 (bottom) in auklet nesting area 1 on Año Nuevo Island.