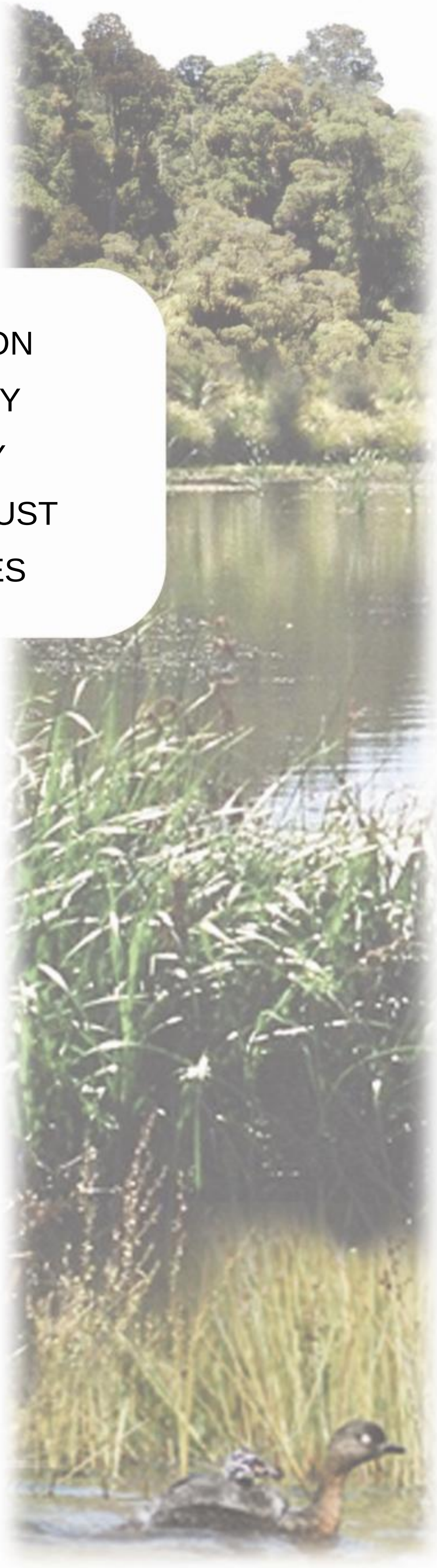
OPTIONS FOR CALCULATION AND USE OF BIODIVERSITY CREDITS GENERATED BY YELLOW-EYED PENGUIN TRUST CONSERVATION ACTIVITIES



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1. INTRODUCTION

Biodiversity offsetting in New Zealand has, to date, been applied only in cases where adverse effects are certain, or have taken place, and the concomitant conservation activities that would address these impacts are envisaged, but have not yet taken place. There is potential for these parameters to be reversed, such that the conservation activities of a conservation provider might gain credits for these activities, which can subsequently be purchased by a developer, or any individual or agency causing an adverse impact, to offset the adverse effects of their development. This could provide a potentially significant source of funding for conservation activities undertaken by individuals, agencies, corporates, and trusts.

A key requirement for the operation of a biodiversity credit market is a transparent and robust method for calculating the value of conservation activities and impacts. The Department of Conservation has a Biodiversity Offsets Programme that is currently investigating these and other biodiversity offsetting issues. The project covered by this report explores biodiversity offsetting from a conservation provider's perspective, using the Yellow-Eyed Penguin Trust (YEPT) as a case study provider. The objectives of the project are to compare and contrast a range of biodiversity offsetting measures and models, identify the features of rigorous offsetting from a conservation provider's perspective, and provide comment on a business model for a conservation provider, based on potential sale of biodiversity credits.

This report compares and contrasts the utility of different counts and measures, and accounting models that could be used to assess the value of biodiversity credits generated by YEPT, and identifies issues and constraints relating to the data required to run these models. Concomitant development impacts that biodiversity credits generated by YEPT could address are identified, and exchange restrictions are specified to ensure that any exchanges are carried out on a like-for-like basis. We then discuss the business case for marketing the biodiversity credits and present a business model outlining how YEPT could get the credits to market within current market and regulatory frameworks.

2. YELLOW-EYED PENGUIN TRUST CONSERVATION ACTIVITIES

The Yellow-Eyed Penguin Trust (YEPT) undertakes a range of conservation activities focused on the maintenance of hoiho (yellow-eyed penguin; *Megadyptes antipodes*) populations. These activities include the purchase of coastal reserves, restoration of indigenous coastal vegetation, and pest control to benefit hoiho populations. The Trust is based in Dunedin and its activities are centred on coastal habitats in Otago and Southland. The Trust manages four coastal reserves, scattered from North Otago to the Catlins in Southland. The northern-most reserve is Tavora (40 ha) in North Otago, with Okia (231 ha) and Otapahi (16 ha) on the Otago Peninsula, and Long Point (70 ha, incorporating a breeding population of hoiho at Cosgrove Creek) in the Catlins.

As part of their activities, YEPT have collected information for the last five years on the numbers of hoiho breeding pairs, hatching rates, and fledging rates at sites under active management by YEPT. Penguin breeding sites have also been mapped and quantified.

YEPT have also undertaken significant indigenous vegetation restoration projects in coastal habitats, including indigenous revegetation of sand dunes, coastal hills, and the margins of coastal streams.

YEPT do not undertake ecotourism activities, hence there are no issues in separating activities undertaken for tourism purposes (for example amenity plantings) from those undertaken for conservation purposes. YEPT activities are directed solely towards biodiversity outcomes.

PART 1:

COUNTS, MEASURES, AND BIODIVERSITY CREDIT ACCOUNTING MODELS

3. METHODS

This project involved collection of ecological data, application of that data in the form of different biodiversity offsetting currencies, and assessment of the relative merits of different data metrics and offsetting currencies for use in generating biodiversity credits. The data and currencies used in this project are stored in an excel file which is supplied separately. A further stage in the project, asssessment of a business model under which biodiversity credits could be marketed, was completed by a different contractor (Millar 2011).

4. CURRENCIES USED FOR THIS PROJECT

Currencies for biodiversity offsetting fall into two types: site-level currencies, and context-dependent currencies (Stephens & von Hase 2010). Site-level currencies are restricted to like-for-like approaches because they do not take account of wider contextual information. All of the currencies used in the project were site-level currencies. Context-dependent currencies were unable to be used due to the lack of systematic conservation planning information.

4.1 Area

As well as being a biodiversity measure, area (hectares) can be used as a simple currency as a proxy for the biodiversity of interest within an area, but only when the amount of biodiversity is proportional to area. Area of coastal habitat protected by YEPT could not be used as proxy for the amount of penguin breeding habitat protected or actively managed by YEPT, because the number of hoiho nests at a site was not proportional to site area. However, hoiho breeding areas within each reserve were able to be estimated. Area of land protected and enhanced by YEPT was used as a more general currency, to cover all conservation activities that YEPT undertakes within its sites.

4.2 Condition-area

Condition-area models used measures of condition multiplied by area (hectares) to create proxy currencies. These are then raised to the power of the species-area exponent z, which varies between 0.15 for relatively homogenous continental ecosystems, to 0.4 for strongly-patterned small island systems to reflect the rate at which biodiversity accumulates with increasing area (Stephens & von Hase 2010). A value of 0.35 was used for the condition-area currencies in this analysis, to reflect the strongly patterned New Zealand landscape.

4.2.1 Habitat hectares

The habitat hectares (HH) model uses attributes of indigenous tier cover (the cover of all indigenous species across each of the ground, understorey, and canopy tiers) in forest and shrubland vegetation, and several metrics of indigenous floristic dominance, including indigenous species richness and proportion of indigenous species at the plot level and across all plots within a type. The average condition of these surrogate attributes was multiplied by site area. Surrogate attributes of biodiversity condition require scaling so that condition accumulates evenly across the full range of condition-area values. In the HH analyses, condition was scaled to the power of 0.3.

4.2.2 Condition-hectares

Condition-area models incorporating direct estimation of attributes were also used. In these models, direct estimates of biodiversity condition were made by assessing cover, stem diameter, and sapling counts in vegetation, and counts of hoiho nests and calculation of fledging rates for hoiho. The use of actual abundance information, expressed as a proportion of the benchmark abundance, obviated the need for scaling of condition.

4.2.3 Iconic species

Iconic species models are a type of condition-area model in which the attributes relate to a single, focal, species. For the YEPT project, hoiho were an obvious candidate for this approach. The value of an iconic species approach is that it may attract more interest from potential purchasers of biodiversity credits, particularly where an iconic species can be aligned with the purchaser's brand.

The attributes chosen for inclusion in the iconic species (hoiho) condition-area model were determined from analysis of published papers and YEPT data. Number of breeding pairs was included as an attribute as it is the most commonly-used measure of hoiho population size, but it is the result of a complex interplay of factors which includes site-specific management actions such as trapping and habitat management. Analysis of YEPT data indicated that the number of breeding pairs was independent from the number of fledglings produced per nest, which was therefore used as an additional attribute. Fledglings per nest is often reported as an indication of the success of a particular site in a particular season. The measure is also influenced by many factors, including site-specific management actions. Both measures were included in the model to give a fuller picture of the 'condition' of hoiho populations at different locations.

4.3 Susceptibility to biodiversity loss

Susceptibility to biodiversity loss (SBL) is a context-dependent currency based on a continuous measure of the threat status of a species or vegetation type. This measure can be constructed using historic and current distribution and abundance information, and the trends in these factors (Stephens & von Hase 2010). It is likely that YEPT and Otago Conservancy of the Department of Conservation hold sufficient data on hoiho distribution and abundance to allow an SBL model to be run for this species, but this information was unable to be accessed within the time frame of this project.

4.4 Benchmark determination

Condition-area models require assessment of a benchmark state, ideally at a site with very high condition, for example the most intact example of the relevant type within an ecological district or other relevant spatial framework. In the case of the YEPT project, benchmarks were created partly on the basis of vegetation plot information from higher quality vegetation, and partly by estimating notional condition values.

5. COUNTS AND MEASURES USED FOR THIS PROJECT

Choice of counts and measures is important when calculating potential biodiversity gains and losses, because they vary in terms of accuracy and information content. Counts and measures that are appropriate for some currencies may have low utility or be inappropriate for use in others. A range of counts and measures was contrasted and evaluated as part of this project. This was achieved by undertaking a range of counts and measures within the same plots, and comparing their utility in biodiversity offsetting models with respect to transparency, accountability, and ability to adequately capture biodiversity values. The counts and measures used are briefly described below.

5.1 Area

Area is an important component of many currencies, and was used to quantify the extent of vegetation/habitat types as part of condition-area currencies, and as a currency itself with respect to hoiho breeding habitat, and to quantify the amount of coastal land and habitats protected by YEPT. Busch and Cullen (2008) calculated the area of each South Island nesting site which gave a total hoiho South Island breeding area of 350 ha.

5.2 Habitats assessed

Most of the vegetation sampling was undertaken at YEPT's Okia Reserve on the Otago Peninsula. A trip to the Trust's Tavora site was also undertaken to sample indigenous foredune vegetation that had been restored by the Trust, as foredune revegetation was extensive at this site. Extensive riparian and coastal forest restoration plantings at Tavora were viewed but not sampled due to limitations of time. They had a similar character to those at Okia, but some differences in species composition.

5.3 Distribution of vegetation plots

Four vegetation plots were located in foredune vegetation, two in rear-dune vegetation, three in coastal forest restoration sites, two in protected existing coastal forest, and two in adjacent grazed and unprotected coastal forest. This sampling was probably sufficient for foredune vegetation, which did not vary greatly in composition, but is very likely to have been insufficient to encompass the variation seen in stands of existing coastal forest. For these reasons, the condition values for existing forest would likely change if further sampling within this vegetation type was undertaken.

5.4 Abundance

5.4.1 Vegetation cover

Visual cover estimates are subject to observer bias, but they are relatively quick and easy to use in the field, and are widely used by vegetation ecologists. For these reasons, cover was an important measure to assess. Cover was estimated at both the level of individual species, and at the level of vegetation tiers where more than one tier was present. Cover was estimated in 10 m × 10 m plots in forest, shrubland, and sand dune habitats.

5.4.2 Stem diameter

In coastal forest vegetation where three-dimensional structure is an important component of the biodiversity value of a habitat, the stem diameters of all woody individuals more than 2 m tall was measured to provide quantitative and objectively measured abundance data. Stem diameters are relatively quick to measure in the field, except in cases where there is a very high density of stems. Stem diameters for species >2 m tall were measured in 10 m × 10 m plots in coastal forest vegetation and on coastal slope and rear dune indigenous restoration sites, but not on foredune habitats because indigenous woody vegetation is absent from this habitat. Stem diameters were summarised into mean basal area per hectare, for all woody species with at least one individual greater than 2 m in height.

5.4.3 Counts of individuals or features

As YEPT conservation activities focus on hoiho, and hoiho is potentially subject to species-level impacts, species-level measures such as numbers of individuals, breeding pairs, and/or successfully fledged chicks per nest were potentially available for calculation of biodiversity credits. In practice, while a number of hoiho attributes were amenable to counting, trends in many of these attributes were difficult to interpret, and only two useful hoiho attributes were found. These were the number of breeding pairs (i.e. nests) at a site, and the number of fledglings per nest. While these and other hoiho attributes fluctuate from year to year, positive trends in the number of breeding pairs and fledglings per nest were interpretable as having occurred as a result of YEPT management. Data on breeding pairs and fledglings per nest were treated as separate attributes for each of the Trust's Okia, Otapahi, and Cosgrove Creek sites. Hoiho breeding data from the Tavora site was not used due to the very low number of hoiho currently breeding at the site, following dog attacks on adult birds prior to and soon after the Trust taking over management of the site.

Counts were also used in a condition-area model where the number of individuals of indigenous woody species <2 m tall were counted in each 10 × 10 m forest plot. These counts were used to define the condition of species attributes in the understorey tier.

6. WEIGHTING OF ATTRIBUTES IN CONDITION-AREA MODELS

Current condition-area models for biodiversity offsetting in New Zealand generally give the same weight to all attributes in the model. This may not be equitable given that it is very likely that some attributes will be more important than others. National priorities and threat classifications provide a basis for assigning weights to attributes. For example, indigenous vegetation growing on sand dunes is a national priority for the protection of indigenous biodiversity, while hoiho and several of the foredune plant species planted by YEPT have national threat rankings (Table 1).

Table 1: National priorities and species classifications relevant to weighting of attributes available to the Yellow-Eyed Penguin Trust (YEPT) for use in biodiversity currencies.

Feature/Species	National Priority	Threatened Status	At Risk Status	Indicative Weighting
Hoiho (*Megadyptes antipodes*)		Nationally Vulnerable		3
Indigenous vegetation on sand dunes	Yes			3
Pingao (*Ficinia spiralis*)			Relict	2
Euphorbia glauca			Declining	2
Cook's scurvy grass (*Lepidium oleraceum*)		Nationally Vulnerable		3
Sand tussock (*Poa billardieri*)			Declining	2
All other attributes				1

Applying the weightings above would give foredune vegetation restoration activities considerable importance, because not only the vegetation, but also the species within it attract more weight. Using the above scheme, the attributes in a species-based foredune vegetation condition-area model would give the foredune vegetation a weighting 12 times greater than if all attributes were given the same weight. It is important to note that the weightings assigned in Table 1 are based on the presence alone of the attribute, which may not be defensible. To be weighted more highly, the attribute may need to exceed a threshold of abundance, or extent. This report does not attempt to define such thresholds.

A good reason for giving more weighting to important attributes is that, in condition-area and habitat-hectares models, the attributes are treated as interchangeable, thus improvement in the condition of one attribute can be traded off against another. Giving more weight to important attributes will lessen the effect of an increase in condition of a less important attribute substituting for a decrease in condition of a more important attribute.

7. INTEGRATION OF TIME INTO CREDIT CALCULATION

YEPT conservation activities are associated with past actions and outcomes, so discount rates for default risk and time preference were not required. Improvement in biodiversity condition due to YEPT conservation activities was assessed for each condition attribute by estimating condition levels at the baseline (identified as the point in time when YEPT began managing the conservation values) and at the date for which the most current information on attributes was available (2010 for hoiho breeding, 2011 for vegetation attributes).

Baseline information was available on the pre-existing vegetation at the Trust's restoration sites and on the dates at which planting was implemented. This information was compiled and used in conjunction with current assessments of condition at these restoration sites to quantify the accumulation of biodiversity credits over time. For the YEPT vegetation restoration projects, initial condition was assumed to be close to zero for restoration sites in pasture. For sites on sand dunes, some allowance was made for the presence of indigenous species at the baseline date. Changes in the condition of existing areas of coastal forest protected by YEPT were assessed by sampling of adjacent unfenced forest subject to grazing by stock.

The baseline for the hoiho attributes was assessed as the condition of those attributes at the earliest monitoring point available within the timeframe of YEPT management.

8. EVALUATION OF DIFFERENT CURRENCIES AND METRICS

Conservation providers such as YEPT are likely to favour robust and transparent currencies and metrics. Currencies and metrics (counts and measures) were assessed for their ability to capture the biodiversity features that YEPT could potentially extract value from in terms of biodiversity credits. The evaluation also compared potential currencies and metrics in terms of their ability to ensure that like-for-like transactions are made, and the need for exchange restrictions to be put in place for currencies and metrics that perform poorly in this respect.

8.1 Spreadsheet-based analysis

Spreadsheet analyses were made using the currencies and metrics described in Table 2. As described above, the excel file containing the data and currencies is supplied separately.

Table 2: Summary of spreadsheet currencies, attributes, and metrics.

Currencies	Cover Estimates	Basal Area Measurement	Counts	Surrogates	Habitats
Area	-	-	-	-	-
Habitat hectares	Vegetation tiers			Indigenous dominance	Coastal forest Rear dunes Fore dunes
Condition-hectares	Species cover	Trees >2 m	Trees and shrubs 0.3-2 m; bird presence	-	Coastal forest Rear dunes Fore dunes
Iconic species	-	-	Hoiho nests and fledglings per nest	-	-

8.2 Comparison of currencies

8.2.1 Area

The Yellow-eyed Penguin Trust has implemented a substantial number of conservation activities at its sites. These are many and varied, and some (for example, banding host trees to protect indigenous mistletoes from possum browse, and pest control to benefit hoiho) were not included as attributes in the biodiversity currencies assessed in this project because of insufficient time or information. YEPT conservation activities are also resulting in important biodiversity outcomes that are difficult to account for in biodiversity currencies. For example, at the Tavora site in North Otago, YEPT activities are progressively restoring indigenous vegetation to areas of foredune, rear dune, a coastal lagoon, stream margins, and coastal slopes. There are no other sites in North Otago where an indigenous sequence between these habitats currently exists. YEPT's activities in restoring ecological connections between these habitats are therefore important, but gradients and connectivity are not easily incorporated into biodiversity currencies.

For these reasons, area of protected land alone would be a defensible currency for use in generating a biodiversity credit for the Trust. Currently, the Trust's four reserves comprise some 357 ha of coastal land. Purchasers of the conservation credits generated from an area currency would need to be satisfied that the Trust was undertaking progressive and ongoing conservation activities within their reserves. This assurance is assisted by management and planting plans being available for each of YEPT's reserves, monitoring and planting records, and its reserves generally being open to public access and thus assessment of areas under active restoration. In recent years the Trust has planted approximately 4-5,000 plants annually across its four reserves.

Within its protected reserves, the area of hoiho breeding habitat maintained by YEPT is currently approximately 18 ha, which is approximately 5% of the total of 350 ha of current hoiho breeding habitat in the South Island (Busch & Cullen 2008). The area of breeding habitat may well increase within YEPT reserves in future, as coastal vegetation restoration activities improve the extent of hoiho breeding habitat. This could provide an additional attribute for the iconic species model, and area of hoiho breeding habitat could also be used as a currency in itself.

To ensure like-for-like exchanges, the benchmark(s) for the impacted coastal land would have to be the same as that used for relevant attributes on YEPT sites, and the condition of the impacted attributes would have to be similar or worse than at the sites managed by YEPT; for example having modified habitats that do not support hoiho breeding populations.

8.2.2 Condition-hectares

The condition-hectares currency populated by species-level attributes is an attractive option for generating biodiversity credits. One of the main benefits to YEPT is that the attributes of the model are explicit and transparent. The benchmarks used in these models effectively define restoration outcomes and are thus suitable for peer review by stakeholders familiar with local vegetation patterns. The utility of the condition-hectares model is further improved if objective metrics are used to define the condition of each attribute. Stem diameter and sapling counts, as used in one of the condition-area currencies, are ecologically-informative, objective measures than can be used in woody vegetation. These measures proved practical and efficient during sampling of woody vegetation for this project. Stem density distribution and tree basal area also provide indicators of successional stage, and thus can be used to forecast or predict the trajectory of the vegetation and its structure over time.

8.2.3 Habitat-hectares

The habitat-hectares model used attributes of indigenous vegetation cover within tiers, indigenous species richness, and proportion of indigenous species. Hoiho breeding area could not be used as there was insufficient information to assess whether the area used by hoiho had increased since YEPT took over management of its reserves.

Use of cover proxies overstated the value of YEPT's restoration projects, in that the cover of understorey vegetation (the new plantings) was greater than expected in the mature forest benchmark.

Another issue is that tier cover contains no information on species composition, which is an important component of biodiversity. Thus, even though understorey cover exceeded the benchmark value, the composition of the understorey vegetation was biased toward the fast-growing tree saplings that are typical of restoration projects, and away from slow-growing divaricating species, including both small-leaved understorey shrubs, and juveniles of canopy and emergent species such as matai (*Prumnopitys taxifolia*), which do not thrive in initial restoration plantings.

For these reasons we suggest that YEPT does not use of a habitat-hectares model with proxy attributes such as these.

8.2.4 Iconic species

An iconic species model using counts of hoiho nests and the number of fledglings per nest showed that YEPT is improving the condition of these attributes at the Okia, Otapahi, and Cosgrove Creek sites, and the average condition of the attributes was approximately double their estimated condition at the baselines for these sites.

New Zealand sea lion (*Phocarctos hookeri*) males are known to use YEPT's Okia site, and breeding females are increasingly utilising the Otago coast. Potentially, if YEPT activities could be shown to improve the breeding success of New Zealand sea lions, attributes for this species could be used in an iconic species model. However the additionality of the Trust's activities would be hard to demonstrate given the low numbers of breeding females using the Otago coast, and relative scarcity of knowledge of factors that affect sea lion breeding success.

The Trust is apparently pursuing options to enhance seabird breeding habitats at its Long Point reserve. Seabird breeding sites lend themselves to metrics such as nest counts, number of eggs laid, and other attributes of breeding success. As nest predation by feral pest animals is a major cause of seabird breeding failure on the mainland, it is very likely that the Trust's pest control activities could result in additional conservation outcomes for seabird breeding.

8.3 Comparison of metrics

8.3.1 Species composition and abundance

A feature of the coastal forest vegetation was that grazed forest used to assess the baseline condition of the coastal forest now protected by YEPT had a greater richness and proportion of indigenous species than the protected forest plots, hence according to these attributes, condition declined due to YEPT management. This was predominantly due to grazing removing the forest understorey, and allowing a large array of indigenous ground layer species to persist, albeit at low abundance. When indigenous species richness and indigenous proportion were used as proxy attributes in the habitat-hectares model, these attributes had higher values in grazed forest than in protected forest. However, when the abundances (percentage cover) of ground layer species were used as attributes in the condition-hectares currency, the protected forests had higher values for ground layer vegetation than did the grazed forests. Species-based percentage cover information allowed indigenous dominance to be assessed in terms of abundance, not just in terms of floristic dominance. The outcome of the condition-hectares currency was more credible in this respect.

Similar issues would apply to fauna assemblages. The condition-hectares currency used in this project included attributes for avifauna, but condition was measured by presence alone in forest vegetation, as there was no existing information on bird abundance (for example 5-minute bird counts), and insufficient time to obtain this information.

8.3.2 Measures of abundance

In woody vegetation, stem diameters and sapling counts are attributes that can be measured objectively and relatively quickly in the field. Objective measurement of attributes is an important feature where credibility of a biodiversity credit or offset model is critical. The cover estimates used during vegetation sampling are subjectively estimated and are subject to observer bias. Cover also has an upper limit (100%) over which further increases in condition of the attribute cannot be assessed. For example, after ten years an indigenous forest restoration project may achieve 100% canopy cover, but the vegetation height will not have reached the height of mature forest, and the stem diameter distribution will be skewed toward a large number of small stems, with an absence of large-diameter stems that are typical of mature forest. A currency that uses stem diameter and sapling counts effectively captures these differences in forest structure, and would enhance the credibility of a condition-hectares currency used to generate biodiversity credits for YEPT.

For obvious reasons, stem diameter measurement and sapling counts are not available for non-woody species. Thus, for ground layer vegetation, estimates or measures of cover or counts of individual plants were required. Subjective cover estimates were selected as the attribute for ground layer vegetation, because objective measures of cover are time consuming, and because identification of individuals is difficult in clonal species such as pingao (*Ficinia spiralis*) and *Euphorbia glauca*. Counts of individuals could, however, be made for plants such as Cook's scurvy grass (*Lepidium oleraceum*) where plants occur as discrete individuals. Where objectivity is important, and the species has a threat classification, counts of individuals would represent a robust approach.

Counts of hoiho nests and counts of the number of fledglings per nest appear to be accurate for South Island sites, as many sites are regularly monitored, and a number of censuses have been undertaken. The monitoring activities undertaken by YEPT will ensure that the condition of these attributes can be accurately determined.

9. ISSUES AND CONSTRAINTS

9.1 Insufficient baseline data

No baseline data were available on the condition and composition of existing indigenous vegetation for the YEPT coastal forest sites that were sampled, which hampered quantification of the biodiversity credit that YEPT had accumulated by protecting indigenous vegetation from stock. This was resolved by sampling adjoining indigenous forest vegetation accessed by stock, and by making assumptions on the likely condition of forest vegetation immediately prior to stock exclusion, but these types of assumptions lack transparency and may not be perceived as credible. For restoration sites in pasture, an assumption was made that there was no pre-existing indigenous vegetation at the site, and field visits indicated that this was the case. At the foredune restoration sites, it was assumed the foredune was dominated by exotic species immediately prior to restoration, as exotic vegetation dominates most foredunes in coastal Otago. At the rear dune sites it was assumed that bracken (*Pteridium esculentum*) and silver tussock (*Poa cita*) were the only indigenous species present immediately prior to restoration, as both were present in sampling plots but there was no evidence that either had been planted.

9.2 Benchmark determination

Determination of the benchmark state for each attribute was facilitated by information on vegetation structure and composition gained during sampling for this project, and by information on hoiho breeding parameters available from reports and databases. Nonetheless, defining the benchmark condition of every species attribute required notional benchmarks to be erected in the majority of cases. This again required subjective assessment and suffers from the same lack of transparency and questionable credibility described above.

9.3 Yellow-eyed penguin data

Population trend data for hoiho are reported as either changes in numbers of breeding pairs or changes in counts of nests (i.e. the same measure). Like many other bird species, the proportion of the breeding population of hoiho nesting in any one season varies from year to year, often significantly. As a consequence, infrequent, 'one-off' counts, when taken together, can misrepresent actual population trends. Data-rich studies from South Island sites indicate major fluctuations in nest counts over long periods of time. Counts over shorter timeframes can give the appearance of declines or increases that are not reflected in long-term trends. The complexity of population fluctuations in the South Island indicates that nest counts may not be a suitable attribute to describe hoiho population health.

The most commonly-used reproductive success measure for hoiho is the number of chicks produced per nest. Reproductive success is influenced by a complex array of often interrelated factors, including diet, sea surface temperature, air temperature, predation, and human disturbance. This makes interpretation of reproductive success estimates difficult without information on other climatic or site-specific variables, and means that the additionality of YEPT activities may not be fully met. Nevertheless, the measure is the most suitable attribute for modelling. Moore *et al*. (1994) categorised reproductive success as "High" (a mean of >1.2 fledglings/nest), "Moderate" (0.8-1.2 fledglings per nest), and "Low" (<0.8 fledglings per nest).

9.4 Lack of information sources

The lack of systematic conservation planning information prevented use of the SBL model, which requires continuous information on the status of biodiversity attributes. If the historic distribution or abundance of an attribute was known, and its current distribution or extent, then it would be a simple matter to assess the value of an increment of improvement of that attribute according to an SBL curve.

A major issue for YEPT, however, is that lack of knowledge of the importance of the different factors affecting hoiho breeding success is likely to make it difficult to quantify the links between, for example, fishery effects on hoiho and the nest count and reproductive success attributes used in this project. It also makes it difficult for YEPT to demonstrate additionality with respect to their management.

10. SUMMARY

A range of biodiversity metrics were either directly measured or estimated in the field, or gained from published data, and their merits were assessed within several different offsetting currencies. The analyses indicate that credible trades of biodiversity credits for losses due to concomitant adverse impacts will require trades to have the following characteristics to achieve credible offsetting:

- Transparent, objectively-measured, sets of attributes;

- Credible benchmarks to be determined for attributes used to assess exchanges;
- Credible baseline information to show that the conservation provider's activities have met the principle of additionality;
- Exchange restrictions to ensure equality of exchanges in type and space;
- Documentation of conservation provider activities to assist verification and auditing.

11. RECOMMENDATIONS FOR YEPT

The second part of this report details potential business models in which biodiversity credits can be marketed. If these models are to be viable, the following issues will need to be considered by the YEPT Board and management.

- The baseline condition of ecological attributes should be assessed and documented prior to new conservation activities (e.g. establishment of a seabird colony) being implemented. This will require selection of appropriate attributes, counts and measures for the new activities, and determination of appropriate benchmark states.
- Consistent methdology should be used to determine the condition of vegetation attributes. We recommend stem diameter measurement for trees >2 m tall and sapling density counts for saplings <2 m tall where indigenous woody species are an important component of the vegetation. Subjective cover estimates are appropriate for ground layer vegetation, both in woody and non-woody vegetation. Counts of individuals should be considered for high value plant taxa where plant growth form makes this feasible (for example important trees, Cooks's scurvy grass).
- Benchmark attributes should be determined in consultation with stakeholders (e.g. the Department of Conservation, local ecologists) to ensure that appropriate benchmarks are used for different conservation activities.
- The full extent and nature of YEPT conservation activities should be quantified, including all areas in which indigenous restoration is being undertaken.
- The condition-hectares or iconic species models populated by species-level attributes are recommended, as they provide the necessary transparency and credibility that YEPT and its stakeholders would require.
- More information is required to assess the additionality of YEPT management activities with respect to maintenance and improvement in the health of hoiho populations. This would include quantification of the different factors affecting hoiho fledging success. Good quality hoiho population information is required to determine hoiho population trends in sites managed by YEPT, and enable comparison of these trends with the overall trend in the South Island hoiho population. YEPT is current collecting good quality population information on hoiho at its sites, and this monitoring should be continued.

PART 2:

A BUSINESS CASE FOR BIODIVERSITY CREDITS

12. UNDERSTANDING THE YEPT BUSINESS CASE FOR BIODIVERSITY CREDITS

This section of the report seeks to understand the market demand for YEPT-generated biodiversity credits, and the various constraints of these markets. It then discusses how a credit can be prepared for sale and delivered to the market.

12.1 YEPT organisational context and considerations

Those conservation activities which result in the generation of viable currencies present opportunities for the YEPT to deliver a tradable commodity to the market, delivering income to finance conservation work. However, in considering this commercial opportunity the YEPT will need to carefully consider how biodiversity credit trading will align with its core organisational values.

The YEPT has a 1,700-strong membership base, largely made up of individuals and families, reflecting its grassroots origins. Maintaining a strong membership base is essential for the long-term sustainability of the organisation, ensuring consistent membership funds and the support of the wider conservation sector. It is considered that by keeping to a simple operating model that is explicitly non-commercial in its intent, the YEPT is able to minimise the potential for ethical conflict within its membership base (Sue Murray, pers. comm., 4/04/2011).

Conversely, the commercial risk of the existing business model that is largely reliant on perpetual access to public funding is well recognised by the Board. This risk has been reduced by securing organisational and project-specific sponsorship. Most notably, since 1989 the YEPT has had cornerstone sponsorship from Mainland Cheese Ltd. Mainland Cheese, a member of the Fonterra co-operative group, contributes funds to the YEPT upon receiving confirmation of sales of specific butter and cheese products. This consumer-supported sponsorship relies upon environmentally conscious consumers who are prepared to purchase the products, and subsequently supply proof of purchase. Mainland Cheese is capitalising on the iconic status of the hoiho and the demonstrable conservation success of the YEPT and in doing so is creating value for its product. Though outsiders may consider the dairy industry and a seabird conservation organisation to be odd bedfellows, the longevity of this relationship is proof of its mutual success.

Though the YEPT has an established history of engaging in commercial transactions, the prospect of engaging in commercial relationships based upon biodiversity offsetting would require significant contemplation by its Board. Trading in an offset market would represent a significant departure from its traditional operating practice, and may require direct engagement with industries that have typically been considered environmental adversaries. Such a business model may not be acceptable to the YEPT's constituency, and may be dismissed as a result. Consideration has been given to these ethical concerns in the evaluation of potential markets for YEPT-generated biodiversity-credits.

12.2 Identification of concomitant adverse development impacts

The biodiversity offsetting approaches outlined in the first section of this report all envisage like-for-like offsetting. The like-for-like basis of these offsetting models requires that the related adverse development impact(s) must be measurable by the same attributes that are used to calculate the biodiversity credit. With respect to the attributes used in the YEPT project, this would require the development impact to affect the condition of one or several of the following:

- Hoiho nest numbers;
- Hoiho fledglings per nest;
- The extent of hoiho breeding habitat;
- Indigenous coastal vegetation on fore dunes, rear dunes, lagoon margins, riparian margins, and coastal slopes;
- Threatened and At Risk plant species present in YEPT sites.

There appear to be many development impacts that could affect hoiho nest numbers and fledging rates. Any activity that resulted in mortality of adult hoiho could have direct effects on hoiho nest numbers. These activities could include commercial and recreational fishing (both through direct by-catch and indirect competition with hoiho for food sources), uncontrolled dogs wandering from farming or residential activities, coastal subdivision, roading development, coastal tourism, and coastal vegetation clearance. Fledging success could be reduced directly through predation by pets, or indirectly through disturbance or mortality effects on hoiho breeding pairs.

The extent of hoiho breeding habitat could be affected by activities that result loss of a hoiho population from a site, because hoiho appear to be faithful to their breeding areas and are slow to colonise new sites. Activites that could cause reductions in the extent of hoiho breeding habitat are the same as those described above.

Clearance of indigenous coastal vegetation could be caused by farming activities, coastal subdivisions, coastal energy generation projects, or any other development activities in coastal areas. Effects on indigenous foredune vegetation are less likely than effects on coastal forest and rear dune habitats, because foredune environments are dynamic and affected by coastal processes, which restrict their utility for coastal developments.

Most of the Threatened and At Risk plant species occurring at YEPT sites are foredune species and thus unlikely to be affected by development activities.

Existing hoiho monitoring information may allow the losses caused by developments to be assessed. However limitations in currently-available data mean there are likely to be difficulties in quantifying the effects of fishery activities on hoiho nesting numbers and reproductive success. The magnitude of these effects may need to be estimated, in which cases the assumptions underlying these estimations will need to be transparent and be supported by stakeholders.

13. BIODIVERSITY-CREDIT MARKET ANALYSIS

Evaluation of potential biodiversity credit markets has occurred as the first step in understanding a potential YEPT business model based upon biodiversity credit trading. The markets identified include development impacts, tourism impacts, fisheries by-catch and biodiversity credits that leverage off carbon credits.

13.1 Regulatory offset market - supplying biodiversity credits for development impacts

Though no regulatory markets for biodiversity offsets currently exist in New Zealand, the recently released Proposed National Policy Statement (NPS) on Indigenous Biodiversity (2011) indicates such mechanisms are being considered. To establish a market for biodiversity in New Zealand would require new legislation that is not currently part of the Resource Management Act (RMA), notably to prohibit adverse effects on indigenous biodiversity unless specifically allowed in circumstances set out in detailed market rules.

Dependent on the relevant District Plan, activities that occur under the RMA may result in vegetation being destroyed or modified if they are not considered to contain significant values. Unlike most international environmental legislation which follows a hierarchy to avoid, remedy and mitigate, under the RMA there is no requirement to consider the least damaging option first. In contrast, the proposed NPS does include adherence to the mitigation hierarchy as a principle to be considered in the application of biodiversity offsets. The NPS also reinforces and clarifies that significant biodiversity values are to be identified at a regional level, contributing to a greater understanding of the national status of biodiversity.

Walker *et al*. (2010) discuss the conflict that exists between the current RMA legislation and the potential development of biodiversity offset markets. The report highlights legislative conflicts; the limited transferability of consents and permits, an inadequate capacity for Councils to set caps, and the inadequate allocation of property rights. Notwithstanding these issues, and for the purposes of this report, consideration has been given to how the YEPT would consider a business model based on the sale of biodiversity credits to offset impacts that have been caused by land development practice.

A like-for-like basis of offsetting models requires the related development impacts to be measured by the same attributes used to calculate the biodiversity credit. As such, the development impact would need to affect hoiho abundance, the extent of hoiho population distribution and coastal vegetation and/or coastal plant species. The considerable differences between the policy and rules of individual District Plans mean offsetting would need to occur within the boundaries of a District in order to avoid the development of distorted market trading across districts, which could result in significant loss of habitat in certain parts of New Zealand.

Likely impacts of development activities which could be considered as part of an impact-offset market are:

- Direct loss of hoiho habitat, or connecting habitat, within coastal Otago and Southland.
- Reduction in hoiho abundance as a result of increased predation caused by development.
- Reduction in hoiho abundance, or extent of distribution, as a result of increased unregulated visitor numbers.

Along the Otago and Southland coastline a large proportion of habitats of significant conservation value are already protected as public conservation land, as YEPT reserves, by territorial authorities, or by willing private landowners. It is considered that the primary sites of importance to hoiho (landing sites and adjoining habitat suitable for nests) are currently sufficiently legally protected (B.McKinley, pers. comm., 30/04/11). However, opportunities still exist in which significant biodiversity benefits may be obtained by buffering existing hoiho habitat or by increasing the connectivity of existing protected sites.

Examination of land-use policies relevant to coastal Otago and Southland shows that District Plan policies have limited control over the removal or disturbance of indigenous vegetation. Most damage to more common indigenous biodiversity in the wider environment is not currently recognised, and when considered cumulatively, these damaging activities can represent significant impacts.

Within Dunedin City recent development in rural-zoned areas has caused fragmentation of land use, and generally has had "significantly greater impact on landscape values than biodiversity values". It is considered that the majority of development does not involve habitat removal or impacts, and "often will result in gains for biodiversity due to localised restoration activities" (Debbie Hogan, pers. comm., 03/05/11).

Further south, in the Clutha District, coastal development has been sporadic, and does not normally involve displacement of native vegetation. Hoiho habitat is legally protected, but development of surrounding areas would undoubtedly cause adverse effects. Increased levels of predation and disturbance that result from developments would be "worthy of offsite offset payments", but "would not demand significant amounts of money" (Murray Brass, pers. comm., 4/04/11). Between 2008 and 2011 there have been four developments that would be appropriate for offsetting, each of which would demand total payments "in the vicinity of $1,000-$4,000 apiece" (Murray Brass, pers. comm., 4/04/11). Only one of these historic developments could be linked to hoiho, due to the inevitable increase in visitor numbers to the area. A ban on dogs and cats, and voluntary covenanting of bush already forms a part of the development proposal.

Given the slow residential population growth (Dunedin City Council, 2006) and relatively low levels of development pressure in the coastal Otago/Southland area, there is likely to be a limited level of market demand for 'like-for-like' credits after the mitigation hierarchy is followed. In the absence of a market place that has a critical mass of buyers and sellers, establishing an offset credit marketplace for managing development impacts at a local level would be unviable.

The primary threat to hoiho habitat arises from unregulated poor farming practices that reduce the quality of indigenous vegetation through stock pressure or physical removal. Without legislative reform that significantly reduces the ability of pastoral farming practices to destroy and modify indigenous vegetation, it is unlikely that a biodiversity offset market could be created.

Expanding the potential pool of credit purchasers to land managers at a regional level would improve the viability of YEPT's participation in a biodiversity offset system. However, to enable a scheme that allows trading of like-for-unlike credit to retain its integrity, it could only enable biodiversity credit purchasers to 'trade up'. This would allow resources to be used on higher conservation priority (regionally significant) habitats and species than those being impacted. The nationally-vulnerable status of the hoiho, along with its irreplaceability and iconic standing, would be likely to attract more market demand than credits being purchased from other offset providers that are selling credits for well protected or readily restorable habitats or species. However such market dynamics could result in a general loss of biodiversity at a wider landscape level, which runs contrary to the NPS.

Under a restructured legislative framework, biodiversity offsets could provide an important mechanism for capturing cumulative impacts on wider biodiversity which are not dealt with by existing mechanisms. Credits would best be sold in a habitat banking market where compensation for impacts on less-significant biodiversity would be the source of demand for credits. Demonstrating additionality would require the YEPT to actively manage habitat restoration processes, with restoration management occurring to certified industry best practice. These actively-generated credits are created by a positive action above a neutral baseline, in this instance through positive action to create credits where there was no forest or habitat previously present. Given the low volume of transactions taking place and the relatively low value of these transactions, any offset trading scheme based on the effects of development would need to minimise transaction costs to ensure viability. This would need to be balanced against the requirement for robust ecological assessments and the need for a transparent transaction.

For the YEPT, the primary factor that will limit the establishment of an offset market based on the unavoidable impact of development activity is the potential loss of support of its constituency. Trading restoration efforts for money given for direct biodiversity loss elsewhere is likely to be considered unacceptable to the Trust's Board and general membership. The conservation advocacy role of the YEPT would become compromised and be considered by some to be untenable. Such a political position effectively removes the likelihood of a supply of credits to service this 'development impact' market. Offset payments generated by the indirect effects of development (e.g. increased visitor numbers, increased dog predation) are likely to be more acceptable, but will be of relatively low economic value.

13.2 Regulatory/voluntary market to supply biodiversity credits for fisheries by-catch

One industry that has been identified as having a direct negative effect on hoiho is the commercial fishing sector. The New Zealand Government has recognised seabird by-catch as being an area that must be addressed by the fishing industry, and in recent times has sought to establish a seabird standard that includes setting seabird by-catch limits. DOC delivers the Marine Conservation Services programme which is subject to cost recovery from the commercial fishing industry. As part of this the Fisheries Observer Programme aims to collect independent catch effort data, biological data and biological specimens for scientific purposes. By-catch data is collected as part of this programme (www.fish.govt.nz).

A 2008/09 summer observer programme has focussed on inshore fisheries, targeted at understanding protected species' interactions. Five hoiho were caught in set nets from the 402 fisher-days that were subject to observation (MFish 2007). Darby and Dawson (1999) believe that the effects of by-catch in gillnets may be severe on a local scale and is "interpreted to be a significant threat to South Island populations". The set net fishery is one of only a few fisheries which do not have any regulated mitigation requirements (Ramm 2009).

Though priority will always be placed on encouraging fisheries to directly mitigate by-catch by avoiding or modifying practice, offsetting by-catch that can't be mitigated directly by funding conservation initiatives that target other mortality threats could assist in achieving conservation gains for the hoiho. Transferring the capital from impacts that result from revenue-earning activities to revenue-negative activities which address impacts would result in cost-effective interventions with high conservation returns (Wilcox and Donlan 2008).

The only comprehensive and reliable way of checking fishery activities against designated by-catch limits is through comprehensive observer coverage and subsequent research to develop robust population models (B. McKinley, pers. comm., 20/4/11). The under-reporting of seabird captures on vessels not carrying observers is a known problem (MFish 2007) so further investment is required to reduce the uncertainty of fishery effects on hoiho.

Population modelling can calculate the level of human-induced mortality that can be sustained by a species before it affects the species' ability to maintain its numbers or recover to healthy levels following declines (MFish 2007). This information could form the basis of lower thresholds for triggering biodiversity offset credit trading across the industry.

The by-catch limits would need to be appropriately set to ensure the fisheries industry cannot seriously impact the hoiho population before the economic implications of this are felt. The price established for the by-catch credit would need to be established at a threshold where fishers were incentivised to search for solutions to minimise by-catch. Maintaining an offset credit market would, therefore, not be considered to be a long-term objective for either the industry or the conservation sector.

The New Zealand fishing industry's incentive to consider offsetting is likely to be driven by increasingly stringent national regulation, or alternatively through a need to satisfy increasing consumer concern about the impacts of fisheries on target and non-target species and seabed habitats, and their subsequent demands for assurances that these impacts are being addressed by the industry (Barna 2008). Certification such as that provided by the Marine Stewardship Council may provide the market recognition that is necessary for the fishing industry to justify the economic investment necessary to engage in offsetting. Though this offset model aims to ultimately be self-defeating, a certification system will honour the progress made and ensure continued market recognition of the environmental gains.

The fishing industry is a NZ$4 billion/annum industry that currently is levied in the order of $17 million annually for the observer programme and related conservation services research. It is recognised that fishing industry lobby groups already strongly voice their concerns about the levied costs associated with the onboard observer programme (MFish 2010) and would be resistant to further costs associated with the wildlife conservation sector (Anonymous, pers. comm., 03/04/11). Payments for biodiversity offsets would likely draw funds away from the existing levies programme, or more likely, would be viewed as the next stage of the conservation services programme after completion of the by-catch monitoring programme.

Encouragingly, as the New Zealand fishing industry operates under the Quota Management System, a property-right based approach to resource management, the legal framework is better aligned with offset-credits than land-based activities which operate under the effects-based RMA.

Busch and Cullen (2008) estimated the average cost of providing hoiho with intensive management to be $45,964 for each site. This form of management was found to show the strongest correlation to penguin population growth rate. Less intensive forms of management such as revegetation and trapping cost $9,602 and $7,141 respectively. Of these three scenarios, a credit being formed on the basis of intensive management would be considered the most robust. However with high levels of uncertainty surrounding likely by-catch numbers, and when considered in the context of existing levels of levy payments, it is unlikely that political support would be obtained for an offset model that sought to recover the costs associated with intensive management of hoiho.

Establishing the economic value of the biodiversity credit would be a consideration for economists and ecologists, and then for consideration by the YEPT in terms of the costs and benefits to the Trust's objectives. The additionality of any intensive management, predator control programme or habitat restoration project would need to be clearly identified. As described in Part 1 of this report, it is not currently possible to demonstrate this. The value of hoiho by-catch debits would also be set at the beginning of the offset agreement. By-catch data provided by independent observers (or electronic data capture) would be used as the basis of credit transactions. An independent organisation would need to act as the portal of information and transactions. Offsets will have to be undertaken with strict protocols for reporting and performance standards and third parties will be needed for certification of both buyers and sellers of the offsets.

It is possible that YEPT members may consider such an offset scheme a 'license to kill' rather than a 'license to operate', and again there might be ethical concerns about trading with an industry that is reducing the numbers of the very seabird species the YEPT is trying to protect. However, full consideration would need to be given to the overall economic, environmental and social benefits of such a business model.

13.3 Regulatory market to supply biodiversity credits for tourism impacts

Tourism can play an important role in conservation issues, because it is a means to add economic value to biodiversity and ecosystem services. The visitor pays to view wildlife - in this instance hoiho - and as a consequence the habitat is protected from other more degrading forms of land use.

However, there are also significant impacts associated with tourism. According to research, tourism, mainly by air transport, is responsible for approximately 5% of total climate change. This is estimated to rise to 10 to 20% by 2030 (Olsder 2006). According to Thomas *et al*. 2004, climate change may contribute to the loss of 25% of total biodiversity. At a local level, it has been noted that unregulated tourism reduces hoiho reproductive success and juvenile survival (Ellenberg *et al.* 2007).

An estimated 126,000 tourists, or 5.7% of New Zealand's 2.2 million international visitors in 2006-2007, visited penguin colonies while in New Zealand. This includes tourists who visited blue penguins and Fiordland crested penguins (Ministry of Tourism, 2007a, in Busch, 2008). Tisdell (2007) estimated that wildlife viewing on the Otago Peninsula generates NZ$6.5 million in direct revenue and NZ$100 million in flow-on expenditure. This revenue is created largely on the back of two iconic seabird species, the albatross and the hoiho.

The private wildlife-tourism industry is already capturing a part of the monetary value of the intrinsic value of the hoiho, by securing access fees from visiting tourists. On the Otago Peninsula four enterprises now have an annual turnover exceeding $1 million dollars each and for some turnover is around $2 million (Tisdell 2007). Typically, private wildlife tourism operators will spend a portion of their revenue on habitat restoration, pest control or other conservation initiatives that benefit the immediate hoiho habitat or hoiho population.

The YEPT has not developed a business model to capture the economic value of the conservation activity that it undertakes. In addition, the YEPT is not recovering any of the costs of the impacts of tourism on the hoiho population or on the wider environment. The YEPT has, over time, been responsible for changing the land use of consecutive parcels of land from farming activity to providing habitat for hoiho. This enhancement of amenity values and public recreation often results in unregulated wildlife tourism.

The Trust makes an important contribution to the resilience of land use along the Otago and Southland coastlines, and generates environmental value beyond its contribution to conserving the yellow-eyed penguin. The habitat restoration and predator control that is instigated by the Trust provides general environmental services and side-benefits of economic value. These services have an existence value to the local community and an economic value to the tourism industry that benefits from a wildlife-rich region. Given the significant environmental, social and economic benefit that YEPT operations provide regionally and nationally, the potential to capture some of the visitor revenue stream warrants consideration.

The development of Local Government policy that seeks to internalise the cost of visitor impacts on biodiversity would underpin a local biodiversity-credit trading system. Tourists responsible for creating the environmental impact can offset this damage by purchasing credits from conservation service providers that are able to mitigate the environmental effects of the travel. The willingness to pay depends on the ability of the visitors to connect their behaviour with the effects, and their ability to pay (Chambwera 2008).

Using the estimated 126,000 tourists that visit penguins annually, a targeted biodiversity credit payment of $5/head would amount to $630,000 per annum. Obtaining a share of this beneficiary-directed payment would significantly reduce the need for the YEPT to rely on public conservation funds for its operations.

The establishment of a local biodiversity-credit bank would provide local landowners or conservation managers with an opportunity to earn credits for creating sites which maintain or improve biodiversity. Visiting tourists would purchase credits at a central register, and then use the credits to offset the negative impact of their travel. Commercial tourism operators who are providing demonstrable environmental improvement would also be eligible to participate in such a scheme, as would other not-for-profit conservation groups. Given the large number of transactions that would occur, it would be important to establish frameworks that allow for consistent and replicable audits of biodiversity credits.

13.4 Voluntary market to supply carbon+ (biodiversity) credits to carbon emitters

The New Zealand Emissions Trading Scheme (ETS) provides a legal framework for a mandatory greenhouse gas market. Participating in the Government-established regulatory ETS is an option for the YEPT, enabling the organisation to trade carbon credits that have been produced from the regeneration of Kyoto-defined forest. Independently established carbon exchange services, such as Landcare Research's Emissions-Biodiversity Exchange for the 21st Century (EBEX 21), provide a market for carbon credits that have been produced from regenerating indigenous forest. EBEX21 requires landowners to enter the Permanent Forests Sinks Initiative (PFSI) to ensure perpetual protection of the regenerating forest.

In New Zealand, and internationally, the carbon market is the most established and credible of the ecosystem service markets currently in existence. The New Zealand carbon market has the necessary political support, regulatory framework and active market setting to be confident about its longevity. Using eligible regenerating coastal forest, the YEPT has an opportunity to enter an established marketplace which places value on carbon credits that clearly incorporate a biodiversity focus.

Biodiversity measurement is being included in the New Zealand system for carbon monitoring because of "the potential for synergistic management of both carbon and biodiversity" (Carswell and Burrows 2006: 32). The authors anticipate a future of 'gold-standard' carbon credits which reward other environmental benefits such as biodiversity enhancement. The carbon + biodiversity product that EBEX21 produces is typically purchased by organisations and businesses that are reducing their operation's carbon footprint, and want to demonstrate their environmental and social responsibility.

A price premium for emissions reductions from ecologically significant biodiversity projects may be paid by buyers of carbon credits who are interested in carbon credits that deliver targeted ecological benefit. Carbon investors who are seeking public relations gains and a spread in investment risk would also be interested. Public relations gains are easy to envisage, as large companies with public profiles seek to prove their performance. Other carbon investors may be interested in slow-growing indigenous vegetation as part of a greater portfolio of carbon products.

Leveraging off the vast framework that has been put in place for both the regulatory Emissions Trading Scheme and for the voluntary carbon marketplace, the Trust could establish monitoring, accounting and governance systems that have much lower start-up costs than a project-by-project approach to biodiversity offsetting. Entering this market would provide the YEPT with an understanding and familiarity of the ecosystem service marketplace, enabling readiness for future opportunities in this field.

Carbon credit currencies that recognise biodiversity attributes typically demand the collection of measures of abundance. A currency that uses woody stem diameter and sapling counts will provide the data to underpin a conditions-hectares currency which will enable verification of biodiversity credits, and more immediately, verification of 'carbon + biodiversity' credit products. The collection of this ecological baseline data will assist with the potential for 'ex-post' trading, and in the future, unbundling of carbon credits from biodiversity credits.

The slow growth rates of coastal vegetation in Otago will limit the prospects of realising significant levels of income from carbon revenue. Expected revenue of $60/ha on land that is actively regenerating would provide the Trust with approximately $14,000 per annum on the estimated 230 hectares of land that is likely to be eligible. The Trust owns considerably more land than this, but a desktop assessment considers that the remaining land within the Trust's estate will be unlikely to achieve the Kyoto definition of 'forest'. Ministry of Agriculture and Forestry (MAF) audit and administration costs, and carbon insurance to protect against loss by fire, would be need to be deducted from this income.

Unless the revenue generation is considered to be too marginal to justify the risk, it is likely that the Board of the YEPT would support entry into a voluntary carbon market that is underpinned by the New Zealand ETS. Income generated from carbon is generated from well managed, successfully regenerating coastal forest ecosystems, and as such, directly contributes to the enhancement of hoiho habitat.

13.5 Market summary

The requirement for equity in type and space means that appropriate development impacts will probably need to be located in coastal Otago or Southland, where YEPT activities are undertaken, but this depends on the currency used. For example, impacts on indigenous sand dune vegetation elsewhere in the South Island could, potentially, be matched to YEPT's sand dune restoration projects. The main indigenous sand binding species are widely distributed and form similar communities in different places, at least within each of New Zealand's main islands. Effects on coastal forest would need to affect the same kinds of coastal forest protected and restored by YEPT, and this would likely restrict such exchanges to the parts of the Otago and Southland coast where YEPT activities are protecting and restoring coastal vegetation. Low levels of housing development occur along the Otago/Southland coastline, and only a small proportion of this is likely to have a significant impact on the hoiho. As such, the pool of market participants in this market will be small. As a consequence, the market demand for biodiversity credits that is generated from development impacts is likely to be low and not commercially viable.

Using iconic species as a currency makes commercial marketing sense. The value of an iconic species approach is that it is likely to attract more interest from purchasers of credits who wish to leverage off the marketing power of readily identifiable species. Data collected by the YEPT show positive trends in the number of breeding pairs and fledglings per nest that can be attributed to positive management. However, the numerous interrelated factors that contribute to the reproductive success of hoiho mean that additionality is difficult to prove. Instead, marine by-catch of hoiho would need to be used as the qualifying factor directly affecting hoiho abundance. The fishing industry has a more consistent and verifiable by-catch debit to service. However, its participation in existing conservation service programmes will limit that industry's enthusiasm to extend the monetary commitment to other initiatives. In the future, following the collection of sufficient by-catch data through existing observer programmes, offsetting may be considered a viable method of mitigating the effects of the inshore fishing industry.

The wildlife tourism market is likely to provide a more active market for offsets, and provide a market which will have greater demand for credits. A consumer-targeted market would provide sufficient purchase-power to fund active restoration and species protection initiatives across the coastal region. This market would be comparatively simple to establish, and if completed in a collaborative manner with the will of the tourism industry, the conservation sector and local government, could add value to the local tourism industry and direct monetary benefit to the conservation sector.

Established markets such as the carbon market are the most accessible, providing a low risk entry point into ecosystem service trading. The economic return from this market place is minimal, but participation in the market will serve to develop the business systems and thinking to consider other ecosystem service markets as they develop.

14. PREPARING THE CREDIT FOR THE MARKET

The YEPT, as an established and trusted provider of conservation services, is well positioned to deliver biodiversity credits to the marketplace. There are, however, a number of challenges in developing a credit and getting it to the market. These challenges include the lack of:

1. A regulatory framework for biodiversity credits.
2. Biodiversity credit standards.
3. Rules surrounding transactions of biodiversity credits.
4. An active market place and a New Zealand based market exchange for buyers and sellers to locate one another.
5. Obvious process or procedures for transactions to be completed.

A nationally recognised set of credit standards and the development of mechanisms to facilitate deals in an efficient and transparent manner will help with purchaser and community certainty of the credit's quality and validity. A central marketplace that is endorsed by central government and approved by regulators would provide an appropriate place for credit transactions to occur, providing a degree of assurance and certainty to investors.

In the absence of the above the YEPT can enter voluntary credit markets using available market systems and certification systems. Voluntary markets provide the potential for innovation and flexibility and therefore a likelihood of lower transaction costs, making transactions of small parcels of credits increasingly feasible. Such flexibility is desirable from both purchasers and sellers, allowing purchasers to rapidly enter the market. For small conservation service providers such as the YEPT, the voluntary market provides a low-cost method of being able to enter the market and realise monetary gain.

To enable sales of credits the Trust will need to present credible information to the marketplace. A project description that outlines the scope of the project and the various indicators that are being used to monitor the success of the project would be required at the front-end of the marketing. Project information will need to include project eligibility, baseline information, proposed ecological management, credit-calculation methods, and protection of credits. Ecological monitoring requirements, as specifically recommended in this report, would form the basis of the project plan and would inform the basis of the project proposal that is delivered to the market.

Appropriate verification, guarantees and certification will be required to satisfy the purchasers of credits that improved hoiho habitat, or an increase in the hoiho population, is occurring as a result of their biodiversity-credit purchase. Certification provides validation of the biodiversity credit product and certainty to the purchaser that the product is being delivered. Certification also serves as a mechanism for satisfying the constituency of the YEPT that the process of generating credits is environmentally and socially robust.

The type of certification required to enable sales of biodiversity credits is dependent on the credit purchaser and the level of regulation surrounding purchase. Credit purchases made under a regulatory framework will demand the use of clearly defined standards that are independently verified by a third party. In the absence of a specific certification system for biodiversity credits, it would be appropriate for the Trust to use existing carbon standards that include explicit biodiversity-focussed indicators. Standards such as the Climate, Community and Biodiversity Standards (CCB) will assist. The CCB standard has a wide range of tools and auditing procedures available to ascertain those biodiversity benefits. The use of these standards should be considered a temporary measure until biodiversity-credit specific standards are produced that are relevant to the New Zealand context.

The small-scale nature of a YEPT biodiversity-credit project will limit the feasibility of using certification using standards such as CCB, due to the high cost of obtaining certification. The YEPT does have an advantage in that it has been collecting ecological information for a significant time and is able to make use of this information as part of the certification process, thereby lowering the process cost. Alternative options for lowering the cost of certification for small providers may include the development of group certification schemes, such as that promoted by the Forest Stewardship Council.

If carbon markets such as EBEX21 are the preferred option for selling credits there is no requirement for certification per se, but just validation of the forest condition and its abundance as per the condition-hectares currency. Using existing frameworks for verification, such as that provided by MAF in the assessment of a forest's carbon stocks could form the basis of such an assessment.

15. TAKING THE CREDIT TO THE MARKET

If the YEPT were to enter the biodiversity-credit trading market place today, four main pathways for credit-delivery could be considered:

15.1 Using the existing carbon market

his established market could be used to trade high-value carbon credits that are recognised for their biodiversity values. This market has the benefit of already being operational and trusted by purchasers and the general public at large. Also, the certification and verification for carbon credits is simpler than that for biodiversity credits, providing an easier transition into the market.

15.2 Developing a local 'over the counter' system for the sale of credits to voluntary purchasers

This market system would require upfront investment in marketing and system design, but could ultimately provide the most dynamic of the markets and the most profitable for the YEPT due to their retention of the full value of the credit. The credit purchaser will ultimately be responsible for the costs associated with delivering the credit, including any certification and verification costs.

An over the counter, web-based system would match requests for credits with those 'in store' in the credit-register. The exchange would help credit buyers find the saleable credits, and it would facilitate efficient exchanges through the use of pre-approved credit verification and certification procedures. A self-administered system would require the YEPT to develop a management system that enables transactions to be tracked and reported.

The exchange would likely be based on bi-lateral exchanges, involving parties that have agreed to a specific set of negotiated terms and conditions with respect to price, quantity, and currency used. The tourism environmental-impact credit is an example, with conditions and terms agreed with tourism operators, hoteliers and transport operators in advance. A variety of credits could be offered to the market, valued according to the credit currency.

15.3 Selling credits to existing corporate sponsors

Utilising existing relationships with corporate sponsors would be an easy option to explore and would provide these sponsors, such as Mainland Cheese, with the opportunity of first mover advantage in an emerging credit market. Lower levels of investment would be necessary as the commercial arrangements could progress in a manner that reflects an established business relationship. Given the history of the commercial relationships and the trust that has developed between the parties, there is also likelihood that there would be less demand for third party verification of internationally validated certification standards.

Given the likelihood of low volumes of credits being traded it would be preferable to develop commercial relationships with one or two main credit purchasers who are able to commit to a long-term contract. Selling the available credits to one or two buyers will be more cost-effective to the YEPT, who currently will not have the capacity to manage numerous and ongoing transactions.

15.4 Participating in an established global market place

Existing international markets that provide access to large numbers of buyers through recognised intermediaries/brokers provide immediate opportunities for the YEPT to begin trading in biodiversity credits as soon as it proves practicable to implement a certification programme that enables external verification of the product. International markets such as these will provide access to the economically profitable, high environmental-impact industries such as mining and fishing. Such industries demand high standards of certification and verification, but will recompense the credit-provider for these high standards within the purchase price of the credit.

Using an intermediary provides options for small volumes of credits to be bundled with other credits, creating saleable parcels. Intermediaries such as Markit Environmental Registry provide an online electronic exchange, providing a virtual meeting site for buyers and sellers of voluntary and pre-compliance ecosystem credits. Though these markets are typically underpinned by carbon trading, there is a sufficiently large volume and range of sales occurring that some credit sales will highlight the biodiversity values of the credits. Prospective credit purchasers can filter searches by Country/Region, Credit Standard, and Project Type, all of which can then be sorted by price.

Purchases can be made online, with instantaneous clearance for buyers who are holding funds with the exchange. The registry confirmation of sale will result in the electronic transfer of ownership to the buyer. Credits are then retired, banked for future retiring, or banked to trade/sell them on. Furthermore, the YEPT could draw on specified ex-ante credits, such as “futures” in order to obtain financing capital. The buyer of the credits must be informed about the type of certificate (ex-ante or ex-post), certificate origin, and the registry, where the certificates are administered. Such a business model enables exchange of equivalent types and forward planning of biodiversity offsets. This enables conservation management planning to occur, based on the anticipated sale of credits.

16. GENERAL CONCLUSIONS

A range of possible markets for YEPT-generated biodiversity credits were explored. Understanding the commercial and ethical constraints of a business model were important first steps in understanding the likely challenges associated with participation in a biodiversity-credit market. Methods for preparing the credit for sale, and delivering it to market were also discussed. Some key points are:

- If trading like-for-like, the local market for credits from development impacts is limited. Given the limited market demand, the regulatory demands for verification, and the ethical conflicts that will be encountered, it is not a favourable business case.

- Bundling biodiversity credits with carbon credits is an option, enabling entry into established marketplace. Local markets could be used, or alternatively, international registries that promote ecosystem markets. Trading in the carbon market has a better ethical ‘fit’ for the YEPT, compared to a biodiversity-credit market that relies on offsetting damage to biodiversity elsewhere.

- Developing a local ‘over the counter’ voluntary market that has the support of local government, tourism operators and/or other businesses will be more flexible and innovative, and less restricted by compliance. Simple certification schemes could be developed to verify the generation of credits, enabling sales to a supportive market that is offsetting environmental-impacts from tourism.

- Continuing commercial relationships with existing sponsors is a low-cost method of entering the market. Verification and certification could be simplified, assisting profitability of such a project.

17. FURTHER RESEARCH

When considering entering a biodiversity-credit marketplace small conservation service providers such as the YEPT will be restricted by the costs of verification and certification of their projects. The technical complexity of evaluating credits and the cost of external certification of the credits will be barriers to developing a business based upon the sale of credits. The likely quantities of credits that could be generated from YEPT activities are unknown, but are likely to be small.

Further research should investigate methods by which small conservation service providers can most efficiently and effectively verify and certify their credits. The development of guidelines and on-line management systems that are underpinned by stakeholder-developed standards, for example, could assist with these processes. Understanding the most appropriate mechanisms to enable the bundling of small amounts of credits from multiple providers, and the subsequent certification of groups of small providers, is also deserved of research.

Over-the-counter sales to local voluntary markets are likely to be one of the more attractive marketplaces to conservation providers like the YEPT who have a strong local identity and brand. Research should enhance understanding of how a local trading system would work, as well as the processes and mechanisms required to ensure it has a high level of integrity and transparency.

Finally research into the likely levels of demand for biodiversity credits in both the regulatory and voluntary markets, cognisant of the New Zealand context, would serve to enhance the market understanding of biodiversity credits and increase the likelihood of preparation for market participation.

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REFERENCES

Barna C. 2008: Re-thinking the role of business in biodiversity conservation. Spiru Haret University.

Bishop J., Kapila S., Hicks F., Mitchell P., Vorhies, F. 2010: New Business Models for Biodiversity Conservation. IUCN-The World Conservation Union, Gland, Switzerland Shell International, Ltd., London, UK Forest Trends, Washington, DC, USA Green Horizons, UK Earthmind.net, Geneva, Switzerland.

Busch J. and Cullen R. 2008: Effectiveness and cost effectiveness of Yellow-Eyed Penguin conservation measures. AARES 52nd Annual Conference

Christensen M. 2008: Biodiversity Offsets - a suggested way forward. Presented to the RMLA conference.

Darby J.T. and Dawson S.M. 2000: By-catch of yellow-eyed penguins (*Megadyptes antipodes*) in gillnets in New Zealand waters 1979-1997. Otago University

Darby J.T. and Seddon P.J. 1990: The biology of the yellow-eyed penguin, *Megadyptes antipodes*. In: Davis, L.S., Darby, J.T. (Eds) penguin Biology. San Diego.

Department of Conservation 1991b: Hoiho species conservation plan. Department of Conservation, Dunedin.

Dodd A.M. 2007: EU Habitats Directive and Habitat Compensation, Oxford Brookes University, pp. 1-143.

Dunedin City Council 2006: Residential capacity Study. District Plan Monitoring Series. Research Report

Ellenberg U., Setiawan A.N., Cree A., Houston D.M., Seddon P.J. 2007: Elevated hormonal stress response and reduced reproductive output in Yellow-eyed penguins exposed to unregulated tourism. *General and Comparative Endocrinology 152*: 54-63.

Lloyd K. 2011: Methodology for calculation of biodiversity credits generated by Yellow-Eyed Penguin Trust activities. Report No. 2554 for the Department of Conservation.

Massaro M**.** and Blair D. 2003: Comparison of population numbers of yellow-eyed penguins, *Megadyptes antipodes*, on Stewart Island and on adjacent cat-free islands. *New Zealand Journal of Ecology* 27: 107-113.

Ministry for the Environment 2011: Proposed National Policy Statement on Indigenous Biodiversity, Wellington.

Ministry of Fisheries 2007: Proposals for managing the fisheries related mortality of seabirds. Discussion document

Ministry of Fisheries 2011: Fisheries and Conservation Services cost recovery levies for the 2010/11 fishing year.

Ministry of Tourism 2007: Average visitor spend by purpose. International Visitor Survey: YE March 2007.

Molloy J. and Davis A.J. 1994: Setting priorities for conservation of New Zealand's threatened species. Department of Conservation, Wellington.

Moore P.J., Wakelin M., Douglas M.E., McKinlay B., Nelson D., Murphy B. 1995: Yellow-eyed penguin foraging study, south-eastern New Zealand, 1991-1993. *Science & Research Series No. 83*. Department of Conservation, Wellington.

Olsder K. and van der Donk M. 2006: Destination Conservation: protecting nature by developing tourism. IUCN, Amsterdam.

Parker C. and Cranford M. 2010: Little Biodiversity Finance Book. Global canopy programme.

Ramm K. 2010: Conservation Services Programme Observer Report: 1 July 2008 to 30 June 2009. Department of Conservation, Wellington.

Southland District Council 2009: Stewart Island Visitor Levy. Regulatory Impact Statement.

Rowe S. 2010: Level 1 Risk Assessment for incidental seabird mortality associated with New Zealand fisheries in the NZ-EEZ. Marine Conservation Services, Department of Conservation, Wellington. 75 p.

Stephens T. and von Hase A. 2010: A draft conceptual framework for quantifying losses and gains in biodiversity offsets, for discussion with the BBOP Advisory Group.

ten Kate K., Bishop J., Bayon R. 2004: Biodiversity offsets: views, experience, and the business case. IUCN, Gland Switzerland and Cambridge, UK, and Insight Investment, London, UK.

ten Kate K., Treweek J., Ekstrom J. 2010: The use of market-based instruments for biodiversity protection - the case of habitat banking. Technical report for European Commissions DG Environment

Thomas C.D., Cameron A., Green R., Bakkenes M., Beaumont L.J., Collingham Y.C., Erasmus B.F.N., Ferreira de Siquira M., Grainger A., Hannay L., Hughes L., Huntley B., van Jaarsverld A.S., Midgley G.F., Miles L., Ortega-Huerta M.A., Peterson A.T., Phillips O.L., William S.E. 2004: Extinction risk from climate change. *Nature 427*, 145-148.

Tisdell C. 2007: Working Paper No. 145 Valuing the Otago Peninsula: The Economic Benefits of Conservation . University of Queensland.

Van Heezik Y. and Davis L. 1990: Effects of food variability on growth rates, fledging sizes, and reproductive success in the Yellow-Eyed Penguin (*Megadyptes antipodes*), *Ibis 132*: 354-365.

Walker S., Greenhalgh S., Lee B., Stephens T., Sinclair R.J. 2010: Environmental markets for New Zealand: The barriers and opportunities. Landcare Research, Lincoln.

Wilcox C. and Donlan J. 2008: Integrating invasive mammal eradications and biodiversity offsets for fisheries by-catch: conservation opportunities and challenges for seabirds and sea turtles. Advanced Conservation Strategies, Cornell University.