



# East Coast Bay of Plenty Conservancy Science & Research Prospectus 2011

TECHNICAL REPORT SERIES 4



Department of Conservation  
*Te Papa Atawhai*

# East Coast Bay of Plenty Conservancy Science & Research Prospectus 2011

Technical report series 4

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# 1. Introduction

## 1.1 RESEARCH PROSPECTUS

The East Coast Bay of Plenty (ECBOP) Conservancy Science & Research prospectus outlines the key research questions within the Conservancy for 2011 and onwards. In addition to science and research, this covers survey and monitoring needs, as operational conservation management research needs. The objective of identifying and prioritizing conservation research needs is to promote investigations, and to make the best use of available funds (Christensen 2009). This work follows the previous Science & Research prospectuses by Christensen (2009; 2010), and uses the Department of Conservation (2001; 2002; 2003): Science Counts! National Strategic Science Research Portfolios, Programmes, Priority Actions to characterize each research question.

This recent prospectus also has a new section, with specific local research needs identified by 'place'. This place-based approach helps to identify where the greatest conservation gains can be made in the next 3-5 years (DOC 2010).

## 1.2 RESEARCH MANAGEMENT

The majority of internal research projects at the Conservancy level are managed and completed on an annual basis. With adequate planning and involvement of DOC staff, post-graduate student projects for example, can be relatively easily facilitated by way of funding and/or logistical support.

We would encourage external researchers to consider the prioritized research projects identified in the 2.1 & 2.2 Science and Research Prospectus sections. These priorities will be updated on a continual basis, thus external researchers are encouraged to contact the Conservation Analyst (previously known as the Conservancy Advisory Scientist), at the address below.

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## 2. Science & Research in ECBOP

### 2.1 RESEARCH PROSPECTUS – by Portfolio

The ECBOP Science & Research Prospectus – 2011 is updated and revised from the previous prospectuses published as Bay of Plenty Conservancy Series – Technical Report 30 (Christensen 2009), and the East Coast Bay of Plenty Conservancy – Technical Report 1 (Christensen 2010). This version expands more on the actual research needs and questions required by the new Conservancy. The prioritization methodology remains the same as outlined by Christensen (2009)<sup>1</sup>, although the level component has been reversed to increase the priority of local needs.

The ECBOP Conservancy's Research Prospectus is a list of its currently identified (although not active) science and research needs. In addition each portfolio has its highest twenty projects listed (as of 21/01/2010), so that 100 projects in total are identified (Tables 1 – 5). A brief summation of the research priorities within each portfolio is given below.

#### **Terrestrial Restoration & Pests**

Sarah Crump, Shane Grayling & Rhys Burns

This portfolio has three programmes; Ecosystem restoration, Animal Pests, and Weeds. Specifically it looks at improving our understanding of the impact (consumption and competition) of pests on ecosystems, and the improvement of pest control techniques.

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<sup>1</sup> In 2010, the Average Project Score components were changed to increase the relative value of the research project importance; Project Importance = 0.77, Project Risk = 0.14, Project level = 0.09.

**Table 1:** Top twenty research needs (Terrestrial Restoration & Pests) projects identified.

<b>Research Project</b>
<p><u>General introduced mammalian impacts</u> Mammalian predators have a large impact on native forest ecosystems by preying on native fauna. We are interested in determining;</p> <ul style="list-style-type: none"> <li>➤ What ability do we have to predict any long-term effects of introduced mammals on forest ecosystems?</li> </ul>
<p><u>Rodent and Mustelid monitoring</u> Rodents and mustelids have a large impact by preying on many native species. We are interested in identifying;</p> <ul style="list-style-type: none"> <li>➤ What improved methodologies can be developed for determining stoat abundance?</li> <li>➤ What can be done towards automation of rat monitoring? [E.g. video monitoring rats in middle of plots as an addition/replacement of rat tracking monitoring].</li> <li>➤ What is the effect of beech masting on rat numbers at high altitude beech forest sites (e.g. Manuoha, Te Urewera)?</li> </ul>
<p><u>Impacts of red deer</u> Red deer can have a negative impact on native ecosystems, and particular plant species. It is possible that knowledge of red deer movement patterns in different terrain, could improve current hunting methodologies. We are interested in;</p> <ul style="list-style-type: none"> <li>➤ Characterising red deer behavioural movement in different terrain (Nb. food availability will differ at different terrains) and management regimes. [An example may include satellite transmitters attached to red deer in 3 very different terrain environments: flat (e.g. Whirinaki), steep (e.g. Te Urewera) and very steep (e.g. Raukumara), to understand their daily, and seasonal movements, and compare with intensively hunted (ground and/or aerial sites) and low intensity hunting sites. Information gained can be used to more effectively target deer by hunting].</li> <li>➤ Determining how large of a control/management buffer is required to protect an area from the impacts of red deer?</li> <li>➤ Identifying impacts on forest ecosystems of reduced management of red deer?</li> </ul>
<p><u>Wetland Predators</u> Mammalian predators, including feral cats and dogs, are having a large impact on wetland ecosystems, especially on native birds. We are interested in determining;</p> <ul style="list-style-type: none"> <li>➤ What is the best management regime for managing and/or excluding cats or dogs in wetlands?</li> <li>➤ How do cats utilise Kaituna wetland? [As a case study Kaituna wetland could be used for understanding how cats utilise a wetland. With planned developments around Kaituna wetland a study into cats using the wetland now could be repeated in later years when wetland is surrounded by subdivision and new developments].</li> </ul>
<p><u>Dama Wallaby</u> Dama wallaby have a detrimental impact on the vegetation where they have established in the wild around the Bay of Plenty region. We are interested in determining;</p> <ul style="list-style-type: none"> <li>➤ What are the best bait-toxin combinations for dama wallaby preference, acceptance and susceptibility?</li> <li>➤ What are new and innovative ways for detecting and monitoring wallaby at low densities?</li> </ul>

#### Wasp control

Exotic wasp populations can have a severe impact on native invertebrate species. We are interested in determining;

What is the optimum bait station matrix, in a field trial, for e.g. Xstinguish™ (Fipronil) bait for wasp control?

#### Geothermal Restoration

By their very nature some active geothermal sites are difficult places to restore back to a natural state. We are particularly interested in:

- What are the best techniques for establishment of native restoration plantings in active geothermal sites (hard sinter, etc)?
- What are the ecological impacts of pigs at geothermal areas (e.g. Te Kopia)?

#### Spread of Weeds via birds

A basic definition of a weed is a plant growing where it is not wanted. Unfortunately more plants are ‘escaping’ from gardens every year and becoming environmental weeds. Many of the weeds are being spread via birds. We are interested in:

- What is the impact of birds (native and exotic) on the spread of ecological weeds, particularly new crop and garden plant varieties?

#### Threats to kowhai ngutu-kaka (kakabeak)

The two species of kowhai ngutu-kaka or kakabeak are endemic shrubs on the verge of extinction in the wild (Status: Threatened–Nationally Critical). Both species are considered high priorities for conservation management and species recovery by the Department of Conservation. The long term goal for the kowhai ngutu-kaka recovery plan is that both species of kowhai ngutu-kaka exist in the wild throughout their natural range. The research objectives of this recovery plan relating to research into the threat/pest management area of conservation management are:

- What are the impacts of introduced garden snails and slugs on kowhai ngutu-kaka adults and seedlings in the wild? [e.g. effects of snail browse on seedlings and adult plants, incidence of snails and slugs at wild kowhai ngutu-kaka sites, can snails be controlled in the wild, how long do slug and snail baits last in the wild].
- Do ground cover weeds (e.g. Mexican daisy and exotic grass swards) compete with kowhai ngutu-kaka or suppress germination; and if they do what are the best ways to minimise these impacts?
- What level of browser control (deer, goats, hares, rabbits, possums, snails, slugs etc) will enable kowhai ngutu-kaka to survive in the wild without use of fences and treepel™?
- Are all animal repellents equal for kowhai ngutu-kaka protection and how long do animal repellent sprays last in the wild?
- Do rats eat and/or destroy kowhai ngutu-kaka flowers, pods (and their seed) and/or seedlings in the wild and does this affect kowhai ngutu-kaka population viability?



## Species & Ecosystems under Threat

Rhys Burns, Paul Cashmore & Keith Owen

This portfolio has three programmes grouped by ecological organisation structure, e.g. Species, Communities and Ecosystems. This portfolio broadly looks at improving our knowledge of the distribution of species, and the impact of conservation efforts on species, communities and ecosystems.

**Table 2:** Top twenty Species & Ecosystems under Threat projects identified.

Research Project
<p><u>Species</u></p> <p>Information gaps exist regarding several threatened species found within ECBOP Conservancy, and as some species are predominantly found in this Conservancy, their research needs are accordingly given higher status. We are particularly interested in furthering knowledge on:</p> <ul style="list-style-type: none"><li>➤ NZ dabchick <i>Poliiocephalus rufopectus</i> ecology: Several aspects of their ecology are unknown or poorly understood (e.g. agents of decline, dispersal, factors determining preferred sites, home ranges, winter flocking sites, breeding/non-breeding rates, night roosting sites, nesting habitat).</li><li>➤ <i>Chaureopa roscei</i> (landsnail) ecology: Their ecology, distribution and threats are poorly documented.</li><li>➤ Banded dotterel <i>Charadrius bicinctus</i> ecology: Their distribution, breeding sites and migration/dispersal in coastal and inland braided rivers of ECBOP are poorly understood.</li><li>➤ The pollination processes of kowhai ngutu-kaka (kakabeak) <i>Clianthus maximus</i>: This is poorly understood (e.g. lack of pollinators could be limiting cross-pollination and seed production in <i>C. maximus</i>, as <i>C. puniceus</i> can self-pollinate but not <i>C. maximus</i>).</li><li>➤ Meta-population dynamics of kowhai ngutu-kaka: How these can best be managed and restored? (E.g. seed dispersal distances have yet to be determined and patch occupancy, seed bank persistence, plant longevity and production is unknown).</li><li>➤ Kowhai ngutu-kaka ecology: specifically on seed bank characteristics such as; structure longevity, viability, persistence of seed bank are not fully understood, the development of methods to stimulate seed bank germination, and research into site niche requirements.</li><li>➤ Whio (blue duck) <i>Hymenolaimus malacorhynchos</i> ecology: The quantification and correlation of river levels with whio breeding success and management regimes (e.g. development of cheap dataloggers to measure levels of many individual waterways to determine site-specific thresholds for flood effects on breeding whio) .</li><li>➤ Speckled Skink <i>Oligosoma infrapunctatum</i> ecology: Population estimation on Mokoia Island, Lake Rotorua (e.g. using Mark-Recapture methods).</li></ul>

### Natural Ecosystems

These are sites that have had relatively little modification, yet still require research to understand various aspects of their composition or function. We are particularly interested in furthering knowledge on:

- What factors make the Maketu estuary a hotspot for a wide range of avifauna, particularly shorebirds? (E.g. modelling and monitoring the impacts on avian fauna of proposed diversion of Kaituna River into Maketu estuary).
- The use of geothermal sites by invertebrates (to possibly focus on *Lepidopteran* fauna).
- Mainland versus islands ecosystem processes: Exploring the limitations of ECBOP islands for threatened species and threatened ecosystem restoration.
- What are the minimum habitat requirements (including size) of small freshwater wetland areas (e.g. raupo, carex habitats) for avifauna (e.g. fernbirds, spotless crane etc.)?

### Modified Ecosystems

These are sites that have been recently heavily modified, and we are interested in determining the wide variety of responses of native species to these dramatic changes in habitat. Specifically we are interested in:

- The seasonal movement of native birds (e.g. tui, kaka), and their use of lowland areas over winter and in orchards (the priority would be to relate this to native and introduced plant flowering, seeding, fruiting times. etc).
- The positive and negative effects of introduced plants on native fauna (eg rhododendron poisoning on tui; sustenance of tui by eucalyptus over winter; fruit, nut and pine trees for kaka)
- The impact of different aspects of production forestry harvest regimes on low mobility native fauna (e.g. ground birds, frogs)
- Comparing ecosystem processes on similar ecosystems on the mainland and pest-free or recovering island sites. [For example, determining the most important components (including the biomass of different trophic levels) missing from different mainland ecosystems (e.g. seabirds, lizards, weta, pollinators), and the result of this on mainland ecosystems].

### Monitoring

Many species are difficult and expensive to monitor. It is important that inexpensive yet robust methods are developed that can aid in increasing the understanding generated from a monitoring regime. Some of these species are very cryptic, or little work has even been undertaken on them. We are particularly interested in:

- Developing highly efficient lizard capture and detection methods (e.g. forests - arboreal and ground methods).
- The development of robust monitoring and sampling methods for the fungus *Phanerochaete luteoaurantiaca*.

### Translocations

Translocations can provide solutions to many aspects of species and ecosystem conservation management, yet they also generate their own uncertainties and challenges. Having a high level of understanding of the details and results of past translocations is important if we are to further develop robust translocation protocols that increase the chance of all translocations being successful in short, medium and long-term time scales. We are interested in:

- The assessment of genetic diversity of bottlenecked species (e.g. translocations, remnant mainland species) and its relationship to potential long-term population viability at these sites. We are particularly interested in the implications for long-term management to overcome any genetic issues.
- The population dynamics and trends of tuatara on BOP islands (and to compare translocated vs non-translocated populations).

## Conservation Assessment

This portfolio has one very broad programme that encompasses ecological and environmental classification issues, measurement and monitoring development, technological development and general science needs. This is basically concerned with how ecological and conservation data and information is gathered and made available.

**Table 3:** Top twenty Conservation Assessment projects identified.

<b>Research Project</b>
<p><u>Conservation in changing economic and societal complexity</u> As political, social, economic, environmental events and impacts occur (e.g. peak oil, local-regional-national-international recessions etc) and can effect social-value costs such as conservation. We are interested in;</p> <ul style="list-style-type: none"> <li>➤ Identifying policies, methods, actions and behaviours etc that support resilient area protection and support of local and large-scale conservation efforts.</li> </ul>
<p><u>Conservations contribution to regional and local economies</u> Conservation as a group of active management efforts provides economic input and benefit to local communities spread throughout the Conservancy. We are interested in identifying and quantifying the contribution of the following three approaches of Conservation to the Conservancy's prosperity;</p> <ul style="list-style-type: none"> <li>➤ Biodiversity protection,</li> <li>➤ Outdoor recreation, and</li> <li>➤ Historic preservation.</li> </ul>
<p><u>Quantification of ecosystem services with the EC/BOP Conservancy</u> Ecosystems in and of themselves have an economic value and also marginal costs. They contribute to the local, regional and the national economy, by way of a large number of attributes e.g.; water catchment and storage, water filtration, tourism, energy exploitation, flood mitigation, etc. We are keen to determine in current approximate dollar figures the economic contribution that the following ecosystems/sites/habitats (as public conservation land and indigenous vegetation) provide;</p> <ul style="list-style-type: none"> <li>➤ River &amp; wetlands,</li> <li>➤ Geothermal sites,</li> <li>➤ Indigenous forests,</li> <li>➤ Coastal areas &amp; estuaries,</li> <li>➤ Marine environments – specifically the three Marine Reserves,</li> <li>➤ The Rotorua Lakes area.</li> </ul>

#### Data poor/data deficient threatened species

We need initial surveys with GIS analysis for the presence, density and extent for a range of data poor/data deficient threatened species such as;

- Skinks: *Oligosoma "Whirinaki"* and the *Oligosoma striatum* Striped skink.
- Liverworts: e.g. *Cephaloziella* spp.
- Freshwater invertebrates: e.g. *Helciopsyche hauropango* (caddisfly), *Mauuiulus aquilus* (mayfly).
- Terrestrial invertebrates: e.g. *Megascolides* spp. (earthworm), *Ericodesma* sp. "mingimangi" (moth), *Mesodorylaimus profundis* (nematode) (Cobb, 1904) Goody, 1963.
- Vascular plants: e.g. *Vittadinia australis* (white fuzzweed), *Lagenifera montana* (papataniwha).

#### Population measures: resistance, persistence, resilience and variability in ecological communities

The protection of fragmented communities occurs across a spectrum of threats and over temporal and spatial scales. We are interested in obtaining baseline measurements for ecosystems, communities and (threatened) species populations for the four characteristics;

- resistance
- persistence
- resilience
- variability

#### Tuhua historic ecology

Tuhua (Mayor island) is the largest offshore island in the Bay of Plenty, and is a key site for the security of threatened species. We are interested in gaining a better understanding of the island's historic ecology, and potential future by;

- Analysis of the midden fauna, and wetland pollen.

## People, History & Conservation

Jane Roberts & Steve Brightwell

This portfolio has three programmes based on Historic & Cultural Heritage Protection, Visitor Use, and Community Participation and involvement. This looks to develop cooperative management and participation of the New Zealand Public (and key stakeholder groups) through the assessment of visitor expectations and community responses.

**Table 4:** Top twenty People, History & Conservation projects identified.

<b>Research Project</b>
<p><u>Conservation with community groups and succession planning</u></p> <p>Conservation now and in the future will depend strongly on engagement with and direction from community groups. As these community groups become more important to the management of conservation projects, it is prudent that succession planning is integrated into community groups to ensure key leadership within the group is strong. We are interested in case studies which showcases a key community group and their influence on conservation. It will show their structure, planning and policies, approaches, projects, obstacles and successes. Possible community group case studies could focus on;</p> <ul style="list-style-type: none"> <li>➤ The Nukuhou Saltmarsh Care Group.</li> <li>➤ The Kaharoa Kokako Trust.</li> </ul>
<p><u>Conservation with iwi</u></p> <p>There are multiple land settlement negotiations taking place throughout the East Coast Bay of Plenty Conservancy. It is expected that multiple public conservation land blocks will be returned to iwi, some remaining jointly managed by the Department of Conservation and Iwi. We seek to increase conservation efforts and outcomes through partnership with Iwi and are interested in the development of Iwi conservation skills and involvement. We are interested in;</p> <ul style="list-style-type: none"> <li>➤ Case studies which showcases an iwi and its influence on conservation. [Ideally it will show the Iwi structure, planning and policies, approaches, projects, obstacles and successes].</li> </ul>
<p><u>Iwi and historic heritage experiences</u></p> <p>Maori offer a unique understanding to experiencing New Zealand's heritage. We are interested in;</p> <ul style="list-style-type: none"> <li>➤ Case studies throughout the region on conservation outcomes Iwi expect from management of historic sites.</li> <li>➤ The identification of a range of methods which bring Maori heritage to visitors to public conservation and jointly managed Department of Conservation/Iwi land. [This project is ideally led by or done in partnership with iwi].</li> </ul>
<p><u>Understanding visitors</u></p> <p>In order to improve our understanding of visitors and better inform management decisions at our key sites (such as the Te Tapuwae o Rongokako Marine Reserve (MR), and Tauwhare Pa) in the ECBOP region, we seek information through survey methods on the following visitor;</p> <ul style="list-style-type: none"> <li>➤ demographics</li> <li>➤ use</li> <li>➤ dispersion</li> <li>➤ experiences</li> <li>➤ satisfaction</li> </ul>

Kaimai Heritage Trail business opportunities barriers

The Kaimai Heritage Trail is a project currently being led by the Department of Conservation. It is a multi-day, easy tramping experience that is surrounded by rich mining and timber history. We wish to engage with and empower the communities that neighbour access points to the trail, to connect with each other. This will help foster the establishment of new business opportunities, resulting in the realisation of social and economic benefits. We would like to know;

- What the barriers are that these local communities are being faced with in realising these opportunities?

Mitigate threats to historic assets

The Department of Conservation is responsible for a large portfolio of actively conserved historic sites ranging from Pa to bridges. It is important that management techniques used to mitigate or restore such assets are recorded for others to benefit from in the future. We would like to;

- Record the restoration of the Eastern Portal Bridge in the Karangahake Gorge.

Joint DOC/iwi managed Islands

The Department of Conservation has joint management agreements with iwi for a number of islands within the East Coast Bay of Plenty Conservancy, and annually contributes resources and funding towards a range of projects on the Islands. We are interested to find out what the public's perception is of jointly DOC/Iwi managed Islands in the East Coast Bay of Plenty region. Key Islands include:

- Tuhua (Mayor Island)
- Moutohora (Whale Island)
- Mokoia Island

Feasibility study – Monitoring for visitor asset maintenance and biodiversity

Internationally we have seen conservation bodies take advantage of the increasing portable technology carried by members of the public to help monitor the maintenance needed on tracks, and also for species monitoring. We seek a study examining the feasibility of using such a concept in New Zealand. We would like to investigate;

- The concept and its applicability to New Zealand conservation. [The study will include but is not limited to equipment, procedures, establishment, running costs, limitations and testing].

Geothermal-based recreation opportunities

Geothermal-influenced ecosystems are priorities for conservation management due to their uniqueness. We are interested in a specific review of the recreation management issues;

- Research and management issues pertinent to visitor sites that are geothermally-influenced.

Old railways and tramways

Recreational use of conservation sites, and visitor enjoyment can be increased by the provision and support of new activities. We are interested in identifying;

- Disused and abandoned railways and tramways.
- Evaluating their potential for bikeways and walkways.

DOC information

We are interested in improving conservation information to the public. We are interested in identifying;

- Who obtains DOC information, how do they use it, and which media applications may promote further engagement.

## Aquatic Protection & Restoration

Rebecca Lander & Dr. Kim Young

This portfolio has two broad programmes: Freshwater Protection & Restoration, and Marine Protection and Restoration. This is focused on developing our knowledge on the classification of aquatic environments and their components, and being able to transfer this information readily.

**Table 5:** Top twenty Aquatic Protection & Restoration projects identified.

<b>Research Project</b>
<p><u>Marine Protected Area (MPA) planning and evaluation</u></p> <p>The MPA process seeks to identify a network of protected areas which collectively provide for the long term viability of New Zealand's unique and representative biota. To assist this process we are presently describing biological communities and social values associated with the marine environment. The present context for our evaluations is the North Eastern Marine Bioregion. We are particularly interested in:</p> <ul style="list-style-type: none"> <li>➤ A description of the mobile and sessile biological communities associated with Whangaokena MR and an evaluation of the distinctiveness and representativeness of such communities in the context of the North Eastern Marine Bioregion.</li> <li>➤ Habitat mapping: a GIS layer of habitats as described in the MPA implementation plan and habitats report. The current area of priority interest extends from Opotiki to East Cape. This includes ground-truthing of existing predicted habitats. A particular focus on; <ul style="list-style-type: none"> <li>• Biogenic reefs: a GIS layer of biogenic reefs within the coastal margins of the Conservancy.</li> </ul> </li> <li>➤ Geothermal vents: a description of mobile and sessile biological communities associated with geothermal vents in the Conservancy.</li> <li>➤ Community and stakeholder values: the production of GIS layers of community values and stakeholder interests in the Conservancy such as recreational fishing interests, diving interests and kaimoana gathering areas. Initial focus is from the base of the Coromandel to East Cape.</li> </ul>
<p><u>Marine mammals - Impacts of commercial and recreational activities</u></p> <p>With growing interest in commercial marine mammal activities, we are interested in the resilience of marine mammal populations in the Bay of Plenty in response to recreational and commercial tourism marine mammal activities. We are particularly interested in;</p> <ul style="list-style-type: none"> <li>➤ The population and spatio-temporal distributional response of bottlenose and common dolphins to commercial tourism operations.</li> <li>➤ The population and spatio-temporal distributional response of fur seals to commercial tourism operations.</li> </ul>
<p><u>Fur seal ecology and populations</u></p> <p>Fur seals are recovering from previous exploitation and re-colonizing their former breeding range. Presently fur seals are establishing breeding areas in the Conservancy. We are interested in;</p> <ul style="list-style-type: none"> <li>➤ The spatio-temporal distribution of fur seals and the distribution of breeding in the conservancy.</li> <li>➤ The seasonal composition of fur seal diets in the Conservancy.</li> </ul>

#### Marine Reserve management and conservation outcomes

Marine reserves are the key marine management tool for protection of marine biodiversity. We are interested in evaluating the;

- The key conservation outcomes including successional changes in communities in the three Marine Reserves (Te Tapuwae o Rongokako Marine Reserve, Te Paepae Aotea Marine Reserve, and Tuhua Marine Reserve) following protection.
- The annual economic contribution of the three Marine Reserves to local and regional economies.
- The distribution and intensity of commercial fishing activities about Tuhua and Te Paepae Marine Reserves.

#### Distribution and abundance of freshwater fish populations

Up-to-date information on native freshwater fish populations is particularly useful when prioritising protection of species and waterways, and when identifying candidate areas for restoration. We are interested in determining;

- The composition of fish communities in waterways within East Coast Bay of Plenty Conservancy, in particular:
  - Communities in previously un-surveyed areas.
  - Distribution and abundance of At Risk native fish species.
  - Updating information on records of At Risk species that are more than 10 years old.
  - Genetic variation among land-locked galaxiid populations of the Rotorua lakes, Waikaremoana and Lake Waikareiti.
  - Spawning sites, timing and behaviour of forest galaxiids in the Conservancy's waterways.
- The recruitment and abundance of each galaxiid species within the whitebait runs of major East Coast Bay of Plenty Rivers? How this changes through the upstream migration season, whether recruitment has changed and/or is changing over time, and how it is affecting the maintenance of upstream populations?
- Inanga spawning grounds (locations, vegetation composition, protection and restoration etc) and updating information on historical inanga spawning sites - are they still being used?

#### Functions and efficiencies of riparian margins on the East Coast

Riparian margins buffer in-stream habitat from the impacts of forest harvesting operations. Forestry blocks on the east coast of the East Coast Bay of Plenty Conservancy are often situated on highly erosion-prone soils and have the potential to cause a large amount of in-stream damage, through impacts such as sedimentation, both during and after harvesting. We are particularly interested in;

- The effectiveness of current East Coast riparian margin species compositions and widths for maintaining stream health before, during and after forestry harvesting.
- Optimum riparian margin widths and species compositions for maintaining stream health in commercial forests on the East Coast.



#### Human impacts on native freshwater fish populations

Human activities and man-made structures can have detrimental impacts on native fish migrations, populations and habitats. We would like to compile information on their effects in East Coast Bay of Plenty waterways and on solutions to improve situations for native fish. We are interested in developing;

- An inventory of the locations and types of in-stream structures that present barriers to fish passage in the East Coast Bay of Plenty Conservancy (excluding the Gisborne Region where this work has already been completed) that includes:
  - locations of in-stream structures causing barriers to fish passage
  - reasons each structure presents a barrier
  - impacts of the barriers on upstream fish populations
  - remedial/retrofitting solutions
  - prioritisation of remedial work in each catchment and within the region
  - key sites for water flow management, and water take limitation, for the protection of threatened aquatic species
- Practical, cost effective measures that improve the habitat value of flood protection structures and systems (rock riprap, floodgates, drains etc) for native freshwater fish.
- Knowledge on the impacts of reduced flow rates on native freshwater fish and their habitats, and the value of retaining natural variations in flow as a means of protecting them.

#### Prevention of aquatic pest establishment

Lake Waikaremoana is an internationally renowned lake ecosystem. Aquatic pests have the potential to seriously compromise its ecological and recreational values. Presently Lake Waikaremoana is free of the most invasive introduced aquatic pest weeds and fish. However, recently a considerable effort was spent to eradicate *Lagarosiphon major* from this lake. We are keen to avoid this situation occurring again and to minimise the risk of the spread of aquatic pests to the Lake.

- What is the feasibility of a washdown station for trailer boats at both approaches to Lake Waikaremoana [The study will follow a similar study completed for the Rotorua lakes and will include details of potential locations, equipment, procedures; and establishment and running costs].

## 2.2 RESEARCH PROSPECTUS – by Place

This section is a new addition, specifically divided by conservation ‘place’ (DOC 2010). This contains the above research questions and some additional options specific to the Conservancy’s conservation ‘place’.

### **Te Urewera**

- What is the effect of beech masting on rat numbers at high altitude beech forest sites (e.g. Manuoha, Te Urewera)?
- Characterising red deer behavioural movement in different terrain (Nb. food availability will differ at different terrains) and management regimes. [An example may include satellite transmitters attached to red deer in 3 very different terrain environments: flat (e.g. Whirinaki), steep (e.g. Te Urewera) and very steep (e.g. Raukumara), to understand their daily, and seasonal movements, and compare with intensively hunted (ground and/or aerial sites) and low intensity hunting sites. Information gained can be used to more effectively target deer by hunting].
- Determining how large of a control/management buffer is required to protect an area from the impacts of red deer?
- The ecology and distribution of *Chaureopa roscei* (landsnail), and their associated threats.
- Whio (blue duck) *Hymenolaimus malacorhynchos* ecology: The quantification and correlation of river levels with whio breeding success and management regimes (e.g. development of cheap dataloggers to measure levels of many individual waterways to determine site-specific thresholds for flood effects on breeding whio) .
- Quantification of ecosystem services within this place, with specific regard to the current and potential economic values and marginal costs of TUMI to local communities.
- Modelling the effects on vegetation (including fire behaviour) under different future climate scenarios - within and about Te Urewera.

### **Whirinaki – Te Pua a Tane**

- Characterising red deer behavioural movement in different terrain (Nb. food availability will differ at different terrains) and management regimes. See Te Urewera above.
- Determining how large of a control/management buffer is required to protect an area from the impacts of red deer?
- Quantification of ecosystem services within this place.
- Ecology of *Lobelia careens*, at Arahaki Lagoon.

### **Raukumara**

- Characterising red deer behavioural movement in different terrain (Nb. food availability will differ at different terrains) and management regimes. See Te Urewera above.
- Quantification of ecosystem services within this place.
- Documentation of the ungulate control history: conservation and economic benefits to date.

### **Kaimai-Mamaku**

- Quantification of ecosystem services within this place.
- What the barriers are that the (Kaimai Heritage Trail) communities are being faced with in realising these opportunities?
- Record the restoration of the Eastern Portal Bridge in the Karangahake Gorge.
- Recreational use of old tramways and disused railways: evaluating their potential for bikeways and walkways.
- What is the recreational value of the Kaimai-Mamaku Forest Park: demands and concerns of the Park users?

### **Volcanic & Geothermal Environments**

- What are the best bait-toxin combinations for dama wallaby preference, acceptance and susceptibility?
- What are new and innovative ways for detecting and monitoring wallaby at low densities?
- What are the best techniques for establishment of native restoration plantings in active geothermal sites (hard sinter, etc)?
- What are the ecological impacts of pigs at geothermal areas (e.g. Te Kopia)?
- NZ dabchick *Poliiocephalus rufopectus* ecology: Several aspects of their ecology are unknown or poorly understood (e.g. agents of decline, dispersal, factors determining preferred sites, home ranges, winter flocking sites, breeding/non-breeding rates, night roosting sites, nesting habitat).
- Speckled Skink *Oligosoma infrapunctatum* ecology: Population estimation on Mokoia Island, Lake Rotorua (e.g. using Mark-Recapture methods).
- What are the invertebrates (specifically the *Lepidopteran* fauna) at geothermal sites?
- Quantification of ecosystem services within this place.
- Case study on conservation with community groups and succession planning – Kaharoa Kokako Trust.
- Recreation management issues pertinent to geothermally-influenced visitor sites.

### **Coastal Ecosystems, Forests and Dunelands**

- What is the optimum bait station matrix, in a field trial, for e.g. Xstinguish™ (Fipronil) bait for wasp control?
- What are the habitat values of the different stages of mangrove forests?
- Ecology of the banded dotterel *Charadrius bicinctus*, focusing on their distribution, breeding sites and migration/dispersal in coastal and inland braided rivers.
- What factors make the Maketu estuary a hotspot for a wide range of avifauna, particularly shorebirds? (E.g. modelling and monitoring the impacts on avian fauna of proposed diversion of Kaituna River into Maketu estuary).
- Quantification of ecosystem services within this place.
- Case study on conservation with community groups and their succession planning – Nukuhou Saltmarsh Care Group.
- Who visits Tauwhare Pa? What are the visitor demographics and satisfaction levels?
- Who visits Te Tapuwae o Rongokako Marine Reserve (MR)? What are the visitor demographics and satisfaction levels?

### **Freshwater Wetlands**

- What is the best management regime for managing and/or excluding cats or dogs in wetlands?
- How do cats utilise Kaituna wetland? [As a case study Kaituna wetland could be used for understanding how cats utilise a wetland. With planned developments around Kaituna wetland a study into cats using the wetland now could be repeated in later years when wetland is surrounded by subdivision and new developments].
- Ecology of the NZ dabchick *Poliiocephalus rufopectus*: Several aspects of their ecology are unknown or poorly understood (e.g. agents of decline, dispersal, factors determining preferred sites, home ranges, winter flocking sites, breeding/non-breeding rates, night roosting sites, nesting habitat).
- What are the minimum habitat requirements (including size) of small freshwater wetland areas (e.g. raupo, carex habitats) for avifauna (e.g. fernbirds, spotless crane etc.)?
- Quantification of ecosystem services within this place.
- See the above Aquatic Protection & Restoration section for additional Freshwater research questions.

## **Islands**

- What is the optimum bait station matrix, in a field trial, for e.g. Xstinguish™ (Fipronil) bait for wasp control?
- Ecology of the Speckled Skink *Oligosoma infrapunctatum*: population estimation on Mokoia Island, Lake Rotorua (e.g. using Mark-Recapture methods).
- Mainland versus islands ecosystem processes: Exploring the limitations of ECBOP islands for threatened species and threatened ecosystem restoration.
- Comparing ecosystem processes on similar ecosystems on the mainland and pest-free or recovering island sites. [For example, determining the most important components (including the biomass of different trophic levels) missing from different mainland ecosystems (e.g. seabirds, lizards, weta, pollinators), and the result of this on mainland ecosystems].
- The population dynamics and trends of tuatara on BOP islands (and to compare translocated vs non-translocated populations).
- Quantification of ecosystem services within this place.
- Analysis of the Tuhua (Mayor Island) midden fauna, and wetland pollen.
- What is the public's perception is of jointly DOC/Iwi managed Islands in the East Coast Bay of Plenty?
- Survival and population dynamics of translocated animals (e.g. orange-fronted parakeets) onto Bay of Plenty islands.

## **Marine Environment**

- Quantification of ecosystem services relevant to Marine Reserves.
- Who visits Te Tapuwae o Rongokako Marine Reserve (MR)? – determination of visitor demographics and satisfaction.
- See the above Aquatic Protection & Restoration section for additional Marine Environment research questions.

### 3. Science & Research in ECBOP: 2009/10 – a brief discussion

During the 2010 year, 13 projects that were pertinent too, or directly involved with conservation management within the ECBOP Conservancy were completed. All of these projects had at least some scientific or research component (see Appendix 1: Completed Research Projects 2010). Some of these projects have already influenced conservation thinking and approaches, with key work such as;

- An evaluation of the ecosystem services provided by the protected areas and ecological corridors within the Kaimai-Tauranga catchment (van Meeuwen-Dijkgraaf et al. 2010).
- Advancing humane toxin options for and wallaby management (Eason et al. 2010).

Ecosystem services provided by nature are vital for humans, and have recently been broadly quantified in terms of direct monetary value. While horticulture and agriculture can provide provisioning (ecosystem) services, most of the crucial regulating and supporting services are provided by natural (and largely unmodified) ecosystems such as forests, rivers and wetlands. The Kaimai-Tauranga catchment area (over 123,000 ha) contains a growing population and important commercial industry and agriculture. van Meeuwen-Dijkgraaf et al. (2010) quantified the value of the Kaimai-Tauranga catchment ecosystem services as up to \$NZ 195 million per annum, and is likely to contribute at least 5% of the Regions GDP.

Wallaby research is steadily progressing within New Zealand and especially in the Bay of Plenty Region. While the management of pest vertebrates and especially mammals using pesticides is sometimes a controversial area for certain groups, ongoing ecological and ethical justification and including the consideration of animal welfare remains important (Eason et al. 2010). Eason et al. (2010) found that Feratox™ (Cyanide pellets) presents few undesirable animal welfare signs when used a management tool to reduce wallaby numbers.

This prospectus follows the previous Christensen (2009; 2010) Science & Research prospectuses with updated sections, and the removal of the prioritization methodology. Lists of the Technical Report Series publications<sup>2</sup> are given in Appendix 7.2 & 7.3. Reports from ‘The Eastern Region Regional Report Series’, when the ‘Rotorua Conservancy’ existed (similar in size and extent as the current ECBOP Conservancy) are listed in Appendix 7.4.

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<sup>2</sup> A further six published and one unpublished ECHB Technical Report Series have been sourced at this point of time.

## 4. Further information

Should any researcher be interested in science and/or research projects within the ECBOP Conservancy, they should discuss options including possible funding with the Conservation Analyst, at the address below. All research undertaken by researchers external to the Department requires a research permit. The ECBOP Conservancy also has a set of guidelines for researchers planning to work within the Conservancy. These documents, including research application forms can be found on the webpage below.

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<http://www.doc.govt.nz/about-doc/concessions-and-permits/research-collection-and-wildlife-permits/>

## 5. Acknowledgements

A number of people both internal and external to the ECBOP Conservancy have provided consideration and ideas on research needs over the last year, and this work is rightfully a compilation of such discussions. As Compiler of this work, I would like to especially thank the members of the ECBOP Conservancy Conservation Support Unit and the Area staff for their identification of and debate on research projects. The ECBOP Conservancy Conservation Support Unit staff, led by Rebecca Lander, Rhys Burns, Jane Roberts and Sarah Crump drafted four portfolio sections, and chose the respective research ideas listed. Elizabeth Griffiths and the DOC Knowledge Services team (in particular Janet Forbes) have been instrumental in identifying the mis-located or mis-labelled East Coast Hawkes Bay Conservancy Technical Series Reports, as well as the previous Eastern Regional Series reports.



## 6. References:

- Christensen, B.R.; 2009: Bay of Plenty Conservancy Science & Research prospectus. *Technical Report Series 30*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Christensen, B.R.; 2010: East Coast Bay of Plenty Conservancy Science & Research prospectus. *Technical Report Series 1*. East Coast Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Department of Conservation. 2001; 2002; 2003: *Science Counts! National Strategic Science Research Portfolios, Programmes, Priority Actions*. Department of Conservation. Wellington.
- Department of Conservation. 2010: *Te Ara Whakamua Hou: the journey forward*. East Coast Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Eason, C.T.; Shapiro, L.; Adams, P.; Hix, S.; Cunningham, C.; MacMorran, D.; Statham, M.; Statham, H. 2010: Advancing a humane alternative to sodium fluoroacetate (1080) for wildlife management – welfare and wallaby control. *Wildlife Research*: 37, 497–503.
- van Meeuwen-Dijkgraaf, A.; Shaw, W.B.; Mazzieri, F. 2010: Ecosystem Services of Protected areas and Ecological Corridors within the Kaimai-Tauranga Catchments. *Technical Report Series 2*. East Coast Bay of Plenty Conservancy. Department of Conservation. Rotorua.

# 7. Appendix

## 1. Completed research projects<sup>3</sup> for 2010

- Baker, B.; Hedley, G.; Cunningham, R. 2010: *Data collection of demographic, distributional, and trophic information on the flesh-footed shearwater to allow estimation of effects of fishing on population viability: 2009-2010 field season*. Report for the Ministry of Fisheries PRO2006-011, (unpublished). Latitude 42 Environmental Consultants, Kettering, Australia.
- Christensen, B.R.; 2010: East Coast Bay of Plenty Conservancy Science & Research prospectus. *Technical Report Series 1*. East Coast Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Cook, L.A.; Trewick, S.A.; Morgan-Richards, M., Johns, P.C. 2010: Status of New Zealand cave weta (Rhaphidophoridae) genera Pachyrhamma, Gymnoplectron and Tubottoplectron. *Invertebrate Systematics* 24: 131-138.
- Eason, C.T.; Shapiro, L.; Adams, P.; Hix, S.; Cunningham, C.; MacMorran, D.; Statham, M.; Statham, H. 2010: Advancing a humane alternative to sodium fluoroacetate (1080) for wildlife management – welfare and wallaby control. *Wildlife Research*: 37, 497–503.
- Foster, S.P. 2010: *Interspecific competitive interactions between *Rattus norvegicus* and *R. rattus**. Masters of Biological Sciences theses (unpublished). Waikato University. Hamilton.
- Kusabs, I.; Mitchell, C. 2010: *Waitahanui stream: an assessment of fisheries and aquatic values and comments on the potential impacts of a proposed waste water treatment plant*. Report prepared for Rotorua District Council (unpublished). Ian Kusabs and Associates Ltd. Fisheries Consultants. Rotorua.
- MfE. 2010: Measuring carbon emissions from land-use change and forestry: The New Zealand Land-use and Carbon Analysis System. Ministry for the Environment. Online report: <http://www.mfe.govt.nz/publications/climate/carbon-emissions-land-use/measuring-carbon-emissions.pdf>. Accessed 1/4/2011.
- MfE. 2010: New Zealand's Greenhouse Gas Inventory 1990–2008. Ministry for the Environment. Online report: <http://www.mfe.govt.nz/publications/climate/greenhouse-gas-inventory-2010/greenhouse-gas-inventory-2010.pdf>. Accessed 1/4/2011.
- Owen, K.L.; Smith, I.; Cashmore, P.; Crump, S.; Christensen, B.R.; Staite, C. 2010: Report on Debris Flood Recovery and Rehabilitation of Matata Wildlife Refuge Reserve (Te Awa O Te Atua Lagoon). *East Coast Bay of Plenty Conservancy Technical Report Series 3*. East Coast Bay of Plenty Conservancy, Department of Conservation, Rotorua.
- Payne. B. 2010: *The role of GIS in inter-agency cooperation for invasive species management: a case study of wilding conifer management in the Central North Island*. Report in partial fulfilment of Post-Graduate Diploma in Arts in Course 132.798 Research Report (unpublished). Massey University. Palmerston North.

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<sup>3</sup> Also includes some general texts that have had some degree of scientific content, e.g. ECBOP Technical Reports, and MfE LUCAS reports.

- Payne, B. 2010: *Using remote sensing for the mapping of Dracophyllum subulatum-dominated frost flats and the monitoring of Pinus contorta invasion in the Kaingaroa and Whirinaki Ecological Districts*. Report in partial fulfilment of Course 189.171. Applied Remote Sensing (unpublished). Massey University. Palmerston North.
- Sinclair Knight Merz. 2010: *Reporoa MT survey*. Operational report for Department of Conservation (unpublished). Auckland. 17p.
- Tompkins, D.; Castro, I.; Barraclough, R.; Jakob-Hoff, R. 2010: *A field study into the ecology of vectors and vector-borne diseases in New Zealand*. Landcare Research Contract Report. Prepared for MAF Biosecurity New Zealand (unpublished). Dunedin.
- van Meeuwen-Dijkgraaf, A.; Shaw, W.B.; Mazzieri, F. 2010: *Ecosystem Services of Protected areas and Ecological Corridors within the Kaimai-Tauranga Catchments. Technical Report Series 2*. East Coast Bay of Plenty Conservancy. Department of Conservation. Rotorua.

## **2. East Coast Bay of Plenty Conservancy Technical Report Series**

Christensen, B. 2010: Bay of Plenty Conservancy science & research prospectus. *Technical Report Series 1*. East Coast Bay of Plenty Conservancy. Department of Conservation. Rotorua.

van Meeuwen-Dijkgraaf, A.; Shaw, W.B.; Mazzieri, F. 2010: Ecosystem Services of Protected areas and Ecological Corridors within the Kaimai-Tauranga Catchments. *Technical Report Series 2*. East Coast Bay of Plenty Conservancy. Department of Conservation. Rotorua.

Owen, K.L.; Smith, I.; Cashmore, P.; Crump, S.; Christensen, B.R.; Staite, C. 2010: Report on Debris Flood Recovery and Rehabilitation of Matata Wildlife Refuge Reserve (Te Awa O Te Atua Lagoon). *Technical Report Series 3*. East Coast Bay of Plenty Conservancy, Department of Conservation, Rotorua.

### 3. East Coast / Hawkes Bay Conservancy Technical Report Series<sup>4</sup>

A further six published East Coast Hawkes Bay Conservancy Technical Reports (No.s: 3 or 4, 6, 7, 9, 11, 12, 15, 19, 20, 23 and 24), and one unpublished draft technical report (No. 16) have been sourced over the last year.

- B.T. Coffey & Assoc. 1998: Preventative aquatic weed management strategy for Lakes Waikaremoana and Waikareiti, Te Urewera National Park. *Technical Support Series no. 1*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- King, D. 1998: Review of species protection programme: North Island brown kiwi. *Technical Report Series no. 2*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- Thompson, D.; MacLaurin, K. 2000: Waikaremoana Catchment recreation strategy 2001 – 2010. *Technical Report Series no. [3 or 4]*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- Harrison, A. 2000: Ecological restoration of Whanga-o-kena (East Island): a discussion paper. *Technical Support (Report) Series no. 5*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- Freeman, D. 2001: Te Angiangi Marine Reserve biological monitoring plan. *Technical Report Series 6*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- Freeman, D. 2001: Te Tapuwae o Rongokako Marine Reserve biological monitoring plan. *Technical Report Series 7*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- DOC. 2001: Hydrilla in New Zealand: a review of the problem and recommendations for future actions. *Technical Report Series 9*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- Freeman, D. 2001: Te Tapuwae o Rongokako Marine Reserve baseline survey report. *Technical Report Series 10*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- Freeman, D. 2003: A review of records of Hector's dolphin (*Cephalorhynchus hectori*) from the East Coast of the North Island. *Technical Report Series 11*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- Thorsen, M. 2003: Threatened plant strategy 2003 to 2008. *Technical Report Series 12*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- King, D. 2003: Waikaremoana ecosystem restoration project strategy 2003-2013. *Technical Report Series 13*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- Freeman, D.; Duffy, C.A.J. 2007: Te Angiangi Marine Reserves reef fish monitoring 1995-2003. *Technical Report Series 14*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- Lucas, J. 2003: East Coast Hawke's Bay Conservancy feral goat management strategy. *Technical Report Series 15*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- Thorsen, M. 2004: Threatened plant strategy 2003 to 2008. (*Draft*) *Technical Report Series 16*. Unpublished report. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.

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<sup>4</sup> Reports 3 or 4, and 8 in this series have yet to be sourced or found. Some reports may still be active and/or yet to be published, and if considered appropriate will be added to the new East Coast Bay of Plenty Conservancy Technical Report Series; e.g. Armstrong, D. (2008): Draft: *Barriers to native fish passage in the Gisborne region*. Unpublished report. Department of Conservation. Gisborne.

- Walter, L.; Gosling, D. 2002: Otatara Pa Historic Reserve Napier conservation plan. *Technical Report Series 17*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- Goodman, J. 2004: East Coast Hawke's Bay Conservancy freshwater strategy and action plan. *Technical Report Series 18*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- Riddell, K.; Thorsen, M. 2004: Threatened plant survey May-June 2004. *Technical Report Series 19*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- Thorsen, M. 2004: Threatened plants of the East Coast and Hawke's Bay: identification and management guide. *Technical Report Series 20*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- Griffiths, J. 2004: Island biosecurity plan: East Coast Hawke's Bay Conservancy. *Technical Report Series 21*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- Jack, D. 2004: Kaweka lakes freshwater fish survey and threats assessment. *Technical Report Series 22*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- Jack, D. 2004: Ruapani Tarns and Kaipo Lagoon wetland inventory, Te Urewera National Park. *Technical Report Series 23*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- Lee, M. 2006: Visitor monitoring strategic work plan 2006-2011. *Technical Report Series 24*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- Freeman, D. 2005: Reef fish monitoring Te Tapuwae o Rongokako Marine Reserve. *Technical Report Series 25*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.
- Freeman, D. 2006: Te Angiangi and Te Tapuwae o Rongokako Marine Reserves: intertidal paua and kina monitoring. *Technical Report Series 26*. East Coast Hawke's Bay Conservancy. Department of Conservation. Gisborne.

## 4. Bay of Plenty Conservancy Technical Report Series<sup>5</sup>

- Beadel, S. M. 1988. Wild animals of the Urewera forests. 1980 – 1987. *Technical Report Series No. 1*. Department of Conservation. Rotorua. 20p.
- Froude, V.; Richmond, C. J. 1990. Aquatic weed control in the Rotorua Lakes: a discussion paper on management issues and options. *Technical Report Series 2*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Richmond, C.J.; Forbes, S.P. 1990: Maketu estuary restoration strategy: a proposal to central and local government. *Technical Report Series 3*. Department of Conservation. Rotorua.
- Jones, A. J.; Garrick, A. S. 1991: Tuhua (Mayor Island) marine habitats: a preliminary intertidal and subtidal survey. *Technical Report Series 4*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Wallace, S. W. 1988: Distribution and status of North Island kokako (*Callaeas cinerea wilsoni*) in the Eastern Region. *Technical Report Series 5*. Bay of Plenty Conservancy. Department of Conservation. Rotorua. 20p.
- Beadel\*, S. M. 1988: A register of threatened and local plant taxa in the eastern region, their distribution and status. *Technical Report Series 6*. Bay of Plenty Conservancy. Department of Conservation. Rotorua. 20p.
- Grouden\*, V. J. 1990: Taheke-Paengaroa area archaeological inventory survey. *Technical Report Series 6*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Llewellyn\*, M. C. 1988: Impact of dama wallaby on kanuka dominant forest at Lake Okataina as shown by exclosures. *Technical Report Series 7*. Bay of Plenty Conservancy. Department of Conservation. Rotorua. 20p.
- Grouden\*, V. J. 1991: Te Kauri Village: a report on authority 1990/64 to modify an archaeological site. *Technical Report Series 7*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Owen\*, K.L. 1991: Survey of stag beetle (*Dorcus auriculatus*) on Mount Te Aroha. *Technical Report Series 8*. Department of Conservation. Rotorua. 13p.
- Llewellyn\*, M. C. 1988: The Bay of Plenty sambar herd: current status with options and recommendations for future management. *Technical Report Series 8*. Bay of Plenty Conservancy. Department of Conservation. Rotorua. 20p.
- DOC\*. 1989: Recreation strategy: a workplan 1989/1990 (draft). *Technical Report Series 9*. Bay of Plenty Conservancy. Department of Conservation. Rotorua. 20p.
- Bowers\*, L.; Jones, K. 1991: Tauwhare Pa archaeological investigation and site restoration. *Technical Report Series 9*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- DOC\*. 1989: Matata Wildlife Refuge: management plan (draft). *Technical Report Series 10*. Bay of Plenty Conservancy. Department of Conservation. Rotorua. 20p.
- Irving\*, R. M.; Beadel, S. M. 1992: Botanical surveys and assessments of wildlife reserves in the Te Teko Ecological District. *Technical Report Series 10*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Owen, K. L. 1992. A blue duck survey of the upper Whirinaki River, Bay of Plenty. *Technical Report Series No. 11*. Department of Conservation, Bay of Plenty Conservancy. 7p. 9 refs.

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<sup>5</sup> An asterisk \* represents where two reports have a duplicate number. Report No. 22 in this Series has yet to be sourced.

- Rasch\*, G. 1989. Wildlife and wildlife habitats in the East Cape region. *Technical Report Series 12*. Rotorua Conservancy. Department of Conservation. Rotorua.
- Irving\*, R. M. 1992: Botanical surveys and assessments of Kapenga Swamp lease area & Waikite Wildlife Management Reserve. *Technical Report Series 12*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Beadel, S. M. 1992: Threatened and local plants of Bay of Plenty Conservancy. *Technical Report Series 13*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Montgomery, P. J. 1991: The effects of water-based recreational disturbance on water-birds at Lake Rotoiti, Rotorua. *Technical Report Series 14*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Shaw, D. J. 1992: Trout fishing in the Rotorua Fishing District 1986-1987: an evaluation of the characteristics of anglers and their activities in the Rotorua Fishing District with particular attention to the Rotorua lakes fishery during the 1986 - 1987 trout fishing season. *Technical Report Series 15*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Beadel, S. M. 1993: Vegetation and flora of Tumurau (Braemar) Lagoon. *Technical Report Series 16*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Owen, K. L. 1994: Protection and restoration of marshbird habitat in Tauranga Harbour, 1993. *Technical Report Series 17*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Grouden, V. J. 1993: Matata and Ohope Scenic Reserves historic resources inventory. *Technical Report Series 18*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Grouden, V. J. 1993: Kaimai-Mamaku Forest Park historic resources inventory. *Technical Report Series 19*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Beadel, S. M. 1993: Vegetation and flora of Matahina Conservation Area. *Technical Report Series 20*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Beadel, S. M. 1994: Exclosure and vegetation plots in Rotoehu Conservation Area. *Technical Report Series 21*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Wills, D. E. 1994: New Zealand dotterel on Matakana Island: October 1992 - January 1993. *Technical Report Series 23*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Patrick, B. 1998. Invertebrates of Moutohora. *Technical Report Series 24*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Owen, K. 1996. Case for greater protection of the Australasian [sic] harrier (*Circus approximans*). *Technical Report Series 25*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Owen, K. L.; Wilson, T. D.; Latham, P. D.; Young, K. D. 2006. Distribution and conservation of shorebirds in the Bay of Plenty, New Zealand, 1984-2003. *Technical Report Series 26*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Hochstein, M.P. 2007: Changes in geothermal manifestations and other surface features since the start of the thermal exploitation of the; Mokai and Rotokawa Geothermal Fields, and an assessment of the Tokaanu-Waihi-Hipaua, Te Kopia and Reporoa Geothermal Fields and their Regional Plan Classification. *Technical report series 27*. Department of Conservation. Rotorua.
- <sup>6</sup>DOC (2007 – revised 2010). Draft Flood recovery and rehabilitation of Matata Wildlife Refuge. *Technical Report Series 28*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.

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<sup>6</sup> This report following the debris flood in May 2005 was never published in its initial state in 2007, however it was updated with a 2010 postscript and photos, and was published in the recently established East Coast Bay of Plenty Conservancy Technical Report Series (Appendix 7.2).



- Young, K.D.; Smith, F. 2007: Monitoring and management of Tuhua Marine Reserve: a case study of how local initiatives contribute to broad scale objectives for marine reserves nationally. Proceedings of a workshop held 21 June 2005, Tauranga. *Technical Report Series 29*. Department of Conservation. Rotorua.
- Christensen, B. 2009: Bay of Plenty Conservancy science & research prospectus. *Technical Report Series 30*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Christensen, B. R.; Hustedt, S. 2009: Prioritization of biodiversity projects: at a conservancy and area office level. *Technical Report Series 31*. Bay of Plenty Conservancy. Department of Conservation. Rotorua.
- Christensen, B.; Jefferson, B.; Murphy, I. 2009: Bay of Plenty Conservancy vertebrate skull and sign reference collection. *Bay of Plenty Technical Report Series 32*. Department of Conservation. Rotorua.

## 5. Eastern Region Regional Report Series

The Eastern Regional Report Series was initiated in 1987, although was changed to the two Technical report series (Bay of Plenty and East Coast Hawkes Bay Conservancies) within the same year. The ISSN (0113-3799)<sup>7</sup> for the Eastern Regional Report Series is the same for the Bay of Plenty Conservancy Technical Report Series, which may have contributed to the duplicate numbers (see Appendix 7.4 and footnote 5). The Rasch report is listed in both the Bay of Plenty report series, and in this series. Reports 4-10 have yet to be sourced or found at this time.

DOC. 1987: Nutrient retention in small wastewater effluents: the proceedings of a seminar convened by the Guardians of the Rotorua Lakes on 27 May 1987 in Rotorua. *Eastern Region Regional Report Series 1*. Department of Conservation. Rotorua.

Beadel, S.M. 1987: Assessment of vegetation condition using permanent photographic points, Horomanga catchment, Urewera National Park. *Eastern Region Regional Report Series 2*. Department of Conservation. Rotorua.

Beadel, S.M., Shaw, W.B. 1987: Assessment of feral pig (*Sus scrofa*) impact on indigenous forest, Tauranga River, Urewera National Park: some preliminary results. *Eastern Region Regional Report Series 3*. Department of Conservation. Rotorua.

Rasch, G.1989: Wildlife and wildlife habitat in the Bay of Plenty region. *Regional Report Series No.11*. Department of Conservation, Rotorua.

Rasch, G.1989: Wildlife and wildlife habitat in the East Cape region. *Regional Report Series No.12*. Department of Conservation, Rotorua.

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<sup>7</sup> An additional report was found that also has this ISSN:  
Sutton, A.E.; Daniel, L.J. 1989: A guide to protection mechanisms. *Central Office Technical Report Series no.3*. Department of Conservation, Wellington.

New Zealand Government