

**1. Introduction:**

Funding was received in June 2008<sup>1</sup> from World Wildlife Fund to do baseline surveys of the Waikawau Bay wetlands and estuary and also to produce educational material associated with this project. Further funding was received in August 2008 from Environment Waikato, primarily to look at the spread of saltwater paspalum (*Paspalum vaginatum*) and its impacts in the estuary.

In 2010 WWF Habitat Protection Fund provided a further two years funding to complete the animal predator control infrastructure, and begin a weed pest programme. Some enhancement planting will take place as well.

It was expedient to combine the two projects, both from the economic point of view, but also because it was thought likely that the spread of saltwater paspalum was affecting the life and physical environment of the estuary and saltmarsh, as well as the wetlands behind the estuary.

Rodent control, monitoring of some species, and vegetation restoration of some areas, had begun in the wetlands and estuary, two years prior to the funding of this project. All this work had been carried out by the authors and overseas students on a voluntary basis.

Considerable restoration plantings have been carried out over the last four years. To date over 1000 trees and shrubs have been planted and released, all by schoolchildren, the authors and other volunteers.

Two ecologists have worked two days per week since October 2008 on this project. Many more volunteer hours have supplemented this work.

This wetland project is part of greater system of restoration being undertaken by Moehau Environment Group in the Northern Coromandel. Other MEG projects include: a buffer zone for pest control of approximately 2km wide, in operation from the east to the west coast, just north of the wetlands and estuary; a rodent control project, which has recently allowed the reintroduction of North Island robins into the Pt Charles area; mustelid control over an area of 10,000ha (the MEG Kiwi Zone); and considerable environmental education, such as the annual MEG Summer Holiday Programme. All projects have a public buy in, which has leant greatly to their success.



Waikawau stream, North Waikawau Bay. Wetlands from the Benton track

Waikawau Estuary and saltmarsh

**2. Objectives of Study:**

- To conduct baseline surveys of the flora and fauna and the ecological condition, of wetlands and estuary system of Waikawau Bay

<sup>1</sup> Recently, a further contribution from WWF has been received. This will be distributed over a two year period and will greatly help supplement the funding required to promote the work already done.

- To monitor the growth and impacts of saltwater paspalum in the estuary and saltmarsh systems of North Waikawau Bay.

### **3. Background:**

#### **3.a Site description:**

Waikawau Bay is situated on the Northern Coromandel on the eastern seaboard. The survey area comprises: the estuary/wetlands proper, of approximately 75ha, which is a remnant part of a much larger river/estuary/ harbour/lagoon system, characterized by in-filled, coarse to fine grained silts, sands, and dune and marsh systems. The survey area encompasses both public and private lands.

The Northern Coromandel has a warm moist maritime climate, influenced by two bodies of water (Hauraki Gulf –western side, Pacific Ocean –eastern side). The prevailing winds are gusty southwesterlies (bringing little rain); or easterlies bringing intense and often severe rainstorms (200mm+/hr have been recorded). Heavy rainfall is common with frequent flooding and sea wash.

Tidal influences in association with heavy rainfall events cause severe flooding because valleys are long, narrow, and low lying with abrupt steep ranges behind them. Erosion is often severe with silt laden flood waters.

Salt laden winds during severe easterly storms damage vegetation and cause coastal erosion. These easterlies and the strong southwesters have caused noticeable damage to the dune systems at the northern end of the bay in the past ten years.

The systematic stripping of riparian forest remnants in the farming valley behind the estuary, to the northwest has contributed to this, and there is now little vegetation to break the south-westerlies as they gust down the valleys. As a result of this lack of vegetation, a sand island of some 1200 cu.m (approx.) in the mouth of the estuary eroded away in two years 2006 - 2008. This has led to the mouth of the estuary being more exposed to the sea.

Geology is characterized by andesites with occasional basaltic extrusion plugs. Rhyolite clays are present behind the wetlands. Yellow clays are present throughout rest of the estuarine area. Soils are of medium to poor fertility. There is little evidence of peat deposits.

Thirteen streams feed into Waikawau Bay with two fourth order streams feeding the northern end wetland and estuary. Two third order streams also feed directly into the north end wetland system. The two largest stream watersheds are estimated to be in excess of 5,500ha (approx).

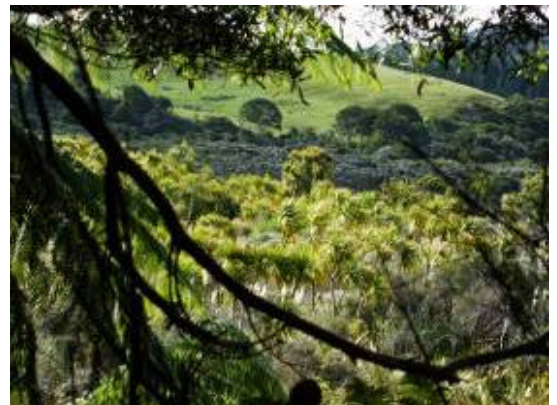
The Bay itself is dominated by the DOC Farm Park Reserve with a large dry stock beef and sheep farm lease. A long narrow fore dune reserve (100m wide) with regenerating native flora separates the agricultural lands from the beach. Farmlands are hard up on the southern edge of the estuary but with good fences to keep stock out.

#### **3.b Human Occupation:**

The Waikawau Bay area has a long history of human occupation and land modifications. There is considerable evidence of Maori occupation throughout the Bay and includes all the common indicators (eg. kianga and pa sites, middens, fish traps, earthworks, gardens and mounds). There is evidence to suggest early occupation about 850 – 950 AD

Midden evidence suggests major occupation between 1300 – 1600 AD. While there is no visible evidence of land clearance, there is evidence of several large garden sites and food storage pits, suggesting that some land was cleared for gardens. There is no way of knowing exactly how many species of flora and fauna were modified due to Maori occupation.

Coromandel was renowned for the quality of its kauri timber and extraction took place from the early 1800's right up into the early



1900's. Other high quality timbers were also being removed at this time. Gum digging and gold mining followed and there is evidence throughout the Bay of adits, mine shafts, tramway beds, dams, tailings mounds, stamper batteries

Traditional farming of sheep, beef and dairying was carried out from the late 1800's to the early 1970's. Dune stabilization was carried out in the early 1900's and there is evidence still of berms, floodgates and tidal stock gates. There are examples throughout the estuary of reclamations; however, most of these are now abandoned.

All farmed lands received significant government subsidies for fertilizers, clearance, fuels and stock transportation. Farm subsidies pre 1970 contributed to some major environmental impacts in the area. Farmers cleared land, dug ditches, diverted streams and drained wetlands in an effort to make the land more agriculturally productive. With the removal of subsidies much marginal agricultural land was retired, converted to forestry, or sub divided into smaller lifestyle blocks. The more gently rolling hill country and valley floors remained in farms.

Almost all of this retired land is now in regenerating scrub and forest (and weeds); and is contributing positively to reduction of steep hill country erosion, (and therefore improved water quality) and the water purity of streams, and the subsequent health of wetland, estuary and ocean beach ecosystems. Forest remnants are all heavily modified.

There are now only two major farms in the Bay, one of which is the DOC Farm Park lease. Both farms are dry stock. There are three large lifestyle blocks (175ha + each) which are mainly made up of regenerating forest and several small lifestyle blocks (20ha or less), two of which are small dry stock farms – the rest are regenerating forest lands.

### **3.c. Animal Pest Control<sup>2</sup> and Monitors:**

Considerable pest control had been carried out in the area prior to the funding of the baseline work. Monitoring of rodent numbers, pateke and fernbird numbers has been carried out since 2006. Most pest control, the development of a pest control infrastructure, and all monitor work has been carried out by volunteers.

In 1999, 36 traps were installed for trapping mustelids and hedgehogs<sup>3</sup> along the foreshore of the Bay and the northern margins of the estuary system. Traps are serviced by volunteers on a monthly basis, except over the summer period when they are checked weekly. Further trap lines for mustelids were installed on the eastern, western and southern margins of the wetlands in 2005. These traps are serviced by contractors employed by Moehau Environment Group (with funding from BNZ Save the Kiwi Trust) as part of kiwi protection work.

In 2006, 150 rat traps were installed around the margins of the wetlands. At this time 75 bait stations were also installed around the perimeter and on two lines in the heart of the wetlands.<sup>4</sup> Rat traps are checked approximately every two weeks by volunteers. Bait stations are serviced every three months. Data is kept of all rats and mice trapped. Monitoring of the effectiveness of trapping is done every three months by independent auditors. To date, monitors show that rodent numbers have declined significantly and weta and skink numbers have increased. More traps are presently being installed on the north western margin of the salt marsh, along the Waikawau Bay Road margins, and upgrades are underway along the back edge of the wetlands.

In the past 4 months a completely new bait station infrastructure (a separate project) has been installed covering some 500ha in the surrounding upper catchment behind the estuary and wetlands. This effectively creates a buffer for the work currently underway in the wetlands and estuary and helps to reduce impacts from animal predator reinvasions. While it is early days yet, there are signs that this animal control project is contributing significant gains to the wetlands especially, with a much reduced rodent presence evidenced from the recent monitoring.

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<sup>2</sup> All animal pest control is carried out after full consultation with landowners. Only methods approved by each landowner (be they public or private) are utilized. Approval by all landowners to carry out pest control has been given.

<sup>3</sup> Hedgehogs are trapped along the foreshore and dune systems, as they are one of the main predators of NZ Dotterels and Variable Oyster Catcher eggs and chicks.

<sup>4</sup> Rat traps were not placed in the heart of the wetlands, so that human impacts are minimized in this fragile environment.

#### 4. The Surveys:

Baseline surveys cover five broad fronts, each interconnected or overlapping:

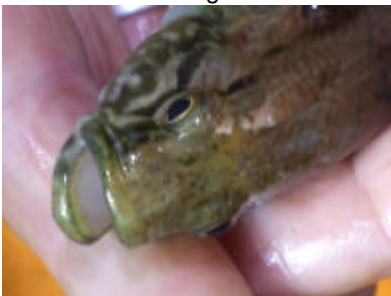
- Flora studies:
  - A full list of botanical species present.
  - Saltwater paspalum monitors (see below)
- Fauna studies:
  - Reptile surveys: Artificial gecko houses  
Pitfall traps  
Tracking tunnels  
Each surveyed every 1-2 months
  - Invertebrate surveys:  
One survey over a 2 week period by an entomologist covering prescribed survey lines in the area.  
Material found in pitfalls used for reptile surveys or under artificial reptile houses.  
Observations made during the course of other survey work.
  - Shellfish Surveys:  
Three survey areas on the north and south sides of the estuary.  
Each area containing 16 survey plots (2.5mX2.5m), dug and sifted to a depth of 8cm.
  - Bird Surveys: Five minute bird counts, covering 2X2k lines (two surveys; late spring and late autumn)  
Pateke census (annually)  
Fernbird monitors (Twice a year)  
Shore and wader bird census( annually)  
Observations made during the course of other survey work.
  - Freshwater fish surveys:  
Daylight trawls of streams, inundated pastures and ditches, using handheld nets  
Baited fish traps placed in streams and ditches overnight  
Night surveys of streams and ditches using nets and spotlights  
'G-Minnow' traps placed in likely places for a number of nights and checked daily.
- Saltwater paspalum surveys:
  - Measurement of growth (tenx10m wide plots established, [including two test spray plots] which are to be measured every three months, for two years. Four surveys completed.
  - Core sampling and random fauna squares taken in each of the measurement areas established (above)
  - Photo diary and photo plots (two 10X10m sq plots established in the saltmarsh in north and south side of estuary). All plant species were mapped.
  - Observations made during the course of other survey work.
- Mapping:
  - An independent mapping expert was employed to construct maps from the GPS data obtained in the survey work and to construct other maps where required.
- Physical studies:
  - 7 Profile lines were surveyed across the estuary , from estuary mouth to upper reaches . Core samples and fauna sample were taken at intervals along key lines. Surveys of these lines will be repeated at six month intervals, or after heavy weather events, to determine changes in the estuary floor and hydrology.

Anecdotal evidence was used where appropriate to supplement survey work.

#### 5. Findings:

5.1 All common native flora species were well represented in both the saltmarsh and the wetlands. This was established and verified by the Waikato Botanical Society.

- 5.2 Significant patches of pampas, mistflower and small amounts of woolly nightshade and grey willow are present in the wetland. In the saltmarsh there are large patches of pampas, and spartina and significant areas of saltwater paspalum. The paspalum is changing the hydrology, flora, fauna and physical makeup of the environment.
- 5.3 It was expected that copper skinks would be present. However, fewer have been found than anticipated. Rainbow skinks, however, were found in abundance throughout the survey area. It is possible that the rainbow skink is supplanting the copper in this habitat.
- 5.4 The golden/green bell frog was found. This exotic frog is now returning after a dramatic decline due to the chytrid fungus in the area.
- 5.5 A forest gecko has become resident in one of the artificial gecko houses. This is on the bund in the northern part of the estuary and about 250m from other suitable dry land habitats. Green geckos and common forest geckos were found on the margins and in the surrounds of the survey area, but not in the area itself.
- 5.6 For the five minute bird counts A total 289 birds were recorded in the December survey. There were 34 species. A total of 22 species were either native or endemic (65%). 12 species were exotic (35%). Of these 172 birds were native (60%) or endemic and 117 were exotic (40%).
- 5.7 A recent shore and wader bird census was carried out. Variable Oystercatchers, NZ Dotterels, Banded Dotterels, Pied Stilts, Caspian Terns, Black Backed Gulls, Red billed Gulls, Australasian Gannets were noted.
- 5.8 There were a total number of 317 birds recorded during the April five minute bird counts survey. There were 28 species recorded. 19 species were native or endemic (68%) and 9 were exotic (32%). 217 of the birds recorded were native or endemic (68%) and 100 were exotic (32%).
- 5.9 There is a healthy and rapidly increasing (recently established) population of pateke (100+).
- 5.10 There is a healthy and abundant fernbird population (120+).
- 5.10 Banded rail are present and increasing. They are now seen most days during field surveys.
- 5.11 Australasian bittern are regularly seen in the area. On one occasion in 2007, five birds were sighted in the Karuna Pond. Bittern are now known to be breeding in the area, with the positive identification of two juveniles in the last two years.
- 5.12 Spotless crane are also present. It is not known how many spotless crane there are, but two pair have been observed so far.
- 5.13 Observations suggest that as a consequence of animal pest control there has been a noticeable increase in the number of birds and bird species present in the area under survey:- shore, waders, wetland, bush and field species.
- 5.14 Large numbers of banded kokopu and short finned eels were found in all the streams and ditches. Some long finned eels have also been sited.



Giant kokopu netted in Leo's ditches



Wayne Todd, netting for surveys



Inanga netted in Whitehouse ditches.

- 5.15 Large numbers of giant bullies and red finned bullies were also found in some streams.
- 5.16 Healthy populations of inanga and freshwater shrimps were found.
- 5.17 No exotic freshwater fish species were found.
- 5.18 Ground beetles were abundant in some areas.
- 5.19 Large numbers of spiders, including the Australian whitetail were found.
- 5.20 At least one species of ground weta are present and cave weta and tree weta species have also been caught.
- 5.21 Few species of butterflies were recorded. None were recorded in the wetlands area. There are few day flying moth species also, but further work is required on this.
- 5.22 Several introduced predatory wasp species were found with the Asian paper wasp present in significant numbers throughout the wetland and upper estuary.
- 5.23 Cockle beds are large, healthy and densities are up with the highest recorded in the North Island. Other common shellfish species are present, including Wedge shells. Pipsis are small in size and number, Tuatua are present but are multi year cyclic in abundance. About once in 10-15 years are they in very large numbers. 2005-06 was the last population expansion.
- 5.24 As a consequence of trapping and baiting over the last three years, rodents are now present in reduced numbers. Rat presence is being monitored at between 0-5%. Mouse presence is much more variable. Early in 2010, during the drought, mouse presence escalated in the wetlands, (85% of sights monitored, around the pampas and the bunds had mouse prints). It is thought that mice were moving from dry areas to the water. Latest monitors (August 2010), once again, show a very low rat presence (5%). A number of feral cats have also been taken out of the wetlands/estuary/dunelands area over the last three years.
- 5.25 Core samples, fauna squares and saltwater paspalum growth measurement rates have been carried out every 3 months, at 9 specified sites on each of the estuary over the past 15 months. Provisional findings indicate little native fauna within saltwater paspalum growth areas and silt build up with anoxic patches within these survey areas.

## **6 Recommendations:**

- 6.1 Continued reptile monitors using pitfall, artificial shelters and tracking tunnels be carried out every two months for the next two years. Particular efforts need to be made to locate copper skinks. Night searches need to be instigated.
- 6.2 Continue 5 minute bird counts in Spring and Autumn and carry out estuary and coastline census of wading bird species at least once per year.
- 6.3 Pateke populations continue to be monitored annually.
- 6.4 Fernbird monitoring, as an indicator of rodent control, be carried out twice a year.
- 6.5 A shore and wading bird census will be taken annually.
- 6.6 Rodent monitoring, using tracking tunnels, continue to be done every three months.
- 6.7 Eradication of introduced wasp species and monitoring of butterfly species needs to be initiated (wasps have been shown to wipe out our native butterflies). Wasps may also have an impact on fernbirds, as they are competing for the same food sources.
- 6.8 The health of the estuary is indicated by shellfish beds. These beds filter sediments, support bird life and fish stocks. Therefore, further work assessing the health and size of the shellfish

beds is desirable. Impacts of saltwater paspalum growth on the beds will need to be monitored closely.

6.9 Netting to live capture, identify, measure and release estuarine fish species, be carried out in the next twelve months.

6.10 Core sampling, fauna plot sampling, and other measurements along profile lines, to be carried out for at least two years.

6.11 Paspalum measurements should continue to be done three times per year, for the next two years. A Report assessing of the impacts of this weed will need to be completed<sup>5</sup>, and a Management Plan for controlling the saltwater paspalum constructed.

6.12 Work to control pampas and other invasive weeds needs to be initiated immediately.

6.13 Restoration planting (using locally sourced plants) will need to be continued, especially in areas where weed species are removed.

6.14. Write a Management Plan for the restoration of the wetlands and estuary.

## **7. Conclusions:**

7.1 A substantial amount of survey work has been completed. Findings indicate that there is much more that can be investigated. However initial findings suggest that while the estuary may be threatened by introduced species of plants and some invertebrates, it is in surprisingly good health with robust numbers of many native flora and fauna species.

7.2 As improvements are made and monitored there has been a substantial, and immediately noticeable change in bird populations (fern birds, banded rail, and pateke in particular), but all species.

7.3 Further gains will be made as impacts of alien plant and animal species are reduced.

7.4 It is hoped that monitoring positive changes over time will provide useful examples, for educational purposes, and inspire other coastal wetlands restoration projects.

**Report and surveys by Wayne Todd and Kathi Parr, for: Moehau Environment Group,  
World Wildlife Fund and Environment Waikato**

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<sup>5</sup> A 12 month Provisional Report has been written and is available on request (July 2010).