

CHAPTER 12

NATIVE FAUNA

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NATIVE FAUNA

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CORINNE WATTS, MONICA PETERS
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Wetlands provide specialised habitats for a variety of fauna, including birds, fish, skinks, geckos, frogs and invertebrates – both terrestrial and aquatic. Many of New Zealand’s wetland fauna are endemic, in other words, found nowhere else in the world. Species in this category include the green skink (*Oligosoma chloronoton*), fernbird/matata (*Bowdleria punctata*), brown teal/pateke (*Anas aucklandica*), New Zealand dabchicks/weweia (*Poliiocephalus rufopectus*), scaup/papango (*Aythya novaeseelandiae*), paradise shelducks/putangitangi (*Tadorna variegata*), kokopu (*Galaxias* spp.), mudfish/kowaro (*Neochanna* spp.), and freshwater crayfish/koura (*Paranephrops* spp.). The majority of invertebrates are unique to New Zealand. This includes the recently discovered moth named *Houdinia flexilissima* (which describes its hidden threadlike larval form), beetles, dragonflies and midges, as well as snails, and small crustaceans called “seed-shrimps” and “water fleas”.

Despite the limited area covered by remnant wetlands in New Zealand, wetlands are home to 22% of our bird species and 30% of our native freshwater fish. We do not know what proportion of New Zealand’s invertebrates live within wetlands, but we do know that similar numbers of different invertebrate species are found in wetlands as in rivers and streams. Wetland restoration projects provide important wetland habitat that this diverse range of fauna need and also help ensure our wildlife survives into the future.

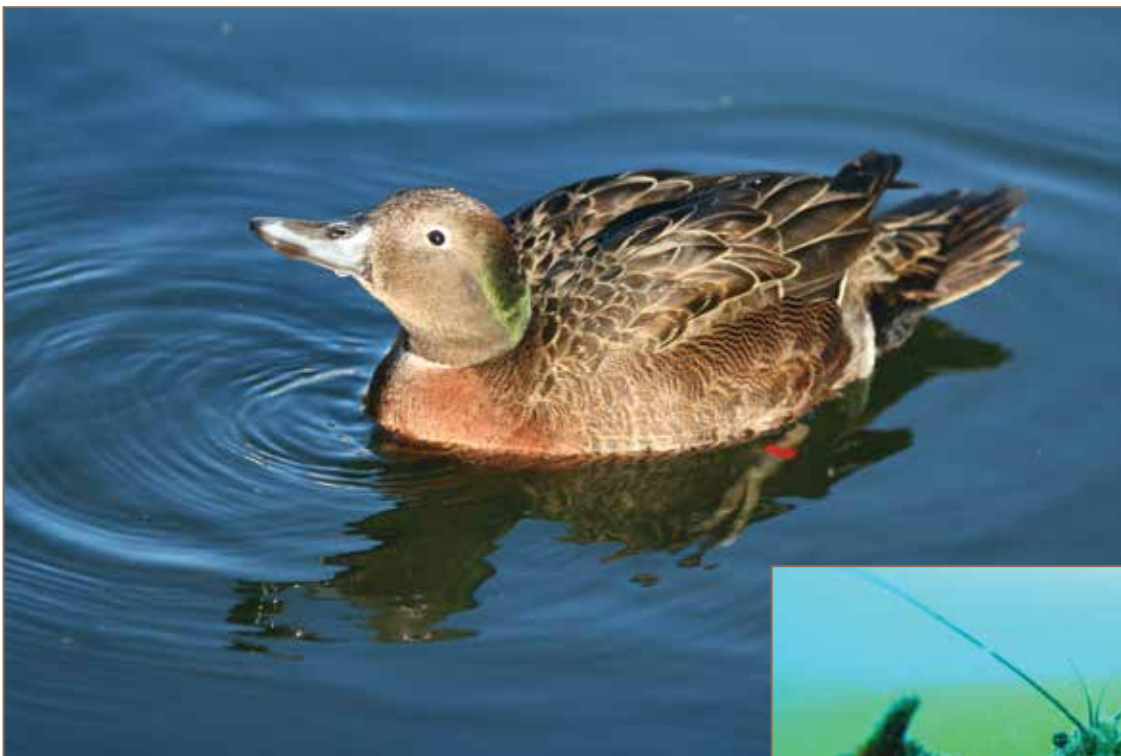
The two case studies in this chapter profile the ZEALANDIA - Karori Sanctuary in urban Wellington and wrybill conservation efforts in the braided rivers of the Ashburton lakes area. The goal of the first case study is to reintroduce native fauna characteristic of region, while the second case study highlights the challenges of managing and monitoring a unique endemic bird.

Previous page: A glimpse of the secretive spotless crane.

Photo: Andrew Bauke. Crown Copyright, Department of Conservation



There is still much to be learned about wetland insect fauna — *Houdinia flexilissima* is a recently named new genus of moth associated with a rush species endemic to the Waikato. Larvae and rush stem (on right) showing distinctive feeding scars. Photo: Birgit Rhode, Landcare Research



Brown teal is the rarest waterfowl species on the New Zealand mainland with fewer than 2000 remaining. Photo: Tom Lynch. Copyright ZEALANDIA Karori Sanctuary Trust



Koura, the freshwater crayfish can burrow well down into swamps that dry out over summer, waiting there until the water returns.

Photo: John Clayton, NIWA

1 Restoring your wetland

1.1 Developing a Wetland Restoration Plan

A Wetland Restoration Plan is extremely useful for gathering information about the restoration site, clarifying and setting goals, as well as the designing the implementation and monitoring phases of the project. A list of actions such as pest control (see Chapter 11 – Pests) will be necessary to successfully encourage native fauna into your wetland, and/or provide the best conditions for species translocations. Follow the steps outlined in Chapter 2 – Restoration planning or use one of the templates listed at the end of the chapter.

1.1.1 Mapping

A useful starting point for developing a Wetland Restoration Plan is a sketch map. A bird's-eye view sketch map is important as it helps to summarise knowledge about the natural and man-made character of the restoration site. It is a practical tool to define, for example, management zones and locations of permanent plots or sites for monitoring. The map can be hand drawn using a range of resources such as aerial photos, topographic maps and Google Earth combined with your own knowledge.

The following features should be included:

- Vegetation types
- Water sources and outflows, hydrological modifications, water level
- Soil type
- Man-made, natural and cultural features

For more detail on what to include, see Chapter 2 – Restoration planning.

Opposite: All five whitebait/inanga species spend part of their lifecycle in freshwater and part in the sea.

Photo: Phillippe Gerbeaux. Crown Copyright, Department of Conservation

1.2 Determining wetland type

Determining the type of wetland you have is important, as each type has specific nutrient and hydrological regimes that favour specific plant communities and therefore animal communities. For example, recent studies have shown that acidic fens and bogs support very different aquatic invertebrate assemblages than less acidic swamps, with many species of snails being absent in wetlands with acidic water. This absence reflects that fact that snails cannot obtain enough calcium from acidic waters to build their shells. Detailed information to help with determining what type (or types) of wetland the restoration site is, can be found in Chapter 3 – Wetland types.

1.3 Understanding the site

Researching historical records and locating similar wetlands (outlined in Chapter 4 – Site interpretation 1) may yield important information on both species and population sizes of fauna (though is usually limited to birds and fish). Knowledge of the types of species that were once likely to be present in the wetland, or that are found in similar, but unimpacted wetlands can help guide restoration goals (see also Chapter 5 – Site interpretation 2).



The New Zealand dabchick is called weweia by Maori for the sound of its occasional shrill call “wee—ee—ee”.

Photo: Dick Veitch. Crown Copyright, Department of Conservation



1.4 Setting realistic goals and objectives

An important goal, and normally the last to be implemented, of any wetland restoration project is to encourage native fauna into your restored wetland. Specific objectives linked to this goal may, for example, be to:

- encourage native waterfowl to visit your wetland to establish a breeding population
- reintroduce an iconic wetland species, e.g., brown teal and fernbird
- build populations of eel/tuna for sustainable harvest
- establish new populations of endangered species within their former range (e.g., mudfish)
- remove barriers from streams and ditches connected to the wetland restoration site to promote colonisation by native fish species
- increase suitable habitat for whitebait within the wetland and connecting waterways
- create a refuge for lizards by carrying out pest control and planting suitable food species
- improve invertebrate numbers as food for native fauna

Other general goals may be to restore wetland habitat to create more natural conditions to enable natural colonisation by desired species. This is particularly true for aquatic habitats, which have often been dramatically altered or destroyed as a result of wetland drainage. Aquatic habitats in modified wetlands have often been reduced to little more than small straightened channels, with poor habitat quality. Their banks are also often vertical, giving little cover to animals among overhanging material. Any aquatic plants growing in these channels are often mechanically or chemically removed, further lowering the habitat value of drains. Restoration activities such as

blocking up flowing channels can help improve aquatic habitats by encouraging both native aquatic and native wetland plants to grow.

1.4.1 Keeping it legal

Most native wetland bird species are fully protected under the Wildlife Management Act (1993), which is administered by the Department of Conservation. This means that the majority of species translocations you may consider as part of a restoration project will need specific approval. For example, releasing fish into a restored waterway may require a number of permits, namely from the Department of Conservation Fish and Game Council, and/or the Ministry of Fisheries. The Department of Conservation has strict guidelines, set out in the 'Standard Operating Procedure for Translocation of New Zealand's Indigenous Flora and Fauna', (2002), The translocation proposal must, for example, consider:

- the effect of translocation on the source population and release site
- the method of translocation
- monitoring, research, and management requirements

Even releasing invertebrates into newly restored wetlands will require permits. Permits are also required to trap, catch and handle all lizards (i.e. skinks and geckos), hence the focus in the last section of this chapter on "passive" monitoring methods that do not involve handling. Contact the Department of Conservation for further advice if you are considering translocating native fauna or may be handling or trapping any native fauna for monitoring purposes. You will also need to contact the Department of Conservation for a permit to undertake customary and recreational fishing in Department of Conservation Wildlife Management Reserves.



Example of a degraded aquatic habitat in a highly modified wetland. Mechanical clearing, herbicide use and trampling by cattle further reduces any potential habitat values for aquatic fauna.

Photo: Alastair Suren, NIWA

Example of a healthy habitat dominated by native wetland plants. Despite the canal being a man-made feature, note the dense growth, lack of weeds and stock damage on the banks. Kopuatai peat dome, Waikato.

Photo: Monica Peters, NZ Landcare Trust



CASE STUDY

ZEALANDIA – KARORI SANCTUARY: WHAT NATIVE FAUNA SHOULD BE REINTRODUCED?

In the heart of Wellington lies the ZEALANDIA - Karori Sanctuary. An 8.6-km predator-proof fence surrounds 225 ha of regenerating lowland forest and wetlands. The goal is to reintroduce native fauna characteristic of the southern lowland North Island, both before human settlement and naturally established since then. This includes 35 species of bird (of which 10 are now extinct), 2 species of semi-aquatic amphibian (1 now extinct), and approximately 19 species of fish (1 now extinct). There are no historical data on wetland invertebrates. As a “mainland conservation island”, successful reintroductions to ZEALANDIA already include tuatara, little spotted kiwi, brown teal/pateke, saddleback/tieke, and stitchbird/hihi.



The brown teal occupies a unique ecological niche among waterfowl with its omnivorous diet, restricted annual range, and mainly terrestrial lifestyle. Photo: Tom Lynch © ZEALANDIA/Karori Sanctuary Trust

Native fish

Wetland areas developed around two old water reservoirs will provide habitat for a range of aquatic species. Long- and short-finned eels/tuna, and banded kokopu are already present. Bullies and other galaxiids are some of the native fish species that will be introduced as they are able to:

- pass through the predator-proof fence; or
- be caught and transferred over the fence to complete their migration.

However, before any new native fish species can be released, brown trout and perch (both exotic fish species) will need to be eradicated.

Aquatic Birds

The lakes, streams and wetlands in ZEALANDIA provide a variety of habitats that are attractive to a range of aquatic birds. A recent self-introduction is the pied shag/ karuhiruhi; however, other species need help. Brown teal and New Zealand

scaup/papango (all sourced from captive breeding programmes) have already been released. As the wetland and lake habitats improve, further releases could include the Australian coot and grey teal/tete. Species such as dabchick, marsh crake, and spotless crake have never been transferred and new techniques may need trialling. Source populations for each will also need to be identified.

Invertebrates

Diverse freshwater invertebrates inhabit the streams in ZEALANDIA. To date 2 new species of water beetle have been discovered. Wetland invertebrate reintroduction is an unknown science therefore any transfers will need careful monitoring and evaluation. As with reintroducing native fish, exotic fish will need to be eradicated first.

– *Raewyn Empson, ZEALANDIA – Karori Sanctuary*

REF: www.sanctuary.org.nz/



Following protocols: powhiri to welcome tuatara (gifted by kaitiaki Ngati Koata) 2007. Photos: Alan Dicks © ZEALANDIA/Karori Sanctuary Trust



ATTRACTING BIRDS WITH PLANTS

- Paradise shelducks feed on pasture next to wetlands
- Rails, crakes, pukeko and fernbirds feed and nest around damp areas of vegetation
- Fernbirds prefer wetlands with dense ground cover under a selection of shrubs and small trees (e.g., manuka)
- The spotless crane and marsh crane are secretive birds that feed in permanently shallow water under cover of dense raupo or flax. They build nests under sheltering sedges among stands of manuka. You would need less than half a hectare of this habitat to support a breeding pair of spotless crane
- Pied stilts feed on worms and insects in temporary winter pools in paddocks and nest in scattered clumps of rushes
- Tui, waxeyes and bellbirds will feed on flax and kowhai. Kereru will visit fruiting kahikatea

– www.waikatoregion.govt.nz "Attracting birds"

2 Encouraging native fauna

Given the legal requirements for translocating native fauna, it will be much better (and easier) in many cases to try and create the right habitat conditions within a restored wetland, and then wait for these habitats to be naturally colonized by desired native fauna such as birds, fish, lizards and invertebrates (terrestrial and aquatic). The advantages of natural recolonisation are that it is much less labour intensive, cheaper, and most species by virtue of their proximity will be eco-sourced. However, the further away a restored wetland is from natural populations, the harder it will be for them to colonise.

2.1 Birds

Well over 50 species of native bird use wetlands at some time in their lifecycles. Some, such as the kingfisher/kotare (*Halcyon sancta*), use a variety of water locations including the coast, while others, such as the fernbird/matata (*Bowdleria punctata*), rely on specific types of freshwater wetlands. A number of birds that depend on freshwater wetlands are highly secretive and therefore not very visible, e.g., the spotless crake/puweto (*Porzana tabuensis*) and marsh crake/koitareke (*Porzana pusilla*), banded rail/moho-pereru (*Rallus philippensis*), and the Australasian bittern/matuku (*Botaurus poiciloptilus*). Many wetland birds nest on or close to the ground or on floating platforms of vegetation, which makes them highly vulnerable to predation. Pest animal pressure combined with habitat loss mean many native wetland birds are now highly dependent on wetland restoration and conservation initiatives for their survival. Species currently most at risk include the New Zealand dabchick/weweia (*Poliocephalus rufopectus*) – currently classified as threatened, the black stilt/kaki (*Himantopus novaeseelandiae*) – highly endangered, and the brown teal/pateke (*Anas aucklandica*) – endangered.

Opposite: Fernbirds are very weak flyers, and reluctant to leave cover.

Photo: P. Thompson. Crown Copyright, Department of Conservation

A basic need for wetland birds is pest control. Rodents, possums, hedgehogs, mustelids and cats all take invertebrates, birds' eggs, chicks, and even adult birds. Weed control and planting desirable natives will also help create a better habitat for birds. 'Extras' you can provide during the course of the wetland restoration include:

- Logs and trees for perching sites and shelter for birds
- Gently sloping, irregular shorelines to allow easy access to and from any water within the wetland
- Safe nesting sites, e.g., islands or floating rafts of plants on open water within the wetland
- Nesting boxes (links are included at the end of the chapter)
- A 'green corridor' of native plants to join the wetland to native bush areas or other wetlands

Importantly, stopping or significantly reducing grazing and other activities near the wetland during the bird breeding season (Sept–Dec for most species) will help minimise any unnecessary disturbance.



Although pukeko are native they are naturally inquisitive and can uproot areas of new plantings (see Chapter 10 – Revegetation for tips on “pukeko proofing” your plantings).

Photo: Monica Peters, NZ Landcare Trust

Opposite: A dead tree is put to good use as a strategically placed bird perch and is viewable from the hide. Otatara, Southland.

Photo: Monica Peters, NZ Landcare Trust



The marsh crake inhabits fresh and salt water swamps and can also be found along the marshy banks of rivers. Photo: Peter Moore. Crown Copyright, Department of Conservation



The substantial Kaitoke Swamp on Great Barrier Island provides a wide range of different habitat types including shrubland, sedgeland, and shallow water. Photo: Danny Thornburrow, Landcare Research



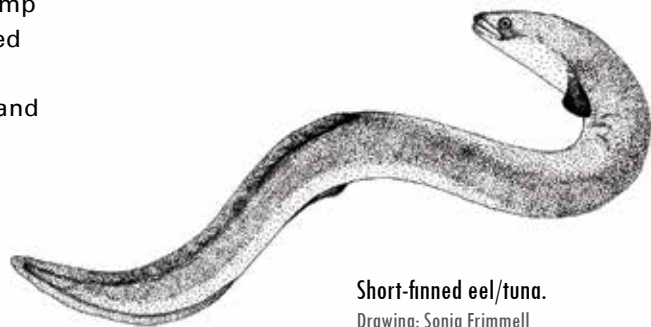
ATTRACTING BIRDS WITH WATER

- All waterfowl need open water to moult in safety, away from predators
- New Zealand scaup like deep, open, clear water
- Mallards, grey ducks, shoveler, and grey teal favour shallow water around the edges of a pond or lake
- New Zealand dabchicks feed in deep, open water, but build their nests on floating rafts of vegetation among reeds

2.2 Fish

Short finned eels (*Anguilla australis*), whitebait/inanga (five separate galaxiid species), and giant kokopu (*Galaxias argenteus*) are some of the native fish that live in wetlands for some or all of their lives. These fish are diadromous, in other words they travel between fresh and salt water. To complete their lifecycles, they journey to and from the sea along rivers, streams and drains. Whitebait has similar needs. Whitebait is the collective term for giant, banded and short jawed kokopu (*Galaxias argenteus*, *G. fasciatus* and *G. postvectis*), inanga (*Galaxias maculatus*), and koaro (*Galaxias brevipinnis*). Their eggs hatch in autumn and the larvae are washed out to sea. Six months later as juveniles they return to streams and wetlands, some migrating over 100 kms upstream from the sea. Juvenile kokopu and koaro can even climb up damp rocks alongside steep waterfalls to reach sheltered streams and wetland habitats. Wetlands are also home to our native freshwater crab, pea mussel and crayfish/koura (*Paranephrops* spp.).

Although birds, plants and many insects can migrate into newly restored wetlands from surrounding areas, the colonization of aquatic habitats by fish is only possible if they are linked to other habitats via rivers, streams or ditches. In other words, creating an isolated pond within a wetland is unlikely to result in fish being found there. Long stretches of fast-flowing or polluted water, flap gates, or over-hanging culverts act as impassable barriers for fish movement. Instead, native fish need streams with fairly clear water, shading and cover, though bear in mind that pest fish will also use these routes to invade wetlands (see Chapter 11 – Pests).



Short-finned eel/tuna.
Drawing: Sonia Frimmell



Giant kokopu. Photo: Stephen Moore, Landcare Research



Whitebait/inanga.
Drawing: Sonia Frimmell



Strategically placed ropes can help whitebait travel up streams where there are perched culverts.
Photo: Bruno David, Environment Waikato



Coromandel potter Barry Brickell uses discarded plates and bowls to create novel fish ladders in the Driving Creek Wetland Sanctuary.
Photo: Monica Peters, NZ Landcare Trust



Perched culvert preventing fish passage. Raglan, Waikato.
Photo: Monica Peters, NZ Landcare Trust

HELP FISH FIND YOUR WETLAND BY:

- ensuring watercourses (natural and manmade) connected to wetlands are at least 10 cm deep
- planting overhanging plant species (flax and sedges) for shelter and to keep the water cool
- placing a hay bale at the head of a ditch entering your wetland to act as a simple silt trap as muddy water limits their vision and reduces their food supply of aquatic insects
- leaving one side of drains untouched when you are cleaning them
- placing culverts low in the stream bed to enable fish passage through them
- roughing up the bottom of long culverts with, e.g., concrete and rubble or ropes to slow the speed of the water

– www.ecan.govt.nz "Wetland wildlife"



Mudfish.

Drawing :Sonia Frimmell

Mudfish (five species located in the North, South and Chatham Islands, all classified as threatened) spend their entire lives in wetlands or other habitats such as drains or weed-filled creek beds. In contrast to diadromous fish, mudfish (*Neochanna* spp.) are able to burrow deep into mud or under logs where they aestivate (hibernate) for weeks at a time during dry spells. In doing so, mudfish occupy a unique niche not accessible to other fish. However, at other times, mudfish still fall prey to introduced fish like trout and mosquito fish, which also impact on other native fauna. Creating isolated ponds just for mudfish where these predators can not gain access may be the key to their survival in our wetlands.



Canterbury mudfish (*Neochanna burrowsius*) habitat. Hororata, Canterbury. Photo: Sjaan Charteris. Crown Copyright, Department of Conservation

2.3 Invertebrates, lizards and other native fauna

Although wetland restoration projects are often focussed on introducing, maintaining and/or enhancing populations of wetland fish, birds and lizards, it is also important to consider the invertebrates. Despite their small size, invertebrates perform key roles in many ecosystem processes, including pollination of wetland plants, litter decomposition and nutrient cycling, soil aeration, herbivory, seed dispersal and predation. Invertebrates also provide a source of food for native vertebrate populations. For example, many of the small snails, crustaceans and midges that live in wetlands are important components of the diets of fish and wading birds. Typical wetlands can have hundreds of unseen invertebrate species – both terrestrial and aquatic.

Encouraging aquatic invertebrates into restored wetlands is relatively easy. Small drains can easily be blocked, turning flowing water into standing water. This was successfully done at Bullock Creek, a small wetland on the West Coast (north of Greymouth). Though now under the stewardship of DOC, the wetland had been subject to human disturbance for over a hundred years. Part of the restoration included blocking drains to raise the water table, which enabled wetland plants to re-establish. Invertebrate communities within the drains were also monitored to assess the effect of drain blockage. The resulting invertebrate community became increasingly similar to those found in natural wetlands, suggesting blocking the drains helped return the wetland to a more natural condition. The fascinating thing about this work was that, apart from the initial drain blocking, no further actions were taken, yet the invertebrate community changed itself and began to resemble those in other natural wetlands.

Terrestrial invertebrates will also disperse into restored wetlands relatively quickly if the habitat created is favourable – ‘if you build it, they will come!’ To encourage invertebrates provide

habitats that include dead logs, a dense leaf litter and native vegetation. Other important factors are controlling those pest animals that are predators and competitors (see Chapter 11 – Pests), and creating a ‘green corridor’ between other wetlands or native bush areas. Experiments undertaken at Torehape peat mine (Hauraki Plains) showed that insect communities dispersed into restored habitats using ‘stepping stones’ of native vegetation. The furthest distance insect communities (particularly beetles) were able to travel over bare ground was 400 m, highlighting the importance of green corridors and the presence of a source population of insects to colonise restored areas.



Even the smallest inhabitants of wetlands, such as the nursery web spider, are often overlooked, despite their important ecological role. Te Hapua, Wellington. Photo: Monica Peters, NZ Landcare Trust

Lizards are omnivores, eating a variety of insects such as moths and flies, as well as fruit (from, e.g., *Coprosma* spp.) and nectar from flowers. Lizards, like other invertebrates, also help disperse seeds and pollinate some species of native wetland plants. Simple shelters for lizards can be made from stacking 2–3 sheets of corrugated roofing material, using small stones as spacers between the layers (see photo). Shelters can be placed around the edges of a wetland in dry sunny areas with good shrub or tussock cover. Lizards are extremely sensitive to disturbance so minimise any intrusions. While providing a safe haven from predators, the lizard shelters can also help track of lizard populations in the wetland – see the monitoring section at the end of the chapter for further information.

In most cases, frogs found in/near wetlands are likely to be exotic – only one native frog is found in damp areas such as alongside streams. Hochstetter’s frog (*Leiopelma hochstetteri*) is widely distributed in the northern half of the North Island; at least 10 fragmented and isolated populations have been documented. The frog, however, is listed as vulnerable and this is due to the ongoing destruction and modification of its habitat both directly (e.g., afforestation, gold mining, storm water discharge) and indirectly (e.g., erosion caused by feral goats and pigs leading to waterway siltation). The frogs are nocturnal. The 3 introduced frogs, namely the green and golden bell frog (*Litoria aurea*), southern bell frog (*Litoria raniformis*), and brown tree frog (*Litoria ewingii*), are all found in wetland habitats, though their distributions vary.

ENCOURAGE INVERTEBRATES, LIZARDS AND OTHER FAUNA BY:

- controlling pest animals that are predators and competitors (see Chapter 11 – Pests)
- providing dead logs for terrestrial invertebrate habitat
- providing native vegetation for native insects, lizards and frogs to feed on and shelter in
- creating lizard refuges using corrugated materials
- linking wetlands near native bush areas or other wetlands with a ‘green corridor’ of native plants where possible

Te Hapua wetland (Wellington) is a fragmented wetland being restored by local landowners. With increasing pressure on coastal areas for development, these sites provide valuable refuges for native fauna. Photo: Monica Peters, NZ Landcare Trust





An artificial retreat made of two layers of Onduline, which attracts lizards because it absorbs heat and provides shelter and protection from predators. Photo: Marieke Lettink, Fauna Finders



In the 19th century at least 8 species of frogs were imported into New Zealand, though only three, including the green and golden bell frog, established populations that still exist today. Photo: D. Garrick. Crown Copyright, Department of Conservation



The green skink (*Oligosoma chloronoton*) is a large diurnal skink known from wetlands and other habitats in the southern South Island. Photo: Marieke Lettink, Fauna Finders



As ground dwelling predators, Carabid beetles are commonly found in drier fens and bogs. They “stink” when disturbed and are not palatable to mammals. Photo: Danny Thornburrow, Landcare Research



The larva of the native chafer beetle (*Odontria* sp.) eats the roots of wetland plants and is readily identified by its “c”-shaped body. Photo: Danny Thornburrow, Landcare Research



Hochstetter's frogs are hard to locate as they are well camouflaged and nocturnal. Coromandel. Photo: Gregory Sherley. Crown Copyright, Department of Conservation

CASE STUDY

RANGITATA RIVER: CONSERVATION ACTION FOR THE UNIQUE WRYBILL

Maintaining and enhancing (restoring) the values of the wetlands, rivers and lakes of the upper Rangitata River and Ashburton Basin (O Tū Wharekai) is being undertaken by the Department of Conservation (DOC) as part of the Arawai Kākāriki Wetland Restoration Programme. One of the main objectives of this work is to protect threatened wetland fauna.

A species in decline

The wrybill (*Anarhynchus frontalis*) population is in decline, with less than 5000 remaining. Wrybills nest almost exclusively on braided rivers on the east coast of the South Island, and the upper Rangitata River (part of the O Tū Wharekai wetland restoration project) is recognised as a national stronghold for breeding wrybill.

Nest selection – adapting to the environment

Wrybill nesting requirements on the upper Rangitata River were studied over the 2008/09 breeding season. Wrybills showed a preference for a specific habitat type: fine gravels with no significant vegetation, on elevated gravel beds, and situated on spits or islands. This allows incubating birds a clear view of the surrounding environment allowing them to react to approaching predators.

Concerns for conservation

Only a small proportion of the study area matched these habitat criteria – large sections of river had no breeding birds. Finer gravels are close to the channels and are highly vulnerable to large flood events. The 2008 wrybill breeding season was

characterised by two major flood events that effectively removed a high proportion of the first and second breeding attempts. Broom (*Cytisus* spp., an invasive exotic species) appears to displace wrybill from potential breeding habitat due to the threat of predation. Wrybills choose well-elevated parts of the river to nest, often on gravel spits. These areas are often used for vehicle access, increasing the potential for nests to be run over. Feral cats, ferrets and hedgehogs are frequently detected on the riverbed. Norway rats, possums, stoats and weasels are also detected, and all prey on wrybill nests. Large plants like broom provide cover for predators, which gives wrybills little opportunity to distract predators away from the nest. Black-backed gulls are a native predator of wrybills. This study showed wrybills avoiding nesting near a black-backed gull colony, despite being situated in ideal wrybill habitat.

Targeted management

The location of wrybill nests appears to be quite predictable. Understanding habitat requirements has assisted with targeted monitoring and management, with extensive control programs for broom and lupin by DOC and local landcare groups to maintain the mobile shingles, braids and lack of cover that are characteristic of their habitat. Ultimately, this increased knowledge ensures resources for weed and predator control are allocated where they are most effective.

– Peter Langlands and Wendy Sullivan,
Department of Conservation

REF: www.doc.govt.nz/documents/conservation/land-and-freshwater/wetlands/Otuwharekai/o-tu-wharekai-outcomes-report-web.pdf



Female wrybill incubating with good vision around the nest . Photo: P. Langlands. Crown Copyright, Department of Conservation



Ideal wrybill habitat with 4WD tracks within metres of a nest. Photo: P. Langlands. Crown Copyright, Department of Conservation

3 Monitoring

Encouraging native fauna into your wetland is an ongoing project and requires a long-term commitment. This chapter outlines several commonly used approaches for recording increases in native fauna. Being able to quantify increases will help with designing appropriate pest animal control programmes – once a resident native bird population has been established pest control may be intensified before and during the breeding season (see Chapter 11 – Pests, for possible methods). In addition, monitoring will help you develop a general understanding of the site and how it responds to restoration efforts. Knowing, for example, what types of food resources are available at the restoration site can provide valuable insights on factors influencing the success of any species translocations.

Setting up a monitoring programme will require input from experts. Scientists from DOC, Landcare Research and Regional Councils can assist with information on the most up-to-date and appropriate methods and equipment to use, as well as which permits you may require. Established community groups may also be able to pass on valuable advice based on practical on-ground experience. A number of web-based identification guides in addition to books are available and are listed at the end of the chapter. For additional information on monitoring overall wetland restoration success, see also Chapter 13 – Monitoring).

3.1 5-minute bird count

In a 5-minute bird count the observer records the number and species of all birds seen and heard. Each bird is only counted once. As with other index counts, it is important to remember that a 5-minute bird count does NOT result in an accurate count of all birds present. The numbers recorded are used to indicate the number of birds present, though many factors need to be taken into account including observer skill levels and hearing ability, bird habitat preferences and bird visibility.

Bird counting stations can be set up throughout the wetland. These should be at least 200 m apart to avoid duplication of bird calls from one station to another. Small wetlands therefore may only have one station. In larger wetlands, stations should be distributed so that they cover all vegetation types. In the original method (Dawson & Bull 1975) 200 m was specified as the cut off distance for recording birds. Though many current studies don't stipulate an actual cut off distance, it is recommended not to record birds that are obviously very far away (e.g., on the other side of the valley). The number and species of all birds seen and heard should be documented along with the station location, name of person doing the bird count, date, start time, temperature, wind, other noises, sun, and precipitation. The DOC website listed at the end of the chapter details the method more fully and includes field sheets and digital data entry sheet.

Additionally, keep an annual list of bird sightings and observations throughout the year. Information on specific monitoring of bird populations, e.g., threatened species, can also be accessed via the DOC website.

3.2 Fish trapping

Many wetlands contain populations of native fish and restoration should encourage these populations to thrive. To detect whether fish are present in your wetland simply shine a flashlight into the water at night as this is when many native freshwater fish species are most active. Contact DOC for standard methods for monitoring fish, especially if threatened species such as mudfish are involved.

A basic monitoring method is to use traps or fyke nets. It is, however, worth noting that each type of sampling gear has a bias toward different fish species so it pays to use a range of methods to get a full picture of the fish community. The traps and nets are easy to use and if set properly are unlikely to kill fish. Set up in a secure place overnight, for example, under overhanging stream banks or vegetation. Mark the spot with flagging tape so the traps can easily be found the next morning. It is important to leave an air gap at the top of the traps and nets because water in wetlands can become de-oxygenated overnight. Care should also be taken to avoid setting gear during floods when water levels can drop and expose fish. As well as trapping native fish, you may also trap unwanted introduced fish such as *Gambusia*/mosquito fish, koi carp or catfish. In this case you should contact DOC as this information could help the Department and other interested parties keep track of the spread of these species. See also Chapter 11 for information on pest fish.

Populations of the threatened mudfish can be monitored by setting unbaited traps overnight and counting, measuring and releasing the fish the next morning. Using a permanent station, traps can be set once a month for several months, avoiding the mid-summer to early autumn period if water becomes scarce. Alternately, mudfish fry can be observed in pools during the day. The case study on Fensham wetland in Chapter 13 – Monitoring, demonstrates how mudfish monitoring has been integrated into a wider programme of wetland restoration monitoring. The group received guidance from both the Regional Council and DOC.



A careful investigation around the base of dense wetland vegetation may yield whitebait/inanga eggs. Canterbury.
Photo: Sjaan Charteris. Crown Copyright, Department of Conservation



Inanga eggs. Canterbury.
Photo: Sjaan Charteris. Crown Copyright, Department of Conservation



The giant kokopu usually waits for its prey (e.g., koura, spiders and cicadas) in sheltered places with overhanging vegetation, logs, or debris clusters. Photo: Crown Copyright, Department of Conservation

3.3 Lizard and frog counts

Lizard retreats as described in Section 2.3 can also be used to gain a snapshot of presence/absence without any handling. Handling hazards requires a permit (see Section 1.4.1 – Keeping it legal). Another basic method that doesn't involve any handling is tracking tunnels. These are made from light-weight plastic and contain a pre-inked tracking card. U-shaped pins secure the tunnel to the ground. Food, e.g. banana, honey or tinned pear, is placed on the ink free section in the centre of the card. The lizard stands on the inked section while eating, and the ink is then transferred from the lizard's feet to the ink-free ends of the card. This method provides a useful record of presence/absence and can help estimate abundance. Footprint guides (see Useful websites section at the end of the chapter) will highlight the difference between gecko and skink tracks, though not between species. Tracking tunnels can also be used for frogs and some invertebrates as well as for pests (see Chapter 11).



Gecko tracks showing front and hind foot tracks and tail drag.

Image: www.gotchatraps.co.nz

3.4 Terrestrial invertebrate trapping

Invertebrate communities often change as a result of restoration activities. The success of restoration activities can be measured by comparing invertebrate communities in the restored wetland with those in similar but natural wetlands. If the communities become similar, the restoration could be considered successful.

Tracking tunnels (see previous section) can be used for larger invertebrates such as weta. Pitfall traps are small containers filled with a preservative solution (e.g., antifreeze), which are dug into soil. Invertebrates that fall into them are preserved for collection, identification and counting. The containers are shielded from the rain (e.g., with a plastic plate wired to the cup). A small amount of detergent is added to break the surface tension on the liquid contents, preventing insects from escaping.

Malaise traps are designed to capture low-level flying invertebrates, guiding them into a container for later identification and counting. A structure shaped like a small tent traps invertebrates emerging from the ground as well as those flying within about a metre of the ground. Though more time consuming to set up than pitfall traps, malaise traps sample a greater range of invertebrates.

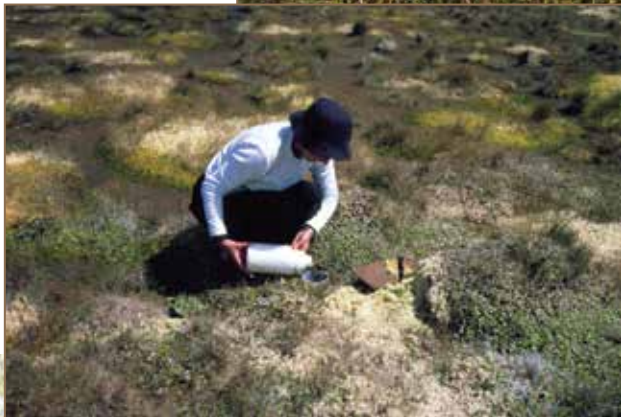
3.5 Aquatic invertebrate trapping

Monitoring aquatic invertebrates as part of wetland restoration projects is relatively easy – it just takes time and a bit of practice. Collecting invertebrates is best done with a small, fine-meshed net that is swept through the different habitats within the wetland, for example, in the water column, along the bottom, and among any submerged plants. The contents of the net are then examined to search for the many different types of invertebrates. It helps to spread some of the sample evenly across a white tray with bit of water in it, and then search for the swimming and crawling invertebrates. Some, such as beetles, dragon flies and midges, are relatively easy to see, while others are much smaller and are best seen with a magnifying glass or a small microscope.



Malaise trap set up in the Ramsar listed Kopuatai peat dome, Waikato.

Photo: Danny Thornburrow, Landcare Research



Although setting up a pitfall trap is relatively straightforward, analysing the results, i.e. identifying the insects and counting them, can be very time consuming. Photo: Danny Thornburrow, Landcare Research

A hand-held net with fine mesh (usually 0.5 mm) will greatly assist in the collection of freshwater invertebrates from wetlands. South Westland. Photo: Brian Sorrell, NIWA



6 References and further reading

Crowe, A. 2002. *Which New Zealand insect?* Penguin Books, New Zealand.

Dawson, D.G. and Bull, P.C. 1975. *Counting birds in New Zealand forests*. *Notornis* 22: 101–109.

Moon, G. 2009. *New Zealand wetland birds and their world*. New Holland, New Zealand.

Winterbourn, M. J., Gregson, K. L. D. and Dolphin, C. H. 2006. *Guide to the aquatic insects of New Zealand*. *Bulletin of the Entomological Society of New Zealand* 14: 1–108.

Suren, A.M. and Sorrell, B. K. 2009. *Aquatic invertebrate communities within New Zealand wetlands: characterising spatial, temporal, and distribution patterns*. Department of Conservation Science for Conservation Report, New Zealand.

6.1 Useful websites

Wetland restoration templates

Waikato Regional Council Wetland Restoration Plan templates

www.waikatoregion.govt.nz/PageFiles/5799/Wetlandtemplate1.pdf

www.waikatoregion.govt.nz/PageFiles/5799/Wetlandtemplate2.pdf

Wetland restoration guides and factsheets (New Zealand)

Northland Regional Council

[www.nrc.govt.nz/upload/2217/Wetland%20Restoration%20Guide%20\(second%20edition%20Feb%202009\).pdf](http://www.nrc.govt.nz/upload/2217/Wetland%20Restoration%20Guide%20(second%20edition%20Feb%202009).pdf)

Auckland Regional Council

www.arc.govt.nz/albany/fms/main/Documents/Environment/Plants%20and%20animals/wetlandsfacts2.pdf

Waikato Regional Council

www.waikatoregion.govt.nz/Environment/Natural-resources/Water/Freshwater-wetlands/

Hamilton City Council

www.gullyguide.co.nz/index.asp?pageID=2145821537

Bay of Plenty Wetlands Forum

www.doc.govt.nz/upload/documents/conservation/land-and-freshwater/wetlands/wetland-restoration-guide.pdf

Greater Wellington

www.gw.govt.nz/a-beginner-s-guide-to-wetland-restoration/

Department of Conservation Protecting Natural Areas Design Guide

www.doc.govt.nz/publications/getting-involved/volunteer-join-or-start-a-project/start-or-fund-a-project-/nature-heritage-fund/protecting-natural-areas-design-guide/

Wetland restoration guides (International)

USA Environmental Protection Agency

www.epa.gov/owow/wetlands/pdf/restdocfinal.pdf

Native fauna fact sheets and identification guides

Birds

www.whatbird.co.nz

www.nzbirds.com

www.brownteal.com/

Freshwater Fish

www.doc.govt.nz/conservation/native-animals/fish/facts/

www.niwa.co.nz/our-science/freshwater/tools/fishatlas?a=26663

www.doc.govt.nz/upload/documents/about-doc/concessions-and-permits/conservation-revealed/nz-native-freshwater-fish-lowres.pdf

www.nhc.net.nz/index/fresh-water-fish-new-zealand/freshwater-fish.htm

www.mudfish.org.nz/mudfishInfo.html

www.igrin.co.nz/trisha/black%20mudfish.htm

Invertebrates (terrestrial and aquatic)

www.landcareresearch.co.nz/research/biosystematics/invertebrates/invertid/

Reptiles and Frogs

www.doc.govt.nz/conservation/native-animals/reptiles-and-frogs

www.nzfrogs.org

www.reptiles.org.nz

Monitoring native and introduced fauna

5 minute bird count methods, field sheets and digital data entry sheet

www.doc.govt.nz/conservation/native-animals/birds/five-minute-bird-counts/

www.wildaboutnz.co.nz/index.php?option=com_content&view=article&id=54:5minbird&catid=52:landmethods&Itemid=74

Footprint Identification Guide for tracking tunnels

www.rimutakatrust.org.nz/downloads/download.htm

www.gotchatraps.co.nz/html/photo_gallery.html

Protocols for using wax tags

www.pestcontrolresearch.co.nz/docs-monitoring/waxtagprotocol.pdf

Bird counts, setting up photopoints, pest animal transects

www.formak.co.nz

Foliar browse index

nvs.landcareresearch.co.nz/html/FOLIAR_BROWSE_INDEX.pdf

Freshwater Fish

www.wildaboutnz.co.nz/index.php?option=com_content&view=article&id=53:fish-surveying&catid=51:watermethods&Itemid=75

Lizards and frogs

www.wildaboutnz.co.nz/index.php?option=com_content&view=article&id=90:racking&catid=52:landmethods&Itemid=74

www.gotchatraps.co.nz/html/photo_gallery.html

www.gotchatraps.co.nz/html/photo_gallery.html

Invertebrates (terrestrial and aquatic)

www.wildaboutnz.co.nz/index.php?option=com_content&view=article&id=55:inverts&catid=52:landmethods&Itemid=74

www.wildaboutnz.co.nz/index.php?option=com_content&view=article&id=55:inverts&catid=52:landmethods&Itemid=74

Note that many of the resources above are available as hard copy from the respective organisations. There is also a CD containing all above hyperlinks at the back of this Handbook. If you are using the online version of the Handbook and having problems with the hyperlinks above, try copying and pasting the web address into your browser search bar.

