An Introduction to the Whanganui River Estuary

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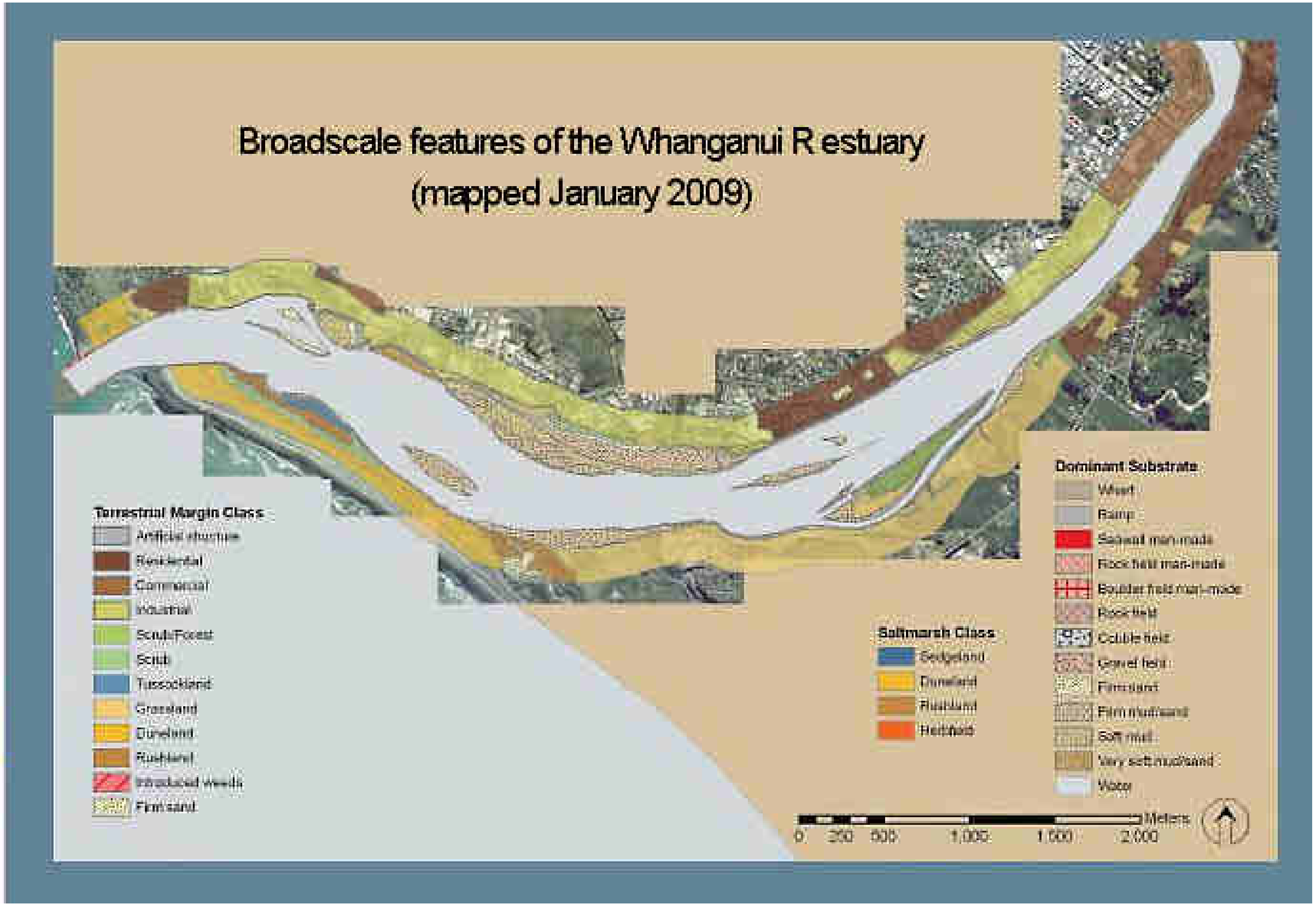

Figure 1. Substrates and vegetation of the Whanganui R estuary, mapped in January 2009 by Wriggle Ltd for the Department of Conservation (Stevens, L. and Robertson, B. 2009. Whanganui River Estuary. Broad Scale Habitat Mapping 2008/09. Report prepared for the Department of Conservation, June 2009. Department of Conservation, Wellington, New Zealand.

The Whanganui River Estuary

The Whanganui estuary lies at the mouth of the 290 km long Whanganui River, the third longest river in New Zealand. The river drains a catchment of about 7100 km^2, extending from north of Mts Ruapehu (2797 m) and Ngaruhoe, west and southwards to Wanganui. Throughout much of its length, the river is deeply incised in the landscape, especially in the middle reaches, between Whakahoro and Pipiriki, where it passes through a series of narrow, scenic, sandstone and mudstone gorges. The river here is flanked by lowland forest, most of it in the Whanganui National Park. The gradient of the river is relatively shallow, although there are 239 significant rapids along its length. All of these are traversable, however, so that the river is navigable as far as Taumarunui, 230 km upstream, making it longest navigable river in New Zealand. The river has great cultural and spiritual significance to Māori *iwi*, and has long served as a transport and communications route, both for Māori and later settlers, from the coast into the interior of the North Island.

The north-western parts of the catchment have been substantially transformed by the clearance of native forest and bush and their replacement by open pastures, cultivated lands, and pine plantations. These changes have increased the rate of erosion in the catchment, both on the surface and through extensive landslip, resulting in more sediment being transported down the river to the estuary, hastening a process of infilling. Whereas a century ago small ships could sail up the Whanganui R and berth at the town wharf (Taupo Quay), today that is only possible for relatively shallow-bottomed pleasure craft. The effects of various engineering works such as roads, bridges, rock walls in the river, groynes, occasional dredging, stabilized embankments and sundry other flood-control measures, also affect the river, along with water abstraction for hydropower and agriculture in the headwaters, and runoff from agricultural, urban and industrial land and industry, Despite this, the estuary still functions largely naturally and retains many of its essential features.

Estuaries are formed at the mouths of rivers where they open into the sea. They are characterised by the throughflow of freshwater and sediments eroded from the land and river courses upstream, and by a twice-daily influx of seawater and marine sand on the rising tides. This mixing of freshwater and seawater produces a salinity gradient from the river mouth (most saline) upstream to the limits of the tidal reach, more than 10 km upstream on the Whanganui (least saline). The transport of sediment into and out of the estuary with the river and tidal flows creates a complex patchwork of sandbanks and mudflats that provide a variety of habitats for animals and plants. Generally the finest sediments are found towards the fringes of the estuary, and in the creek and backwater behind Corliss Island, where the water current is slow moving. Conversely, the main channel and other areas where the water flows fastest, are filled with sands of varying grain sizes. Finer material — clay and fine organic particles — generally remain suspended in the water column and flow out to sea. A recent survey of the estuary showed that firm mud and sand comprised 59% of the intertidal substrates, with soft mud (25%), firm sand (6%), very soft mud/sand (3%), and artificial substrates (rock walls, groynes, ramps, bridge supports – 6%), making up much of the rest (Figure 1).

Estuaries are usually highly productive, being sustained by nutrients and organic matter brought in both on the tides and through river flow from upstream, and supplemented by that produced by plants growing in salt marshes and along the estuarine fringe. The amount of saltmarsh on the fringes of the Whanganui estuary is limited, reflecting the extensive modification of its margins as the city of Wanganui/Whanganui has expanded on either side. Although typical intertidal estuarine organisms such as mud snails, cockles, bloodworms, nereid worms, small crustaceans (including small crabs), and other invertebrates that feed by filtering organic matter from the water are present in the estuary, these do not seem to be as abundant as in more mature and less disturbed estuaries elsewhere. Nevertheless, they support a reasonable number of wading birds and fish. The estuary serves both as a nursery area for fish and as a conduit for those fish species (collectively known as whitebait) that spawn further up the river in small tributary streams. Siltation and pollution have almost certainly diminished the importance of the estuary as a nursery for fish.

Birds of the Whanganui River Estuary

At least 25 wader and waterbird bird species have been recorded on the Whanganui estuary in recent years. A list of these and other species that can be seen on the estuary margins is given in Table 1. Some of the more conspicuous species are shown in the centrepiece of this booklet.

Table 1. A list of some of bird species found on and around the Whanganui R estuary.

Black Shag	*Phalacrocorax carbo*	Pukeko	*Porphyrio porphyrio*
Little Shag	*Phalacrocorax melanoleucus*	Black Backed Gull	*Larus dominicanus*
Little Black Shag	*Phalacrocorax sulcirostris*	Red-billed Gull	*Larus scopulinus*
White-faced Heron	*Ardea novaehollandiae*	Black-billed Gull	*Larus bulleri*
Royal Spoonbill	*Platalea regia*	Caspian Tern	*Sterna caspia*
Black Swan	*Cygnus atratus*	White-fronted Tern	*Sterna striata*
Paradise Duck	*Tadorna variegata*	Black-fronted tern	*Sterna albostriata*
Mallard Duck	*Anas platyrhynchos*	Sacred Kingfisher	*Halcyon sancta*
Pied Oystercatcher	*Haematopus ostralegus*	Skylark	*Alauda arvensis*
Variable Oystercatcher	*Haematopus unicolor*	Welcome Swallow	*Hirundo tahitica*
Spur–winged Plover	*Vanellus miles*	Blackbird	*Turdus merula*
Pied Stilt	*Himantopus himantopus*	Song Thrush	*Turdus philomelus*
Banded Dotterel	*Charadrius bicinctus*	Silvereye	*Zosterops lateralis*
Red-necked Stint	*Calidris ruficollis*	Yellowhammer	*Emberiza citrinella.*
Curlew Sandpiper	*Calidris ferruginea*	Chaffinch	*Fringilla coelebs*
Lesser (Red) Knot	*Calidris canutus*	Greenfinch	*Carduelis chloris*
Wrybill	*Anarchynchus frontalis*	Goldfinch	*Cardulelis carduelis*
Bar-tailed Godwit	*Limosa lapponica*	House Sparrow	*Passer domesticus*
Turnstone	*Arenaria interpres*	Common Starling	*Sturnus vulgaris*
Australasian Harrier	*Circus approximans*	Australian Magpie	*Gymnorhina tibicen*

Ten species account for more than 97% of the almost 55,000 birds counted on the estuary in the past 5 years, of which Black-backed Gull (54%), Red-billed Gull (15%), Pied Stilt (11%), Mallard (4%), Bar-tailed Godwit and White-fronted Tern (both 3%) are the most abundant. Black-backed Gulls breed locally on the dunes of the nearby Whitiau Scientific Reserve (a few breed within the estuary). Numbers are highest in autumn and winter, and lowest during the breeding season (September-December). Numbers recorded in the estuary fluctuate greatly within and between days, depending on the weather, tides, and whether the birds are feeding and resting in the estuary, offshore, or in adjacent industrial sites (Figure 2).

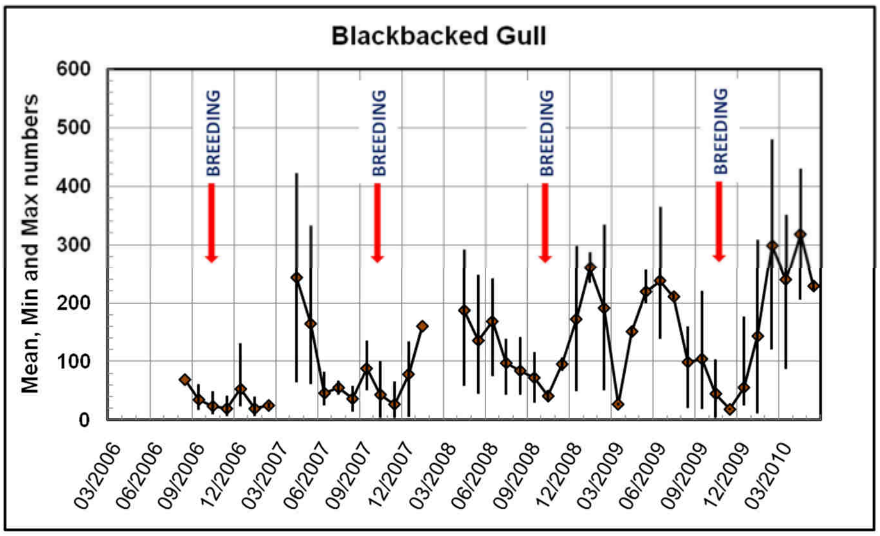

Figure 2. Monthly fluctuation in numbers of Black-backed Gull on the Whanganui estuary.

Red-billed Gulls are seasonal migrants, arriving in mid January after the season, mostly from colonies in the South Island, and departing again in August-September (Figure 3). Pied Stilt and White-fronted Tern follow a broadly similar pattern. Mallard are resident on the river, but numbers increase in later autumn and winter, during the hunting season.

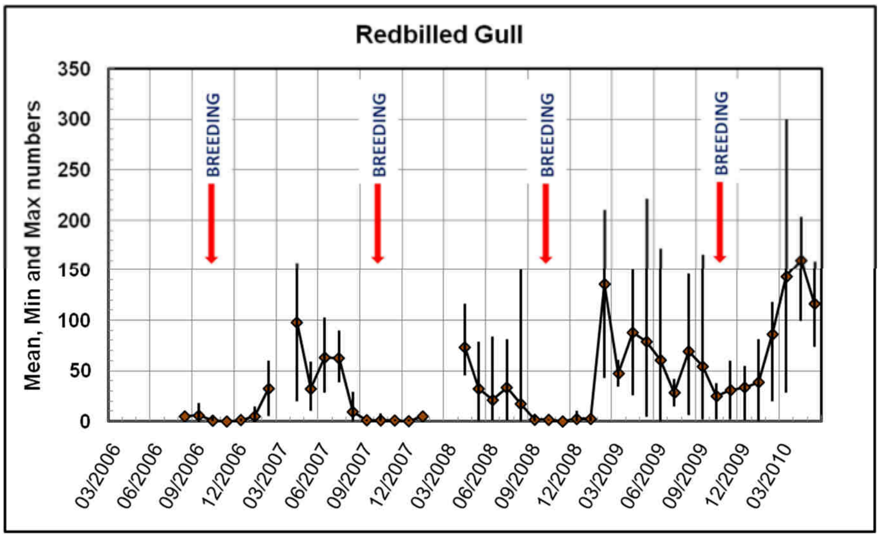

Figure 3. Monthly fluctuation in numbers of Red-billed Gull on the Whanganui estuary.

In contrast, Bar-tailed Godwit are summer migrants from the northern hemisphere, arriving in early October and departing for their breeding grounds in Alaska in late March (Figure 4). A few non-breeding birds stay over in winter, but usually move to larger estuaries elsewhere when the winter storms begin. The Whanganui estuary is particularly exposed to westerly gales. No species of wader nests on the estuary, although Banded Dotterel, Spurwing Plover and Variable Oystercatcher nest at various sites nearby.

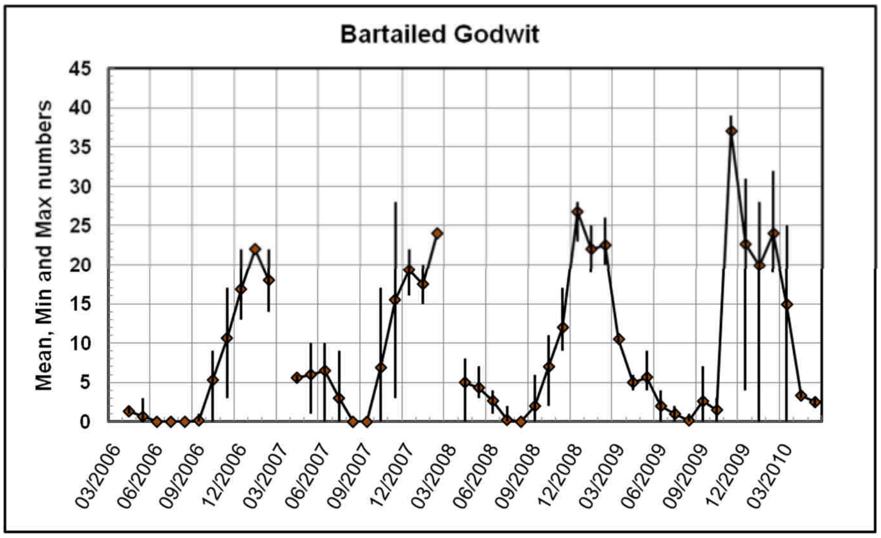

Figure 4. Occurrence of Bar-tailed Godwit on the Whanganui estuary

A number of these species are of conservation concern, including Black-fronted Tern ("nationally endangered"), Caspian Tern and Wrybill (both "nationally vulnerable"), Black-billed Gull ("serious decline"), and White-fronted Tern, Banded Dotterel and Red-billed Gull (all "gradual decline").

Centrefold (overleaf): Photographs of some of the species that you might see on the estuary


White-faced Heron (Matuku-moana)
Ardea novaehollandiae


Royal Spoonbill (Kotuku-ngutupapa)
Platalea regia


Red-billed Gull (Tarapunga or Akiaki)
Larus novaehollandiae


Black-billed Gull (Tarapunga)
Larus bulleri


Black-backed Gull (Karoro)
Larus dominicanus


Caspian Tern (Taranui)
Sterna caspia

Bar-tailed Godwit (Kuaka)
Limosa lapponica

Red or Lesser Knot (Huahou)
Calidris canutus

Pied Stilt (Poaka)
Himantopus himantopus

Wrybill (Ngutuparore)
Anarhynchus frontalis

Pied Oystercatcher (Torea)
Haematopus ostralegus

Variable Oystercatcher (Toreapango)
Haematopus unicolor

Black Shag (Kawau)
Phalacrocorax carbo

Masked Lapwing (-)
Vanellus miles

Migrant Waders

As mentioned earlier, two groups of migrant birds visit the Whanganui estuary. First, in addition to Pied Stilt and Red-billed Gulls, species such as Pied Oystercatcher and Wrybill, which breed in the South Island during the southern spring and summer, pass through the estuary to and from their wintering grounds on estuaries of the upper North Island. Also included in this group are species such as Royal Spoonbill and Caspian Tern, some of which pass through but small numbers of which stay over during the winter. The second group of migrants comprises those waders that breed during the northern summer mainly in Siberia and western Alaska, and then winter in Australasia, including New Zealand. Bar-tailed Godwit is the commonest of these, both locally and within New Zealand. Up to 60 birds visit the estuary in summer, about half of which are transient, moving on to other locations. This is only a small proportion of the estimated >75,000 godwit that winter in New Zealand annually. Nevertheless, for those individuals, a number of which return year after year (confirmed by observations of individually marked birds), the estuary is important in their lives.

To understand the patterns of migration between the two hemispheres, scientists in New Zealand, Australia, East Asia, and North America are marking birds with combinations of individually numbered metal bands, coloured plastic leg bands and flags, and, more recently, satellite-tracked transmitters. Data from these studies is giving us a clearer picture of the birds' migration patterns: where they come from and where they fly to; where they stop over on the way, and for how long; and the duration of their flights, especially those over the Pacific Ocean. This research is also giving us important insights into the physiological capacity of these birds to fly exceptionally long distances non-stop, and what areas need to be conserved along the way to sustain this remarkable migration.

In early 2007, satellite-tracked transmitters were implanted in 16 Bar-tailed Godwits, 8 at Farewell Spit, at the top end of the South Island) and 8 at Miranda on the Firth of Thames, south-east of Auckland. One female, "E7", was tracked all the way from the Piako R mouth at Miranda on the Firth of Thames, New Zealand, to her breeding ground in Alaska (Figure 2). She left Piako on 17 March 2007, flying almost 10,300 km non-stop across the Pacific Ocean in just over 7 days to Yalu Jiang, a nature reserve near the city of Dandong in north-eastern China. From another study, we know that female Bar-tailed Godwits weigh on average 419 g just prior to leaving New Zealand, whereas birds arriving at stop-over sites such as Yalu Jiang average 249 g. This means that the birds burn up about 170 g of fat or 40% of their initial body mass en route. She stayed at Yalu Jiang for just over 5 weeks, from the last week of March to beginning of May 2007, no doubt recouping her energy reserves. In early May, she set off on a 6,300 km, 5-6 day trip over the northern Pacific Ocean to Alaska, eventually ending up in mid-May at Manokinak, about 600 km north of Port Heiden in Alaska. Here she stayed for about two months, probably nesting. In mid July, she headed south to Cape Avinof and the Kuskokwim Delta in Alaska, a major feeding area for godwits and other waders, where the birds fatten up before migration.

She left Kuskokwim on 30 August, flying south over the Alaskan Peninsula and out over the Pacific, towards Hawaii. On 1 September 2007, about 600 km north of the island of Kauai, Hawaii, she turned SW and headed to Fiji, which she overflew, arriving off North Cape, New Zealand, on 6th September. There she turned south and flew on to Piako on the Miranda Estuary, arriving on 7th September. In crossing the Pacific Ocean, she had flown almost 11,700 km non-stop in 8½ days at an average speed of 57 kph. In all, her migration route covered about 29,100 km (not counting the flights around her breeding ground).

The important thing is not just that E7 did all this, but that she confirmed that it can be done, as tens of thousands of other godwits do each year, migrating to and from their breeding grounds in eastern Siberia and Alaska, and New Zealand (and Australia). It is also amazing that the transmitter lasted this long, as it was expected to last only long enough to track the bird from New Zealand to the bird's breeding ground.

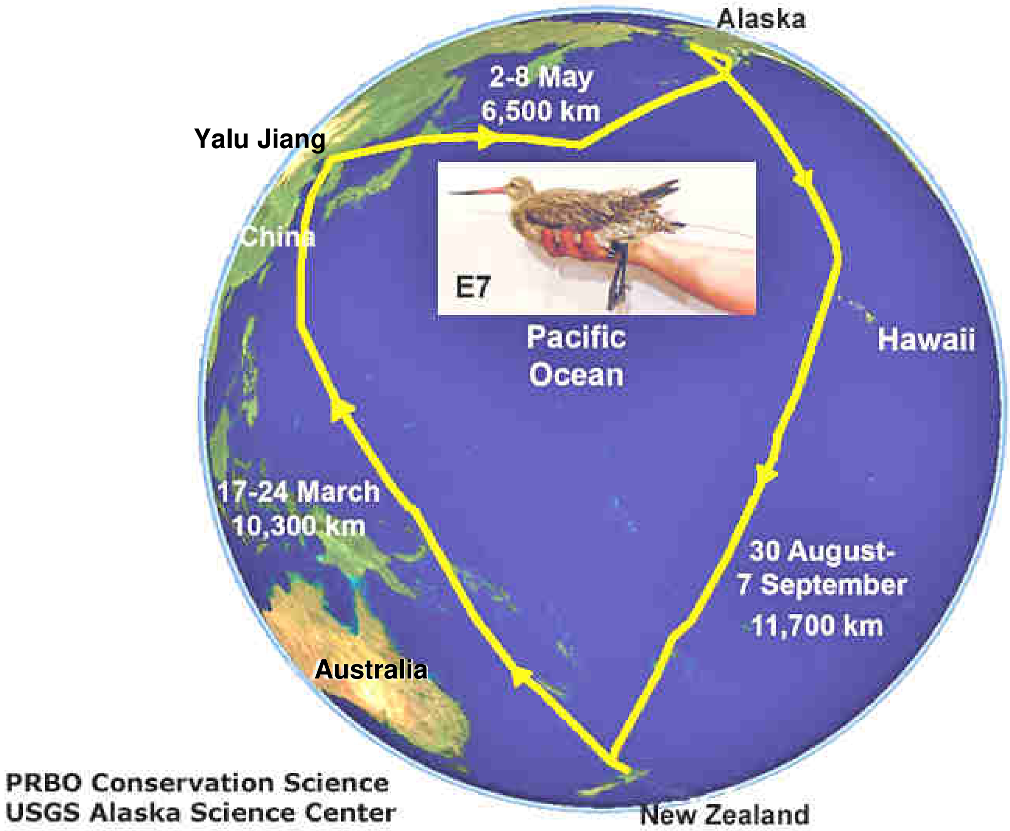

Figure 2. Migration route of female Bar-tailed Godwit E7 from New Zealand to Alaska via Yalu Jiang in China (March-May 2007), and back across the Pacific (August-September 2007). Original image at http://alaska.usgs.gov/science/biology/shorebirds/barg_updates.html, modified here to improve clarity.

This research is important for a number of reasons. It helps us identify the intermediate staging areas that the birds use on their long journeys to and from their breeding areas (e.g. Yalu Jaing, Kuskoswim Delta in the case of trans-hemispheric migrants such as Bar-tailed Godwit; at a much smaller scale, estuaries such as the Whanganui may serve a similar purpose for local migrants). Birds need these areas to replenish their energy stores so that they can complete their journey back to their breeding grounds. The energy, protein, and nutrients stores carried to the breeding grounds may also be important in supporting the physiological changes that the birds undergo in preparation for breeding. Given the short breeding season at high latitudes, any delays could compromise the chance of successful breeding.

Coordinated international action is required to ensure that these staging areas, as well as the birds' main wintering grounds and nesting areas, are fully protected. Unfortunately, a number of these staging areas are being threatened by changes in tidal regime, disturbance and pollution, caused by industrial expansion and other coastal developments such as aquaculture. Birds displaced by such developments do not easily re-establish themselves elsewhere or, if they do, they may simply increase the pressure on local food sources because such areas already support their own populations of migratory and resident shorebirds. One prominent example of this is the "redevelopment" of the 40,000 ha Saemangeum coastal wetland in Korea, a major shorebird staging area in East Asia, involving the construction of a 33-km long sea wall to "reclaim" 400 km^2 on which are being built factories, water treatment plants, golf courses, and supporting infrastructure.

What does this have to do with the Whanganui R estuary? It illustrates at a larger scale and in a much more prominent way the increasing problem of the multiple and often conflicting demands being made on estuaries and their resources. These reflect different value systems and interests. Given this diversity, how best can we manage these systems? What potential is there for reconciling these different demands? What should be the respective roles of public education, positive incentives, and regulation and enforcement in achieving a balance between conservation and use?

The value of estuaries

Horizons Regional Council, the body charged with managing the use of natural resources within the Manawatu–Wanganui region[1], has identified several significant or important natural values associated with the Whanganui River Protection Zone (that area seaward of Cobham Bridge in Wanganui). These are:

- national importance as a nursery for freshwater and estuarine species;
- a nationally important ecosystem for bird species;
- a nationally important strategic site for migratory bird species;
- a habitat for threatened species;
- an important roosting and feeding area for wading birds (especially the shellfish beds);
- an important feeding and breeding ground for many fish species (especially access upstream for whitebait and lamprey);
- Corliss Island has a saltmarsh fringe and is important for hawks [i.e. Australasian Harrier];
- Landguard Bluff contains a nationally important sequence of Pleistocene sedimentary strata and pectin shells; and
- the coastal landforms and adjacent dunes are important nesting habitat for birds.

Other groups within society see other values in the estuary: **cultural** (the estuary in particular and the river in general have great significance for local Māori, both spiritually and as a source of food); **recreational** (the estuary is used by people for all manner of recreational purposes — fishing, sailing, boating, swimming, walking on the intertidal flats and margins, either alone or with pets, cycling, and hooning around in cars, scrambler motorbikes, and ATVs); **residential** (both Māori and early settlers settled preferentially close to the river and estuary; but for the flood risk, many more might like to do so); **commercial** (the lower estuary has a small port, and once served as the conduit for ships passing to the town wharf); and **industrial** (the estuary is flanked by light industry on one side, many of which businesses used to discharge effluent into the river; some would still like to do this). The city's storm water drainage system discharges into the river. (Fortunately, human effluent is no longer discharged in the same way.)

Looked at more broadly, the estuary lies at the end of a long river into which flows run-off from agricultural lands and forestry, as well as eroded sediment resulting from human land use. (Erosion is a natural process, so all rivers carry some sediment, but the quantities and nature of the material entering a river can change dramatically when landcover is reduced and livestock are introduced.) Water is also abstracted from the river for a variety of purposes: hydropower, agriculture, domestic, and for small-scale industry.

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1 Regional councils in New Zealand are also responsible for protecting land, water, airsheds, coastal systems, and biodiversity; regulatory management, by providing resource consents; emergency management, flood protection, biosecurity (including controlling invasive alien species and vectors of animal diseases such as Tb); and regional transport planning, road safety, and regional passenger transport, including for people with limited mobility.

Approaches to management

Managing this complexity, both locally and in New Zealand more broadly, is done through a process of issuing (or declining) resource consents for various activities, all governed by the provisions of the Resource Management Act 1991. In terms of this Act, the various activities that might impact the environment are categorised according to sets of rules formulated by the different regional councils in their plans. These activities can fall into one of six categories:

> **Permitted activity** — no resource consent is required provided that the activity complies with any standards, terms or conditions specified in the relevant plan or proposed plan.
>
> **Controlled activity** — resource consent is required but cannot be declined by the consenting authority, which must specify in its plans those matters over which it has reserved control, and to which any conditions on resource consent is restricted, provided that the activity complies with any standards, terms, or conditions specified in the plan.
>
> **Restricted discretionary activity** — resource consent is required for matters specified by the consenting authority in its plans as ones over which it has restricted its discretion, and for which it has the power to decline resource consent or impose restrictions specified in the plan, providing that the activity complies with any standards, terms, or conditions specified in the plan.
>
> **Discretionary activity** — an activity that requires resource consent, which the consenting authority may granted with or without condition, or decline, and which must comply with any standards, terms, or conditions specified in the plan.
>
> **Non-complying activity** — an activity that requires resource consent, which the consenting authority may granted with or without condition, or decline. The activity must have only minor environmental effects, and must not be contrary to any objectives or policies of any plan or proposed plan. The consenting authority may disregard any adverse effect on the environment is the plan permits an activity with that effect.
>
> **Prohibited activity** — one for which no application can be made or granted.

The Resource Management Act is a formidable document, almost 800 pages long (including its various amendments). Regional council plans, to give effect to this Act, in turn run to hundreds of pages. For example, within the Manawatu-Wanganui (Horizons) region, into which the Whanganui estuary falls, activities in the coastal marine area are governed by two objectives[2], 12 policies, and 43 rules (17 governing 'permitted activities', 6 'controlled activities', 9 'restricted and discretionary activities', 4 'discretionary activities', 3 'non-complying activities', 2 'prohibited activities', and 2 'non-complying and restricted activities', a conflation of two separate sets of activities as defined in the Act).

The policies and rules making up these plans are subject to public consultation, hearings, decisions by commissioners, and appeals. Applications for resource consent frequently go through a similar process, sometimes ending up in the Environment Court, the final arbiter on these matters. It is an adversarial process that keeps armies of lawyers and consultants engaged on all sides, more often than not resulting in 'winners' and 'losers'. Is it the best way to manage a complex environment? If not, what alternatives are there? Would incentives work better, at least for certain classes of

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[2] **Objective 17-1: Activities in the CMA**
The regulation of activities in the CMA in a manner that enables or restricts activities within the Port, Protection, or General Activity Management Areas or Aquaculture Management Areas, in a way that reflects the [specified] characteristics of the Areas.
Objective 17-1A: Water quality in the CMA
Water quality in the CMA is managed in a manner that sustains its life-supporting capacity and has regard to the values, management objectives and the [specified] water quality targets.

activities? (The Minister of Conservation has authority under the Act to consider and investigate the use of economic instruments, including charges, levies, or other fiscal measures and incentives, to achieve the purpose of this Act — the only time that 'incentives' are mentioned in the Act — but this seems to have taken distant second place to a regulatory and enforcement approach).

Alternatively, would better public education produce more sustainable and equitable outcomes? Should more effort go into seeking mediated outcomes, perhaps with a requirement that those wanting to use an area or the resources in it consult with interested and affected parties beforehand, rather than afterwards, or not at all?

What information do we need to promote better outcomes, and is information itself sufficient? If not (and it probably is not sufficient), what else do we need to do?

These are perhaps topics that you might like to debate as you discover more about the river, its estuary, and those who use it. The issues do not relate just to New Zealand, but more widely in both developed and developing countries.

Photo credits

Peter Frost: frontpiece; White-faced Heron; Royal Spoonbill; Red-billed Gull; Caspian Tern; Wrybill; Masked Lapwing; E7 migration (from information given at http://alaska.usgs.gov/science/biology/shorebirds/barg_updates.html).

Paul Gibson: Bar-tailed Godwit; Black-billed Gull; Black-backed Gull; Red Knot; Pied Stilt; Pied Oystercatcher; Variable Oystercatcher.

Lynne Douglas: Black Shag.