waitaha wai

water of canterbury

Section Four: Discovering your local waterway

Lake Ellesmere / Te Waihora and its tributaries

Living Streams

Environment Canterbury
Your regional council

Contents

Continues overleaf

We would like to acknowledge Environment Canterbury staff, Don Heslop, Ngai Tahu, and Roger Gilbert for their help, advice and support in developing and producing this resource.

Aerial view of Lower Selwyn River and Lake Ellesmere/Te Waihora.

LEARNING OUTCOMES

- **An understanding of human interaction with lake and river habitats**
- **An understanding of the dynamic nature of local waterways**
- **An understanding of the different values of this area in particular Tangata Whenua and their association with the area**
- **How to monitor water quality of a lake and/or river**
- **A generic understanding of the influences and factors affecting waterways**

Introduction

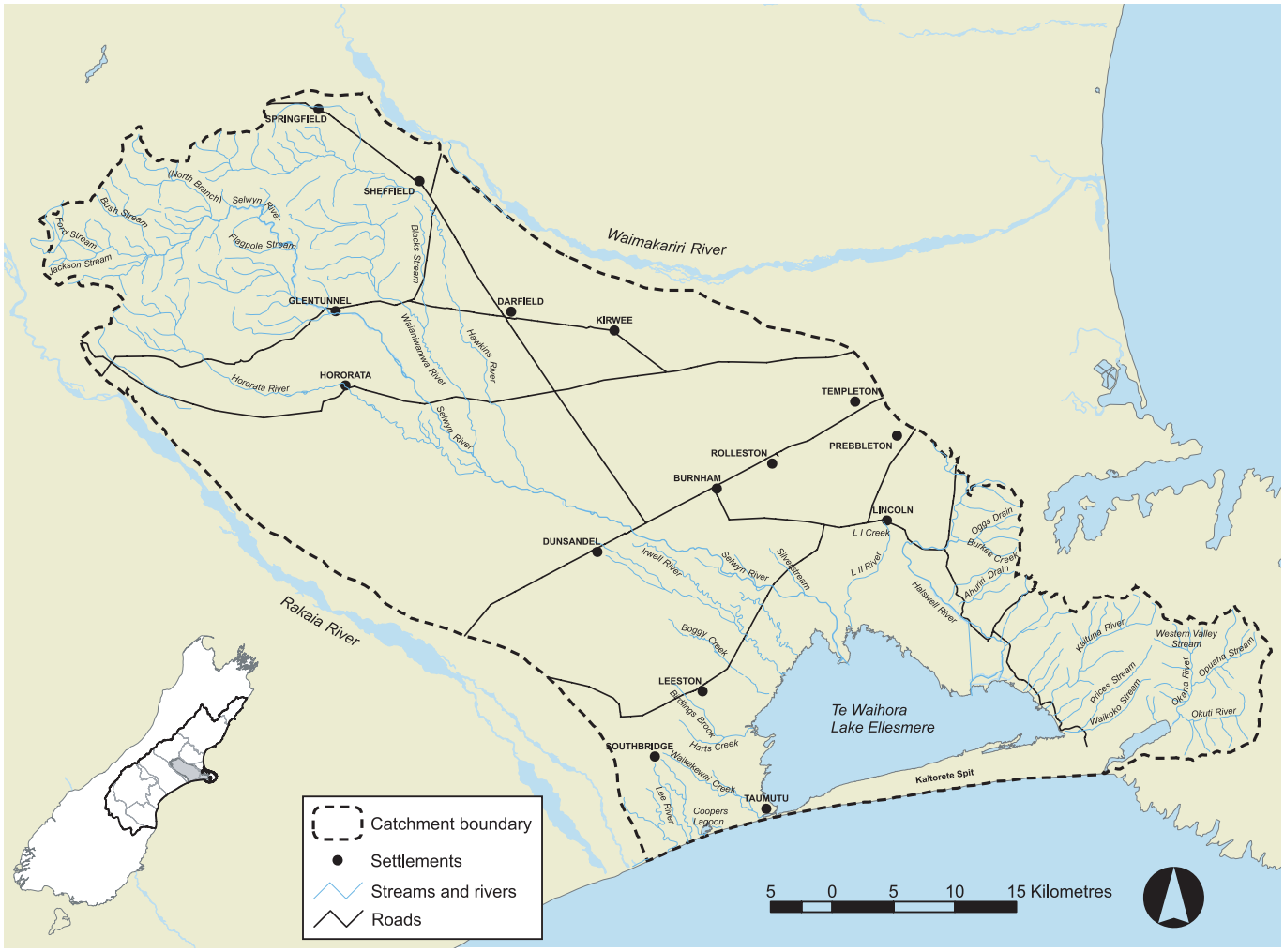
Lake Ellesmere/Te Waihora is New Zealand's fourth largest lake. It is the most important wetland habitat of its type in New Zealand and is particularly known for its bird life (migratory and threatened bird species) and fish habitat.

Te Waihora and the tributaries that feed the lake are of traditional and cultural importance to Ngai Tahu, who have used, guarded, and lived with the lake and its resources, particularly the native fishery, for many generations. This is recognised in one of the lake's early names, Te Kete Ika a Rakaihautu – the fish basket of Rakaihautu. Natural processes and human activity have influenced the lake and its surrounding wetland area. The international significance of Lake Ellesmere/Te Waihora is highlighted as it meets all of the criteria for a Wetland of International Importance under the Ramsar Convention on Wetlands.

This resource is designed to provide information about the lake and its tributaries. It is recommended that teachers use this resource in conjunction with the Waitaha Wai resource (Environment Canterbury) and the Guidelines for Environmental Education in New Zealand Schools (Ministry of Education 1999).

Included in this document is information relating to:

- The settlement of the area;
- The ecology of the lake and its tributaries;
- Issues concerning the lake and its tributaries;
- Current activity in and around the lake catchment;
- Values of the lake;
- Activities for students to undertake in relation to this resource.



Lake Ellesmere/Te Waihora catchment.

Where is Lake Ellesmere/Te Waihora?

The area and boundaries of Lake Ellesmere/Te Waihora

Lake Ellesmere/Te Waihora is located just south of Banks Peninsula on the Canterbury coast, 30 minutes southwest of Christchurch. It is opened artificially to control the level of the lake. When opened, it is linked to the sea at the southern end of Kaitorete Spit.

Today, Lake Ellesmere/Te Waihora covers 20,000 hectares. It can be up to 3.6 metres deep with an average depth of the 2.1 metres at 0.9 metres above mean sea level.

The catchment drains 256,000 hectares. It stretches from the Big Ben Range on the eastern side of the Southern Alps to the sea. It is bounded to the south by the Rakaia River, and to the north by the Waimakariri River. Its northeast boundary is the Port Hills.

The eastern (coastal) boundary of the catchment is an example of the interplay between marine and river processes, producing a large permanent bar or barrier, known as Kaitorete Spit or Ka Poupou a Te Rakihouia - The eel weirs of Rakihouia. This is an ancient name associated with the lake referring to the importance of its fisheries to Tangata Whenua. It is not really a 'true spit' despite the name because it joins to the mainland. This 'spit', largely composed of sand and shingle, forms a 26 kilometre-long, 5-metre high boundary between the lake and the sea. A northward coastal current transports most of the sand and shingle from southern rivers such as the Rakaia, that formed, and maintains the spit.

TRIBUTARIES TO THE LAKE
(discussed in this document)

- **Halswell River/Huritini**
- **Irwell River/Waiwhio**
- **L-II River/Ararira**
- **Kaituna River**
- **Birdlings Brook/Waitatari**
- **Harts Creek/Waitatari**
- **Selwyn River/Waikirikiri**
- **Silverstream (Selwyn River/ Waikirikiri catchment)**
- **Boggy Creek/Te Raki**
- **Waikekewai**

Who owns and manages the lake, its resources, and the land and wetland areas surrounding it?

The lake and its catchment have a complex web of ownership and management. This involves Tangata Whenua, private landowners, district and regional councils, Department of Conservation, Fish and Game Council, as well as the Ministry of Fisheries.

The lakebed

Ngai Tahu, as part of the Ngai Tahu Claims Settlement, own the Lake Ellesmere/Te Waihora lakebed. This ownership consists of the bed of the lake only and does not include the water above or the aquatic life within. It does, however, include plants attached to the lakebed.

The Ngai Tahu-owned lakebed also includes the entire width of Kaitorete Spit at the southwestern corner of the lake at Taumutu, and the mahinga kai site, Te Waiomakua, along the spit.

The lake margins

The Department of Conservation (DOC) administers a significant area of the wetland margins of and near Lake Ellesmere/Te Waihora, as well as other land areas in the Lake Ellesmere/Te Waihora catchment. Environment Canterbury owns a large area of land on Kaitorete Spit with significant wetland margins.

There are stretches of land of other tenure around the lake margin. This includes private freehold land, council endowment land, legal roads, Maori owned land (other than the Ngai Tahu lakebed), and conservation and reserve lands.

Local Papatipu Runanga, Te Runanga o Ngai Tahu and the Department of Conservation are working on a Joint Management Plan for Lake Ellesmere/Te Waihora, which will be publicly notified in the near future.

Lake Ellesmere/Te Waihora.

The lake resources

The Ministry of Fisheries manages the commercial eel and flounder fishery within the lake, and the Fish and Game Council have responsibilities for game birds and fish of the lake. Tangata Whenua also has a role within the management of both these areas.

The lake waters and wider catchment

Through responsibilities under the Resource Management Act 1991, Environment Canterbury manages a number of significant issues in regards to the lake water and wider catchment. These include such things as the lake opening, water abstractions, and discharges onto land and into water. The Christchurch City Council, Banks Peninsula District Council and the Selwyn District Council manage subdivision and land use in the different areas of the catchment.

Natural history of the lake

Lake Ellesmere/Te Waihora was once an estuary of the mighty Waimakariri River. It covered an area approximately twice as large as it does today, and a canoe could be paddled almost unhindered from Taumutu, at the southeast corner of the present lake to the Avon-Heathcote Estuary. Although now modified by both human activities and natural events, the lake and its tributaries continue to be of high ecological, cultural and historical importance.

Lake Ellesmere/Te Waihora, including the open water area and the lake margins, can also be described as a wetland. Wetlands are water bodies like rivers, lakes and streams and as such play an important role in catchment hydrology. Wetlands are integral parts of the water flow within the Lake Ellesmere/Te Waihora catchment. They act as ponding areas in wet periods when lake levels are high, and release water in droughts when lake levels are low. Wetlands also play an important role in protecting water quality through filtration and maintaining the health and mauri (life force) of the water body. However, over 80% of Lake Ellesmere/Te Waihora's original wetland area has now been drained.

Up to 98,000 wetland birds can use (visit, feed/breed/nest on or near) the lake at any one time. There are recorded sightings of 168 species. Around 90 species are regular inhabitants of the lake and its margins. It is the breeding place for 37 species and a resting-place for 39 species of migratory wading birds.

The lake and its surrounding area are also of high recreational value. Some of the activities people utilise this area for are:

- Bird watching
- Fishing
- Whitebaiting/Eeling
- Mahinga kai
- Waterfowl hunting
- Water sports eg windsurfing and sailing
- Land yachting
- A tranquil location for people just to 'be'

The Conservation status of Lake Ellesmere/Te Waihora

In 1985, the Wildlife Service (now the Department of Conservation) applied for a National Water Conservation Order for Lake Ellesmere/Te Waihora. The intention was to define and protect the lake's wildlife habitats. The main thrust of the application was to shift the basis for lake level management from agricultural to ecological requirements.

In 1990 Lake Ellesmere/Te Waihora was issued with a National Water Conservation Order. This order recognises that Lake Ellesmere/Te Waihora provides an outstanding wildlife habitat. This order also allows for lake openings at specified minimum lake levels, with the provision to open the lake at any time from mid September to mid October, and for artificial closure to the sea.

Canada geese and black swans at Lake Ellesmere/Te Waihora. Photo courtesy of D.R. Maindonald.

The lake

Lake Ellesmere/Te Waihora is shallow, with an average depth of 2.1m and an artificial maximum depth of 3.6m. It is a brackish (salt-freshwater mix), bar-type lagoon, with a long shoreline and varying lake levels.

The lake is neither entirely freshwater nor estuarine. Salinity (salt level) varies and is at its highest concentration at the Taumutu opening. Some seawater seeps through the gravels of Kaitorete Spit and large amounts can enter during storm events when the sea overtops the spit, particularly at the Taumutu end. The proportion of seawater in the lake is around 20 percent. Salt concentrations also rise after the lake has been opened.

The formation of Lake Ellesmere/Te Waihora

Geologically, Lake Ellesmere/Te Waihora is a very recent feature. Initially, it was part of a depression on the Canterbury Plains. It then became a bay as the sea level rose. Erosion along the coastline south of the lake, in conjunction with the northward drift of sediment, resulted in the formation of the Kaitorete Spit barrier system. This eventually enclosed the bay. Subsequent natural breaches of the spit then resulted in the development of a lagoon environment that is partway between an estuary and a freshwater lake.

Taitapu after the floods of August 1992. Photo courtesy of John Weeber.

Lake Ellesmere/Te Waihora was formed between 6,000 and 14,000 years ago, after the last ice age. The 26-kilometre-long Kaitorete Spit encloses the lake on the seaward side. It is behind this spit that Lake Ellesmere/Te Waihora has formed, filled by the inflows particularly of the Selwyn/Waikirikiri, Irvell/Waiwhio and Halswell/Huritini River systems.

Lake levels

River and lake water comes from rain, fresh springs and groundwater. The lake level at any time is determined by the balance between inflows and outflows and the storage of water in the lake. The inflows come from the lake's tributaries, rainfall, groundwater seeping into the lakebed and from seawater flowing through or over Kaitorete Spit. Outflows are due to evaporation, breaching of the spit, and seepage through the spit.

Nowadays the lake levels need to be controlled. The lake's higher level is approximately 1.2 metres above mean sea level but if not controlled the lake could rise as high as four metres above mean sea level, flooding the surrounding areas such as Gebbies Valley and Taitapu.

Lake openings

In the past, there were times when the lake naturally breached Kaitorete Spit and flowed into the sea.

Nowadays, the primary reason for opening the lake is to limit flooding of the area of land now used for agricultural production.

Lake openings, then: preparing the Lake Ellesmere/Te Waihora outlet (1900). Photo courtesy of Canterbury Museum.

Lake openings, now: Dragline and bulldozers opening the cut at Lake Ellesmere/Te Waihora.

The lake levels in Lake Ellesmere/Te Waihora are managed through controlled openings to the sea by Environment Canterbury approximately three times per year. The openings are paid for through a special rate levied on that part of the surrounding land and agricultural community who benefit from the openings, as well as general rates and income from lands owned by Environment Canterbury along Kaitorete Spit. However, resource consent is currently being sought to continue the lake openings. Consideration under the Resource Management Act 1991 may result in a different lake opening regime.

The current regime has resulted in the present day ecosystem. Changes to the lake level opening regime will therefore affect the ecosystems and other values that people have for the lake, its wetlands, and its wildlife in both a positive and negative way.

Groundwater in the catchment area

It is estimated that 840 million cubic metres of groundwater moves through the Lake Ellesmere/Te Waihora catchment each year. Replenished by water from rivers and rainfall, groundwater filters down through permeable water-bearing layers of gravels called aquifers. It moves slowly through these aquifers at speeds of up to 100 metres per day.

Groundwater generally flows from the foothills of the Southern Alps across the Canterbury plains to the coast in a southeasterly direction. It comes from rainfall, rivers and their tributaries, water race seepage, foothill runoff and drainage from irrigation.

Groundwater acts as a source to the spring-fed streams in the lower catchment. These springs supply up to two-thirds of the fresh water input into Lake Ellesmere/Te Waihora.

Surface water in the catchment area

Surface water is the water that flows on the surface of the land eg lakes, rivers.

The main source of surface water is rainfall in the hill country of the upper Selwyn River/Waikirikiri. Some surface water comes from the hills of Banks Peninsula including Kaituna River, originating in the Port Hills. Water flows from here into the small streams between the Landsdowne and Prices valleys.

Maori history of the area

Hoki mai koe ki te pa a Ngati Moki e	*Let us return to the village of Orariki*
Tu ana ki te taha o te kahu tai pouri	*That stands beside the darkened waters*
O Te Waihora moana	*Of Te Waihora*
E rere ana ki a tatou e	*That flows to us all*
Te tuna kohaka	*Gathering place of the eel*
Whariki o te piharau	*Floormat of the lamprey*
Ripo o te inaka	*Spawning swamps of the whitebait*
Moeka o te mohoao	*Sleeping ground of the black flounder*
Tai timu tai pari	*The tides of Mahaanui*
ka wai o Mahaanui	*Rise and fall*
Ki te Poupou a Te Rakihouia	*Against the great eel weir of Te Rakihouia*
Te takiharuru ki te pïkao mumura	*And the blazing sand sedge*
O Kaitorete whenua	*Lands of Kaitorete*
Pupu mai	*The winds of Tawhirimatea blow forth*
Ka hau o Tawhirimatea	*Cleansing the snow fed rivers*
I whakapurea te awa huka	*And the great spread out lands of Waitaha*
Me te whenua pakihi a Waitaha e	
	Behold the life giving forces!
Tihei mauri ora!	

The village at Taumutu in 1874. Sketch by Eliot Whately. By permission of the National Library of Australia.

Waitaha - Rakaihautu

Present day Ngai Tahu Whanui are of Rapuwai, Hawea, Waitaha, Kati Mamoe and Ngai Tahu ancestry.

Their history within this land goes back many generations to about 850AD, when Rakaihautu (a Waitaha ancestor) came to Te Wai Pounamu (the South Island) from Hawaiki as the captain of the Uruao waka. The waka was beached at Whakatu/Nelson. While his son Rakihouia took some of the party to explore the East Coast, Rakaihautu led the remainder on an inland route over the Southern Alps/Ka Tiritiri o te Moana. With his famous ko (digging stick), Rakaihautu dug the southern lakes (Nga puna kari kari o Rakaihautu). Te Rakihouia proceeded south in the Uruao down the Canterbury coast. It was on this journey that Te Rakihouia discovered the coastal lake (now Te Waihora) and claimed the abundant resources of the area for his father and hence named the lake Te Kete Ika Rakaihautu - the fish basket of Rakaihautu. This name refers to the lake's bountiful fish resources. These are guarded by a taniwha kaitiaki (guardian monster), named Tuterakihaunoa.

Kati Mamoe - Tutekawa

Generations later, the Kati Mamoe people arrived from Te Ika a Maui (the North Island), settling amongst the Waitaha people. A prominent man of this tribe was Tutekawa, who in establishing his home at Waikakahi, pronounced Te Waihora as his own and the lake became known as Te Kete Ika a Tutekawa.

After Tutekawa killed two senior Ngai Tahu women, Ngai Tahu warriors came from the north in pursuit of Tutekawa and his people. It was during these migrations that Te Ruahikihiki at his pa, Omihi, in Goose Bay Kaikoura, came to hear of the large southern lake and its plentiful resources and mahinga kai.

Ngai Tahu – Te Ruahikihiki

In hearing the news of Te Waihora, Te Ruahikihiki proclaimed Orariki, Taumutu his home and thus the resources of the lake as his own. Te Ruahikihiki then moved to Orariki and built his pa which is now the site of the Hone Wetere church at Taumutu, and its associated urupa (burial site). Later, Te Ruahikihiki's son Moki built his pa Te Pa o Moki, just down the road at the site of the current Marae, named Ngati Moki, where the decendants of Te Ruahikihiki and Moki still reside and meet today.

Ngai Tahu hapu occupied all of Canterbury prior to European settlement. The most concentrated areas of occupation were adjacent to the lake, the lower reaches of the Selwyn River/Waikirikiri and in the upper plains area, particularly near Hororata and Homebush. Te Waihora provided them not only food and easy transportation, but also materials for their homes, industries and with a means of defence against enemies.

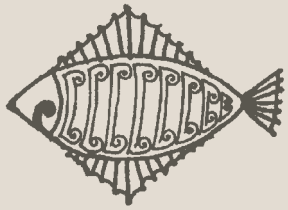
Whanau from all over Banks Peninsula/Horomaka and Canterbury including Tuahiwi, Rapaki, Koukourarata, Onuku, Waiwera and Taumutu, have now lived alongside the lake for more than 40 generations, guarding its magnificent food and cultural resources. Natural resources and the products derived from them had, and continue to have, a number of fundamental values to Ngai Tahu. The central importance of these, mahinga kai was, and still is, reflected in the number of cultural practices.

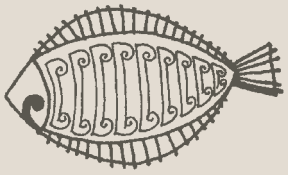
The lake – pre European times

When Maori first came to Te Waihora/Lake Ellesmere the lake waters would have extended back towards Motukarara, (Irwell and Leeston to a lesser extent) covering nearly twice its present day area. The streams flowing into the western and northern sides of the lake, the Halswell River/Huritini, Selwyn River/Waikirikiri, Irwell River/Waiwhio and others spread out widely across the plains.

The whole marginal area of the larger lake was also much more extensive; a vast swampland complex of tall raupo, flax/harakeke, toetoe, sedges/mania and rushes, interspersed with higher, drier strips of land where tussock grasses, tutu and bracken fern grew. Areas of scrub and swamp forest with manuka and kahikatea also grew on the lake margins linking with the mixed forests of Banks Peninsula/Horomaka and the kanuka stands of the Canterbury Plains.

Kaitorete spit was the main north-south route used for those going to and from Banks Peninsula/Horomaka. This concentrated activity gave rise to a large number of settlements and mahinga kai sites along the spit. Ngai Tahu opened the lake when it threatened to flood shoreline occupation sites such as Taumutu, and as a means of defence.





Above: Patiki designs by Taumutu Hakui Cath Brown, which can be seen on the kowhaiwhai panels at Ngati Moki Marae, Taumutu.

Mahinga kai

The term 'mahinga kai' refers to the whole resource chain, from mountain top to ocean floor. It encompasses social and educational elements as well as the process of food gathering. This includes the way resources are gathered, the places where they are gathered from, and the actual resources themselves.

Today, Lake Ellesmere/Te Waihora remains a mahinga kai of great importance to Ngai Tahu. Of all the resources gathered from Lake Ellesmere/Te Waihora the fish are most valued. These resources are considered taonga (particular treasures for food and cultural identity) because they sustained life and an industry for the area and those who resided there. Thus cultural use, traditionally and today, continues within a sustainable use framework.

For Ngai Tahu today, participation in mahinga kai activities is an important expression of cultural identity. This participation is reliant on sufficient access to mahinga kai sites, resources and a healthy environment.

The lake's importance

The vast quantity of mahinga kai contained in and around the lake included patiki (flounder), tuna (eels), aua (yellow-eyed mullet), inanga (whitebait), pingao (sand sedge), harakeke (flax) and paru (mud for dyeing). Brown teal,

The kete is a traditional bag for collecting mahinga kai. Photo courtesy of DOC, © DOC.

pukeko/pakura and paradise shelducks/putakitaki were driven ashore by waka during the moult and caught in nets.

Of all the resources available at Lake Ellesmere/Te Waihora the tuna, or eel was particularly important. References to the various eeling methods are numerous and also refer to the abundance of this resource and the great numbers taken for traditional uses, including trade.

When the gravel bar was opened Taumutu families would come in large numbers and work from dawn till dusk to collect this bountiful resource. When the lake outlet was blocked and the fish were heading for the open sea, local whanau would dig a series of trenches called koumu, into the shingle bank in the direction of the ocean. The eels could then be scooped out and thrown onto the banks.

Eeling methods varied with the season and included: traps known as kaitara; 'tickling'; netting; baited lines; and spearing by torchlight. Rauiri or Patuna (eel weirs) were used year round and could be highly productive. Another method involved the digging of channels in the autumn. The mouths of these channels would then be blocked off with gravel or kohau nets. When the entrances were closed off, the water drained away and the eels/tuna were simply scooped up in the kohau nets.

Of particular importance to the people of Taumutu was the appearance of the pou eel/tuna, the very large longfin eel, which were regarded as kaitiaki and not taken. During the autumn eel gathering, the appearance of the pou tuna signified the end to eel gathering. Unfortunately, today, due to habitat destruction, recreational fishing and commercial eel fishing, these eels are rarely seen.

Prior to 1850 Lake Ellesmere/Te Waihora had flounder/patiki in abundance. Local Maori used flax/harakeke nets to catch these fish. The flounder/patiki came in from the sea when the lake was opened and ascended the several streams that flowed into the lake.

Flounder/patiki numbers have since declined. The historical introduction of trout also changed the focus of the fishery, but trout numbers have also declined significantly, particularly over the last three decades.

These resources not only sustained the families living at Taumutu but also provided them with an industry within which they could trade their resources with others. For example, Maori in Rapaki and Koukourarata (Port Levy) would trade hapuka and mako (shark) for flounder/patiki and herring from the lake. Trading also took place at the Christchurch markets and extended further afield including exchange for muttonbirds/titi in the south and Pounamu in the west.

Eeling/fishing. Photo courtesy Ngai Tahu.

It was the protection of these resource values that Ngai Tahu considered it was guaranteeing when it signed the Treaty of Waitangi in a number of locations in Te Wai Pounamu, including at Onuku in Akaroa Harbour.

In 1848 Henry Kemp purchased Canterbury for the Crown from Ngai Tahu. The Crown thought it had purchased Lake Ellesmere/Te Waihora but the successful Ngai Tahu claim to the Waitangi Tribunal found this was not so (Refer Ngai Tahu Claims Settlement Act 1998).

European history of the area

Both the lake and the district around it are named after the Earl of Ellesmere, a member of the Canterbury Association, who promoted the early settlement of Canterbury, but never came to New Zealand himself. The earliest visits by Europeans to Lake Ellesmere/Te Waihora were in the early 1840s. Until this time, Europeans did not generally know of Lake Ellesmere/Te Waihora.

During the 1830s and 1840s whalers, sealers, missionaries and farmers were among the first settlers to arrive in Canterbury, and the arrival of the first four ships in 1850 brought many more. Extensive pastoralism for wool production flourished in the first two decades of settlement. The settlers quickly took up land across the plains, and drained the swamplands around the lake to farm the fertile soils. Early settlers built homesteads close to the rivers and streams in order to provide for their household and farming needs. Later, settlers had to sink hundreds of wells into the groundwater aquifers to meet these needs. Stock water races were also built across and down the plains to provide for household and stock water needs.

Since European settlement there have been significant changes to wildlife populations. Historically, this has been attributed to factors such as disease, shooting, competition with introduced birds, and the introduction of predators. Loss of habitat through swampland drainage is also likely to have been a significant factor in the Lake Ellesmere/ Te Waihora area. A number of species, including brown teal, banded rail, and fernbird have been affected by this.

The wetlands surrounding Lake Ellesmere/Te Waihora were gradually drained for agriculture and the vast tracts of forest that still covered much of Banks Peninsula/Horomaka were felled for timber and to provide land for sheep grazing, dairying and growing cocksfoot. By 1853 approximately 20 sheep and cattle stations (runs) occupied an area of 100,000 hectares around the lake.

From the earliest days of European settlement, high lake levels caused flooding of farmland. By the 1860s lake-shore land owners wanted lake level control, and a number of parties were involved in opening the lake to the sea, initially using shovels and horse drawn scoops near where Ngai Tahu had traditionally opened the lake. The Selwyn Drainage Board established a subsequent lake opening/lake level regime in 1903. In 1904, engineer Arthur Dudley Dobson designed an outlet culvert that lasted 7 months. John Pannet, a Greenpark farmer, constructed another culvert in 1908, which operated relatively successfully until 1925 when it was destroyed in a storm.

Farming around Lake Ellesmere/Te Waihora

Farming within the Lake Ellesmere/Te Waihora catchment is a major part of the history and current status of the area. The wide range of soils in the catchment has determined the pastoral, arable and horticultural farming in the area.

In the 1850s the leasehold stations on the heavier, wetter soils near the lake ran cattle and the stations on the drier tussockland to the south and west carried sheep. Early farms all had at least one cow, hens and most had pigs, in order to provide for their own food. Small dairy herds (four to ten cows) were also important as a regular source of income on mixed arable farms.

By 1869 Ellesmere district was the leading wheat producing area in New Zealand. During this year members of the Ellesmere Farmers Club sent a shipment of wheat to England. This proved profitable and resulted in the development of arable farming in Canterbury. Recent years have seen the expansion of horticultural crops, vegetable growing eg for Heinz-Watties and McCains and specialised seed growing for overseas markets.

Most of the houses built during this time used the plentiful timber supply that came across the lake from the mills on Banks Peninsula.

Over the years, many stud breeders of sheep and cattle have farmed in the Ellesmere district. The major expansion in recent years has been the growth of dairy farming on lighter, irrigated land.

Being central, Leeston developed as the service centre for the farming district. Most of the businesses in the town today are related to the farming industry.

Leeston 1920s. Photo (W.A. Taylor) courtesy of Canterbury Museum.

The district remains one of the leading agricultural areas and farmers are looking towards sustainable practice. Agricultural research groups at Lincoln and Lincoln University have given the district access to technological advances and this has been well utilised by local farmers. Nutrient budgeting research and the use of GPS (global positioning system) for accurate fertiliser spreading are examples of current technological developments.

Transport and timber

The extensive wetlands of Lake Ellesmere/Te Waihora, were a barrier to early land transport. Consequently, Kaitorete Spit and the river flats to the west and north of the lake were the main travel routes for Maori and Europeans.

In the early 1860s William White established a sawmill at Little River for Christchurch and the nearby timber markets. The sawn timber was punted along Lake Forsyth/Wairewa and, depending on the lake level of Lake Ellesmere/Te Waihora, was taken by tramline to Birdlings Point or Stony Point. From the lakeshore, shallow-draught paddle steamers carried and rafted the timber to Taumutu, Harts Creek/Waitatari and the Selwyn River/Waikirikiri. A major timber yard (Timber Yard Point) was established at Harts Creek/Waitatari.

An early conflict regarding the lake occurred between farmers wanting low lake levels and the saw millers favouring high lake levels for shipping.

In 1866 tramline construction began from Little River to Prices Long Point,

Kaitorete Spit looking southwest. Lake Ellesmere/Te Waihora on the right. Photo courtesy of John Weeber.

'A weighty catch'. From left: Wally Cunningham, unknown person, Jack Vince, Dave Vince.
Photo courtesy of the Ellesmere Camera Club.

and Christchurch to Ahuriri Point. Development of other area sawmills in Little River prompted the construction of the Little River branch railway.

As a result of the development of better roads (the roadway from Christchurch to Little River was opened for traffic about 1870), and the relaxation of restrictions on road transport in the 1950s, the use of the railway line declined and it was finally closed in 1962.

Fishing

In 1864 European flounder fishing began, and in 1865 Thomas Robelli, an Italian, settled at Lake Ellesmere/Te Waihora as a commercial fisherman. At one time as many as 250 men and 20 boats were fishing from Taumutu.

In the early 1900s trout in the lake and its tributaries were harvested commercially for the sale in Christchurch's fish markets. The areas at which streams such as Harts Creek/Waitatari, Irwell River/Waiwhio, L-II River/Ararira and Selwyn River/Waikirikiri enter the lake were also popular with anglers.

In 1979 flounder/patiki from Lake Ellesmere/Te Waihora provided around 5 percent of the total New Zealand flounder/patiki catch. In response to overseas demand the eel fishery grew rapidly in the 1970s and the lake was the most important commercial eel fishery in the country. Yellow-eyed mullet also formed a locally important fishery.

Ecology of Lake Ellesmere/Te Waihora

Wetlands

Wetlands contain a wide variety of plants adapted for survival in aquatic and sub aquatic conditions. The wetland vegetation surrounding Lake Ellesmere/Te Waihora is of particular hydrological importance as it acts as a water storage facility. As the lake levels fluctuate, the wetland vegetation is able to slow the speed of surface water as well as trap sediment from flooding and runoff. This lowers the risk of stream bank erosion, reduces the effects of flooding and helps protect the downstream water quality.

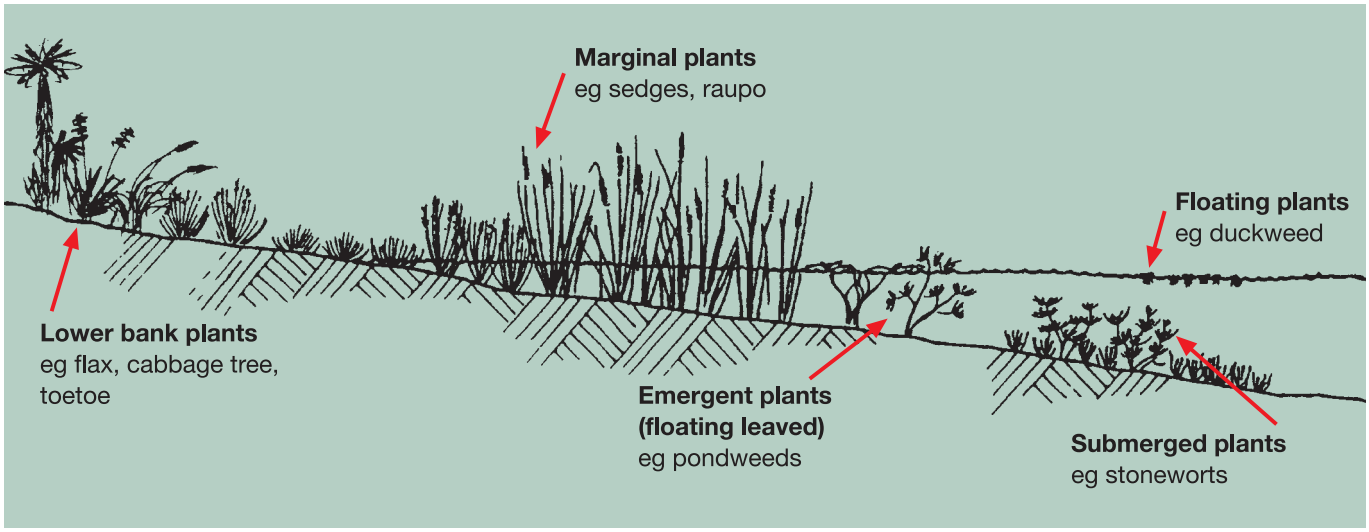
Lake Ellesmere/Te Waihora wetland. Photo courtesy of DOC, © DOC.

One of the most unique aspects of Lake Ellesmere/Te Waihora is the salinity of the water. Throughout the year salinity levels in the lake change due to the levels of freshwater entering the lake. For example, in areas where flooding occurs in spring but dries up later in the season, salt concentrations are much higher than in the lake itself. Plant species that have high salinity tolerance will then dominate in this area. Salinity levels also vary at different locations within the lake and its margins. For example, the area where a tributary enters the lake will have lower salinity because there is a constant supply of fresh water but an area of the lake closer to the sea or prone to flooding will have much higher salinity levels. The variety of salt tolerant plant species that inhabit Lake Ellesmere/Te Waihora and its wetland are highly adapted to these conditions.

The bacteria living in wetland soils absorb and break down nitrogen, which improves water quality. Nitrogen and phosphorus can enter our waterways through groundwater, surface runoff and effluent disposal. Nitrogen is a naturally occurring chemical necessary for plant and animal survival but in excess can result in environmental contamination. Wetlands can remove up to 90 percent of nitrates from our groundwater through a process called ‘denitrification’. This process converts nitrate to nitrogen gas, which is released into the atmosphere.

Wetlands are diverse and complex ecosystems. They support intricate food webs and are sources of many nutrients. Because of this diversity a variety of wildlife live in these areas and the Lake Ellesmere/Te Waihora wetland is no exception. The plants and animals of this wetland are specially adapted to this environment and many are native to New Zealand.

Aquatic zones and wetland vegetation.



Terrestrial and freshwater insects provide food for birds, fish and amphibians. The surrounding riparian vegetation provides important nesting sites for bird life. Each wetland should be considered part of an important network. Migratory bird species are dependent on having a chain of wetland environments for resting and feeding. They are also essential breeding areas for whitebait/inanga species, game fish and a refuge for the Canterbury mudfish.

Eutrophication

The lake is often described as eutrophic – rich in plant nutrients, especially nitrogen and phosphorus. Excessive nutrients can cause profuse aquatic weed growth and algal blooms (rapid algal growth which can form a coloured scum). When these die, the result is deoxygenation (loss of oxygen) and potential loss of animal life.

Although Lake Ellesmere/Te Waihora has very high concentrations of green algae, toxic blooms are rare and the other characteristics of excessive nutrients are not present. The combination of shallowness of the lake, and weather conditions such as winds helping to keep the surface water almost constantly in motion, minimise these adverse effects.

Water clarity in Lake Ellesmere/Te Waihora

Visual clarity is a measure of how far through the water humans and aquatic animals can see.

The water in Lake Ellesmere/Te Waihora is a brown-yellow colour and has low visual clarity. This is the usual appearance of turbid (murky) water – water well mixed by wave action. The turbidity limits light availability for phytoplankton (microscopic floating green algae) because sediments are constantly suspended in the water. These sediments block incoming light from reaching the phytoplankton. This is the probable reason for the lack of algal blooms, which would normally occur in a lake with such high nutrient levels. The poor clarity of the water in the lake is a major issue for many people.

There is a large amount of fine sediment on the bed of the lake. Suspended solids (the amount of sediment suspended) from the 25 or so waterways flowing into the lake also contribute to poor water clarity. Lake clarity has been worse since the Wahine storm of 1968, which ripped up the macrophyte (large, floating aquatic plant) beds. These plants formed dense banks around the lake and helped stabilise the bed. The weed banks helped prevent waves from out in the open lake from getting into this shoreward area so it remained calmer. This improved the clarity of the lake.

Stock grazing to the edges of the lake causing the edges to break down and slough into the lake is also a minor contribution to poor clarity conditions.

Birds

One of the most distinctive natural features of Lake Ellesmere/Te Waihora is its richness of birdlife. 168 species are recorded as having used the lake. This is probably the highest number of birds recorded in any one place in New Zealand. Most bird species are seasonal migrants and numbers fluctuate. For example the white heron stays for winter only and the godwit, wrybill, and red-necked stint stay for only the summer.

Major Bird Species of Lake Ellesmere/Te Waihora

Common Name	*Maori Name*
Australasian bittern (endangered)	*matuku-hurepo*
Australasian/ NZ Shoveler	*kuruwhengi*
Banded dotterel	*powhera, tuturiwhatu*
Bar-tailed godwit	*kuaka*
Black shag	*koau*
Black stilt (critically endangered)	*kaki*
Black swan	*kaki anu*
Black backed gull	*karoro*
Black-billed gull	
Black-fronted tern	*tara*
Brown teal	*pateke*
Canada goose	
Caspian tern	*taranui*
Cattle egret	
Curlew sandpiper	
Golden plover	
Grey duck	*parera, maunu*
Grey teal	*tete*
Kingfisher	*kotare*
Lesser knot	*huahou*
Little shag	*kawaupaka, koau*
Little tern	*tara*
Mallard duck	
Marsh crake	*koitareke*
NZ pied oystercatcher	*torera*
NZ scaup	*papango*
Paradise shelduck	*putakitaki*
Pectoral sandpiper	
Pied stilt	*poaka*
Pukeko	*pukeko, pakura*
Red-necked stint	
Royal spoonbill	*kotuku-ngutupapa*
Sharp-tailed sandpiper	
Spotless crake	*putoto*
Spotted shag	*parekareka*
Spur-winged plover	
Turnstone	
Welcome swallow	
White heron	*kotuku*
White-faced heron	
White-fronted tern	*takkitak, tara*
Wrybill	*ngutu-parore*

NZ Scaup/papango.
Photo courtesy of Tanya Jenkins.

Top: Male Paradise shelduck/putakitaki.
Photo courtesy of P. Morrison, © DOC.

Above: Female Paradise shelduck/putakitaki.
Photo courtesy of Rod Morris, © DOC.

Bird habitat types consist of: open water, exposed mudflats, raupo, rushes, sedges and reeds, flax/harakeke and willow and various levels of saltmarsh. These saltmarsh levels range from tall saltmarsh ribbonwood shrubland to low statured saltmarsh herbfields. It is the structure of this vegetation that is an important determinant of bird habitat.

Most birds can be divided into three main groups – waterfowl, waders and swamp birds. This is based on habitat and food supply requirements. Different habitat types provide different groups of birds with areas to feed, nest, roost and moult. Invertebrates and fish also utilise these habitats.

Waterfowl are the most prominent in numbers, diversity and hunting opportunities. Canada geese, black swans and five duck species – mallard, shoveler, scaup, grey duck and grey teal, are present at Lake Ellesmere/ Te Waihora. Only black swans breed in large numbers. All other waterfowl use the lake for loafing or feeding. Swans and geese have the most impact on agricultural land.

Lake Ellesmere/Te Waihora is New Zealand's largest single recreational duck shooting area and shooters' maimais have become features of the lake's landscape. Canada goose, paradise shelduck/putakitaki, pukeko/pakura, black swan and three duck species are all declared game species.

Wading birds are seasonal visitors to the lake. They are predators and forage for insects in the shallow waters. Waders include the curlew sandpiper, red-necked stint, wrybill, banded dotterel and pied stilt. They use the lake for resting during migration or to escape the Northern Hemisphere winter. The lake is an important habitat and food source for these birds and prepares them for their return flight. The red-necked stint for example completes a round trip of approximately 25, 000 kilometres.

The most common swamp bird is the pukeko or pakura as it is known by Ngai Tahu. The pukeko/pakura feeds on shoots, roots, insects and some young birds. Three other species, seen less frequently, are the Australasian bittern, marsh crake and the rare spotless crake.

Pukeko. Photo courtesy of Rod Morris, © DOC.

Invertebrates

A fairly simple aquatic community of insects exists in the lake. The dominant species are the sediment dwelling larvae and pupae of the large midge (chironomid) and worms (nematodes). There is a super-abundance of adult midges during the spring and summer after the larvae emerge. They provide an abundant food source for fish and birds. Any change in the populations of these lake flies could have a significant impact on the rest of the ecosystem. Surface dwelling species such as caddisflies and snails comprise a much smaller portion of the invertebrate community.

Uncased Caddis larvae

Cased Caddis larvae

Snails

Water Boatman

Fly larvae

Crustacea

Worms

At the bottom of the lake, or attached to stems and leaves of larger plants are amphipods (shrimp-like creatures), snails and several other species of aquatic insects.

Fish

Lake Ellesmere/Te Waihora is rich in both species number and abundance of fish. Many of the fish are migratory and spend only part of their life in the lake or in the lake's tributaries. There are 15 indigenous species of fish recorded in Lake Ellesmere/Te Waihora and five exotic species. A number of additional species are occasionally present or transitory and others are found in the tributaries.

Since European settlement it is likely that drainage, farming and commercial fishing have contributed to the decline in fish stocks and distribution. The loss of weed beds in the lake is also a probable cause (see Issues for food web page 29).

Significant fish species within the lake for cultural, recreational and commercial purposes include tuna/eel, patiki/flounder, inanga/whitebait, aua/yellow eyed mullet, and trout. Introduced fish such as perch, tench and goldfish are also present. Rudd, a pest fish species has also been recorded in the lake. Visiting marine species are occasionally present in the lake and include basking shark, elephant fish, red cod, sunfish and seahorses. Marine mammals such as elephant seals and dolphins have also been seen in the lake.

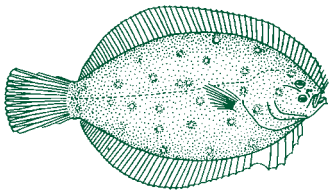
Shortfin eel/tuna, picture courtesy of Stephen Moore, © DOC.

Tuna: Eel

There are two species of freshwater eel/tuna in Lake Ellesmere/Te Waihora: the longfin eel and the shortfin eel. Both species are indigenous, and while the shortfin eel is also found in Australia, the longfin eel is endemic to New Zealand (only found here). Compared to the shortfin, numbers of longfin eels have declined over the years and they have now been classified as 'nationally threatened' according to the DOC classification system. This is a concern for biodiversity, mahinga kai and other cultural values.

Longfin eel/tuna, picture courtesy of Sonia Frimmel, © DOC.

Eels/Tuna prefer water with extensive cover such as raupo, weed beds, overhanging grasses



Black flounder, picture courtesy of Southern Encounter Aquarium.

Inanga/Whitebait, picture courtesy of Stephen Moore, © DOC.

Common skink, picture courtesy of D. Sanderson, © DOC.

Halswell Canal at Hodgens Bridge showing weed cutting, photo courtesy of M. Main.

and other vegetation, as well as undercut banks and submerged debris. They feed on invertebrates, young waterfowl, bullies and other small fish and fauna as they become larger in size.

There is also a significant commercial eel fishery present in Lake Ellesmere/Te Waihora.

Patiki: Flounder

Along with tuna/eel, flounder/patiki is particularly valued by Ngai Tahu. They belong to the flat fish family, of which five species are recorded in Lake Ellesmere/Te Waihora. Most common is black flounder/mohoao followed by yellow-belly flounder/patiki totara and the three corner flounder/patiki. These species are commercially fished and provide an important customary fishery for Ngai Tahu.

Inanga: Whitebait

Whitebait enter the lake when it is open to the sea during the spring and early summer. There are five species of endemic fish that make up what is commonly known as whitebait in New Zealand: inanga, koaro, banded kokopu, giant kokopu and shortjaw kokopu. Inanga is the most common species in whitebait catches in Canterbury.

Most inanga spawn in autumn when adults migrate downstream to estuarine areas during the highest spring tides. Eggs are laid and are incubated out of water until they are submerged on a subsequent spring tide and hatch.

The whitebait fishery is of great value to Ngai Tahu as mahinga kai. It is also an important recreational fishery, and some are caught and sold commercially.

Trout

Brown trout were introduced to the catchment in the 1870s. The fishery grew rapidly in the Selwyn River/Waikirikiri, which became one of the finest trout fishing rivers in New Zealand. Lake water quality has caused this fishery to decline.

Lizards

There are four species of lizard present around Te Waihora/Lake Ellesmere: the common gecko, two species of common skinks, as well as the rare spotted skink.

Aquatic plants

The lake once had extensive macrophyte (large aquatic plant) beds. Two Ruppia species formed these dense canopies or ‘weed beds’. However, after initial decline in the 1920s, they disappeared in the 1940s. Some recovery occurred but the Wahine storm of 1968 destroyed most of the remaining beds.

Macrophytes have a role in habitat diversity, sediment trapping and buffering of nutrient cycles. They are an important food source for some bird species and provide food and shelter for many fish and invertebrate species. The weed beds also reduce the effect of wave action on the shores. This helps reduce lakeshore erosion and water turbidity. The weed beds of Lake Ellesmere/Te Waihora may have played a significant role in the functioning of the aquatic ecosystem.

Today, some natural regeneration of the weed beds is occurring and small beds exist, particularly in areas around the mouths of various tributaries such as Boggy Creek.

A number of other aquatic plant species (both indigenous and introduced) are also present in the tributaries of Lake Ellesmere/Te Waihora. As part of drainage maintenance these plants are cut regularly and the majority removed. Because they are freshwater species they do not spread into the brackish waters of the lake.

Vegetation

The predominant pre-Polynesian vegetation cover of the Lake Ellesmere/Te Waihora catchment was forest. Snow tussock grasslands existed above the bush line. Scrub species occupied stony, well-drained sites on the plains and short tussock grasslands dominated the floodplains.

It is thought that much of the forest was destroyed by fire, following the arrival of the first Polynesians in about 950 A.D. Patches of forest on Banks Peninsula, patches of swamp forest on the plains, and stands of beech forest in the hill and high country, escaped these early fires. Following this forest destruction, scrub and snow grass reoccupied formerly forested sites at higher altitudes.

Elsewhere in the catchment area, a mosaic of short tussock grasslands, bracken fernland, flax/harakeke, cabbage trees/ti kouka, kanuka scrub, matagouri shrubland and kowhai woodland developed and was maintained by periodic fire. The large areas of swamp on the lower plains were dominated by raupo, flax/harakeke and sedges/mania. The remaining areas of swamp forest contained kahikatea, matai, and totara. Salt tolerant plants fringed Lake Ellesmere/Te Waihora; while Kaitorete Spit supported species able to withstand harsh conditions and poor soil for example pingao/native sand binding sedge.

Repeated burning and stocking was a feature of European development. This resulted in a further reduction of forest areas and large tracts of secondary scrub. In the upper Selwyn catchment, red tussock and snow tussock grassland were also depleted. This encouraged fire tolerant and grazing resistant native species (silver tussock and fescue tussock) as well as introduced species (sweet vernal and browntop).

Higher producing pasture species were also introduced in the upper Selwyn catchment and the land was subjected to heavier grazing. Introduced plants such as gorse and broom spread in riverbeds. In the less intensively farmed hill country browntop, sweet vernal, ryegrass, white clover, and cocksfoot became the dominant pasture species. Ploughing the arable land and establishing introduced high-producing pasture species and crop rotations further changed the vegetation. On the lower plains, the swamps were drained and the land ploughed.

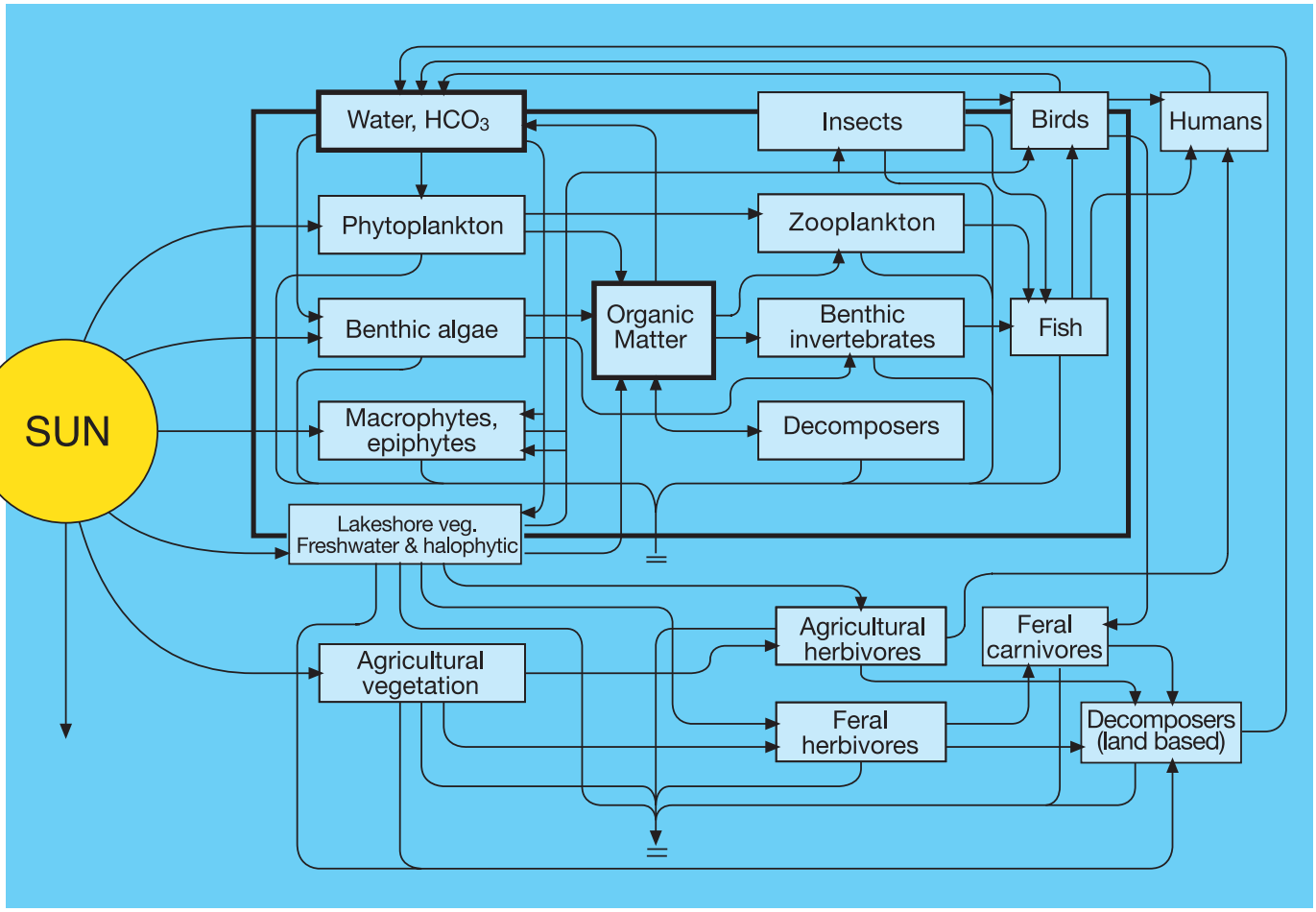
Today woody vegetation on the plains is made up of gorse hedges and shelterbelts, and woodlots of introduced trees, mainly Pinus radiata, cedars, arizonicas, eucalypts and Douglas fir. Willows line the banks and streams and in some places invade the Selwyn River/Waikirkiri bed. Gorse and broom also infest much of the Selwyn River/Waikirkiri bed. Many indigenous salt-tolerant plants, which fringed the lake in the past, still remain. Salt-marsh vegetation is of national importance, with more than 50 different types around the lake.

Several introduced species (eg salt barley grass) are invading these areas. The vegetation around the lakeshore depends on how the land has been used and the intensity of this use. Rare and unusual species found on the lake margins include a native orchid and giant umbrella sedge. One nationally important botanical area, because of the rarity of its vegetation type, is the Greenpark Sands – an extremely rare saline lagoon saltmarsh on sandy soil.

Lake Ellesmere/Te Waihora vegetation, photo courtesy DOC, © DOC.

Stream vegetation.

Plants are the foundation of the lake's ecosystem. Plants provide food and shelter for other plants and animals above and below the water, as well as making a major contribution to the landscape.



Lake Ellesmere/Te Waihora food web.

The lake food web

Lake Ellesmere/Te Waihora's food web is based on green plants, which convert the sun's energy into organic matter through the process of photosynthesis. These plants include phytoplankton, other small-attached algae, large submerged plants, macrophytes, and lake-edge plants that are sometimes submerged. Blue-green algae are also an important feature of the lake.

Algae are an important part of the food chain at Lake Ellesmere/Te Waihora. The algae provide food for zooplankton (microscopic animals living in the lake water) and other invertebrates. The invertebrates are in turn eaten by fish and birds, as are the large plants. Decomposers like fungi and bacteria consume dead plant and animal material. This process releases nutrients for plant growth. The decomposers themselves are eaten by invertebrates and their predators, fish and birds. Large eels are the top predators within the food chain.

Algae are also a vital indicator of water quality. The presence of green and blue-green algae in the water gives the lake its greenish colour, which is more intense in times of increased algae. There have been 38 species of algae recorded in the lake.

Midges are another significant aspect of the Lake Ellesmere/Te Waihora food web. They are in such abundance so provide a major food source for birds and fish, including young eels.

On the shoreline, plants, insects and birds can be found. Insects, birds, sheep, cattle and wild animals, such as rabbits and hares eat the vegetation. The terrestrial food web includes humans.

Introduced species

Introduced plant and animal species impact on the wildlife and habitat of Lake Ellesmere/Te Waihora. They displace species native to the area and change habitat quality. This reduces biodiversity of the area and can result in the loss of wetland species and areas as well as reducing the availability and accessibility of resources for customary harvest.

Introduced pest fish, including rudd and catfish threaten the lake's aquatic species and environment. This is because they stir up sediment making the water murky, increase nutrient levels and algal concentrations, feed on and remove aquatic plants, prey on invertebrates, native fish and their eggs and compete with native species. Other fish introduced to the lake and its tributaries also have an impact. Brown trout, for example, compete with indigenous freshwater fish species such as the kokopu, and commonly feed on smaller fish species.

Introduced mammals around the lake include rabbits and hares, hedgehogs, ferrets, weasels, stoats, cats and rats. These species impact on both indigenous plants and animals through predation and disturbance. Domestic stock such as sheep and cattle also impact on indigenous plants and animals, especially margin vegetation. Grazing and trampling by domestic stock affect wetland species and impact on bank stability increasing erosion and reducing biodiversity. However, domestic stock, especially sheep can also play an important role in managing and controlling introduced plant species such as pasture grass.

Hedgehog, photo courtesy of Don Merton, © DOC.

Rudd, picture courtesy of Sonia Frimmel, © DOC.

Stoat, photo courtesy of DOC, © DOC.

Cat, photo courtesy of Rod Morris, © DOC.

The state of Lake Ellesmere/Te Waihora and its tributaries

Issues of concern for the lake and its tributaries

- Tangata Whenua values
- Water quantity
- Water quality
- Farm owner issues
- Health of the lake
- Population
- Urbanisation
- Issues for the food web
- Access issues
- Recreation related issues
- Fisheries
- Pest plants and animals

Issues that relate to **Tangata Whenua** values have many similarities to those identified in the other categories. However, issues specific to Tangata Whenua include access to, and quality of, mahinga kai; degradation of wahi tapu sites (sites of sacred importance such as burial sites); and taonga.

Water quantity focuses on three primary issues: the effect of low flows on in-stream values, Tangata Whenua values, and the availability of water where and when it is wanted.

Water quality has several issues relating to nutrient levels; suspended solids; pathogens and other potential contaminants, such as heavy metals from storm water; and oestrogen from human sewerage and animal effluent. In addition to these issues,

Tangata Whenua are concerned about the impacts on the spiritual quality of the water (mauri) and the protection of cultural uses of the water bodies.

Many issues relate to the **health of the lake** and its ecosystem. These issues include water quality – particularly as it affects fish health and cultural uses; appropriate management of lakeside lands; maintenance of wildlife habitat; the management of lake levels, and the protection and enhancement of the mauri of the lake. Lack of awareness of the lake and its values is a further issue, as is public access.

Tangata Whenua values

The Tangata Whenua of Te Waihora are Ngai Tahu, for whom the area has considerable spiritual and physical significance. The significance and prominence of Lake Ellesmere/Te Waihora to Ngai Tahu is reflected in the 1997 Deed of Settlement between the Crown and Ngai Tahu whereby the ownership in the bed of Lake Ellesmere/Te Waihora is vested in Te Runanga o Ngai Tahu.

Tangata Whenua have some specific issues relating to:

- The degradation of the mauri (life force, embracing health and spirit) of particular springs, waterways and the lake;
- The protection and enhancement of taonga (things that are highly treasured);
- Access to, and quality of, mahinga kai (food and fibre, traditional ways);
- The degradation of wahi tapu (sacred sites such as burial grounds);
- Degradation of wahi tapu (places of sacred and extreme importance) sites and;
- Decline in stream health and mauri.

Tangata Whenua are firmly of the view that the combination of past and present lake, farm and catchment practices have left Lake Ellesmere/Te Waihora a polluted, shallow remnant of its former self. Few of the resources that originally attracted Ngai Tahu and earlier tribes to the area are now readily available. It is for these reasons that Ngai Tahu are working together with Environment Canterbury, Selwyn and Banks Peninsula District Councils, the Department of Conservation and the community to improve the quality of the lake and its surrounding wetland area.

The Tangata Whenua of Te Waihora have the role of Kaitiaki (guardians). For Lake Ellesmere/Te Waihora this means the ability to manage the resource to ensure healthy mahinga kai that can sustain and nourish the people and the traditions associated with the generations of mahinga kai gathering at Lake Ellesmere/Te Waihora.

Of most importance to Ngai Tahu are those factors that threaten the health of the resources of Lake Ellesmere/Te Waihora, for example, drainage, sedimentation, water abstraction and discharge of nutrients and other pollutants into waterways that feed the lake. Of particular concern are the discharge of human effluent to lake tributaries and the on-going abstraction of water from the catchment. Together, these discharges and abstractions render waterways and their associated areas unusable or unsuitable for cultural purposes, especially mahinga kai. Restoration of mahinga kai or unique and valued flora and fauna is also a major issue for Tangata Whenua.

Planting along Waikekewai. Photo courtesy Ngai Tahu.

The act of sourcing, processing and preparing of mahinga kai is an important vehicle for the transmission of culture within these communities. It is at these times of communal activity that whakapapa, histories, and cultural practices are discussed and handed down from one generation to another.

The breaking of this link has had a serious and damaging impact on Ngai Tahu tribal life. Because of its fundamental importance, the tribe is committed to restoring these resource-centred relationships and activities.

Underlining the importance of these natural resources is the necessity to manage the resources of any given area in a sustainable manner. Over many generations, and after some serious mistakes, these principles of sustainable management were developed, refined, and codified into the laws of society. They were then implemented through religious mechanisms and controls, such as the concepts of rahui (refer Waitaha Wai, p. 10) and tapu (sacred).

Water quantity – streams, rivers and drains

Low flows in the catchment waterways are a major issue. Environment Canterbury seeks to manage the waterways in a manner consistent with protecting the in-stream values. One of the ways Environment Canterbury does this is through issuing consents for water allocation. Water is generally allocated for irrigation. This has an impact on water quantity as the water is taken from underground aquifers and surface water. The groundwater from these aquifers feeds the springs and streams. If water users extract too much from these aquifers it will reduce the spring and stream flows.

Environment Canterbury has indicated it will establish minimum flow levels on 25 waterways in the catchment. The minimum low flows are determined using a combination of methods and will result in conditions being placed on any consent for the abstraction of water affecting flow levels in waterways. This applies to surface water abstractions and to groundwater abstractions that reduce surface flow.

In addition, the Fish and Game Council of New Zealand (and individual recreational fishers) have raised concern that low flows are contributing to a decline in the recreational fishery. Low flows in the waterways can cause:

- Decline in fish habitat due to the exposure of streambed margins;
- An insufficient depth in pools, which the fish need for cover and/or resting as they move up and down the streams;
- Water warming (shallow water heats up more quickly relative to deeper water), which is not conducive to many fish species. It causes a drop in dissolved oxygen (detrimental to fish), and can stimulate excessive weed and algal growth.

Water quality: lowland waterways

Nutrient levels

Water quality, particularly in the lowland streams (ie those southeast of State Highway 1), is considered to be poor due to high nutrient concentrations and concentrations of suspended sediments.

High nutrient status and pathogen concentrations are of particular concern to Tangata Whenua. This relates to the wider issue of the protection and enhancement of the mauri of the waterways, and for the quality of mahinga kai.

While nutrient concentrations in the monitored streams breach guidelines for aquatic ecosystems and aesthetics, they are not considered particularly detrimental to fish health nor do they breach, for example, human drinking water standards. Ammonia levels are generally within the guidelines for aquatic health.

Where do the nutrients come from?

The bulk of the nutrients entering the waterways come from pasture and horticultural runoff, runoff from underground paddock drains, stock access to the waterways and stormwater. Nutrients attached to cultivated soils can also be blown or washed into waterways. Nutrients can also enter the surface waters via groundwater. This is a result of nutrients having leached into the groundwater. There is widespread evidence that waterways are affected by increases in concentrations of phosphorus and nitrogen from farm wastes and fertilisers.

Nutrients often bind themselves to suspended solids. Suspended solids include soil, rock dust, faecal and plant matter. Suspended solids affect the clarity of the streams and the lake.

Healthy stream with good buffers and shade.

Spray irrigation of blackcurrants near Irwell, photo courtesy of John Weeber.

Stock access destroying stream qualities.

Sediment and algae (slime) clogging stream habitat.

Clean vegetation and good mixed habitat for stream life.

Clearing of a waterway.

When suspended solids drop out of suspension and onto the bed of a stream, they can smother aquatic plants, invertebrate habitat, and fish spawning sites. Invertebrates make up much of the food source for fish. Field observations of some streams show evidence of the effects of high levels of suspended solids when they cover gravels and aquatic plants.

Poor water clarity resulting from high levels of suspended solids will mean sight-feeding fish have difficulty locating their food source. In addition, the aesthetic and amenity values of the streams are compromised. The murky conditions experienced in the lake can be partly attributed to the quantity of suspended solids entering it from the 25 or more streams in the catchment.

As recently as 1994, approximately 10 dairy sheds discharged directly into the Lake Ellesmere/Te Waihora waterways. Now there are none. The Leeston sewerage system intermittently discharges into the Tramway Reserve Drain but this system is currently being upgraded. The Lincoln Township sewerage treatment system no longer discharges into the L-Il River/Ararira, which it had done until 1998.

Contaminants can also enter the water through septic tank failures. These are not uncommon in areas such as Tai Tapu and Southbridge.

Excessive fertiliser use can result in nutrients running off into streams during periods of high rainfall. Spray drift can also end up in the waterways.

Suspended solids can increase in streams where stock are allowed access. Stock can break the stream banks causing erosion and consequently, soil enters the waterways. Stock also defecate and urinate directly into the water. On some of the lake margin properties, cattle are allowed to graze to the lake edge. This causes an increase in nutrients to the lake from cattle manure, and erosion of the lake edge, which allows sediment to enter the lake.

Other sources of suspended solids are drain-clearing operations, vehicles crossing the streams, and urban stormwater systems.

Drain clearing

Drain clearing and the effects of sediment from this is also an issue. Because Lake Ellesmere/Te Waihora is a major wetland area, and the springs supplying the local waterways have large flows and stock have access to these waterways, efficient drainage is very important. These drainage systems need to be cleared regularly. During the clearing process, weeds are cut and drift down waterways into the lake. Some sediment is also removed and much released back into the surrounding waterways.

Farm owner issues

Farmers in the Lake Ellesmere/Te Waihora catchment have a number of issues that they must consider and contend with. Successful agriculture within the vicinity of Lake Ellesmere/Te Waihora is dependent on lake level control, flood control and drainage.

The flood risk from intense rainfall, river flooding and lake flooding is a major concern for farming in the catchment. The saline nature of floodwater affects water quality for stock and irrigation of grass and crops. The impacts of this are both short and long term.

Stopbanks have been constructed to protect some of the lake edge farmland

Surface flooding around the northeast margins of the lake, photo courtesy of John Weeber.

in the event of the lake not being successfully opened. The Water Conservation Order now prohibits the issue of consents for stopbanks below 1.13m above sea level.

The quantity of water available to carry out farming practices efficiently eg irrigation schemes is also an issue of concern. Landowners in the lower catchment are concerned that if the proposed Central Plains Irrigation Scheme goes ahead the scale of the irrigation will cause an increase in groundwater levels in the lower catchment. In the winter, this could be a major problem.

Drainage is another issue for farmland owners as is the drying out of soils during the summer, reducing crop and pasture production.

Another problem is waterfowl. When food is in short supply the waterfowl, mainly Canada geese, can descend on crops and pastures in very large numbers. This results in crop damage or grazing lost, and the fouling of pastures.

As awareness grows, farming practices continue to change. Many landowners in the Lake Ellesmere/Te Waihora catchment are participating and leading environmental enhancement projects in the area, for example increasing water quality by restricting stock access and riparian plantings. The projects currently running in Harts Creek/Waitatari and Silverstream are examples of this (see tributaries pages 31-35).

A general concern has been expressed over the likelihood of groundwater contamination due to agricultural practices. This is a particular issue for some lowland farmers who believe that the proposed Central Plains Irrigation Scheme will increase the nutrient levels in the groundwater in the upper catchment, which will eventually find its way to the lower catchment.

Black swans grazing on farmland near Lake Ellesmere/Te Waihora, photo courtesy of M. Main.

Health of the lake

The lake receives the water from more than 25 streams, rivers and waterways in the catchment. The quality of the lake water is determined by:

- Contaminants and nutrients already attached to sediment in the lake;
- The quality of the water entering the lake;
- The frequency and duration of lake openings;
- The management of the lake margin, its wetlands and wildlife habitat.

Water quality issues for the lake have been expressed as:

- Nutrient levels;
- Other contaminants, particularly pathogens and oestrogen;
- Salinity;
- Water clarity.

The lake is considered in biological terms to be highly productive, or highly eutrophic. The lake however, does not display the usual characteristics of a highly eutrophic lake (see Eutrophication section page 12).

The perception of poor water quality affects the ability of Tangata Whenua to enjoy mahinga kai, and the values to recreational users such as fishing and other water sports.

Grazing

Grazing has been described as the greatest threat to the lake's wetland fringe. The effects of grazing can include reduced vegetation stature and density; the spread of exotic plants through seeds in dung and hooves; the opening of indigenous vegetation, giving exotic plants a competitive advantage. Pugging and compaction of the soil surface breaks up indigenous herb fields. A further effect is the increase in dung and urine, which in turn increases fertility. Increased fertility leads to a change in the vegetation away from indigenous species to introduced species. The increase in nutrients also runs off into the lake.

Common grazing animals: deer, cattle and sheep.

While cattle grazing is considered to be the most significant issue with respect to the destruction of remaining wetland habitats, deer and sheep can also have a detrimental effect. For example, when sheep numbers are high, particularly under rotational grazing regimes during dry summer periods, sheep can break the surface of fragile saline herb fields and cause soil contamination.

It must also be recognised that there are some beneficial effects of sheep grazing for example weed and grass control. In addition to this, sheep don't like to 'get their feet wet'; so do not cause the same problems as cattle and deer that do like to wallow in water.

Dairy farming

Dairying is an important land use and industry in New Zealand. It produces 23 percent of New Zealand's total export income ($6.88 billion in 2000/01) and involves 3.45 million dairy cows (in the 2000/01 season).

Stock in local waterways is a significant issue. Like many animals, cows are much more likely to defecate and urinate when they wade in water. Even small amounts of cattle effluent can make the water unsuitable for swimming, drinking, stock drinking water or food gathering. Cattle effluent also reduces water quality by introducing nutrients that encourage excessive plant growth, and ammonia that is toxic and can kill fish and invertebrates.

If waterways in the area are not fenced off, cattle can wander close to the water and in and out of streams and drains, destroying bank stability and causing erosion. Erosion causes an increase in siltation. This makes the water dirty and affects the habitat of birds, fish and invertebrates.

Evidence of stock damage in an unfenced waterway.

Stock also defecate in dry drains that are not fenced off. During high rainfall these drains collect water and the effluent runs into the rivers and streams, which also contributes to water degradation.

Many dairy farmers use nitrogenous fertilisers to grow more grass in the spring and autumn. Cows also produce large amounts of nitrogenous waste when they urinate. The effect of this when it gets into the waterways, is prolific plant growth. This prolific growth causes the waterway to become clogged, destroying habitats for fish and invertebrates. Consequently, floodwater cannot drain away. Clearing blocked waterways often requires the use of diggers and/or sprays, both of which can affect fish and bird habitats.

Arable farming

Arable farming makes up a large proportion of landuse in the Lake Ellesmere/ Te Waihora catchment. Within the Selwyn district alone, 53, 000 hectares of land is irrigated and non-irrigated, arable land. Most crop farmers use some type of fertiliser. How much of this fertiliser leaches into the environment, or where the runoff from fertiliser goes is a contentious issue.

Fertilisers generally contain one or both of the essential plant nutrients (phosphorus and nitrogen). Studies indicate that nitrogenous wastes from some cropping practices such as long periods of fallow ground, can also potentially lead to high nitrate leaching (percolating through soil) losses. Fine cultivated soils containing fertiliser can also blow, or wash into waterways.

Cultivation/cropping close to a stream.

Population

Population in the catchment is on the increase. The Christchurch commuter zone is spreading outwards with the demand for lifestyle blocks and retirement homes near the city. In the 1996 census the Selwyn District was the fourth fastest growing district in New Zealand. The population distribution generally reflects the variations in intensity of land use, which ranges from small horticultural units to large pastoral farms. With population increases, the impact on the land and water intensifies.

Concerns have been expressed over the likelihood of toxic contaminants entering the waterways through the stormwater discharges from residential development. Common toxic substances in stormwater include zinc, copper and polycyclic aromatic hydrocarbons (PAH).

Urbanisation

Urban development in the catchment is of concern due to the potential impact of stormwater discharges into waterways, both in terms of water quality and water quantity. Sediment from subdivision can also be blown or washed into waterways.

Issues for the food web

The loss of the weed beds has resulted in significant loss of food supply to wildlife, and habitat loss for fish and invertebrates. Should management of inputs to the lake result in either nitrogen or phosphorus reducing to the level that they limit plant growth, this could also affect the productivity of the lake, thereby impacting on the food chain.

More than 80 percent of the large wetlands of flax/harakeke, raupo and sedges/mania, which once surrounded the lake, have been destroyed or modified with conversion of the lake margin to farmland. The clearance of plants from streams and drains to aid land drainage has further reduced habitat for birds and other animals, and the efficiency with which contaminants can be filtered before entering the lake.

Access issues

Access issues were identified by three major lake user groups: Tangata Whenua, with regard to access to mahinga kai; recreational fishers and hunters regarding access to good sites for the pursuit of their activities; and for passive lake recreationists (such as walkers and birdwatchers).

Access to mahinga kai sites relates not only to the physical access to the resource, but also access to good quality resources. This relates to water quality and habitat issues.

While access for passive recreational pursuits is considered fairly good by those consulted with, it has been acknowledged that the access at various points is not well known or signposted.

The Selwyn Huts, 1924. Photo courtesy of Aotearoa NZ section, Christchurch City libraries.

Recreation related issues

Lake Ellesmere/Te Waihora and its tributaries are of international, national, regional and/or local importance to various recreational user groups.

If recreational activities are not well managed they have the potential to impact adversely on a range of natural values associated with the lake. For example the potential impacts of recreational fishing and associated activities include decreased fish stocks, disturbance of lake habitat and riparian margins and boat spillages. Water sports also have the potential to disturb habitat and wildlife when sports people access the water and land.

Conflict between the different users is an important issue, particularly with regard to disturbance of tranquillity and habitat.

At Coes Ford (a popular recreation site on the Selwyn River/Waikirikiri) E.coli concentrations often exceed the Council's guideline for recreational waters. E.coli and faecal coliforms are "indicator bacteria" indicating the presence of faecal contamination by human or animal faeces. In most cases, this contamination results from pastoral land runoff, or when grazing animals defecate directly into drains, streams and rivers. If these are present above a certain concentration there may be a risk to human health.

The high concentrations at Coes Ford are caused by the influence of Silverstream, a major tributary that joins the Selwyn River/Waikirikiri immediately above Coes Ford. Silverstream contributes a high percentage of the flow to Coes Ford during low flows, and it tends to have very high bacterial concentrations.

Monitoring for E.coli in the lake has occasionally found high levels but generally measurements have shown that the lake complies with the Ministry of Health's guidelines for contact recreation.

Faecal contamination is not only a public health concern, it is also of particular concern to Tangata Whenua as contamination of this sort compromises the mauri of the water.

Early fishermen on Lake Ellesmere/Te Waihora, photo courtesy of Ellesmere Camera Club.

Fisheries

The lake supports a highly valued cultural fishery as well as an important commercial fishery. Water quality and its effects on the fish stock, and the quality and quantity of suitable habitat are issues of concern.

Lake Ellesmere/Te Waihora receives inflows from many small catchments that can variously contain silt, treated sewage, surfactants, pesticides and other contaminants. Because of this there is potential for oestrogen to be present in the lake waters, and the potential for adverse effects on fish in the lake. However, this is not likely to be an issue for Lake Ellesmere/Te Waihora.

The opening regime of the lake has an impact on the commercial fishery. Of particular concern is the timing of the openings. In the past, these have not necessarily 'lined up' with the time when fish and eels are returning to the lake from the sea and vice versa. The timing of lake openings can also affect recruitment of sea-run brown trout, which is thought to be greatest in spring when whitebait and smelt enter the lake if it is open.

Lake clarity remains a concern for the fisheries, although there is little evidence to suggest that clarity has an impact on fish numbers.

Flood control works and drain maintenance can also affect fish habitat and fishing. These activities can disturb trout spawning sites, and foul lines and nets.

Management of commercial fishery for sustainability by the Ministry of Fisheries is another concern.

The tributaries

Te Waihora/Lake Ellesmere tributaries:

More than 25 streams, rivers and drains flow through the Lake Ellesmere/Te Waihora catchment and enter the lake. Most of these are spring-fed meaning that the water in these streams comes primarily from groundwater emerging at the ground surface. The groundwater system is primarily recharged by seepage from the Selwyn River/Waikirikiri, and rainfall recharge on the Canterbury Plains. Only the Selwyn River/Waikirikiri has its headwaters in the hill country. A small number of streams discharging into the lake originate on the southern slopes in Banks Peninsula.

Although DOC administers much of the land around Lake Ellesmere/Te Waihora, its tributaries are bordered, to a large extent by private land. Therefore access to the water in some places is restricted.

WATERWAYS THAT ARE OF RELATIVELY HIGH QUALITY SOUTH OF THE LAKE ELLESMERE/TE WAIHORA CATCHMENT:

- Youngs Creek
- Lee River
- Jollies Brook
- Tent Burn
- Okuti River

Halswell River/Huritini

The Halswell River/Huritini catchment is comprised of hill catchment, which provides the bulk of the runoff water, and the plains catchment, where flooding and drainage problems occur. The Halswell River/Huritini provides an outlet for an extensive system of tributaries, drains and streams on the Canterbury Plains.

The Halswell River/Huritini is a spring-fed river with a relatively stable flow. Concentrations of nitrogen in the Halswell River/Huritini are higher than those in the Kaituna River. This reflects the higher concentrations of nutrients in groundwater. Concentrations of dissolved oxygen are always high enough to support aquatic life.

The Halswell River/Huritini, its old course, and two major diversions from it, all discharge into Lake Ellesmere/Te Waihora and their lower reaches are affected by the lake level.

The Halswell River/Huritini has similar issues to other lowland streams, but has the added problems of urban and industrial development in the headwaters, run off from the Port Hills and intensive rural sub division.

L-II River/Ararira

The L-II River/Ararira is a spring-fed river that rises near Lincoln. Concentrations of nitrogen and phosphorus (nutrients) are relatively low despite the discharge of oxidation pond effluent from Lincoln until 1998. Suspended solids concentrations are also relatively low except for the odd peak during floods. Concentrations of dissolved oxygen are always high enough to support aquatic life.

The L-II River/Ararira also had high recreational use relative to other rivers because of easy access and proximity to Christchurch. The west bank of the L-II River/Ararira contains extensive stands of native freshwater vegetation of regional botanical importance including taller raupo and tall sedge/mania.

The L-II River/Ararira is also at potential risk of localised impact from continued urban development.

Photo courtesy of John Glennie.

Irwell River/Waiwhio

The Irwell River/Waiwhio flows through the centre of Irwell Village. It was once held in high regard as a small stream trout fishery and had high use and a very high catch rate.

The Irwell area was once an area of relatively undisturbed native freshwater vegetation, of regional botanical importance. However, land use in the area has modified this and the relatively poor water quality of the river due to high sediment levels is an indication of this.

Kaituna River

The Kaituna River catchment was once covered in mature native forest providing abundant food resources for early Maori of the area. The Kaituna River originates in the Port Hills. It is rain-fed and the flow in this river is characterised by long periods of low flow interspersed with floods of short duration.

Concentrations of nitrogen and phosphorus in Kaituna River are relatively low. Nitrogen concentrations can build up over winter when plant growth decreases but when plant growth increases again during spring and summer these concentrations are reduced.

Photo courtesy of J. M. Glennie.

The water in the river is generally clear but floods can cause temporary increases in suspended solids concentrations. Also, in the lower reach, algae from the lake affect the river. Concentrations of dissolved oxygen are always high enough to support aquatic life.

Another significant feature of the lake is Kaituna Lagoon. Situated at the eastern end of the lake at the mouth of the Kaituna River it is only a distinct lagoon at very low lake levels. This area is particularly shallow and flat and provides an important refuge for wildlife, as its waters are sheltered during storms. It is also the area of the lake most recognised by the public as it is viewed from the Christchurch-Akaroa Highway.

Birdlings Brook/Waitatari

Birdlings Brook/Waitatari is a major tributary of Harts Creek. It is a spring-fed stream that rises near Leeston and joins Harts Creek/Waitatari about 2.5 km above Lake Ellesmere/Te Waihora.

It is located in a highly modified, dairying and mixed stock and arable catchment. Aquatic weeds in Birdlings Brook/Waitatari have grown rapidly since stock have been removed from much of the waterway. It is hoped that the establishment of native plants on the riverbanks will provide shade that will reduce weed growth in the stream.

Stream monitoring done by the Harts Creek-Birdlings Brook stream care group in 1999 indicated high levels of sediment coming into the river system from Birdlings Brook/Waitatari. Landowners have since erected fences to keep stock out of the stream and drains. This has reduced the sediment getting into the stream.

Current monitoring of invertebrate health at specific sites in Birdlings Brook/Waitatari now appear to indicate that there has been an improvement.

Harts Creek/Waitatari

Like its major tributary, Harts Creek/Waitatari is a spring-fed stream that rises between Leeston and Southbridge and flows for about six km before reaching Lake Ellesmere/Te Waihora. Harts Creek/Waitatri is well known for its trout fishing, especially in the lower reach.

An initial investigation found that the sediment in Harts Creek/Waitatari was originating from Birdlings Brook/Waitatari. In conjunction with Environment Canterbury and the Selwyn District Council a stream care group comprising local landowners was established.

Since this time, changes to riparian management practices appear to have caused a reduction in suspended solid concentrations, and a consequent improvement in visual clarity. Fishermen have also reported that large fish have returned to the stream.

Nitrate concentrations in Harts Creek/Waitatari are very high but this has not resulted in nuisance plant growths. This is probably because plant growth in Harts Creek/Waitatari is limited by low concentrations of phosphorus. Aquatic life is sustained in the creek by the high dissolved oxygen concentrations.

The mouth of Harts Creek/Waitatari at the lake edge is an area of high value for waterfowl and swamp birds, although it has been largely invaded by willow species. The lower reaches of Harts Creek/Waitatari are held as a Wildlife Management Reserve with an overlying wildlife refuge status. There is also a bird hide in the reserve for bird watching.

Fishing on the Selwyn River, 1925. Photo courtesy of Aotearoa NZ section, Christchurch City libraries.

Selwyn River/Waikirikiri

Hydrologically, the Selwyn River/Waikirikiri is complex. It is rain-fed at Whitecliffs, but disappears into the gravel of the plains downstream from Hororata. It re-emerges above Chamberlains Ford as a groundwater-fed river, and at base flows, about half of its flow is from a tributary (Silverstream) at the top end of Coes Ford. The middle section of the river only carries flow after periods of heavy rain in the hills.

Flooding from the Selwyn River/Waikirikiri has caused problems since the early days of European settlement, particularly in its lower reaches where it can inundate extensive areas of productive farmland. In 1947 a more direct outlet from the river to the lake was constructed to hasten the passage of flood flows.

Nutrient concentrations in the Selwyn River/Waikirikiri are varied. Very high concentrations of phosphorus sometimes occur due to the increase in flow during floods. This is because the floodwaters cover dry areas and flush phosphorus that has been deposited there. Because of the influence of groundwater, concentrations of nitrogen are far higher at Coes Ford than at Whitecliffs during base flows.

Suspended solids concentrations in the Selwyn River/Waikirikiri are usually low, and hence the river is normally clear at Coes Ford, except at high flows.

Aquatic life is sustained in the river by the high dissolved oxygen concentrations.

Silverstream

Silverstream is a tributary of the Selwyn River/Waikirikiri. Land use in the Silverstream catchment includes dairy, sheep and crop.

Historically, Silverstream has been labelled as one of the main contributors of faecal bacteria concentrations into the Selwyn River/ Waikirikiri. It also contributes a significant proportion of the bacterial loading at Coes Ford. Stock in the Silverstream catchment are probably the principal cause of this.

Water quality of the upper Silverstream catchment has been found to be low. In response to this finding the Silverstream Water Improvement Group (SWIG) comprised of local landowners in the catchment and Environment Canterbury has been established. The group aims to improve water quality standards in the stream.

There are encouraging signs that the actions of this group have begun to improve the microbiological quality of the Selwyn River/Waikirikiri at Coes Ford.

Boggy Creek/Te Raki

Boggy Creek/Te Raki is a spring-fed stream. It rises on the southern side of the Selwyn River/Waikirikiri about 3 km southeast of Dunsandel and drains into Lake Ellesmere/Te Waihora. It is 22.8 km long.

Agricultural grazing is the prime land use in the catchment, with dairying the most intensive user. Horticulture is the second largest land use with horses and lifestyle blocks making up the rest. Boggy Creek/Te Raki forms an important part of the drainage network and is a source of irrigation and stock water for farms in the area. These land uses obviously affect the water quality of the creek.

The stream contains a wide variety of introduced and native aquatic life and has significant ecological values, despite being highly modified. Some replanting, through environmental enhancement projects has already taken place. For example two local landowners Bert Millin (gardener and nurseryman) and Phil Garrett (dairy farmer), who received Environmental Enhancement Funds from Environment Canterbury, are planting natives in areas around Boggy Creek/Te Raki. Mr Garrett is also fencing off the streams that run through his property and water quality and stream health here is improving.

North Canterbury Fish and Game have a wetland reserve in the lower reaches of Boggy Creek/Te Raki and there is a management plan for this.

Waikekewai

Planting along Waikekewai. Photo courtesy Ngai Tahu.

Waikekewai is a spring-fed stream and the southern most tributary feeding into Lake Ellesmere/Te Waihora, situated just south of Harts Creek/Waitatari. Together with its sub-tributary that meet at, and run past Ngati Moki Marae, it is of utmost importance to the Ngai Tahu hapu of Ngai Te Ruahikihiki ki Taumutu. These streams not only provide life-giving water and mahinga kai, but also provide a link between the current marae – Ngati Moki, and the pa site Te Pa o Moki with an up-stream water burial site – Waiwhakaheketupapaku. The stream also links the pa site of Ruahikihiki – Te Pa Orariki, the Hone Wetere church and burial site (urupa), as well as the lake itself. The name Waikekewai refers to the invertebrates and freshwater crayfish that were found in the large wetland associated with this stream.

Much of its upper reaches are dry due largely to the reduced water holding capacity of the land, which is now largely used for agriculture, and the drainage networks that have been established and have redirected water sources within the

catchment. It is also believed that groundwater takes have also contributed to water loss from the catchment. Fortunately many large springs in the lower reaches of the stream continue to flow. The people of Ngai Te Ruahikihiki are particularly keen to see that these springs, and waters that flow from their ancient burial site, are protected today and for the generations that follow.

What is being done to manage this area?

Te Taumutu Runanga

Te Taumutu Runanga have a voluntary committee and employ staff that work on resource management matters in the Taumutu takiwa (area) and in particular the lake and its catchment. The main work of the committee and staff regards resource consents and statutory planning documents under the Resource Management Act. This work is often done in conjunction with Te Runanga o Ngai Tahu and other neighbouring Papatipu Runanga, including Waiwera, Tuahuhiri, Rapaki, Koukourarata, Onuku and Arowhenua.

The Runanga has also initiated a restoration project that involves replanting and enhancing the riparian zone along the banks of Waikekewai, between the Marae and church. This work has been supported by Environment Canterbury and the Department of Conservation, and to date has included the fencing of the riparian area and the planting of 500 native plants along the stream. Te Taumutu Runanga is also involved in the Living Streams Programme for the Waikekewai catchment.

Te Waihora Joint Management Plan

Te Runanga o Ngai Tahu, local Papatipu Runanga and the Department of Conservation (DOC) are developing the Te Waihora Joint Management Plan to manage the Ngai Tahu owned lakebed and the surrounding lands administered by DOC. The purpose of this plan is the integrated management of the natural and historical resources of those areas for the purpose of mahinga kai and conservation.

Lake Ellesmere Issues Group and the Waihora Ellesmere Trust

The Lake Ellesmere Issues Group came together to develop the non-statutory Community Strategy, which outlines a way forward for the future management of Lake Ellesmere/Te Waihora and its tributaries. Representation on the group was wide including local residents and local landowners; Te Runanga o Ngai Tahu and Taumutu Runanga; Federated Farmers; Department of Conservation; regional and district councils; commercial fishers; Fish and Game Council; other recreational interests; and individuals with a general interest in the ecology of the lake and its tributaries.

This group was established to discuss the:

- Values of the lake;
- Threats to those values;
- Development of a vision and goals for the lake and;
- Identification of management options and activities needed to achieve these goals.

Since completion of the non-statutory Community Strategy the Waihora Ellesmere Trust has formed, whose role is to see the strategy implemented.

North Canterbury Fish and Game Council

It is the role of the Fish and Game Council to manage, maintain and enhance the sports fish and game resources in the recreational interests of anglers and hunters in the Lake Ellesmere/Te Waihora area. This includes the management of game species such as Canada goose, black swan, various duck species and brown trout. North Canterbury Fish and Game Council also manage maimai on the lake in association with DOC and Ngai Tahu in accordance with the Ngai Tahu Claim Settlement.

Department of Conservation (DOC)

DOC administers lands on the margins of and near Lake Ellesmere/Te Waihora as well as other areas in the catchment. DOC is responsible for the management of protected species and ecosystems, providing for public enjoyment of public conservation lands, conserving historic resources to protect areas and promoting the conservation of natural and historic resources generally. This includes the preservation of indigenous freshwater fisheries and the protection of recreational freshwater fisheries and their habitats.

Environment Canterbury

It is Environment Canterbury's role to manage and sustain the natural and physical resources of the Canterbury region. This includes monitoring and controlling lake levels, some drainage in the surrounding catchment, water and discharge permits, water quality and certain uses of the lakebed. Environment Canterbury is also responsible for controlling plant and animal pests in the area.

'Living Streams' is a new Environment Canterbury programme providing a community based resource care approach to improving on-farm environmental practices. The focus of the programme will be working in partnership with farming communities to improve water quality.

The Resource Care team at Environment Canterbury is currently working with groups of landowners to enhance and restore the streams and rivers in this catchment.

Selwyn and Banks Peninsula District Councils and Christchurch City Council

The Selwyn District Council maintains drains and streams that provide drainage and outfalls to the area. The Banks Peninsula District Council maintains a further system of drains and streams including the Kaituna Valley catchment with outlets that discharge directly into Lake Ellesmere/Te Waihora. Christchurch City Council is also involved in drainage in the Halswell River upper catchment.

Ministry of Fisheries (MFish)

MFish is the Government agency responsible for the management of fisheries. Its primary purpose is to ensure that fisheries are sustainable and occur within a healthy aquatic system. For Lake Ellesmere/Te Waihora this involves managing the quota of eel, flounder and mullet fisheries as well as legal obligations under the Treaty of Waitangi Settlement Act 1992 and the Fisheries Act 1996 for customary fishing.

Historic Places Trust

The New Zealand Historic Places Trust – Pouhere Taonga is a charitable trust established in 1954. All archaeological sites are protected under the Historic Places Act (1993) and permission is required from the trust for any destruction, damage or modification to any archaeological site. Because of the archaeological significance of many sites around Lake Ellesmere/Te Waihora the Historic Places Trust has an active role in the preservation and protection of this area.

A co-operative approach between all the interested groups is recommended as the best way of achieving long-term results.

Activities

Below are some activities that will enable students to gain a better understanding of the values of Lake Ellesmere/Te Waihora and its tributaries. The activities are designed to enable students to raise public awareness about the state of Lake Ellesmere/Te Waihora and its catchment.

- Locate Lake Ellesmere/Te Waihora and all of its tributaries on a map. You could draw your own précis map showing other nearby rivers, roads, settlements, and different land-uses. You can also access GIS (geographic information system) maps from the Environment Canterbury website: www.ecan.govt.nz.
- As a class, discuss what has an effect on these waterways and who is involved.
- Divide the class into different representative groups. Have them brainstorm arguments as to why their activity should be allowed to continue and whether the positives outweigh the negatives. Each group should present their arguments to the class.
- Undertake a restoration project for one of the waterways in this catchment. Create a long-term plan looking how it will be organised and tended to in the future. Section Four of the Waitaha Wai water education resource gives more detail on how students could do this.
- Visit the bird hide at Harts Creek/Waitatari. You could Undertake a specific species study on one of the wetland birds looking at:
  - Why does it come to the lake?
  - Where else could it go?
  - What issues will this species have to contend with in the future?
- Write a story from the perspective of either an early Maori or European settler. Take yourself back in time and imagine you are one of these. Imagine what Lake Ellesmere/Te Waihora would have looked like and what you would have seen there. Where would you live? What would you use for tools? What would you eat? How would you provide for your family? Focus on water and how early settlers' lives relied upon it.
- Talk to your family/whanau or local iwi, friends and neighbours, local fisher people and business people about their memories Lake Ellesmere/Te Waihora and its catchment. How has it changed? You could interview a member of the Historic Places Trust or a local community group. Write up the stories for display in school or write up a play showing how the river has been modified by people.
- Undertake a study of the lagoons and lakes of Canterbury. Highlight the similarities and differences and why these areas are so important.
- Write a short play highlighting a restoration issue. Perform it to other classes in your school. Host a question and answer session afterwards.
- What have you seen lately that you feel might have a negative impact on Lake Ellesmere/Te Waihora and/or its catchment? Design a poster identifying the issues surrounding Lake Ellesmere/Te Waihora with symbols to show tourists or recreational users how to look after the area. The poster could also target homeowners or land developers. Symbols could include an empty tin can to signify litter or a scull and crossbones to illustrate poisons.

- Using the table below, identify the species of traditional importance to Tangata Whenua. How many are there? Research one species noting where it lives, what habitat and food it requires, why it is highly valued by Maori and what threats there are to its survival. Develop a presentation of your research for your class.

Ika (fish)

Maori name	English name
tuna	eel
inanga	adult whitebait
kokopu	native trout
mata	juvenile whitebait
patiki totara	yellow-belly flounder
mohoao	black flounder
patiki	sand flounder
kakahi	freshwater mussels
waikoura	freshwater crayfish

Manu (birds)

Maori name	English name
pukeko/pakura	swamp hen
putakitaki	paradise duck
parere/maunu	grey duck
papango	New Zealand scaup
parera	grey duck
ka hua	eggs
karoro	black backed gull
kotuku	white heron
kaki anau	swan
koau	shag

Ka rakau (plants)

Maori name	English name
whiwhi/wewe	reeds and sedges
ti kouka	cabbage tree
raupo	bullrush
harakeke	flax
aruhe/tauhinu	fern root (bracken)
pingao	sand sedge
watakirihi	watercress
toe toe	sedge grass

Marine mammals

Maori name	English name
kekeno / pakake	fur seal
aihe	dolphins
tohora	right whale

Things you can do from home:

- Talk to your parents about directing the rainwater that runs down the spout away from the storm water drains and into a large plastic drum. This can be used to water the garden and recharge the groundwater (See your local recycling centre about a drum).
- Naturalise your garden so it can soak up rain: provide habitats and food for birds.
- Pick up the rubbish around the streets to prevent it from finding its way into the river.
- Wash your car on the lawn not the road, and use a bucket not the hose.
- Research the plant species that could be planted along river banks to assist restoration. Develop an action plan and organise a planting day.

58 Kilmore Street, PO Box 345, Christchurch. Customer Services: (03) 353 9007
Free Phone: 0800 EC INFO (0800 324 636) Timaru: (03) 688 9069
Fax: (03) 365-3194 Email: ecinfo@ecan.govt.nz Website: www.ecan.govt.nz