

Upper Waitaki Zone Committee Field Trip – Lake Middleton

Friday 17 May 2019

Assemble near lake at DOC camping ground
(if wet, the briefings and discussion will take place at Ohau Lodge)

- 11.00am** Welcome and introductions. Health and Safety.
- 11.05am The state of the lake – Graeme Clarke, Environment Canterbury
- 11.15am Questions and comments
- 11.25am The lake and its margins, visitor management, farming adjacent to the lake: contributions from (if present):
Department of Conservation;
Shelton Downs (not able to attend);
Ohau Conservation Trust (Grant Eames);
Waitaki Boys High School;
Waitaki District Council (Anna McKenzie);
Fish and Game (Jayde Couper);
Other interested parties.
- 12.00pm Discussion: what are the issues facing the lake and its management? What could be done to address them?
- 12.25pm** Conclusion. Depart to Ohau Lodge for lunch.
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Field trip purpose:

- To provide the Zone Committee and others with an understanding of Lake Middleton and the management of the lake and its margins.
- To provide an opportunity for those interested in the lake to talk with the zone committee.
- To identify issues relating to the management of the lake and its margins to inform discussion on what, if anything, the zone committee could recommend for improving the management of the lake and its margins or to maintain its good management.

Some background information:

The lake and its margin are public land management by the Department of Conservation (DOC). The lake is popular with visitors for camping, swimming, fishing and boating.

The Alps to Ocean (A2O) cycleway and Te Araroa Walking Trail pass the lake on its eastern side. The number of people using the A2O and Te Araroa is increasing.

There is a DOC-managed campsite next to the lake at its north end. Facilities include flush toilets, drinking water (from Ohau Village supply), a campervan dump station, and a boat ramp. The campsite is downgraded to a “Basic” campsite with reduced facilities (vault toilet) after Easter weekend to 30 September.

The campsite and lake are highly rated on TripAdvisor with 63 reviews and an average rating of four stars out of a possible five.

Shelton Downs, the farmland adjacent to the lake, is owned by Ohau Property Trust. Alastair Ensor provided the following by email regarding Shelton Downs and the lake:

“the creek that flows into the Lake from Shelton we believe is about as good as it could be and is the water supply for Shelton. Just up from the lake it goes into a small gorge that is full of scrub and stock can't get into it. Then above that, 18 months ago, we have fenced off each side of the creek for some 500 metres then the creek goes back into a gully that is impenetrable matagouri and the block is old browntop pasture with a low stocking rate.

I don't think more fencing would do anything to keep the odd deer or possums out of the creek.

Our observations would suggest that oil from lots of boats put an oil slick round the lake by end of summer and we question the integrity of the effluent systems that have to cope with all those people in summer.”

Waitaki Boys High School leases a lodge near the lake from DOC.

Ohau Village is close to the lake.

The water quality of the lake is described in the **attached** from Graeme Clarke, Science Team Leader, Environment Canterbury. Swimming water quality (*E. coli*) is monitored weekly by Environment Canterbury from 01 November to 31 March. In 2019, 83% of the samples met the swimming water quality standard.

Graeme summarises the water quality as:

Lake Middleton was mesotrophic when sampled in 2012, 2013, 2017, and 2018 and failed to reach Land and Water Regional Plan (LWRP) objectives in all years. Because of the very limited historic data for this lake, it is difficult to assess if recent TLI scores deviate from a natural reference state. The increase in exotic weeds caused a shift from a high to moderate ecological state between 2012 and 2017. While this may be a negative regarding native biodiversity, it doesn't necessarily make the lake more prone to changes in trophic status and associated impacts on lake values (water clarity, biodiversity, aesthetics etc). As a positive development, recreational water quality has improved markedly since 2011/12, due to decreasing bacterial contamination. While high nitrogen concentrations could indicate that managing phosphorus inputs is a priority, the high degree of internal nutrient (particularly phosphorus) cycling means management of both nitrogen and phosphorus loads is critical.

The Ohau Conservation Trust are very interested in working with others to enhance Lake Middleton.

In emails Viv Smith-Campbell, Chairperson of the Trust, says the lake *“is a little treasure that is just a bit unloved at present. We have a project about Middleton in our Strategic Plan that you can find on our website - <http://ohauconservationtrust.nz/page/316/projects>*

We'd love to see a formed walkway around the lake and riparian enhancement such as planting, removal or thinning of willows and pine trees and making sure that activities in the reserve and surrounding land are not impacting on water quality. The lakes rich wildlife population also needs consideration - we've had grebes breed and raise chicks 3 times in the last 2 years - after many many years of no success at all. All with some small floating nesting rafts. It's great that something so simple is so successful.”



One-page information prepared by Ohau Conservation Trust including a drawing (left) of what enhancement around the lake could look like.

Another issue to be considered at Lake Middleton is its recreational use. The use of the surface of the Lake is administered by the Waitaki District Council in the district plan. The current district plan is silent on use of the surface of the lake.

ECan have bylaws in place to manage safety in relation to motorised boating on the lake. The 5 knot restriction for motorised craft within 20m of the shore has been uplifted at Lake Middleton – between the hours of 10am to 12 noon and 2pm to 7pm. With increasing use of the lake by non-motorised recreational craft and by swimmers, there is an increasing conflict between recreational users.

The northern end of the lake is roped off with a buoy line to demarcate where non-motorised boating and swimming recreation can occur. The northern end of the lake is filling in with sediment with banks of sediment on the lake floor up to 1 metre deep in some places. There is also abundant weed.

The “swimming area” is now entirely unsuitable for swimming and if it is used, results in large amounts of silt being put into suspension in the lake water. Most visitors no longer swim behind the buoy line because of the unpleasant swimming conditions there. This increases the risks of conflict between motorised boats and other recreational users.

The potential for motorised boats to impact on the wildlife that live at the lake is also significant. The crested grebes are generally tolerant of other activities on the lake apart from when the eggs are hatching. They will abandon the nest after the first chick hatches if disturbed at this time (advice from John Darby from his experience with the Lake Wanaka grebes and nesting rafts). This occurred at Lake Middleton in late Feb 2019 when only 1 chick was raised by the parent birds – a motorboat was on the lake at the time of this hatching.

A larger area for non-motorised boat use is needed on the Lake. The Trust will be advocating for this in the Waitaki District Plan review that is underway. The Waitaki District Council should be involved in any multi-agency group that is formed (formally or informally) to work on the future of Lake Middleton.

There is also the wilding trees around Lake Middleton. Last year the Trust had a meeting with MPI (Alan Tinnley), DOC (Sally) and ECan (Lance Smith and Steve Palmer) about future wilding tree work, subject to further funding, in the Ohau Basin. Larger concentrations of wilding tree species are proposed to be the focus of this further work.

The larches and the wilding-prone pine species in the Lake Middleton recreation reserve as well as the road reserve (along the Lake Ohau side of Lake Ohau Road) were identified as a priority for control and removal overtime (funding permitting). The Trust was happy to be involved in this as saw a connection between the enhancement work at Lake Middleton with gradually replacing the wilding tree species with more appropriate native species. This would remove a large source of wilding trees and enable a richer native biodiversity and habitats to be established. Another piece of the puzzle at Lake Middleton - and again, a multi-agency approach being taken.

The Ohau Conservation Trust has set aside some funds (from donations) specifically for works to enhance Lake Middleton. The Trust is keen that a multi-agency approach is taken to coordinate the work and this should be guided by an agreed restoration plan prepared by an ecologist/landscape architect, with freshwater ecology input as well.

The Trust is aware of a number of funding sources that could be available to achieve the enhancement of the lake and its surrounds and is keen to work with agencies and funders to coordinate funding and work programmes.

See **attached** information from the Ohau Conservation Trust's Strategic Plan.

FRUGAL COUNTRY AND HARD ON THE BOOTS



The causeway between Lakes Ohau and Middleton, ca 1925. The Avoca Homestead is visible on the far shore, with the woolshed to its left. *Photo courtesy Bruce Nehoff*

Memo

Date	7/5/2019
To	Upper Waitaki Zone Committee
cc	Ian Whitehouse
From	Graeme Clarke. Team Leader – Water Quality and Ecology

**Subject:
Lake**

Middleton

Lake is a small, shallow lake (of 4m maximum depth and a surface area of 0.23km²) next to Lake Ohau. There is a well utilised campsite on the lake shore, and the lake is used for swimming and boating activities, partly because of the relatively clear water column and warm temperatures compared to other glacial lakes in the area. Inflows to the lake are via a small stream, and a wetland.

Water Quality Summary

Lake Middleton was mesotrophic when sampled in 2012, 2013, 2017, and 2018 and failed to reach Land and Water Regional Plan (LWRP) objectives in all years. Because of the very limited historic data for this lake, it is difficult to assess if recent TLI scores deviate from a natural reference state. The increase in exotic weeds caused a shift from a high to moderate ecological state between 2012 and 2017. While this may be a negative regarding native biodiversity, it doesn't necessarily make the lake more prone to changes in trophic status and associated impacts on lake values (water clarity, biodiversity, aesthetics etc). As a positive development, recreational water quality has improved markedly since 2011/12, due to decreasing bacterial contamination. While high nitrogen concentrations could indicate that managing phosphorus inputs is a priority, the high degree of internal nutrient (particularly phosphorus) cycling means management of both nitrogen and phosphorus loads is critical.

Nutrients, Phytoplankton biomass, Trophic Level Index

Lake Middleton was mesotrophic in 2012, 2013 and 2017, 2018 (Table). The lake had elevated concentrations of TN in all years (Table 1).

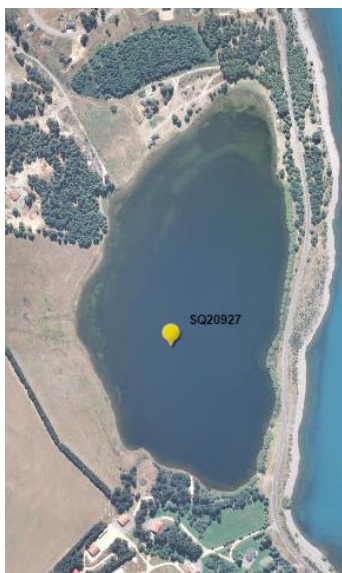


Figure 1: Sampling location in Lakes Middleton – aerial photograph from EcanMaps

Table 1: Overview of Lake Middleton TLI status from 2012-2017

Year	TLI	Grade	Meets LWRP objective?
2012	3.5	MESO	No
2013	3.6	MESO	No
2017	3.4	MESO	No
2018	3.4	MESO	No

Table 2: Attribute states for Lake Middleton from 2012-2017 (according to NPS-FW 2014)

Year	Numeric Attribute State (in µg/L)				Attribute State			
	Chla - MAX	Chla - MED	TN-MED	TP-MED	Chla - MAX	Chla - MED	TN	TP
2012	6.7	1.5	320	9.0	A	A	B	A
2013	6.8	0.6	340	14.0	A	A	B	B
2017	3.5	1.5	350	9.0	A	A	B	A
5 year	6.8	1.5	345	11.5	A	A	B	B

MED = seasonal median concentration (Dec-May); Last line is 5 year average from 2013-2017

Lake ecological condition: LakeSPI

This refers to the aquatic plant community found in our lakes. The lake ecological condition of Lake Middleton was high in 2012 but moderate in 2017 (Table 3).

Table 3: Lake Middleton, LakeSPI overview, 2012-2017

	2012	2017	% Change	Change indicated?
LakeSPI	57	50	-7	Possible
Native Condition	84	77	-7	Possible
Invasive Impact	56	68	12	Probable
Condition	High	Moderate	NA	Yes

Recreational water quality

Suitability for contact recreation was good between 2013 and 2017, but not satisfactory in 5 out of 7 years between 2005 and 2012.

Table 4: Lake Middleton recreational water quality, 2012-2017
(*E. coli* 95th percentile, MFE 2003 classification and NPS-FW attribute)

Season	95 th percentile	Grade	Meets LWRP objective?	Grade NPS-FW
2005/2006	457	C	No	B
2006/2007	18	A	Yes	A
2007/2008	1454	D	No	C
2008/2009	67	A	Yes	A
2009/2010	388	C	No	B
2010/2011	1327	D	No	C
2011/2012	313	C	No	B
2012/2013	57	A	Yes	A
2013/2014	152	B	Yes	A
2014/2015	37	A	Yes	A
2015/2016	175	B	Yes	A
2016/2017	140	B	Yes	A
2017/2018	184	B	Yes	A

Water colour

The median of the dominant wavelength between 2013 and 2018 was 502nm, i.e. blue-green, with a distinct seasonal pattern in most years (**Figure**).

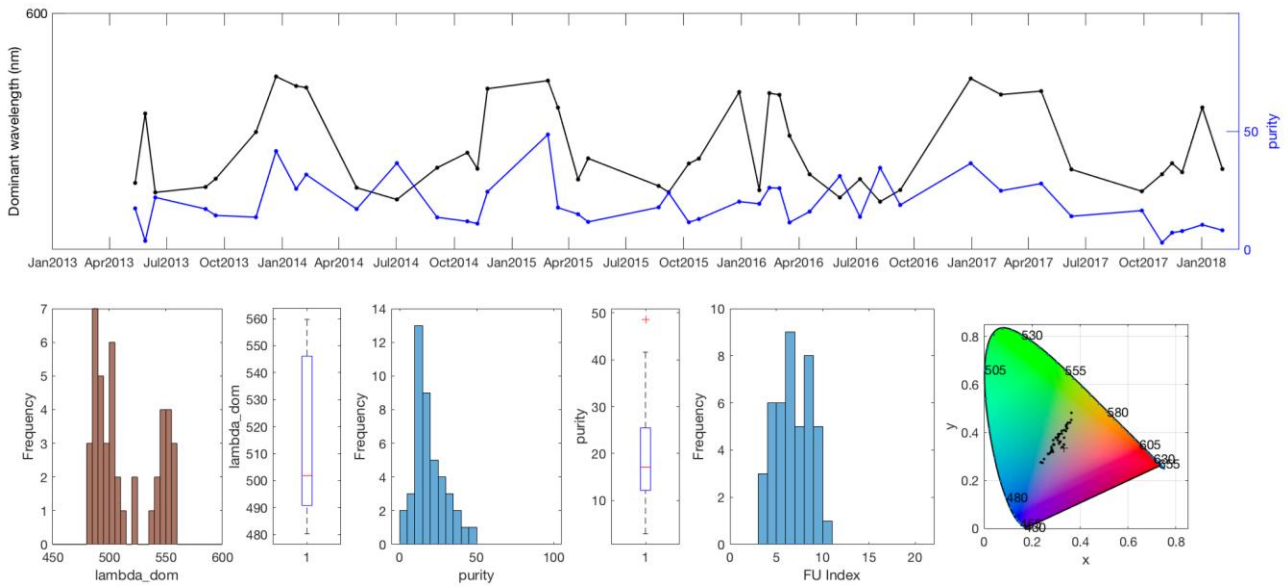
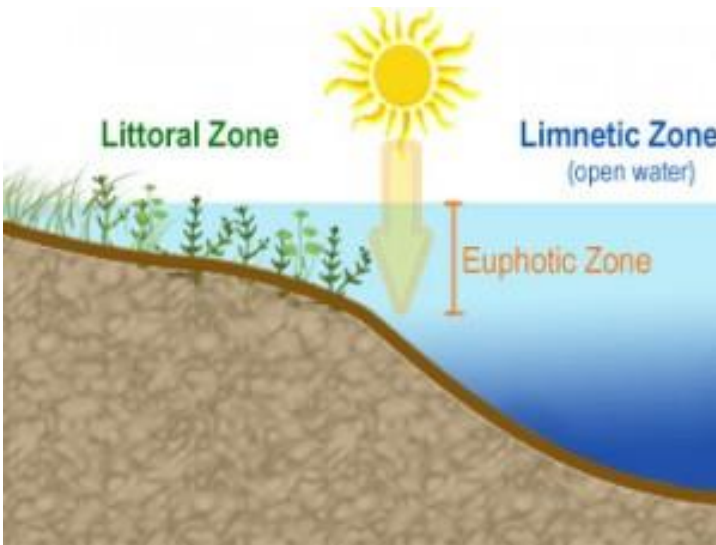
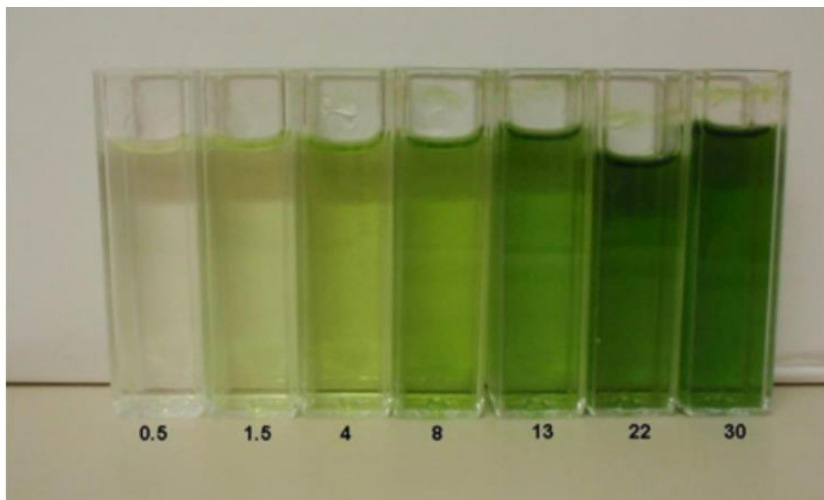
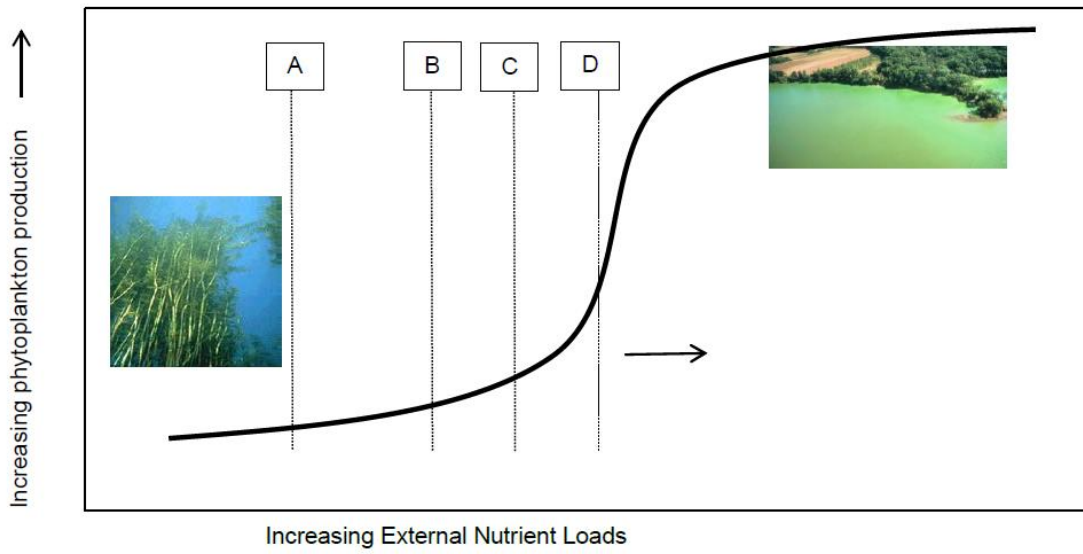


Figure 2: Landsat derived water colour data for Lake Middleton, 2013-2018 (n = 43): Dominant wavelength (λ_{dom}), purity and Forel-Ule (FU) colour index. The ‘horseshoe plot’ shows the distribution of dominant wavelength with the cross representing the white point and the black outline the pure spectral colours. Source: Moritz Lehmann, University of Waikato





Extracts from the Ohau Conservation Trust's Strategic Plan

The Strategic Plan has a description of what the Trust would like to see in 3 to 5 years, including:

“Redevelopment of the facilities and habitats around Lake Middleton, including:

- i. full perimeter fencing to stop stock access (on western shores)*
- ii. wetland/native plant restoration for water quality protection, re-development of nesting/spawning habitat, and biodiversity enhancement*
- iii. water quality and aquatic vegetation monitoring programmes*
- iv. partial removal of willow along the foreshore*
- v. re-definition of camping areas and vehicle egresses. “*

The Trust's Strategic Plan lists six “Flagship” Field Conservation Projects (2016 – 2026) including:

“Project: “Middleton”

Lake Middleton is the only small, highly accessible, lake in the Ohau Basin that is warm and sheltered in summer and well suited for human recreation. It is a key asset for the local community and attracts significant holiday makers (usually family camping groups and boat users). It is also the home to a number of indigenous semi-aquatic birds such as crested grebes and scaups. However, the habitats surrounding the lake have been largely destroyed by land development and now the water quality is showing signs of severe degradation from eutrophication. This enhances the potential for toxic algal blooms and excessive growth of aquatic weeds (eg, Elodea and Ceratophyllum). The lake is in desperate need of measures to mitigate water quality degradation and restore safe habitat for indigenous aquatic bird populations. Key tasks are to include:

- i. Riparian fencing on the western side to prevent stock encroachment on the lake shore and margins*
- ii. Restoration of native wetland vegetation on the western shores for nutrient and sediment abatement and improvement of bird habitat*
- iii. Fencing and restoration of riparian vegetation along the inflow stream on Shelton Downs Station for sediment and nutrient abatement, and for enhancing the mountains to lake riparian corridor for birds*
- iv. Willow thinning and replanting of native lake-edge trees*
- v. Extensive predator control*
- vi. Re-definition of camping areas to protect key habitats and lake-side vegetation.*
- vii. Working with other organisations to establish a formed walking track around the lake and to provide information about the lake and the wider Ohau Basin.”*