



Otago
Regional
Council

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MEMORANDUM

To: Matthew McCallum-Clark
From: Hugo Borges
Date: 05/12/2023
Re: Recommendation of TAS and baseline states for lakes in Otago
Reviewer: Jason Augspurger

Purpose

The purpose of the memo is to present the best information available to inform the Target attribute state and baseline states for lakes in Otago.

Context

New Zealand's freshwater environments are under pressure from land use intensification resulting in deteriorating water quality and ecosystem health. To halt, and reverse, declines in freshwater ecosystem health, an amended National Policy Statement for Freshwater Management was released in 2020. This policy statement provides ecosystem health bottom lines for a suite of attributes and requires that ecosystem health be maintained, or improved, above these bottom lines. To do so, ORC must set freshwater visions, outcomes, and target attribute states (Ministry for the Environment 2020).

To facilitate aligning freshwater outcomes with the target attribute state that achieves them, it is useful to understand what state occurs under reference conditions. This memo presents information on baseline data and target attribute state.

Results

For lake attributes, the baseline state is best represented by the results previously published in [Ozanne et al, \(2023\)](#). This report uses an alternative period of 2017-2022. An alternative period is used for lakes as a monitoring programme review in 2017 resulted in site, and measurement, changes to better represent state and comply with NPSFM (National Policy Statement for Freshwater Management) requirements. For some attributes, including submerged plants (NPSFM table 11 and 12), dissolved oxygen (NPSFM table 18 and 19), and cyanobacteria (NPSFM table 10) there is insufficient data to evaluate attribute state. For lake SPI (Appendix 1), dissolved oxygen (Appendix 1), and cyanobacteria (Appendix 1) interim results are available in the respective references."

Attempts to model all Otago lakes were unsuccessful and results did not correspond with the actual state of the monitored lakes. Given this, extrapolating from the 8 monitored lakes to other locations based on a class system has limited utility at the moment.

Baseline state and TAS information for E. coli, Chl-a, Total Nitrogen (TN), Total Phosphorus (TP), Ammonium (NH4) can be found on the following spreadsheets:

Upper Lakes Rohe - [UpperLakes_Lakes Target Attribute States.xlsx](#)

Taieri - [Taieri_Lakes Target Attribute States.xlsx](#)

Roxburgh - [Roxburgh_Lakes Target Attribute States.xlsx](#)

Lower Clutha - [LowerClutha_Lakes Target Attribute States.xlsx](#)

Dunstan - [Dunstan_Lakes Target Attribute States.xlsx](#)

Appendix 1: Interim results for lake attributes

Table 1: Interim results for mid-hypolimnetic dissolved oxygen (NPSFM Table 19) from 2018-2022

Site	Depth	Annual minimum	NOF
Lake Wanaka Open	150m	9.205798522	A
Lake Wakatipu Open	200m	9.271542512	A
Lake Hayes Mid Lake	27m	0	D
Lake Hawea South Open	150m	9.275392457	A

Table 2: Interim results for lake-bottom dissolved oxygen (NPSFM Table 18) from 2018-2022

Site	Annual minimum	NOF
Lake Wanaka Open	9.21	A
Lake Wakatipu Open	9.3	A
Lake Hayes Mid Lake	0	D
Lake Hawea South Open	9.3	A
Lake Waiholā at Waiholā Mid	6.9	B

Table 3: Interim results for cyanobacteria-planktonic (NPSFM Table 10) from 2018-2022

Site	Cyanobacteria biovolume (mm ³ /L)	NOF
Lake Onslow	0.048	A
LakeWanakaOpen	0.001	A
LakeWanakaNorthOpen	0.000034	A
LakeWakatipuOpen	0.0003	A
LakeWakatipuNorthOpen	0.0002	A
LakeHayesMidLake	0.002	A
LakeHaweaSouthOpen	0.00062	A
LakeHaweaNorthOpen	0.000152	A
LakeDunstanatBoatClub	0.0012	A
Lake Dunstan at ClydeDam	0.001	A

Table 4: Interim results for submerged plants (NPSFM table 11 and 12) from 2020-2022

Lake	Most Recent LakeSPI Survey	LakeSPI Index (%)	Native Condition Index (%)	NPS-FM 2020 Attribute band (native)	Invasive Impact Index (%)	NPS-FM 2020 Attribute band (invasive)	Overall Condition (LakeSPI status)
Hāwea	26/02/2020	82	80	A	12.6	B	Excellent
Wakatipu	2/11/2020	81	77.3	A	11.9	B	
Wānaka	4/11/2020	78	78.7	A	20.7	B	
Waihola	21/06/2023	54	64	B	47	C	High
Onslow	6/11/2020	67	53	B	17.3	B	
Dunstan	5/11/2020	49	57.2	B	55.6	C	Moderate
Tomahawk Lagoon (upper)	20/06/2023	38	36	C	60	C	
Hayes	26/02/2020	40	29.3	C	45.2	C	
Tuakitoto	22/06/2023	0	0	D	0		Non-vegetated