CENTRAL SOUTH ISLAND REGION

Sockeye Salmon Population Monitoring 2025

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July 2025

Prepared for the Central South Island Fish and Game Council

Report number: CSI2025-028

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Sockeye Salmon Population Monitoring 2025 (1.1.11) (N Dellaway)

1. Executive Summary

Sockeye salmon (*Oncorhynchus nerka*) that reside in the Waitaki Lakes were introduced in 1901 from anadromous stocks in British Columbia, Canada to establish a sea-run salmon population in the Waitaki River. Some did not run to sea and took residence in Lake Ōhau and became lake dwelling instead. Once the Waitaki Hydro Scheme was commissioned, Lake Benmore became a stronghold for the sockeye population. Sockeye are a valued sports fish among Lake Benmore anglers and serve as a possible forage food for trout.

This sockeye salmon monitoring programme was developed over three years and uses a combination of ground surveys and aerial counts to make estimates of the total number of spawning sockeye for the season in the Waitaki catchment.

The estimated 2025 spawning run for the Waitaki Lakes was 52,038 sockeye salmon. Notable contributions came from the Lake Benmore and Lake Pūkaki populations, with Lake Pūkaki recording its highest sockeye salmon spawning estimate on record.

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2. Background and life history

New Zealand's sockeye salmon populations (*Oncorhynchus nerka*) (hereafter referred to as "sockeye") that reside in some Waitaki catchment lakes were introduced in 1901 from anadromous stocks in British Columbia, Canada to establish a sea-run salmon population in the Waitaki River. A proportion of these sockeye did not run to sea however, and instead took residence in Lake Ōhau. Though these fish were smaller and had lower fecundity *(Quinn, et al. 1998)* non-anadromy became the naturally selected life history of the NZ sockeye. This population is the only self-sustaining population of sockeye in the Southern Hemisphere. Like all Pacific salmon, sockeye die shortly after spawning *(Couper 2018).*

The first of the Waitaki Valley dams was commissioned in 1935, and the last in 1981. These dams resulted in several different lake catchments forming somewhat distinct populations allowing only for downstream migration of sockeye through the power stations and spillways.

Sockeye are now established in lakes Pūkaki, Ōhau, Benmore and Aviemore. Spawning occurs in most tributaries of these lakes. Lake edge spawning is believed to be minimal *(Couper 2019).* Sockeye are periodically witnessed below Lake Aviemore as a result of spills but they do not typically reside there. Despite sockeye regularly appearing in the Upper Ōhau River an established population in Lake Ruataniwha has not been confirmed.

NZ sockeye are a valued sports fish among Lake Benmore anglers and sockeye juveniles serve as a possible forage food for trout. Sockeye are predominantly filter feeders and less likely to compete with trout and chinook salmon for food. The most recent sockeye gut samples contained primarily *Daphnia pulex,* an introduced zooplankton *(Couper 2021)* commonly referred to as the water flea.

3. Methods

3.1 Survey Design:

This sockeye spawning monitoring programme follows the "Couper model" developed between 2018 and 2020 over three spawning seasons, as outlined in Couper's 2020 Report. Key assumptions of this model are that the estimated peak spawning date is the 15th of March and the residence time (the average number of days between stream entry and death of an individual sockeye) is 15 days.

For the purposes of this programme the Waitaki Lakes were split into 6 Lake catchments. Pūkaki, Ōhau, Ruataniwha, Benmore, Aviemore, and Waitaki.

Each lake catchment has "indicator rivers" that are surveyed and used to estimate the total spawning population for that catchment

Given the size and significance of Lake Benmore to the total Waitaki population, 5 sub-catchments of Lake Benmore have been identified *(table 1).*

Table 1: Lake Benmore Sub-Catchment descriptions

Catchment	Waterways
Lake Benmore	
1. Twizel River	Twizel River and Fraser Stream
2. Ahuriri Arm	Ahuriri River and tributaries including Omarama River
3. Lower Ohau	Lower Ohau River and Mint Stream
4. Tekapo River	Tekapo River, Grays River, Fork Stream, Mary Burn
5. Haldon Arm minor tribs	Falstone Creek, Shepherds Creek and Scrubby Creek

3.2 Catchment Estimation:

Ground surveys were conducted at the Aviemore Spawning Race, Fork Stream, the lower section of Falstone Creek, and sections of Mint Stream. On the 14th of March, an aerial survey of eight key spawning reaches was also completed. These surveyed reaches are referred to as indicator or representative reaches, as they are understood to represent a known percentage of their wider sub-catchment or catchment. The number of sockeye observed in each reach is scaled up using these percentages to estimate the total number of sockeye present in the catchment on the survey date—this is referred to as the *catchment estimate*. The scaling factors used were derived from the original Couper model, though some have since been adjusted based on new information and observed changes in habitat availability.

3.3 Season Spawning Estimation

Catchment estimates are scaled up using a multiplication factor from the Couper model to estimate the total sockeye run over the full spawning season. The model is based on the Area Under the Curve (AUC) method, which accounts for fish being present across multiple days—not just on the survey day. It uses historical run timing data to assign a date-specific correction factor that estimates the proportion of the total run observed on a given day. For example, the 14th of March corresponds to Day 22 in the model, with an AUC factor of 1.45554. This means the observed count on that day is multiplied by 1.45554 to estimate the total seasonal run in the catchment. The final Waitaki Lakes spawning run estimate for 2025 is the sum of these adjusted totals from each catchment

4. Results

4.1 Spawning run estimates

As shown in table 2, the 2025 estimated sockeye salmon spawning run total for the Waitaki Lakes is 52,038. Notable contributions to this year's total are the Lake Pūkaki and Twizel catchments.

Table 2 Spawning totals from 2018 - 2025 with highest run for the period shown in red on the mini-graph.

Catchment/Subcatchment	2018	2019	2020	2021	2022	2023	2024	2025	
Lake Benmore	**32,000**	**36,580**	**42,770**	**64,770**	**44,381**	**72,177**	**38,541**	**34,126**	
Twizel River sub	19,110	18,420	20,180	21,450	23,756	34,471	582	14,070	
Ahuriri Arm	150	220	11,390	17,330	291	6,265	9,946	8,127	
Lower Ohau	9,660	9,070	6,100	16,830	3,895	21,139	16,089	4,444	
Tekapo River	1,830	6,530	4,440	6,700	14,403	7,730	9,606	5,411	
Haldon Arm minor tribs	1,250	2,340	660	2,460	1,178	2,572	2,318	2,074	
Lake Aviemore	**2,150**	**-**	**13,610**	**10,430**	**444**	**874**	**890**	**121**	
Lake Pukaki	**4,420**	**6,880**	**5,680**	**2,150**	**15,249**	**7,018**	**11,796**	**17,379**	
Lake Ruataniwha	**300**	**-**	**-**	**600**	**-**	**186**	**80**	**376**	
Lake Waitaki	**-**	**-**	**2,510**	**100**	**-**	**0**	**-**	**-**	
Lake Ohau	**110**	**27,800**	**9,120**	**100**	**199**	**3,936**	**21**	**36**	
Waitaki Lakes Total	**38,980**	**71,260**	**73,690**	**78,150**	**60,273**	**84,191**	**51,328**	**52,038**	

4.2 Lake Pūkaki

The sockeye spawning population in Lake Pūkaki this season was 17,379 sockeye. This is the highest estimate on record for Lake Pukaki. Before the 2024 spawning season, the three braids of Glentanner Stream had been the sole spawning indicators for the Lake Pūkaki catchment. Last season, In 2024, the lower section of the Jollie River and a few braids of the Tasman River were also surveyed and were found to contribute about 15% of Lake Pūkaki's spawning population. This season, the Jollie River and Tasman River braids were estimated to contribute about 2,600 sockeye to the total Pūkaki population.

4.3 Lake Ōhau

The Lake Ōhau sockeye spawning estimate is just 36 sockeye. Only a few small groups were observed in Larch Stream, a tributary of the Dobson River, and the five other streams surveyed in the Ōhau catchment showed no signs of a spawning run. This mirrors what was seen last season. While populations of less than 50 look like unusual outliers, it's not overly concerning given the similarly low spawning returns in 2021 and 2022—the years that produced these generations.

4.4 Lake Ruataniwha

It was estimated that around 376 sockeye spawned in the Upper Ōhau River this year. The Upper Ōhau River is the only river used to estimate the Lake Ruataniwha spawning population. It is unknown if sockeye utilise the Ōhau A tail race, the Ohau B Canal or part of the interconnected Wairepo Arm catchment for spawning.

4.5 Tekapo/ Takapō River sub-catchment – Lake Benmore

The total estimated sockeye spawning population for the Tekapo/ Takapō River sub-catchment equated to 5,411 sockeye salmon and contributes about 16% of Lake Benmore's total sockeye spawning population. This includes approximately 2,700 sockeye from the Mary Burn/ Te Kōhai, although this estimate is likely conservative as the Mary Burn has sections of thick willow and alder cover that provide little to no visibility from the air.

4.6 Twizel River/ Whakatipu sub-catchment – Lake Benmore

The Twizel River is one of the primary spawning rivers in the Lake Benmore catchment and in the 2025 season was estimated to contribute 13,585 sockeye to the Lake Benmore spawning sockeye population, about 41%. Last season the Twizel River, in particular the mouth was affected by drought and created fish passage issues during the sockeye salmon spawning season. This year continuous flow was provided during the season and Twizel returned to being the top contributing catchment to the Lake Benmore spawning population.

4.7 Lower Ōhau sub-catchment – Lake Benmore

The Lower Ōhau sub-catchment this year contributed about 13 percent of the Lake Benmore population with an estimated 4,444 spawning sockeye in 2025.

4.8 Haldon Arm Minor Trib sub-catchment – Lake Benmore

The estimated sockeye spawning run in the Haldon Arm minor tributaries in 2025 was 2,074 individuals.

Falstone Creek is the representative reach for this sub-catchment and the lower section was counted on foot on the 13th March 2025. It is estimated that Falstone Creek contributed about 1,555 sockeye to lake Benmore this season and about 500 are estimated to have spawned in Scrubby and Shepherds Creeks.

4.9 Ahuriri Arm sub-catchment – Lake Benmore

Ahuriri arm contributed an estimated 8,127 spawning sockeye to Lake Benmore this season however the Ahuriri River itself had notably fewer sockeye than has been previously observed in the middle sections. The Ahuriri sub-catchment encompasses the Ahuriri River and it's tributaries including the Omarama River.

4.10 Lake Aviemore

This year's total spawning estimate for Lake Aviemore is around 121 sockeye. The representative reach for Lake Aviemore tributaries is the Otematata River which historically has contributed about 66% of the Lake Aviemore population. This season's Lake Aviemore spawning population estimate is low in terms of historical estimates.

4.11 Lake Waitaki

No sockeye salmon were present in Aviemore Spawning Race this year, which supports the theory that Lake Waitaki does not have a self-sustaining resident sockeye population. On years that sockeye are present they are believed to be the product of recent spills from Lake Aviemore.

5. Future Management

CSI Fish & Game have previously reported Glentanner Stream to account for the total spawning population of Lake Pūkaki. Sockeye sighting reports received from anglers in previous years suggested the Jollie River had spawning sockeye present. In 2024 a section of the Jollie River was surveyed and a population of spawning sockeye was confirmed. Also observed were braids with sockeye present in the Tasman River and approximated counts recorded for these. An adjustment was made to include these counts in the Lake Pūkaki catchment spawning population. A full survey of the Jollie River and the Tasman Braids should be undertaken to assess the extent of sockeye spawning in these waters, assess how that relates proportionately to Glentanner Stream and to consider their inclusion in future surveys.

Currently it is assumed that each lake catchment has the same peak spawning date, the 15th of March which total population estimate is based on. An investigation into each catchment to determine if there is any run variation would be sensible.

The contribution of the Ahuriri River to the sub-catchment should be re-evaluated, as its use by spawning sockeye appears to have changed over time

6. Acknowledgements

Central South Island Fish and Game would like to acknowledge the following people and organisations for their vital contributions to the Waitaki Lakes sockeye salmon monitoring programme:

Mount Cook Alpine Salmon (MCAS). MCAS provide 50% of the funding for the helicopter flight, without whom, the distance surveyed would not be possible.

Heliventures Heli-services.

The Landholders in the catchments where the survey occurred.

7. References

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