CENTRAL SOUTH ISLAND REGION

Sockeye Salmon Population Monitoring 2024

Nicola Dellaway

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For any information regarding this report please contact Central South Island Fish and Game Council - phone: (03)615-8400, email: csi@fishandgame.org.nz

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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 2024 estimated spawning run for the Waitaki Lakes was 51,328 individuals. This is the second lowest estimate in the 7-year history of the monitoring programme. Notable contributions to this year's total are the numbers in Lake Pūkaki and the Lower Ōhau River.

Drought conditions in the Mackenzie Basin during the spawning season resulted in low river flows and disconnections that affected the normal spawning habits of sockeye, especially in Lake Benmore catchment where they were denied access to the Twizel and upper Tekapo/ Takapō rivers.

Background and life history

New Zealand's sockeye salmon populations (*Oncorhynchus nerka*) (hereafter referred to as "NZ sockeye" or "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.

Methods

This sockeye spawning monitoring programme follows the "Couper model" developed between 2018 and 2020 over three spawning seasons, as outlined in Couper's report in 2020 on sockeye spawning. Key assumptions of the Couper 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) 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.

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 description

Sub-catchment	Waterways
Twizel River	Twizel River and Fraser Stream.
Ahuriri Arm	Ahuriri River and tributaries.
Lower Ohau	Lower Ohau River and Mint Stream.
Tekapo River	Tekapo River, Grays Stream, Fork Stream and Maryburn.
Haldon Arm minor tribs	Falstone Creek, Shepherds Creek and Scrubby Creek

On the 13th of March four ground surveys were undertaken at Aviemore Spawning Race, the lower section of Falstone Creek, sections of Mint Stream and Fork Stream.

On the 14th of March an aerial survey of key spawning reaches was completed. The reaches were broken down into sections between "waypoints" and counts of live sockeye are recorded for each section throughout the survey. The surveyed reaches are referred to as the indicator or representative reaches. These reaches represent an estimated percentage of their sub-catchment or catchment. Counts are then scaled up to estimate the total sockeye in the catchment on the survey date (catchment estimates). These scaling factors are obtained from the Couper model although some catchments scaling factors were adjusted as new information was received.

Catchment estimates are then scaled up using a scaling factor outlined in the Couper model to estimate the total run in the catchments over the whole spawning season.

The sum of the total run in each catchment is reported as the 2024 estimated sockeye spawning run total for the Waitaki Lakes.

Results

Spawning run estimates

As shown in table 2, the 2024 estimated sockeye spawning run total for the Waitaki Lakes is 51,328. This is the second lowest estimated sockeye spawning run since the development of the monitoring programme in 2018. Notable contributions to this year's total are the Pūkaki, Lower Ōhau, Tekapo and Ahuriri catchments. Low river flows and disconnections resulted in the absence of sockeye in some established spawning areas.

Table 2 Spawning totals from 2018 - 2024 with highest run for the period shown in red on the mini-graph.

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

Lake Pūkaki

The sockeye spawning population in Lake Pūkaki in 2024 was 11,796 sockeye. The three braids of Glentanner Stream have previously been the sole spawning indicators for the Lake Pūkaki catchment. This year the lower section of the Jollie River was also surveyed and about one-thousand fish recorded there. A few braids of the Tasman River were also noted to contribute to the catchment so the contribution of Glentanner to the Pūkaki catchment was adjusted based on the fish counted at the other sites. This catchment estimation may have been even higher if a more thorough assessment of the Tasman River braids was undertaken however resources did not allow this on the day.

Lake Ōhau

The Lake Ōhau sockeye spawning estimation is just 21 sockeye. Only one a small group were seen in a braid of the Dobson River the five other streams surveyed in the Ōhau catchment showed no evidence of a sockeye salmon spawning run.

Lake Ruataniwha

It was estimated that around 80 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.

Tekapo/ Takapō River sub-catchment – Lake Benmore

The total estimated sockeye spawning population for the Tekapo/ Takapō River sub-catchment equated to 9,606 sockeye.

Fork Stream had no sockeye present and no recent spawning activity when surveyed on the 13th of March this year, when we would expect near-peak activity. It is likely the observed fish passage issues related to drought conditions in the mid-section of the Tekapo/ Takapō River made access to Fork Stream impossible.

Mary Burn/ Te Kōhai had sections that had thick willow and alder cover and provided little to no visibility from the air in places so the 2024 estimate of Mary Burn may not compare directly to previous years counts with lesser tree cover. Approximately 10km of the Mary Burn is surveyed from the confluence with the Tekapo/ Takapō River to the SH8 Bridge. Sockeye were seen further upstream in the Mary Burn than they were last year.

Twizel River/ Whakatipu – Lake Benmore

The Twizel River has previously been described as one of the primary spawning rivers in the Lake Benmore catchment. Last season the Twizel River held about 40 percent of the Lake Benmore spawning sockeye population. This year it held less than two percent. On the aerial survey it was observed that the mouth of the Twizel was dry and disconnected from the Lower Ōhau River, disabling fish passage. Only a couple hundred sockeye were observed upstream of the disconnection and had presumably migrated early in the spawning period prior to the disconnection.

Lower Ōhau Sub-catchment – Lake Benmore

The Lower Ōhau sub-catchment this year contributed about 40 percent of the Lake Benmore population with an estimated 16,089 sockeye spawners in 2024. Last year the Lower Ōhau sub-catchment contributed around 25% of Lake Benmore's total population. While it is common for the Lower Ōhau River to contribute significantly to the sub catchment, this year there were likely many displaced sockeye present due to their inability to continue migrating up the Twizel River due to low and disconnected flows.

Haldon Arm Minor Tributaries - Lake Benmore

The estimated sockeye spawning run in the Haldon Arm minor tributaries in 2024 was 2,318 individuals.

Flooding before the 2023 spawning season in Falstone Creek significantly improved sockeye access beyond Falstone Road Bridge. Historically, a concrete weir impeded fish passage past this point, a build-up of gravel at the culvert now allows passage through the culvert providing access to a further 4 – 5km of spawning ground and reducing competition for space.

This monitoring programme previously used a short section of Falstone Creek to estimate the rest of the spawning in the Haldon Arm. The contribution percentage of Falstone Creek to the catchment was adjusted this year to include the new habitat availabilities and account for the estimated saturation point of the smaller streams in the sub-catchment.

Ahuriri River sub-catchment – Lake Benmore

The Ahuriri sub-catchment contributed an estimated 9,900 total spawners to Lake Benmore this season. This is the third highest contribution the Ahuriri catchment has made since the inception of the project in 2018. In previous years water clarity and weather has been an issue for accurate counts on the Ahuriri River.

Lake Aviemore

This year's total spawning estimate for Lake Aviemore is around 890 sockeye. This is based off a survey of the Otematata River. The Lake Aviemore spawning population estimate is low - moderate in terms of historical data.

Lake Waitaki

No sockeye salmon were present in Aviemore Spawning Race this year which supports the theory outlined in Couper 2020 that Lake Waitaki does not have a self-sustaining sockeye population and that any present are the outcome of recent spills from Lake Aviemore.

Future Management

To date CSI Fish & Game have 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. This year 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 when resources allow.

The contribution of the Ahuriri River to the sub-catchment could be re-investigated as it is possible the popularity of the Ahuriri River has changed over time and is no longer the same indicator it was when the programme was developed.

Falstone Creek's (when counted in its entirety) contribution has been adjusted to be about 70 percent of the Haldon Arm Minor Tributary Sub-catchment. This should be confirmed by revisiting the other Haldon Arm streams.

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