Notes

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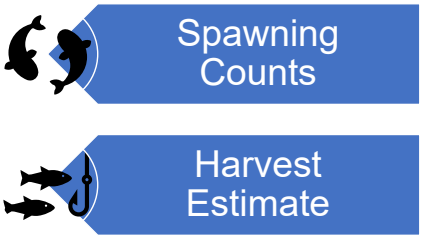
Salmon Management Strategy

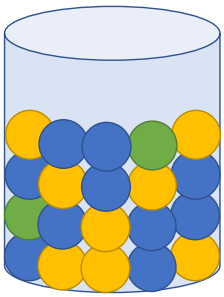


There are 2 main facets to our salmon management strategy: spawning counts and the harvest estimate.

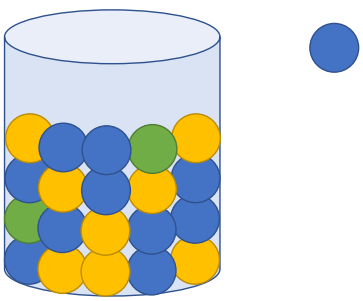
We Are Limited

Notes

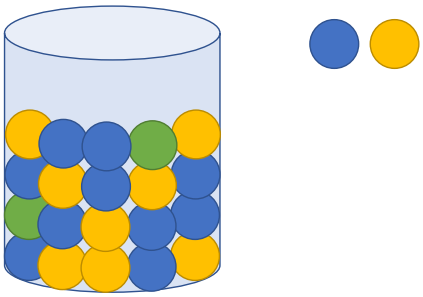
In order to understand why we do our surveys the way we do, it's important to understand our limitations. Being a non-profit organization, predominantly funded by licence sales, money is a major limitation. Time is another major limitation, how many hours staff can commit to a study. Finally, logistics, or what is actually physically possible.



So I want you to imagine that instead of a river full of fish, we have a jar of marbles. We can't see what is in the jar, and we can't tip the jar out and count all the marbles. But we want to know what is in the jar.

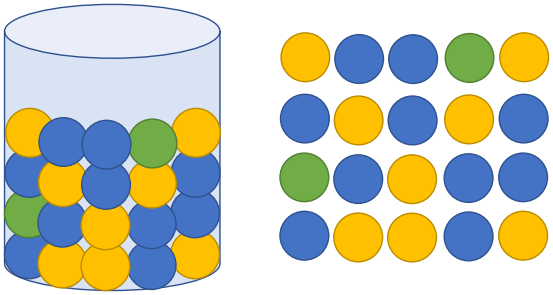


We can pull out one marble at random, and the probability of pulling out a blue marble is proportionate to the number of blue marbles in the jar. But because this is a really small sample size, we still don't have a good idea of what is in the jar.

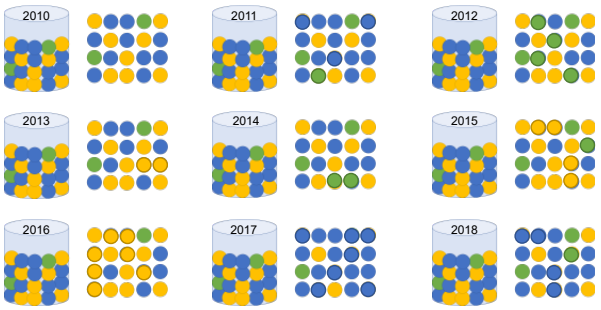


Notes

If we pull out a second marble, again the color drawn is proportionate to what's in the jar. But again, this is a really small sample and doesn't give us a good picture of what's in the jar.

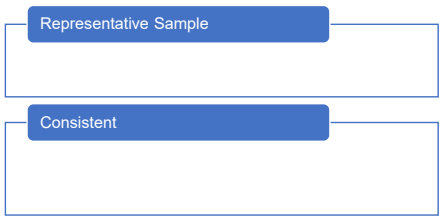


But if we continue to draw a random sample of marbles, and we collect a large enough sample size, we end up with a really good estimation of what is actually in the jar without having to count the whole jar.



And if you imagine the contents of the jar change from to year to year, and we repeat this process every year, we can get a pretty good idea of how the contents of the jar have changed over time.

Population Index

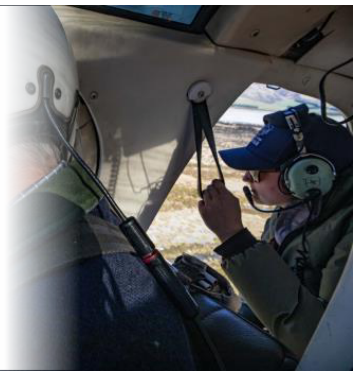


Notes

In biology, this is something referred to as a population index. In order for a population index to work properly there are 2 major requirements: the sample needs to be representative and consistent.

Spawning Counts

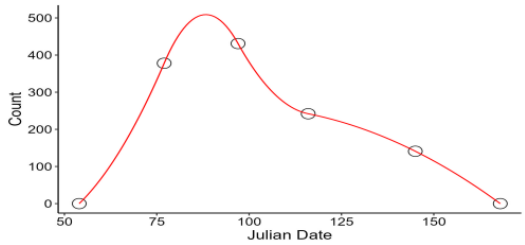
- Use standardized methods developed by NIWA
- Survey known spawning streams
  - Same streams every year
- Survey sites within key indicator rivers



During salmon spawning counts, staff fly over designated sections of spawning streams and count all visible salmon, using standardized methods developed by NIWA.

Spawning Counts

• Area Under the Curve



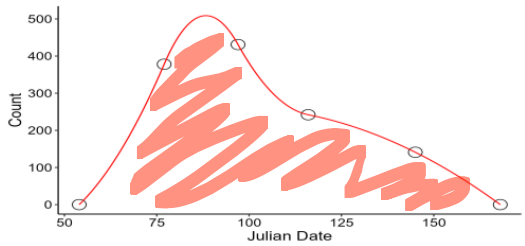
Notes

Once the flights have been completed, we perform an analysis known as “Area Under the Curve”

We mathematically fit a curve to the pattern of the data.

Spawning Counts

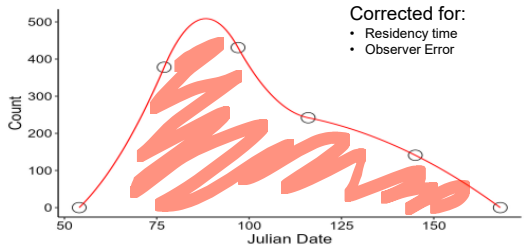
• Area Under the Curve



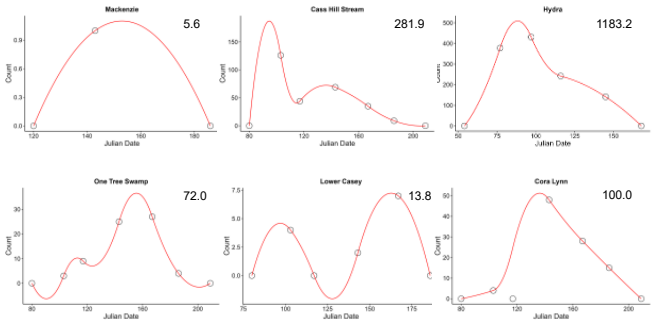
Then if you imagine we shade in all the area under the curve, that area is equivalent to the population during that time frame.

Spawning Counts

• Area Under the Curve



Once we have that number we make 2 major corrections. We correct for residency time, or the time a fish spends on average in the spawning stream, to account for the probability a fish was observed in two consecutive counts. We also correct for observer error, or the probability that, given a fish was present during the survey, it was counted by observers.



Notes

Here are a few examples of curves from last years data. Each curve represents the spawning population of a single surveyed spawning area. The number in the upper right hand of each graph is the estimate for that stream. As you can see, there's quite a bit of variation in spawning timing between streams, the shape of the curve, as well as importance for spawning salmon.

Spawning Counts

- The combined counts for each site within a river make up the Run Estimate
- Final estimate represents a population index NOT the total number of fish

Once we have the spawning estimate for each stream, we add together the estimates for all of the streams in each river. That number is the Run Estimate that is published in our annual salmon report.

It's important to remember that this estimate is a population index and is not intended to represent the total number of fish in the river.

Population Index

Representative Sample

- Spawning stream selection
- Time flights to match spawning

Consistent

- Use the same streams every year
- Use the same methods for the counts every year
- Use same methods of analysis every year

Looking back at our requirements for a population index:

Salmon spawn surveys are a representative sample through the selection of spawning streams as well as the careful timing of surveys.

Salmon spawn surveys are performed consistently from year to year.

Spawning Estimate

Notes

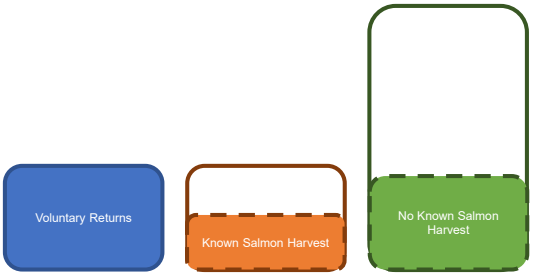
Annual timeline of salmon spawning surveys. Survey period varies year to year to fit the actual timing of salmon spawning.

Salmon Harvest Survey

- Voluntary bag card returns
- Stratified random phone survey
  - Anglers who have reported salmon harvest in the last 5 years
  - Anglers who have not reported salmon harvest in the last 5 years
- *The more voluntary returns we get, the more accurate and precise our harvest estimate is!*

There are 2 steps to producing a harvest estimate: the voluntary bag limit card returns, and random phone surveys.

Salmon Harvest Survey



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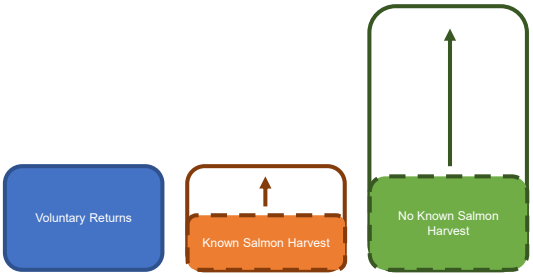
Because we are limited by time and money, we only survey a subset of those who did not return their harvest cards.

Salmon Harvest Survey



We then extrapolate the harvest from the people we surveyed to each of the stratified groups.

Salmon Harvest Survey

If you imagine we increase the number of voluntary returns we get, with the same phone survey effort we can collect data from a much greater proportion of the angling population and have to extrapolate a lot less. This greatly improves the accuracy of our harvest estimate and reduces our margin of error!

Salmon Harvest Survey

Notes

Here is a brief timeline of the salmon harvest survey.

Sea-run salmon regulations are set based off an Adaptive Management Strategy.

Adaptive Management Strategy

- Designed to improve sustainability and ensure adequate escapement each year, especially when return numbers are low
- *The goal of adaptive management is to be able to fish wild sea-run salmon in Canterbury for generations to come!*
- Season bag limits

The Adaptive Management strategy was published in May 2020. Different options for harvest management were considered to aid increased escapement of fish to the spawning streams: season restrictions, area restrictions, and season bag limits (including estimated percentages of harvest reductions based on the 18/19 season catch). A season bag limit was chosen as the most effective tool at reducing harvest whilst simultaneously impacting on the smallest proportion of anglers (only 6% of anglers in the 18/19 season caught more than 2 salmon), and also allowed for an extension of the sea-run salmon season.

Adaptive Management Strategy

- Threshold management system
- 3 “indicator rivers” (Waimakariri, Rakaia, Rangitata)
- Determines bag limit for following season based on population indices

Notes

The threshold management system is used in setting bag limits for the following season, using the combined population indices from the three indicator rivers. These three rivers account for an estimated 75% of all South Island salmon harvest and have most robust and consistent monitoring information.

Adaptive Management Strategy

- “Management bands”

Management Band	Total population index	Season Bag Limit	Harvest reduction	Increased spawning
Healthy	> 7,800	8	4%	3%
Moderate	5,101 to 7,800	4	16%	11%
Low	1,200 to 5,100	2	35%	23%
Severe	< 1,200	1 + possible season and area restrictions	56% +	37% +

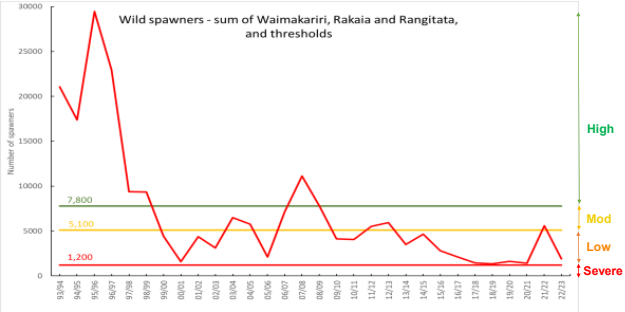
Total population index across the 3 indicator rivers is measured against the management bands (the 20/21 season estimate was in the “Low” management band, starting the season bag limit off at 2 salmon). The combined population index for the 21/22 season was 5,588, placing the index in the ‘moderate’ band.

Harvest reduction and increased spawning estimates in this table were based on 2018/2019 season data – comparing this with 2021/2022 (first bag limit season) data showed harvest reductions of 37% and 38% for the Waimakariri and Rakaia rivers respectively, close to the estimated 35% reduction for a season bag of 2 salmon.

Adaptive Management Strategy

- Increasing bag limit
  - Requiring 3 years worth of consistent population indices at higher management band
- Decreasing bag limit
  - Requires only 1 year of population indices falling below management band

Requiring 3 consecutive years in the next highest management bag ensures that the spawning population index is more likely to indicate a true population increase and is not just a single year event. Population decreases require urgency (decreasing bag limit), while population increases require more certainty (for increasing bag limit).



Notes

The graph shows the total population indices of the 3 indicator rivers since 1993/1994, compared with the current management band thresholds (red, orange and green horizontal lines). The estimate of the 22/23 combined population index was made in early May based off incomplete counts and comparisons with previous years. This estimate is only provisional, and will change once all the counts have been finished.

Adaptive Management Strategy

- Thresholds for increasing the bag limit are under review
- We will be seeking your input in the coming year

Part of the Adaptive management strategy is that the strategy itself is also adaptive; we will be conducting a review of the management strategy in the next year which may include changes to the threshold management system.