![Cawthron logo] CAWTHRON

GETTING STARTED: ECOSYSTEM HEALTH MONITORING FOR CATCHMENT GROUPS

World-class science for a better future.

GETTING STARTED: ECOSYSTEM HEALTH MONITORING FOR CATCHMENT GROUPS

CALUM MACNEIL, ROBIN HOLMES

Thriving Southland

1. INTRODUCTION

In this short guide we provide a plan for starting a community monitoring programme in a small river or stream. A supporting document has been created as part of this project which covers citizen-led catchment monitoring in more detail 'A river health monitoring framework for Southland catchment groups' (link) and more information is also included in the report by MacNeil and Holmes (2021) in Section 6. References. In the supporting document we provide references and links to various New Zealand-specific tools to help people monitor stream health.

As a starting point for monitoring stream health, this guide focusses on just two aspects of stream health monitoring:

1. monitoring using river bugs (also called macroinvertebrates) using a scoring system called the Macroinvertebrate Community Index (MCI) and,
2. physical stream habitat monitoring using the Rapid Habitat Assessment (RHA).

By providing a guide to monitoring with these two techniques, we hope to provide a starting point for a community monitoring programme to get underway.

While MCI monitoring requires professional sample processing, we suggest that community members can collect the samples themselves with minimal training. We think that collecting the samples as a group and getting them professionally processed will strike the balance between affordability and the effort required by catchment group members. MCI scores in combination with RHA done at the same sites should enable community groups to develop their own understanding of stream health. The RHA will allow community groups to investigate how some of the physical aspects of a stream might be driving stream health. For example, applying the RHA will show you if your stream has too much deposited fine sediment which would cause low MCI scores.

It is possible for catchment groups to do their own macroinvertebrate identification but this needs a higher level of training and effort. Details on how to do this are provided in NIWA's Stream Health Monitoring Assessment Kit (SHMAK), freely available at https://niwa.co.nz/freshwater/management-tools/water-quality-tools/stream-health-monitoring-and-assessment-kit. Using the SHMAK kit will produce a SHMAK score which is similar to the MCI but is less sensitive.

The accompanying identification guide for river bugs / macroinvertebrates is available at https://www.nzwatercitizens.co.nz/sites/default/files/2019-12/Benthic%20Macroinvertebrates_Field%20ID%20Guide_Nov%202019.pdf. We strongly recommend the use of these guides as the 'go to' for catchment groups attempting their own macroinvertebrate identification.

2. PLANNING YOUR SITES IN A CATCHMENT

Before you collect your data, you need to plan out where your assessment sites will be. Below is a diagram showing how you might want to place monitoring sites based on various catchment features such as:

1. changes in land use (e.g., from native vegetation to farmland, see Site 1)
2. upstream and downstream of major side-streams (Sites 3 and 6) and
3. upstream and downstream of farm environmental improvements (Sites 4 and 5).

More information on the steps you might want to consider when developing a catchment scale monitoring project are provided in the supporting document (**link**).
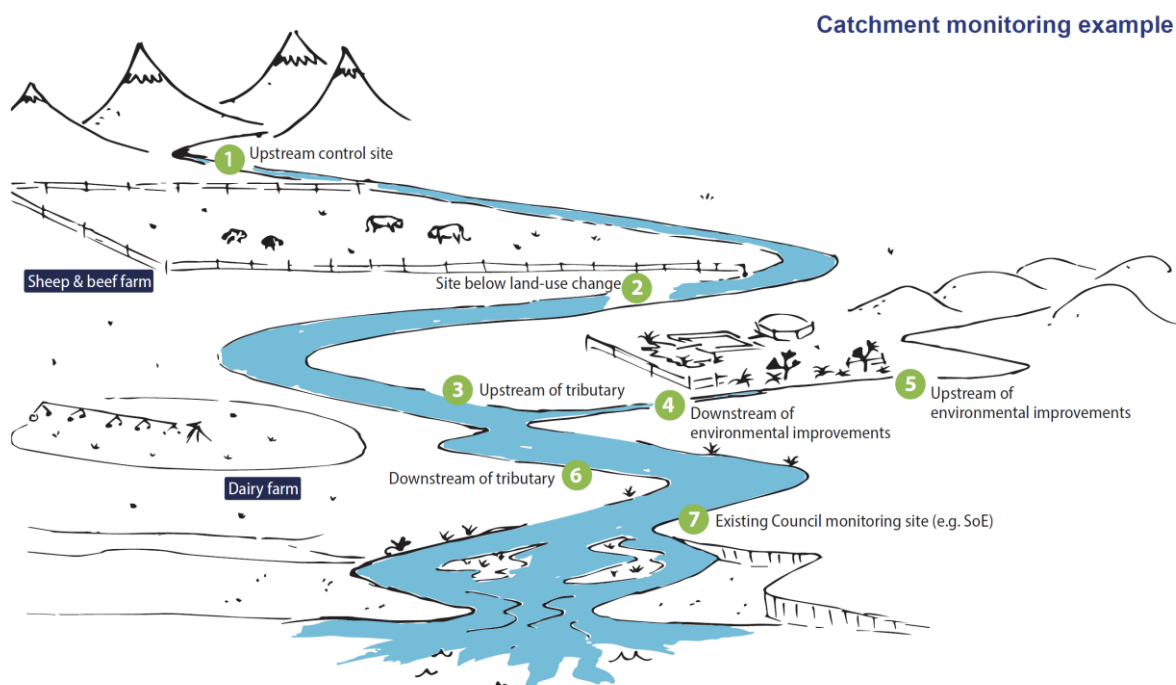

Catchment monitoring example

Figure 1.   An example of monitoring in a small to medium-sized catchment. Shown are seven different monitoring sites that serve different functions as part of a long-term monitoring project. We suggest that, at a minimum, macroinvertebrates and habitat assessments (described below) are done at each site once a year during summer low-flows.

2.1. Develop and undertake an initial survey, then do long-term (annual) monitoring at a sub-set of sites

It's a good idea to do a large-scale survey before 'narrowing down' and doing long-term monitoring at a subset of the sites surveyed initially. An initial 'BioBlitz' approach will help the group understand if there are any pollution hot spots (e.g., below certain

tributaries) which might be an ideal location for long term monitoring to show improvement over time.

2.2. Macroinvertebrates – what are they, how do you sample them and how can they be used to show water quality

- Macroinvertebrates are river bugs without backbones that are visible to the naked eye. They include small insects like mayflies as well as worms and snails that live in the stream bed. They tend to remain in the same reach of river and are long-lived (often surviving for a year or more).

- Because they don't move much and because some of them such as mayflies are very sensitive to pollution, while others such as worms are far hardier and able to tolerate poor water quality, the presence or absence of different types of river bugs can be used to work out the water quality of a site and whether there could be a pollution problem.

- By monitoring river bugs in the same site over time, any changes in river health can be detected by changes in the different types of bugs present.

- Figure 2 shows a selection of river bugs whose presence can show good, moderate or poor river health.

Figure 2.   River bugs / macroinvertebrates which can signal good (green), moderate (amber) or bad (red) water quality, if they are present in a stream. (Photographs provided by Peter Hamill).

The following **green box** is a 10-step program showing how to take an invertebrate sample properly. This can be done either using a Surber sampler or a kick-net. We describe a method for a Surber sampler, the kick-sample method is described in SHMAK. A Surber sampler is a square metal grid with an attached net which is used to collect stream bugs (sometimes called macroinvertebrates). Figure 3 shows a Surber sampler in use.

1. Place the Surber in the shallowest, fastest flowing part of your stream, ideally where the water riffles and barely covers the streambed.

2. Set the Surber with the net upright, water flowing into the net. Work the base of the net into the streambed.

3. Hold the Surber in place while turning over stones within the metal grid and either use a brush or hand-rub all the stones to dislodge bugs that clinging to them. Bugs cling tight so take your time. Make sure all bugs end up in the net.

4. Stir up remaining gravel/ sand/ debris with your hands to dislodge bottom-dwelling bugs.

5. Hand-pick snails and other heavier bugs that are not picked up by the current.

6. Once sample is taken, tip the net into a white tray. Rinse the net with stream water if you need to and make sure all animals on net end up in the tray.

7. Pick out any big stones and big bits of debris from tray. Once you are sure any bugs clinging to them are picked off and put in tray, then these big stones / debris can go back in the stream.

8. Place bugs and any small bits of stone/debris/plant into a plastic pot with a screw lid.

9. Preserve the whole sample in 70% ethanol (alcohol) or methylated spirts. This is 7 parts ethanol to 3 parts water. Ensure all the sample in the pot is covered by preservative. Only use enough preservative to cover the sample, so don't fill the pot. Seal the lid and make sure it is secure. The sample will keep for months if preserved properly.

10. Label the pot with RIVER NAME, SITE NAME, DATE, TIME, WHO TOOK SAMPLE and WHAT SAMPLE IS – i.e. 'MACROINVERTEBRATES IN 70% ETHANOL. Make sure label is secure and writing won't wash off. A paper label written in pencil can also be placed in the pot itself.

Now you are ready for your next sample. Just repeat steps 1-10.

Once the sample is preserved, it will keep for months. There is no need to freeze it, but you should keep it cool. If you are sending it off to be processed by a laboratory, make sure all lids on the individual pots are secure. Then it is a good idea to place all the individual pots in a larger sealable plastic tub, before sending off, in case there are any spillages or an individual pot leaks.

Figure 3.   A Surber sample being taken. Notice the use of a brush to scrape off river bugs clinging to rocks. (DOCDM-724830 Freshwater ecology: quantitative macroinvertebrate sampling in hard-bottomed streams v1).

Some useful tips on Surber sampling:

1. If there is a flood big enough to move sediment on the stream bed, wait at least 2 weeks after the flood has passed and flows are back to normal before taking the sample.

2. Sampling at the same site in different seasons is the best way to really understand the mix of river bugs that are present in the site throughout the year but if you can only sample once a year, sample in summer months (November to March).

3. Although the Surber sample is best collected in a shallow, riffle (fast flowing) area of the stream if this type of area isn't available, consider moving your sampling location. If you can't do that, try to sample in the shallowest, fastest flowing part of your stream. Sampling in the riffle area of the stream means you are sampling in the highest quality area of the stream with the most oxygen. This means you have

the greatest chance of capturing the widest variety of river bugs and the most sensitive types.

4. A scrubbing brush can be used to scrape the surfaces of stones found in the metal square to dislodge river bugs such as snails and worms which may cling tightly to the stones. Waterproof gloves are a good idea as water might be polluted and stone surfaces can be very sharp.

5. Once the area in the square has been sampled (this should take about 3 to 5 minutes if you do it carefully), the bugs should be transferred from the net into a white plastic tray. Then pick out and discard any cobbles, big pebbles and debris, being careful not to chuck clinging river bugs in the process.

6. Make up the preservative by adding 3 parts water / sample material to 7 parts preservative (to make a 70% preservative solution). This can be done on the riverbank and estimated by eye. It is easier to slowly add neat (100%) preservative to the collected river bug sample and the small amount of water collected with the sample in the pot. It is better to add too much preservative than too much water if in doubt, when making up the mixture. Although ethanol is the best preservative, methylated spirit can be used as a substitute.

7. The sample container should be labelled to include name of the site, location of the site (GPS coordinates if possible), the date, the operator (i.e. name of person who took sample) and label it as 'inverts in 70% ethanol / meths' or something similar. You can get GPS coordinates from Map-directions app on a mobile phone and placing a pin in your current location.

The sample is taken – now what ?

- Now that the sample is preserved, you can either try to identify the bugs yourselves using the SHMAK guide or you may want to send it off to get professionally processed. There are a range of firms who can do this—Cawthron, EOS Ecology, Stark Environmental and Ryder Environmental, among others. They all have websites. You can ask your regional council to suggest someone in your area. At the time of writing, processing costs can vary between $200–350 per sample. Whoever you send it to can advise on how they want the sample booked in and what details they need from the catchment group.

- The sample can be processed in the laboratory to indicate the ecological health of a river using the Macroinvertebrate Community Index (MCI) score (Stark et al. 2001). All regional councils use this index to report river health during regular monitoring.

- When talking to a provider, ask for 'MCI' level identification for your sample. We recommend that you also ask for a 'full count' of the macroinvertebrate sample, this will allow you to also get a QMCI score (Quantitative MCI is a version of the MCI which takes into account the numbers of each type of river bug). Full count processing will cost about an extra $50 per sample but will allow a more robust ecosystem health assessment.

- MCI, QMCI, Taxon richness (no. of different types of river bug), EPT abundance (no. of mayfly (E – Ephemeropteran), stonefly (P – Plecoptera) and caddisfly (T – Trichoptera) present in your samples) and %EPT are all things you can request from the same sample (these indices and what they tell you are explained in the supporting document).

- Appendix 1 shows a typical spreadsheet you can expect to get back from providers once your river bugs are processed.

How does the MCI work?

- To calculate the MCI—each type of river bug is given a number between 1 and 10 based upon their tolerance to pollution or fine smothering mud or silt. River bugs that need very clean, unpolluted water and / or stony streambeds score more highly than bugs that can live in polluted conditions or amongst fine river sediments. The most sensitive bugs score 10, the most pollution-tolerant score 1. For each sample, the scores for each type of river bug are added together, then divided by the number of scoring river bugs and multiplied by 20 to give the MCI value. MCI values range between 200 (when every bug scores 10 points each) and 0 (when no bugs are present. It is rare to find MCI values greater than 150 and only very polluted, sandy / muddy sites score under 50.

- QMCI values range from 0 to 10. Unlike the MCI, which is based on only the presence or absence of each type of bug, the QMCI requires the number of each type of bug to be worked out so that the final score is weighted in favour of the most common river bug present.

- Table 1 (on the next page) shows different 'water quality classes' to help understand what your MCI and QMCI means.

- In the current National Policy Statement for Freshwater Management (NPS-FM) the **'national bottom line' score for the MCI is 90.** This is lowest score necessary to meet the national requirements of the current legislation.

- The MCI is best used in stony streams and is not suitable for 'soft bottomed streams' meaning streams that are naturally high in fine sediment. The vast majority of streams in Southland are naturally stony and 'hard-bottomed' but some will have had a build-up of fine silt in patches. These are still naturally stony streams.

- If you want to see what typical MCI scores are for rivers in your area, with 5 easy steps (mouse-clicks) you can access MCI scores for sites from all over Southland (see Appendix 2).

Table 1.   Water quality classes and what different MCI and QMCI scores may mean

Water quality class	Description	MCI	QMCI
Excellent	Clean	> 120	> 6.0
Good	Possible mild pollution	100–120	5–6
Fair	Probable mild pollution	80–100	4–5
Poor	Probable severe pollution	< 80	< 4

- For more info on the MCI score see:

    https://environment.govt.nz/publications/a-user-guide-for-the-macroinvertebrate-community-index/part-2-guidelines-for-using-the-mci-qmci-and-sqmci/

2.3. Physical habitat monitoring in streams using the Rapid Habitat Assessment protocol

The Rapid Habitat Assessment (RHA) protocol is a quick river habitat assessment tool that anybody can use to assess physical habitat condition in a short reach of river (usually 150 m long). It involves rating 10 aspects of river habitat on a 1–10 scale based on the presence / absence and percentages of different habitat features. Once you are familiar with the protocol, it should take about 10–20 minutes to complete a reach.

The RHA provides a 'habitat condition score' for a river reach which suggests the general river habitat condition based on the physical aspects, such as the structure of the riverbed. For example, part of the assessment determines if there are excessive amounts of deposited fine sediment on the riverbed.

The RHA is now used by almost all regional councils during routine monitoring, and increasingly as a part of farm environmental planning. The protocol was developed to help with national standardisation of stream habitat assessment and is designed to complement water quality and macroinvertebrate monitoring data. Aquatic life is dependent on various features of river habitat and riparian areas. Knowing what types of habitats are present, in what amounts and how these habitats might be changing over time is vital to understanding overall stream health. Using the RHA protocol to help track the impact of stream restoration efforts, such as fencing and planting along waterways, and over time can help measure improvements in stream health.

2.3.1. How to do a Rapid Habitat Assessment in a stream reach

A series of videos have been developed which aim to standardise the various visual habitat assessment procedures that form the RHA and can be found here: https://www.cawthron.org.nz/research/our-projects/rapid-habitat-assessment-protocol/

We strongly recommend watching both videos (20 minutes in all) before attempting to fill out the assessment sheet. In brief, once you have picked your site, take a GPS reading and / or hammer in a stake / waratah to mark the bottom of the reach. The length of the assessment reach should be 10 times the average wetted width of the stream, or 150 m long—whichever distance is shortest. Walk the reach several times noting the percentage / occurrence of the relevant habitat features listed and fill out the 10 assessment boxes on the left of the assessment sheet. Once completed, sum the scores to get a total 'habitat condition' score out of 100. Table 2 shows generic score bands to help interpret RHA scores.

Table 2.   Bands for interpreting Rapid Habitat Assessment condition scores

RHA Habitat condition class	RHA score
Excellent	76 – 100
Good	50 – 75
Fair	25 – 49
Poor	0 – 24

On the next page, Figure 4 is an example of a completed RHA assessment at a stream reach. Note how the component scores of the different habitat parameters have been circled and underlined to record the information that makes up the total score.

Habitat parameter	Condition category										SCORE
1. Deposited sediment	The percentage of the stream bed covered by fine sediment.										**9**
	0	(5)	10	15	20	30	40	50	60	≥ 75	
SCORE	10	9	8	7	6	5	4	3	2	1	
2. Invertebrate habitat diversity	The number of different substrate types such as boulders, cobbles, gravel, sand, wood, leaves, root mats, macrophytes, periphyton. Presence of interstitial space score higher.										**7**
	≥ 5	5	5	(4)	4	3	3	2	2	1	
SCORE	10	9	8	7	6	5	4	3	2	1	
3. Invertebrate habitat abundance	The percentage of substrate favourable for EPT colonisation, for example flowing water over gravel-cobbles clear of filamentous algae/macrophytes.										**9**
	95	(75)	70	60	50	40	30	25	15	5	
SCORE	10	9	8	7	6	5	4	3	2	1	
4. Fish cover diversity	The number of different substrate types such as woody debris, root mats, undercut banks, overhanging/encroaching vegetation, macrophytes, boulders, cobbles. Presence of substrates providing spatial complexity score higher.										**3**
	≥ 5	5	5	4	4	3	3	(2)	2	1	
SCORE	10	9	8	7	6	5	4	3	2	1	
5. Fish cover abundance	The percentage of fish cover available.										**9**
	95	(75)	60	50	40	30	20	10	5	0	
SCORE	10	9	8	7	6	5	4	3	2	1	
6. Hydraulic heterogeneity	The number of of hydraulic components such as pool, riffle, fast run, slow run, rapid, cascade/waterfall, turbulance, backwater. Presence of deep pools score higher.										**7**
	≥ 5	5	4	(4)	3	3	2	2	2	1	
SCORE	10	9	8	7	6	5	4	3	2	1	
7. Bank erosion	The percentage of the stream bank recently/actively eroding due to scouring at the water line, slumping of the bank or stock pugging.										**8**
Left bank	0	≤ 5	5	(15)	25	35	50	65	75	> 75	
Right bank	0	(≤ 5)	5	15	25	35	50	65	75	> 75	
SCORE	10	9	8	7	6	5	4	3	2	1	
8. Bank vegetation	The maturity, diversity and naturalness of bank vegetation.										**4**
Left bank AND Right bank	Mature native trees with diverse and intact understorey		Regenerating native or flaxes/sedges/tussock > dense exotic			Mature shrubs, sparse tree cover > young exotic, (long grass)			Heavily grazed or mown grass > bare/impervious ground.		
SCORE	10	9	8	7	6	5	4	3	2	1	
9. Riparian width	The width (m) of the riparian buffer constrained by vegetation, fence or other structure(s).										**3**
Left bank	≥ 30	15	10	7	(5)	4	3	2	1	0	
Right bank	≥ 30	15	10	7	5	4	3	2	1	(0)	
SCORE	10	9	8	7	6	5	4	3	2	1	
10. Riparian shade	The percentage of shading of the stream bed throughout the day due to vegetation, banks or other structure(s).										**1**
	≥ 90	80	70	60	50	40	25	15	10	(≤ 5)	
SCORE	10	9	8	7	6	5	4	3	2	1	
TOTAL	(Sum of parameters 1-10)										**60**

Figure 4.   A completed Rapid Habitat Assessment sheet for a stream reach. Circle the scores for each of the habitat parameters as you go to keep a record of the individual parameter scores, sum the parameter scores to get a habitat condition score out of 100. For Parameter 6 'hydraulic habitat heterogeneity' essentially means the number of different river-flow types—such as riffles, runs and pool habitat.

Regional council staff and some rural professionals are familiar with the RHA, so it might be possible to organise a training session with one of their staff. The RHA habitat assessment recording sheet is provided in Appendix 3.

3. PROCESSING AND STORING THE DATA

Nominate someone in the catchment group to be the custodian of the data. It's a good idea to keep a record of the data on more than one person's computer. The next page shows an example of an Excel spreadsheet showing how you could record your data (Figure 5).

When entering the RHA data we recommend that you enter all the individual parameter scores for the habitat features as well as the total habitat condition score. This will help your catchment group track changes in different habitat features in the stream over time.

Figure 5. Excel screen shot, showing how you could set up a spreadsheet to record your data. The first line shows example data for Site 1 of the 'Wai Burn' entered already.

4. CONNECT YOUR MONITORING FRAMEWORK WITH NEIGHBOURING CATCHMENTS

It could be helpful and fun to connect with other catchment groups to see if / how they are monitoring stream health. If your streams are connected, within a wider catchment, this will help develop an *overall picture of river health* in the wider catchment. With catchment groups regionwide, a connected collection of stream health data will help build a picture of how streams are responding to environmental improvements.

The MCI and RHA data will be compatible with council monitoring. Regional councils use both these methods of assessing stream health at their State of Environment monitoring sites. You can increase the extent of environmental data in your catchment by combining it with council data if you wish.

5. USEFUL FREE ONLINE TRAINING LINKS

NIWA SHMAK river monitoring online toolkit
https://niwa.co.nz/freshwater/management-tools/water-quality-tools/stream-health-monitoring-and-assessment-kit

NIWA SHMAK river monitoring macroinvertebrate identification field guide
https://www.nzwatercitizens.co.nz/sites/default/files/2019-12/Benthic%20Macroinvertebrates_Field%20ID%20Guide_Nov%202019.pdf.

River Habitat Assessment online instruction course (less than 10 minutes)
https://www.facebook.com/NZLAWA/videos/introduction-to-the-rapid-habitat-assessment-rha/625144961670052/.

River Habitat Assessment – written instructions for quantitative and semi-quantitative methods for stream habitat assessment
https://envirolink.govt.nz/assets/Envirolink/1519-NLRC174-National-Rapid-Habitat-Assessment-Protocol-for-Streams-and-Rivers.pdf

6. REFERENCES

Clapcott J 2015. National rapid habitat assessment protocol development for streams and rivers. Prepared for Northland Regional Council. Cawthron Report No. 2649. 29 p. plus appendices. https://envirolink.govt.nz/assets/Envirolink/1519-NLRC174-National-Rapid-Habitat-Assessment-Protocol-for-Streams-and-Rivers.pdf

MacNeil C, Holmes R 2021. A River health monitoring framework for southland catchment groups. Prepared for Thriving Southland. Cawthron Report No. 3681. 26 p. plus appendices. Cawthron Institute.

Stark JD, Boothroyd IKG, Harding JS, Maxted JR, Scarsbrook MR 2001. Protocols for sampling macroinvertebrates in wadeable streams. New Zealand Macroinvertebrate Working Group Report No. 1. Prepared for Ministry for the Environment. Sustainable Management Fund Project No. 5103. 57 p. https://docs.niwa.co.nz/library/public/ProtocolsManual.pdf.

7. APPENDICES

Appendix 1. An example of the types of data spreadsheets that you will get back from sending a set of river bug samples to a laboratory for processing. There are 5 sites (A-E) in a river with only few river bugs present.

On the left of the spreadsheet shown below are the different species that were found. The columns show the number of individual bugs at each site. Scores at the bottom of the table give the MCI and QMCI values for each site – **use these to compare with the water quality bands in Table 1 on page 9.**

Spreadsheet 1   River with 5 sites (A-E)

TAXON	MCI TAXON SCORE	SITE A	B	C	D	E
Ephemeroptera (mayflies)						
Deleatidium spp.	8	1	6	8	22	11
Coleoptera (beetles)						
Elmidae	6	-	-	-	-	1
Diptera (true flies)						
Aphrophila neozelandica	5	-	-	-	-	2
Lobodiamesa spp.	5	-	-	-	-	-
Orthocladiinae	2	3	2	4	18	12
Polypedilum sp.	3	-	-	-	-	-
Tanytarsus sp.	3	-	-	1	-	-
Trichoptera (caddisflies)						
Hydropsyche (*Aoteapsyche*) sp.	4	-	-	-	-	1
Costachorema sp.	7	-	-	1	-	-
Oxyethira albiceps	2	-	-	-	-	-
Oligochaeta (worms)	1	1		1		1
Number of taxa		3	2	5	2	6
Density (no./m²)		50	50	150	400	280
MCI		73	100	84	100	87
QMCI		3.00	6.50	5.53	5.30	4.75

Appendix 2.   **5 Easy steps** on how to use the Land Air Water Aotearoa (LAWA) website to get MCI monitoring results from a stream in Southland

STEP 1

To access the Southland region in LAWA, type 'LAWA' in Google and then type in 'Southland' or click on the Southland part of map. Clicking on the below link takes you directly to the page.

https://www.lawa.org.nz/explore-data/southland-region/
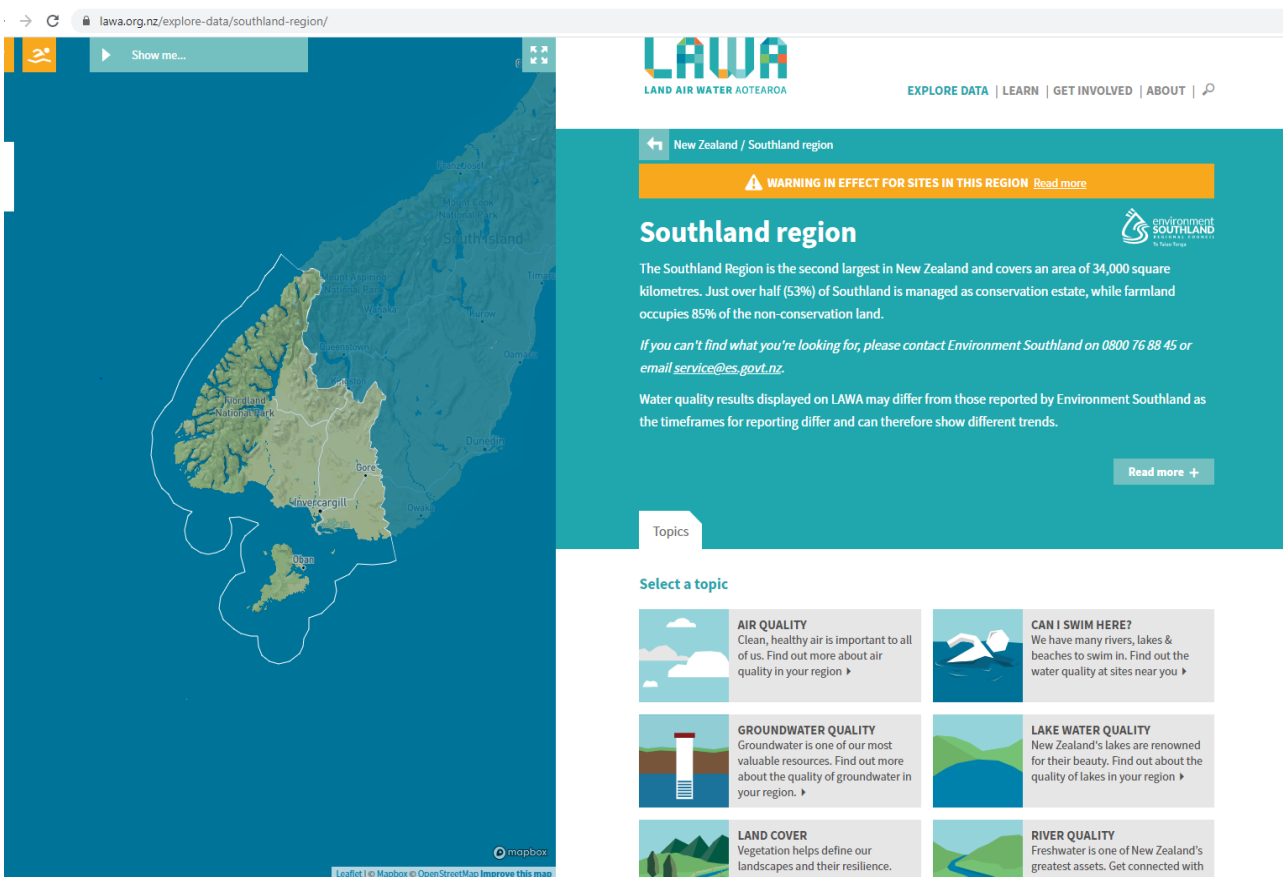
STEP 2

To access river quality in Southland region, click on the river water quality box on the page, or click on the link below.

https://www.lawa.org.nz/explore-data/southland-region/river-quality/

STEP 3

To access river quality in a specific river catchment—see this example of the Pourakino River catchment, click on the Pourakino catchment box or click on the weblink below.

https://www.lawa.org.nz/explore-data/southland-region/river-quality/pourakino-river/

STEP 4

To access river quality in a specific river site in the Pourakino catchment – example of the Cascade Stream at Pourakino Valley Road, click on the Cascade stream at Pourakino Valley Road box or click on the weblink below.

https://www.lawa.org.nz/explore-data/southland-region/river-quality/pourakino-river/cascade-stream-at-pourakino-valley-road/

Then simply click on the Ecology tab to take you to the MCI info.

STEP 5

To access details of past MCI levels in Cascade stream at Pourakino Valley Road monitoring site over a number of years, simply click on the MCI 'state' B circle below or click directly on the weblink below. This will show you a record of past MCI scores at this site.

https://www.lawa.org.nz/explore-data/southland-region/river-quality/pourakino-river/cascade-stream-at-pourakino-valley-road. See the MCI results below.

Appendix 3.   Rapid Habitat Assessment (RHA) recording field sheet

Habitat parameter	Condition category										SCORE
1. Deposited sediment	The percentage of the stream bed covered by fine sediment.										
	0	5	10	15	20	30	40	50	60	≥ 75	
SCORE	10	9	8	7	6	5	4	3	2	1	
2. Invertebrate habitat diversity	The number of different substrate types such as boulders, cobbles, gravel, sand, wood, leaves, root mats, macrophytes, periphyton. Presence of interstitial space score higher.										
	≥ 5	5	5	4	4	3	3	2	2	1	
SCORE	10	9	8	7	6	5	4	3	2	1	
3. Invertebrate habitat abundance	The percentage of substrate favourable for EPT colonisation, for example flowing water over gravel-cobbles clear of filamentous algae/macrophytes.										
	95	75	70	60	50	40	30	25	15	5	
SCORE	10	9	8	7	6	5	4	3	2	1	
4. Fish cover diversity	The number of different substrate types such as woody debris, root mats, undercut banks, overhanging/encroaching vegetation, macrophytes, boulders, cobbles. Presence of substrates providing spatial complexity score higher.										
	≥ 5	5	5	4	4	3	3	2	2	1	
SCORE	10	9	8	7	6	5	4	3	2	1	
5. Fish cover abundance	The percentage of fish cover available.										
	95	75	60	50	40	30	20	10	5	0	
SCORE	10	9	8	7	6	5	4	3	2	1	
6. Hydraulic heterogeneity	The number of of hydraulic components such as pool, riffle, fast run, slow run, rapid, cascade/waterfall, turbulance, backwater. Presence of deep pools score higher.										
	≥ 5	5	4	4	3	3	2	2	2	1	
SCORE	10	9	8	7	6	5	4	3	2	1	
7. Bank erosion	The percentage of the stream bank recently/actively eroding due to scouring at the water line, slumping of the bank or stock pugging.										
Left bank	0	≤ 5	5	15	25	35	50	65	75	> 75	
Right bank	0	≤ 5	5	15	25	35	50	65	75	> 75	
SCORE	10	9	8	7	6	5	4	3	2	1	
8. Bank vegetation	The maturity, diversity and naturalness of bank vegetation.										
Left bank AND Right bank	Mature native trees with diverse and intact understorey		Regenerating native or flaxes/sedges/tussock > dense exotic			Mature shrubs, sparse tree cover > young exotic, long grass			Heavily grazed or mown grass > bare/impervious ground.		
SCORE	10	9	8	7	6	5	4	3	2	1	
9. Riparian width	The width (m) of the riparian buffer constrained by vegetation, fence or other structure(s).										
Left bank	≥ 30	15	10	7	5	4	3	2	1	0	
Right bank	≥ 30	15	10	7	5	4	3	2	1	0	
SCORE	10	9	8	7	6	5	4	3	2	1	
10. Riparian shade	The percentage of shading of the stream bed throughout the day due to vegetation, banks or other structure(s).										
	≥ 90	80	70	60	50	40	25	15	10	≤ 5	
SCORE	10	9	8	7	6	5	4	3	2	1	
TOTAL	(Sum of parameters 1-10)										