Healthy catchments for healthy communities

Catchments are essential for survival, playing important environmental, economic, social and cultural roles. They supply clean water for drinking, domestic use, agriculture and industry, while also supporting recreational opportunities and wildlife that depend on catchments for food, shelter and breeding habitat. They often also include important cultural sites.

A catchment is an area of land where a river collects water from rain, ice or snow. As the water flows over the landscape, it finds its way into streams, creeks, pools, soil and wetlands, eventually feeding the river. Some of this water stays underground and continues to feed the river in times of low rainfall.

The Eastern Mount Lofty Ranges (EMLR) is located east of Adelaide, with its catchments including wetlands and critically endangered swamps.

Catchment health in the EMLR is in poor condition and continuing to decline, with some watercourses going without flowing water for longer periods than ever before.

Flows for the Future is working towards counteracting this decline by reinstating critical environmental flows.

What does a healthy catchment look like?

The development of land and water resources for agriculture, housing, tourism and other purposes has resulted in modified landscapes that lack some of the fundamental elements they require to properly function as ecosystems.

A healthy catchment needs:

- adequate healthy remnant vegetation linked by corridors, with few weeds
- a diversity of species and structural elements (including rocks and leaf litter) for resident species to use as habitat to feed, breed and disperse in
- trees of all ages in farm paddocks (preferably fenced from stock), including dead trees and hollow logs to provide habitat and future-proof against mature tree loss
- healthy soil with diverse biota to promote carbon formation and storage, enable water infiltration/retention and provide a foundation for healthy vegetation, including native species, pasture and crops
- vegetation-lined watercourses with minimal erosion, good water quality, permanent pools and appropriate flow regimes.

As it isn't feasible to measure and assess every change in a catchment over time, **flow, macroinvertebrates and fish are used as indicators to monitor catchment health** and identify links to other potential changes in the catchment.

Organisations such as the Nature Conservation Society, Department for Environment and Water, Landscapes South Australia and the Environment Protection Authority have used vegetation, soil and aquatic indicators to assess catchment health in the EMLR for many years.

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Australian Government

SOUTH AUSTRALIA

Government of South Australia
Department for Environment and Water

How we know EMLR watercourse health is declining

Flow

Water flow is a significant driver of ecological condition but the construction of dams has resulted in disruptions to flow regimes (the timing and volume of water flows) throughout our catchments and, in some cases, has created a total barrier to watercourse flow.

Long-term declining rainfall and changes in land use and water consumption, including direct pumping from watercourses, have also contributed to reductions in flow.

In general, watercourses are experiencing the following changes:

- shorter flow seasons that start later and end sooner
- zero flow periods occurring more often and lasting longer
- smaller and less frequent low flows
- freshes, or small pulse flows, occur less often outside of the high flow season and are shorter in duration.

The specific impact of dams and watercourse extractions is evident when current flow data from EMLR flow gauging stations is compared with the 'No dams or watercourse extractions' scenario flow model (often termed 'natural' flow)[1,2,3].

As part of research to inform the development of the two Mount Lofty Ranges water allocation plans, approximately 50 flow metrics (measurable indicators flow regime indicators, including magnitude, frequency and duration) including were tested across 135 sites. Of these sites, approximately one third failed the metrics relating to 'zero flow' and 'low flows', with effects greatest during the low flow season[4]. One specific example was the Hartley gauging station on the Bremer River that showed the 'current' annual average number of zero flow days for the period 1974-2012 as being 67.5 compared with 9.7 if there were no dams or extractions, and the percentage of years with zero flows as being 84.6% compared with 28.2%[2].

Flow data in Figures 1 and 2 shows a significant declining trend in flow days per year in nearly all EMLR catchments. These changes have been catastrophic in the Marne Saunders, and less extreme in more southern catchments[5].

Number of flowing days recorded at a Marne River and Bremer River site

Figure 1. Marne River Gorge

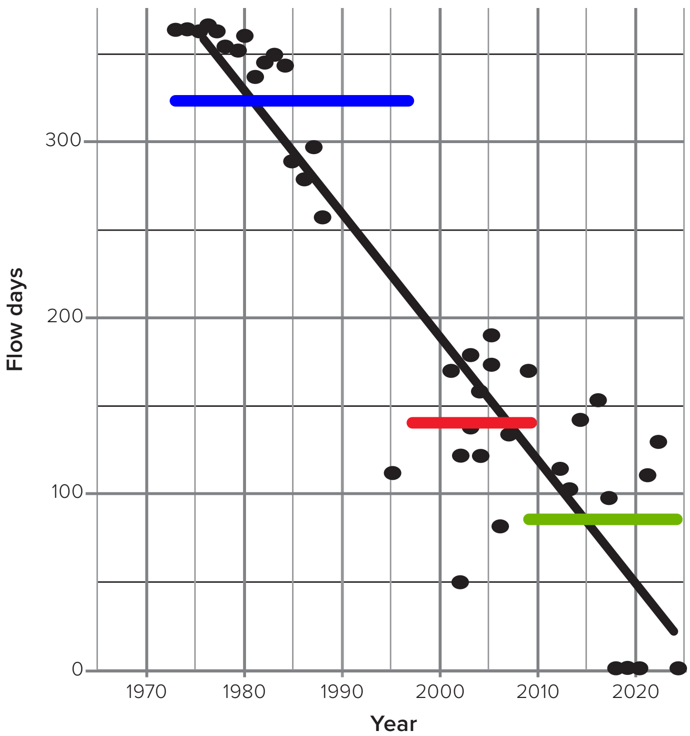
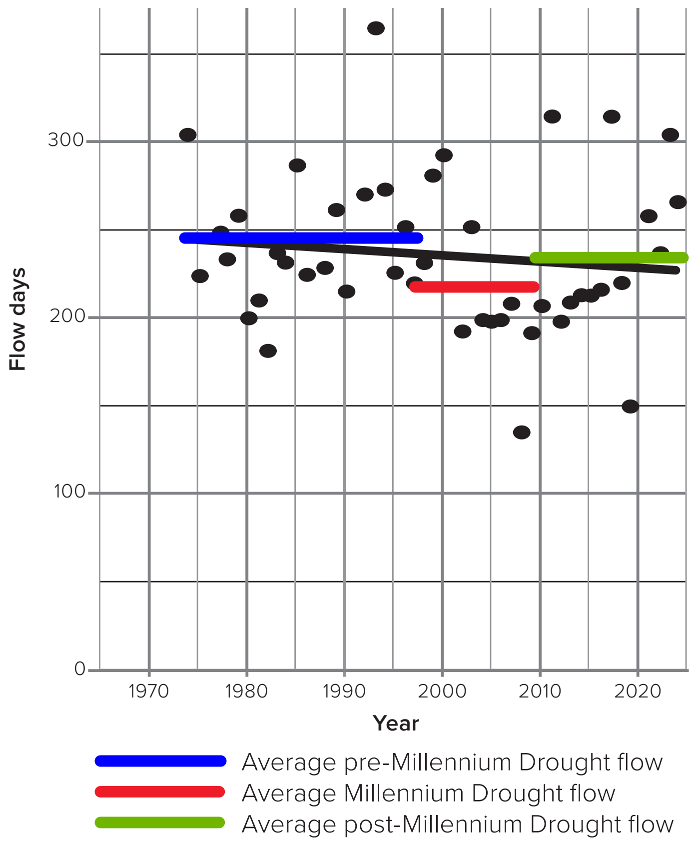


Figure 2. Bremer River Hartley



How we know EMLR watercourse health is declining

Macroinvertebrates

Aquatic macroinvertebrates, also known as waterbugs, including shrimp, snails, aquatic beetles, dragonfly larvae and water boatmen, are good indicators of watercourse health, as water quality and flow have a major effect on their community composition. This is due to some species having particular habitat preferences, such as flowing water instead of still water[6].

An example comes from macroinvertebrate sampling undertaken in the Marne and Saunders catchments in 2023. Sixty-eight taxa were identified from nine sites, with backswimmers *(Anisops spp.)*, which are tolerant of a range of water conditions, being the most common and collected at all nine sites. Species more sensitive to changes in water quality were less present, with the caddisfly *(Triplectides ciuskus)* collected at two sites and the mayfly *(Tasmanocoenis tillyardi)* collected at only one[7].

The EMLR supports a diverse macroinvertebrate community, with more than 400 species recorded by the SA Environment Protection Authority in the past 25 years. Shifts in the types and numbers of macroinvertebrates over time can give us information about changes in the condition of the system. Data collected from the EMLR region between 2008 and 2018 show that the number of macroinvertebrate species (taxa 'richness' or 'diversity') and flow-dependent groups declined significantly as the percentage of zero flow days increased (Figure 3)[2].

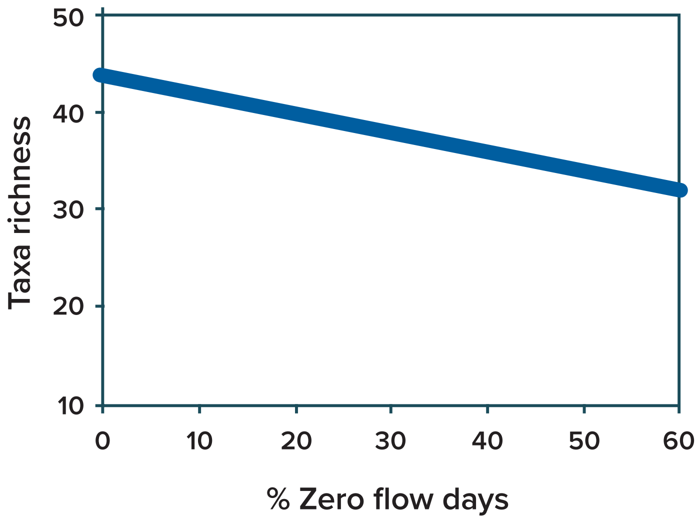


Figure 3: The significant relationship between macroinvertebrate taxa richness and flow intermittency over 10 years (based on generalised linear model and expressed as a percentage of zero flow days).

Comprehensive presence/absence macroinvertebrate data are collected from numerous EMLR sites for multiple purposes, one being the provision of data for the assessment of condition targets set under the Basin Plan. In the assessment using data from 2016 to 2022, the majority of surveyed sites did not achieve the target 'good' or 'fair' condition, as can be seen in Figure 4, and trends were stable or declining at most sites[5,8].

These results raise concerns for macroinvertebrate community resilience in the face of future droughts, as an increase in annual flowing days during the assessment period (which included the extremely dry years of 2018 and 2019, followed by a very wet 2021) should have tended toward an increase in macroinvertebrate diversity.

More data collected over a longer time period, including the possible addition of macroinvertebrate abundance data, may provide more clarity.

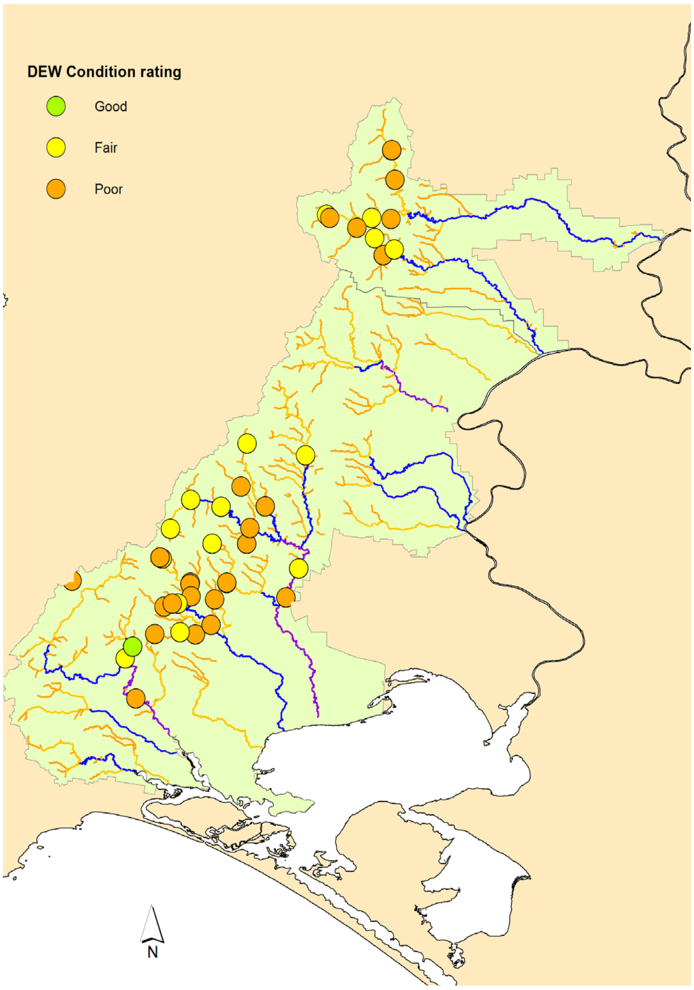


Figure 4: Macroinvertebrate condition ratings from presence/absence data collected from multiple locations in the EMLR and Marne Saunders between 2016 and 2022.

How we know EMLR watercourse health is declining

Fish

Fish are important indicators of watercourse health in the EMLR as:

- they are the aquatic organism that is most commonly associated with rivers
- they are often the apex predator within the system
- their abundance, diversity, recruitment and survivorship are highly influenced by flow regime.

Lack of flow can directly impact native fish movement and dispersal, it can also indirectly affect native fish populations by providing conditions favoured by introduced species, decreasing water quality and killing riparian vegetation.

Case studies illustrating the impact of flow changes on EMLR fish species include:

- A study of obscure galaxias (*Galaxias oliros*) which observed that abundance declines significantly with an increase in the number of zero flow days across the low flow season[9].
- Long-term observations of river blackfish (*Gadopsis marmoratus*), a species historically reported as 'very common', show the species persisting only as small, restricted populations in four catchments. The species is now considered Endangered in South Australia[10].

Many EMLR fish species of regional, state and/or national significance are now threatened. Of the 29 native fish species present in the region, three species are regionally extinct (Murray cod, silver perch and chanda perch) and 11 species are considered threatened, including three Critically Endangered[11].

Long-term fish monitoring in the EMLR over the past 10 years has enabled fish community condition and fish recruitment assessments to be undertaken. Sampling methods for this monitoring are fyke netting, electrofishing, bait trapping, day observations and dip netting. Ecologists expected fish community condition to improve following the end of the Millennium Drought in 2010, but while there was initial improvement, condition was still deemed 'poor' in almost a quarter of the assessed catchments in 2017. After a short period of stability, a further decline was experienced in 2023, with six of the nine catchments considered 'poor'. The three remaining catchments, Angas, Finniss and Reedy Creek, achieved a 'fair' rating[12].

The 2014-2023 portion of the results is presented in Table 1, incorporating 556 site visits across 9 catchments. In the previous 2019 assessment, overall fish community condition scored fair (3.0) and remained fair (3.5) in 2022 but then returned to poor (2.0) in 2023.

No	Catchment	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014
1	Angas	3.3	3.5	3.4	3.5	2.9	3.3	2.5	3.9	3.4	5.1
2	Bremer	2.0	1.0	3.0	3.0	2.0	3.0	2.3	1.0	3.0	3.0
3	Currency	1.5	1.0	4.3	4.8	3.3	3.8	3.5	2.5	5.5	4.0
4	Finnis	3.5	4.9	4.5	4.4	3.0	5.0	4.8	5.5	5.3	5.0
5	Marne	2.5	1.0	2.0	1.0	1.0	2.8	3.8	0.0	1.5	0.8
6	Reedy	4.3	7.5	2.0	3.5	4.8	3.3	3.0	9.0	3.0	1.0
7	Salt, Preamimma & Rocky Gully	0.5	4.0	5.0	10.0	3.5	2.0	2.0	3.0	3.0	1.0
8	Saunders	2.0	0.0	1.0	0.0	0.0	0.0	4.0	0.0	5.0	2.0
9	Tookayerta	2.0	6.0	4.0	5.0	3.3	4.5	2.0	3.3	3.0	2.3
	Overall	2.0	3.5	3.4	3.5	3.0	3.3	3.0	3.0	3.0	2.3

Table 1. Fish community condition scores for the 9 catchments and the EMLR water resource plan area. Cells coloured red represent catchments classed as in 'poor' condition, orange represents 'fair' condition and green represents 'good' condition.

How we know EMLR watercourse health is declining

Fish *continued...*

Fish recruitment was assessed qualitatively by considering the ongoing presence of galaxias species and southern pygmy perch across the EMLR. This assessment considered the previous distribution of these species, current population numbers and current population demographics.

The assessment concluded that the three species are self-sustaining, despite declines in fish community condition over the past decade. However, the declining trends suggest a likely loss of recruitment in the future, beginning with the expected loss of key species in the Marne River catchment.

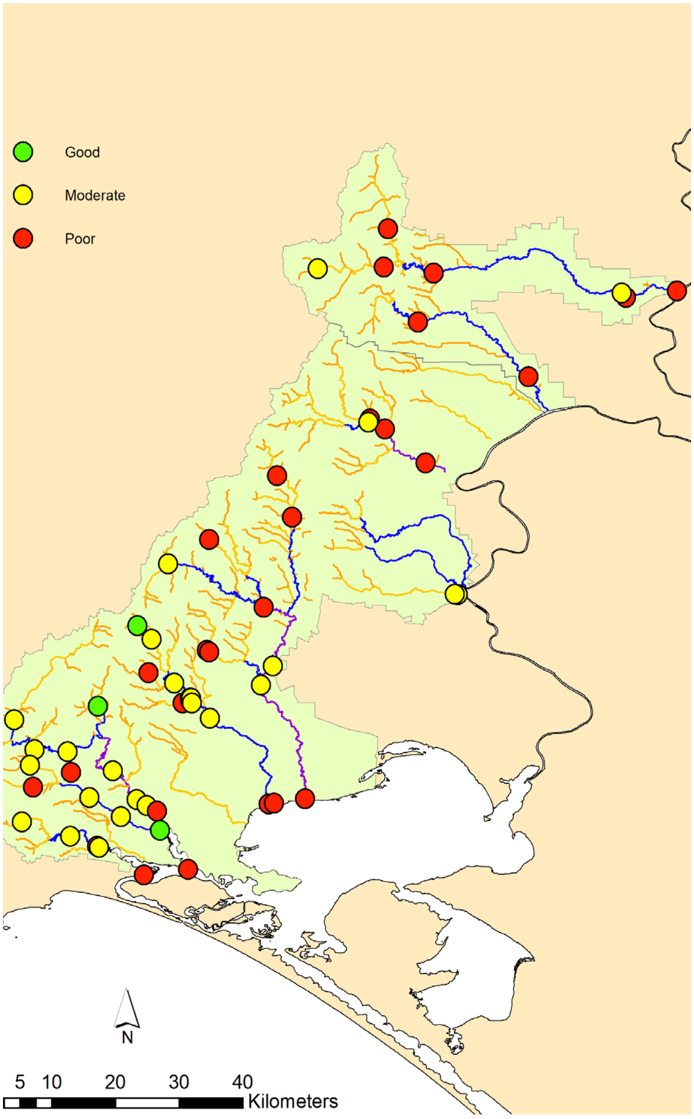


Figure 5. Fish condition ratings based on the Aquasave fish condition model for the 2023 EMLR water resource plan area.

What is being done to restore catchment health?

Many agencies, community groups and individuals are taking action to restore catchment functionality, with the understanding that these landscapes can't necessarily be completely returned to their former state.

Flows for the Future is working with landholders to restore catchment health by reinstating more natural flow regimes to watercourses on private property. To achieve this, the program is installing infrastructure that will allow low flows past or to be diverted from dams. This brings forward the timing of commencement to flow and increases the volumes of water flowing to pools early in the flow season.

Early evaluation of monitoring data from the program suggests that the installation of environmental flow devices is positively influencing pool persistence and riparian plant cover. Other projects have focused on revegetation, protection of mature trees, riparian vegetation management, reinstatement of swamps, biological inventories and soil health.

What you can do to help

- Get in touch with Flows for the Future and find out if an environmental flow device on your dam could help maintain low flows in your catchment.
- Fence-off and manage riparian vegetation, including invasive weed species. Your local landscape board can advise and assist.
- Revegetate your property with appropriate native species.
- Join a local Landcare or regenerative agriculture group.
- Volunteer for the Waterwatch program or local Waterbug Bioblitz events.

More information

For Flows for the Future news, scan the QR code or visit www.environment.sa.gov.au/F4F

Contact Us

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