

Aquatic ecosystem condition reports

2010 panel assessment of creeks and rivers in the Eyre Peninsula NRM region

Issued November 2011

EPA 963/11: This information sheet describes the outcome of the panel assessment of creeks and rivers in the Eyre Peninsula Natural Resources Management (NRM) region during 2010.

Introduction

The Environment Protection Authority (EPA) coordinates a monitoring, evaluation and reporting (MER) program on the aquatic ecosystem condition of South Australian creeks and rivers. This MER program is designed to meet several objectives:

- Providing a statewide monitoring framework for creeks and rivers that revolves through the NRM Regions with sufficient frequency to allow for State of the Environment Reporting purposes.
- Describing aquatic ecosystem condition for broad general public understanding.
- Identifying the key pressures and management responses to those pressures.
- Providing a useful reporting format that can support environmental decision making within government, community and industry.

This information sheet provides a summary of the scientific work used in assessing monitoring data from creeks and rivers. Aquatic ecosystem science is not always rigid and precise; it is often open to different interpretations in several respects. Therefore, the EPA has decided that the best way to assess the condition of streams is through an expert panel deliberation that uses a consistent descriptive modelling approach. The panel members comprised an environmental consultant, a biologist from the biomonitoring team at the Australian Water Quality Centre (AWQC), and two biologists from the EPA (the authors of this assessment). All have at least 10 years experience in monitoring and assessing a range of streams across South Australia.

The panel members were:

- Peter Goonan, EPA (primary author)
- Tracy Corbin, EPA
- Sonia Barter, AWQC
- Chris Madden, Freshwater Macroinvertebrates

This information sheet is a technical document that contains relatively sophisticated concepts and content. It summarises the scientific assessment of data collected from creeks and rivers in the Eyre Peninsula NRM region during 2010.

The assessment

The expert panel assessed 30 sites sampled in the Eyre Peninsula NRM Region during 2010. Members individually rated each site using a descriptive model for interpreting change in aquatic ecosystems in relation to increasing levels of disturbance (Davies and Jackson 2006). The assumption was that biological (ecological) condition deteriorates as the degree of human disturbance in the catchment increases, and conversely, the best condition occurs where there is little to no human disturbance of the environment (Figure 1).

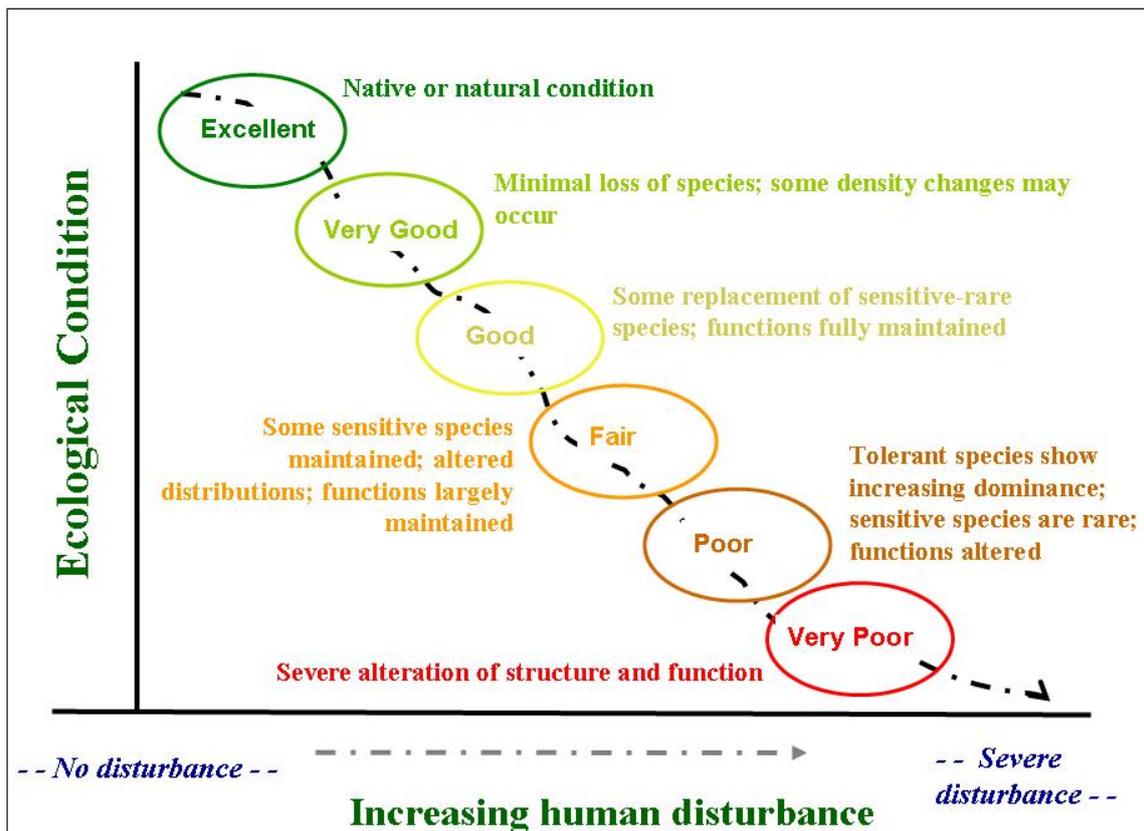


Figure 1 Human disturbance gradient showing the six different ecological condition grades or ratings ranging from excellent (best) to very poor (worst) with a brief definition of each condition

The process used to grade or rate sites involved the following steps. Firstly, a conceptual model describing the ecological responses to a general disturbance gradient in the Eyre Peninsula was developed, reviewed and updated by the panel (Table 1). Secondly, a species lists was compiled for the region based on data collected in 2010, describing the expected biotic assemblage for each of six possible ratings (Table 2). Thirdly, each site was given a rating based on the macroinvertebrate assemblages, vegetation assemblages and extent, water chemistry and sediment condition recorded during autumn and spring sampling periods. Lastly, the individual ratings derived by the panel members were combined to produce an overall, or final, rating for each site (Table 3).

The final reported ratings were derived by initially determining the mode rating (most common rating from the panel ratings for each site), and in cases where two ratings were still possible, using a precautionary philosophy to select the poorer rating.

The ratings in the model range from Excellent with no human disturbances to Very Poor where major disturbances have degraded the stream to such a level that only the most tolerant species are able to survive. Some of the better condition classes were, however, not considered to be present for the Eyre Peninsula NRM region in 2010 due to the extent of land

clearance and lack of undisturbed, well vegetated catchments. For example, no stream in the region has remnant native vegetation covering more than 30% of the catchment and only some of the smaller tributaries and stream segments within inaccessible rocky hills and gullies retain larger areas of native plant cover. Most streams occur in largely cleared catchments used for agriculture and the main areas of remnant vegetation occur on hilltops, roadsides and creeklines. Consequently, the panel considered that sites from the Eyre Peninsula included sites that represented a Fair to Very Poor condition.

Given the level of vegetation clearance, high salinity, nutrient enrichment and lack of permanently flowing streams on Eyre Peninsula, the panel considered that the Excellent and Very Good condition classes no longer occur in the region and that a Good condition was not evident in 2010, probably due to the effects of the prolonged drought and limited extent of flowing habitats. However, since the ratings relate to individual sites assessed rather than the catchment as a whole, it is still possible that future work in some of the vegetated gullies of the upper Tod River catchment or Yeldulknie Conservation Park, for example, may identify sites and stream reaches in better condition than those assessed in 2010.

The results for the 30 sites assessed showed that 11 sites were in a Fair condition, 15 were Poor and four were Very Poor (Table 3). No sites were rated as Excellent or Very Good. In the majority of cases, the panel members assigned the same ratings (nine of 30 sites) or were within one rating class of each other (20 of 30 sites). Only one site, the Driver River near Verran, was assigned a range of different ratings by the panel that included one Fair, two Poor and one Very Poor assessment. In this situation, the Poor result was selected as the final rating for this site using the approach to scoring that was agreed to by the panel.

Table 1 Conceptual model of ecological responses to a disturbance gradient in the Eyre Peninsula NRM region

Rating	Excellent	Very Good	Good	Fair	Poor	Very Poor
Stressor description	As naturally occurs: no longer present on Eyre Peninsula due to the extensive level of vegetation clearance and landscape modification in the region.	Least impacted: no longer likely to be present on Eyre Peninsula due to the extensive level of vegetation clearance and landscape modification in the region.	Best condition sites showing initial signs of nutrient enrichment: only likely to occur in parts of the upper Tod River catchment and other well-vegetated stream reaches on some occasions.	Moderate nutrient enrichment: likely to commonly occur in the region due to the extent of vegetation clearance and associated agricultural development.	Gross nutrient enrichment: likely to commonly occur in the region due to the extent of vegetation clearance and associated agricultural development. Ephemeral and saline streams in the region are likely to show extensive enrichment effects due to the lack of dilution flows.	Severely altered: likely to occur in the region in highly degraded salinised, ephemeral streams in extensively cleared catchments. Sites assigned to this rating will be affected by a toxicant or other disturbance that significantly limits the diversity and abundance of aquatic life.
Biological assemblages	Native assemblages; usually with many rare or sensitive species present; typically high EPT ¹ richness; no symptoms of stress and no introduced aquatic species present. Note that ephemeral habitats may have a rich fauna of colonising insects (eg beetles, waterbugs and dipterans) but usually abundances of all species are low.	Best of what is left assemblages; high richness; intolerants and specialist taxa dominate abundances; may include some introduced species present in low abundances.	Typical assemblages for least impacted streams; good richness; generalist assemblage that includes at least some rare and sensitive species; emerging symptoms of stress in relation to nutrients and fine sediments; at least some remnant native vegetation present.	Impaired assemblages; generalists and tolerant taxa dominate numbers which usually includes some very abundant taxa; sensitive and rare taxa, if present, in very low numbers; usual absence of some taxa expected for the available habitats present; at least some trees present in the local catchment and banks.	Degraded assemblages; tolerants and generalists dominate but numbers usually reduced although 1-2 generalist taxa may be present in high abundances; only 1-2 rare or sensitive species present in low abundances or absent; often few or 1-2 scattered trees in the local catchment and banks.	Severely degraded assemblages with few taxa and generally low abundances; may have large numbers of one tolerant taxon such as oligochaetes, mosquito larvae, amphipods (<i>Austrochiltonia</i>) or chironomids (eg <i>Chironomus</i> , <i>Procladius</i> and <i>Tanytarsus</i>); can include organic feeders from highly polluted waters such as syrphid larvae; vegetation

Rating	Excellent	Very Good	Good	Fair	Poor	Very Poor
						often completely comprised introduced species with little to no remnant native vegetation.
Water chemistry conditions	As naturally occurs; no human contaminants present and pest species not impacting on water quality (eg nutrients, hormones).	Best condition sites with associated water quality; high proportion natural features means well oxygenated and low in nutrients and turbidity. May include freshwater and naturally saline streams.	Largely unremarkable water quality with at least some nutrients present at higher than expected concentrations, coupled with at least one plant indicator showing emerging signs of enrichment effects (eg either chlorophyll <i>a</i> >10 ug/L, macrophyte cover >10% cover and/or filamentous algae >35% cover) but site not overwhelmed.	Fair water quality with generally saturated dissolved oxygen (when sampled during the day), at least one nutrient present at high concentrations and high algal and higher plant growths (eg either chlorophyll <i>a</i> >10 ug/L, macrophyte cover >10% cover and/or filamentous algae >35% cover) evident on occasions.	Poor water quality with generally saturated dissolved oxygen (when sampled during the day), nutrients present at high concentrations and high plant productivity evident at the site (eg usually chlorophyll <i>a</i> >10 ug/L, macrophyte cover >10% cover and filamentous algae >35% cover most of the time).	Very poor water quality with at least one parameter at a toxicant concentration that limits aquatic diversity; often very low dissolved oxygen and may be saline and enriched in nutrients but algal and plant growth limited.
Physical habitat and flow patterns	Natural habitat and flow patterns; no farm dams present; range sediment types and not always anaerobic.	Near natural habitat and flow regimes; mostly well vegetated catchments with few dams present; range sediment types and not always anaerobic.	Good habitat structure and flow patterns; extent of dam development has not caused an obvious loss of riffle habitats; range sediment types and not always anaerobic.	Fair habitat structure and flow patterns; many dams may be present in the catchment; anaerobic fine sediments usually present except when large algal growths present.	Poor habitat structure and flow patterns; may have many dams present in the catchment; anaerobic fine sediments usually present except when large algal growths present.	Severe modifications to physical habitat and flow patterns; little to no remnant native vegetation remaining; cleared agricultural or urban sites; anaerobic fine sediments often dominate.

Rating	Excellent	Very Good	Good	Fair	Poor	Very Poor
Human activities and sources in the catchment	No obvious human disturbances but may include roads and sparse residential housing that is seweraged; no point sources and diffuse pollution not detectable by the extent of vegetation surrounding the waterway.	No significant human disturbances but may include some seweraged housing and roads; no point source discharges and diffuse pollution not obviously affecting the aquatic ecosystem due to the extent of vegetation surrounding the waterway.	Effects of human disturbance becoming obvious; point sources may be present but do not dominate flows; good riparian zones help to mitigate diffuse pollution effects.	Point and diffuse source enrichment effects evident; riparian zone not effective at mitigating nutrients and fine sediment entering waterway.	Obvious point and diffuse source enrichment effects present; unbuffered channel; major changes to catchment land use with little remnant vegetation remaining and agriculture and/or urban uses dominate.	Severe point and/or diffuse source effects that may include toxicant responses; effects dominate water quality and biological response with little signs of the original waterway evident; unbuffered channel that has undergone extreme modifications in an agricultural or urban setting.

¹ EPT = Ephemeroptera + Plecoptera + Trichoptera which refers to a commonly used biological index that counts the number of species and/or individuals of the mayflies, stoneflies and caddisflies collected, with these insects expected to represent the more sensitive macroinvertebrate species in a sample.

Table 2 List of biota expected to occur for each rating in the Eyre Peninsula NRM Region. Note, excellent and very good conditions no longer occur

	Good	Fair	Poor	Very Poor
Attribute 1*: Rare and/or regionally endemic (only found in highly saline systems)	Trichoptera <i>Symphitoneuria wheeleri</i> (only found in highly saline systems); Fish <i>Galaxias brevipinnis</i>	Trichoptera <i>Symphitoneuria wheeleri</i> (only found in highly saline systems); Fish <i>Galaxias brevipinnis</i>	None present	None present
Attribute 2: Sensitive, rare or vulnerable specialist taxa with narrow environmental requirements	Trichoptera <i>Cheumatopsyche</i>	Trichoptera <i>Cheumatopsyche</i>	None present	None present
Attribute 3: Sensitive, ubiquitous taxa	None present	None present	None present	None present
Attribute 4: Opportunistic or generalist taxa	Mollusca <i>Angrobia</i> , <i>Glyptophysa</i> ; Trichoptera <i>Notalina</i> , <i>Oecetis</i> , <i>Triplectides</i> ; Odonata Coenagrionidae (<i>Xanthagrion</i> , <i>Austroagrion</i>), <i>Austrolestes</i> , <i>Orthetrum</i> , <i>Hemicordulia</i> , Aeschnidae; Diptera <i>Cladotanytarsus</i> ; Coleoptera Hydrophilidae (<i>Paracymus</i> , <i>Berosus</i> , <i>Enochrus</i>), <i>Ochthebius</i> , Dytiscidae (<i>Eretes</i> , <i>Rhantus</i> , <i>Platynectes</i>), Hydrophilidae (<i>Limnoxenus</i>); Fish <i>Galaxias maculatus</i>	Mollusca <i>Angrobia</i> , <i>Glyptophysa</i> ; Trichoptera <i>Notalina</i> , <i>Oecetis</i> , <i>Triplectides</i> ; Odonata Coenagrionidae (<i>Xanthagrion</i> , <i>Austroagrion</i>), <i>Austrolestes</i> , <i>Orthetrum</i> , <i>Hemicordulia</i> , Aeschnidae; Diptera Chironomidae <i>Cladotanytarsus</i> ; Coleoptera Hydrophilidae (<i>Paracymus</i> , <i>Berosus</i> , <i>Enochrus</i>), <i>Ochthebius</i> , Dytiscidae [<i>Eretes</i> , <i>Rhantus</i> , <i>Platynectes</i> , <i>Necterosoma penicillatus</i> (only in saline systems)], Hydrophilidae (<i>Laccobius</i> , <i>Limnoxenus</i>); Fish <i>Galaxias maculatus</i>	Mollusca <i>Angrobia</i> , <i>Glyptophysa</i> ; Trichoptera <i>Notalina</i> , <i>Oecetis</i> , <i>Triplectides</i> ; Odonata <i>Austrolestes</i> , <i>Hemicordulia</i> , Aeschnidae; Diptera Chironomidae (<i>Cladotanytarsus</i> , <i>Tanytarsus</i>); Coleoptera Hydrophilidae (<i>Paracymus</i> , <i>Berosus</i> , <i>Enochrus</i>), <i>Ochthebius</i> , Dytiscidae [<i>Eretes</i> , <i>Rhantus</i> , <i>Necterosoma penicillatus</i> (only in saline systems)], Hydrophilidae (<i>Laccobius</i>); Fish <i>Galaxias maculatus</i>	Diptera Chironomidae (<i>Tanytarsus</i>); Coleoptera <i>Necterosoma penicillatus</i> , <i>Laccobius</i>

	Good	Fair	Poor	Very Poor
Attribute 5: Tolerant taxa	Oligochaeta; Amphipoda <i>Austrochiltonia</i> ; Diptera <i>Simulium</i> , Culicidae, Chironomidae (<i>Cricotopus</i>), Stratiomyidae; Odonata <i>Ischnura</i>	Turbellaria; Oligochaeta; Mollusca Hydrobiidae, <i>Coxiella</i> ; Amphipoda <i>Austrochiltonia</i> ; Collembola; Diptera <i>Simulium</i> , Culicidae, Stratiomyidae, Chironomidae (<i>Cricotopus</i> , <i>Procladius</i> , <i>Dicrotendipes</i> , <i>Paralimnophyes</i>); Hemiptera <i>Micronecta</i> , <i>Sigara</i> , <i>Agraptocorixa</i> , <i>Anisops</i> , <i>Enithares</i> ; Odonata <i>Ischnura</i>	Turbellaria; Oligochaeta; Mollusca <i>Coxiella</i> , Hydrobiidae Amphipoda <i>Austrochiltonia</i> ; Collembola; Diptera <i>Simulium</i> , Culicidae, Ceratopogonidae, Chironomidae (<i>Chironomus</i> , <i>Cricotopus</i> , <i>Procladius</i> , <i>Dicrotendipes</i> , <i>Paralimnophyes</i>), Ephydriidae, Stratiomyidae; Hemiptera <i>Micronecta</i> , <i>Sigara</i> , <i>Agraptocorixa</i> , <i>Anisops</i> , <i>Enithares</i> ; Odonata <i>Ischnura</i>	Oligochaeta (often in large numbers); Amphipoda <i>Austrochiltonia</i> ; Collembola ; Diptera Stratiomyidae, Culicidae, Ceratopogonidae, Chironomidae (<i>Procladius</i> , <i>Chironomus</i> , <i>Tanytarsus</i> <i>barbitarsus</i>), Stratiomyidae; Hemiptera <i>Micronecta</i> , <i>Anisops</i>
Attribute 6: Non-endemic or introduced taxa	Mollusca <i>Potamopyrgus</i> in low nos.	Mollusca <i>Potamopyrgus</i> ; Fish <i>Gambusia</i>	Mollusca <i>Potamopyrgus</i> ; Fish <i>Gambusia</i>	Fish <i>Gambusia</i> (rarely present due to poor water quality)

Table 3 Ratings given by each panel member and final overall rating for each of the 30 sites monitored in the Eyre Peninsula NRM region during 2010

Site name	Very Good	Good	Fair	Poor	Very Poor	Final rating
Meadows Creek, near North Shields		1	3			Fair
Mine Creek, near Tumby Bay			4			Fair
Pillaworta Creek, near Koppio			4			Fair
Pokalalie Creek, near Mangalo			3	1		Fair
Poonana Creek, near Cleve			4			Fair
Tod River, Koppio			4			Fair
Tod River, near Yallunda Flat			4			Fair
Tod River, Whites Flat			3	1		Fair
Unnamed Creek, near Charlton Springs		1	3			Fair
Unnamed Creek, near Little Swamp			3	1		Fair
Uranno Creek, near Chinmina Hill			3	1		Fair
Coonta Creek, near Tumby Bay				4		Poor
Driver River, near Verran			1	2	1	Poor
Glengyle Creek, near Wangary				4		Poor
Merintha Creek, near Wangary			2	2		Poor
Millalee Creek, near Peake Bay			1	3		Poor
Minniribbie Creek, near Wangary				3	1	Poor
Rock Valley Creek, near Koppio			1	3		Poor
Salt Creek, near Sheoak Hill Conservation Reserve			2	2		Poor
Tod River, near North Shields			2	2		Poor
Tod River, near Tod River Reservoir			2	2		Poor
Toolillie Creek, near Tod River Reservoir				4		Poor
Unnamed Creek, near Green Patch			2	2		Poor
Waterfall Creek, near Wadella Falls				4		Poor
Woolshed Creek, near Mount Dutton			2	2		Poor
Yeldulknie Creek, near Cleve			2	2		Poor
Edililie Creek, near Edillilie				2	2	Very Poor
Salt Creek, near Lipson				2	2	Very Poor

Site name	Very Good	Good	Fair	Poor	Very Poor	Final rating
Salt Creek, near Mangalo				1	3	Very Poor
Stinky Creek, near Port Lincoln				2	2	Very Poor

Reference

Davies SP and SK Jackson 2006, 'The biological condition gradient: a descriptive model for interpreting change in aquatic ecosystems', *Ecological Applications*, Volume 16, pages 1251–1266.

Further information

Legislation

Legislation may be viewed on the Internet at: <www.legislation.sa.gov.au>

Copies of legislation are available for purchase from:

Service SA Government Legislation Outlet
Adelaide Service SA Centre
108 North Terrace
Adelaide SA 5000

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Website: <shop.service.sa.gov.au>

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