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Water notes

Natural Heritage Trust

GOVERNMENT OF WESTERN AUSTRALIA

ADVISORY NOTES FOR LAND MANAGERS ON RIVER AND WETLAND RESTORATION

Habitat of rivers and creeks

Stream systems play an important role in the hydrological cycle, transporting water off the landscape and back to the estuaries and oceans. The role of rivers and creeks, however, is far greater than simple drainage since they provide crucial habitat for many of Western Australia's aquatic flora and fauna.

This Water Note aims to provide an introduction to habitat in rivers and creeks and a tool for assessing habitat in these systems. For those that want to go further, some direction is given towards the process of recognising and improving habitat.

Seasonally inundated floodplain vegetation provide important breeding grounds for our native fishes. *L. Pen*

What is a habitat?

A habitat is basically an environment in which a living organism occurs. Habitats can be very large or very small, ranging from the river or creek itself through to the area under a river stone or log. Habitats are defined according to the distribution of the organism (e.g. a plant or animal) in question. Habitats are also defined by the distribution of a community, which is a collection of organisms. Many animals, and to a lesser extent plants, are adapted to specific habitats and are not found outside these.

There are many habitats within a river or stream in which animals and plants occur for all or part of their life cycles. The types of animals and plants that occur in any one habitat may be quite distinct or they may overlap among habitats. Generally the more variety there is in habitat in and next to a river or creek, the more variety there may be in the types of plants and animals that occur there.

What factors influence the distribution of species?

A variety of factors, both physical and biological, combine to influence the distribution of species within a river or stream. These are too numerous to describe in detail, but broadly they fall into four categories as outlined below:

The presence of water

Often, when we think about rivers we perceive them to be large expanses of flowing water. In many cases this is true, but in Western Australia a large number of our upland rivers and creeks flow for only part of the year. Many of our native fauna and flora are adapted to cope with these recurrent periods of drought and utilise upland streams throughout the year. These species may 'over-summer' in moist habitats deep within the streambed or in burrows made by freshwater crayfish, such as gilgies and koonacs. Some macroinvertebrates lay resistant eggs in the streambed so that when flow resumes juveniles will hatch from the eggs and readily colonise the stream.

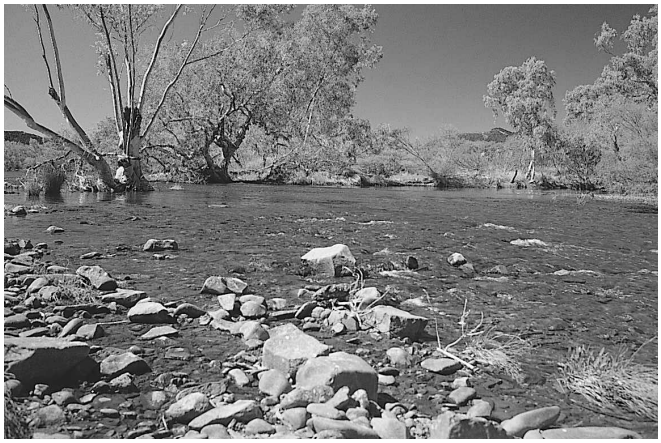
Other species of aquatic fauna require permanent water and are behaviourally adapted to seek areas that are permanently wet. The fauna will often leave a drying upland creek and move downstream in search of deep pools and permanent stream sections during the dry period. They then migrate back to the upland sites when flow resumes.

Areas next to rivers and creeks that are seasonally flooded during high flow periods provide an important habitat to small crustacea, wading birds, frogs and fish. For some species the inundation of the floodplain is crucial to part of

their life cycle. During winter, many native fish species migrate out from rivers and into annual creeks or the floodplain to spawn in flooded vegetation. Juvenile fishes then develop in these "nursery" areas before moving downstream to permanent waters.

Flow conditions

Rivers tend to meander naturally through the landscape and, as they do so, a variety of fast and slow flow areas are created within the channel. The speed at which water moves through a section of river and the amount of turbulence that occurs will influence the type of animals and plants that occur there. Swift flowing areas, where the water is rippled or broken and cascades over rocks or logs are known as riffle zones. Riffle zones are often turbulent, well aerated areas and are favoured by filter feeding macroinvertebrates that are able to exploit the current for gathering food. For macroinvertebrates to live in these areas they need to be adapted to withstand the current and not be swept downstream. Macroinvertebrates that occur in these areas are benthic (living on the bottom) and are often flattened or streamlined in shape. Others have suckers or hooks or use silk threads to enable them to remain within the flow. Still others have behavioural adaptations to live in riffle areas and hide from the current in crevices, cracks and under rocks or between gravel. Introduced trout are strong swimmers and are often found in riffle areas feeding on the macroinvertebrates that occur there.



Areas of broken water known as "riffles are a favoured habitat for many macroinvertebrates. *K. Trayler*

Slower flowing areas in rivers and streams such as channels or runs, pools, backwaters or edgewaters are often the preferred habitat of species that are unable to cope with fast flow. Many of Western Australia's native fish species occur in these areas. Suspended sediments often settle out in slower flowing waters. Where this occurs in shallow areas with abundant light penetration, rooted plants are able to grow in-stream. Benthic macroinvertebrates that occur in slower flowing areas are adapted to tolerate the sandy environment and lower oxygen levels that occur in these areas. Tiny invertebrates and plants, which are suspended in the water column and are known as plankton, often inhabit slower flowing areas of rivers and streams.

Emergent vegetation provides both food and shelter to range of aquatic and semi-aquatic fauna. *K. Trayler*

Substratum type

The material that comprises the substratum or bed of a stream is a major factor contributing to the distribution of benthic macroinvertebrates. Rocks and boulders that are not easily moved offer a stable substratum, even under fast flow and are a preferred habitat for macroinvertebrates. Many macroinvertebrates live under rocks or in the cracks and crevices between them and some can live up to 1m into the bed of the stream. In contrast, sand is a poor habitat for macroinvertebrates because of its unstable nature and capacity to be moved by the current. The invertebrates that inhabit sand are often burrowers with long thin bodies and thick body walls that enable them to withstand the abrasive action of the sand.

In sandy rivers, large woody debris, which is submerged or semi-submerged along the watercourse provides a stable substratum for macroinvertebrate fauna. These animals are often more abundant, diverse and productive on wood than elsewhere in sandy rivers. Some macroinvertebrates are specifically adapted for inhabiting wood. These have specialised mouthparts with which to gouge and tunnel into the submerged wood.

The presence of vegetation or organic material

Submerged and emergent rooted plants as well as floating vegetation provide a habitat for many aquatic fauna. The vegetation provides a shelter for our native fish, water birds and frogs in which they can escape predators and the harsh summer sun. Food resources are also abundant for fishes among the vegetation as many macroinvertebrates occur within it. These may be feeding directly on the vegetation or on the bacteria and algae that grow on it. Other macroinvertebrates, such as freshwater mussels attach or

cling to the vegetation and use it as a substratum. From here they are able to obtain their food. Mussels do this by filtering small particles from the water itself.

The presence of algae growing on rocks will often determine the distribution of fish and macroinvertebrates. A few species of native fish and many macroinvertebrates, including snails and some mayflies and caddisflies, feed directly upon the algae.

Terrestrial vegetation that grows on the mid and upper banks along watercourses is as important to stream habitat as either emergent or submerged vegetation. The most obvious reason for this is that this vegetation is the source of the large woody debris that falls into our waterways. In addition to this, leaf material that arises from these terrestrial sources and which falls or is blown into a watercourse is often deposited in slow flowing areas or is trapped against large woody debris. Accumulated leaves are colonised by microbes and are inhabited by macroinvertebrates that feed on either the microbes or on the leaf material itself. These macroinvertebrates are called "shredders". Fine particles of organic material are often trapped within the leaf litter as the water passes through it and algae may also grow on the leaves. These food resources attract other invertebrates to the habitat provided by the accumulated leaf material.

Large woody debris influences flow and the downstream transport of food resources. *G. Hyndes*

Collectively the emergent and terrestrial vegetation along banks of watercourses is known as the riparian zone. Riparian vegetation[i] provides stability to the watercourse banks enabling them to resist the erosive power of the flowing water and thus reducing the potential for subsequent sedimentation. Sedimentation has the potential to reduce instream habitat value[ii].

Riparian zones with high productivity and diversity of plants provide habitat for a diverse and abundant fauna. They also act as corridors for the movement of terrestrial fauna. This is particularly important in areas where clearing is widespread as these corridors may provide safe cover for the movement of fauna between areas of remnant bushland.

The presence of other animals

Many animals are predatory on other animals and will not inhabit areas where their prey is not present or where they themselves are eaten. Aquatic predators include some macroinvertebrates, fish, waterbirds and water rats. The presence of an array of predatory animals is often a sign of a healthy ecosystem with good habitat value, because it is indicative that food resources are diverse and abundant.

It is important to note that competition between one species and another for space, light or a food resource may exclude a plant or animal from a habitat in which it would otherwise occur.

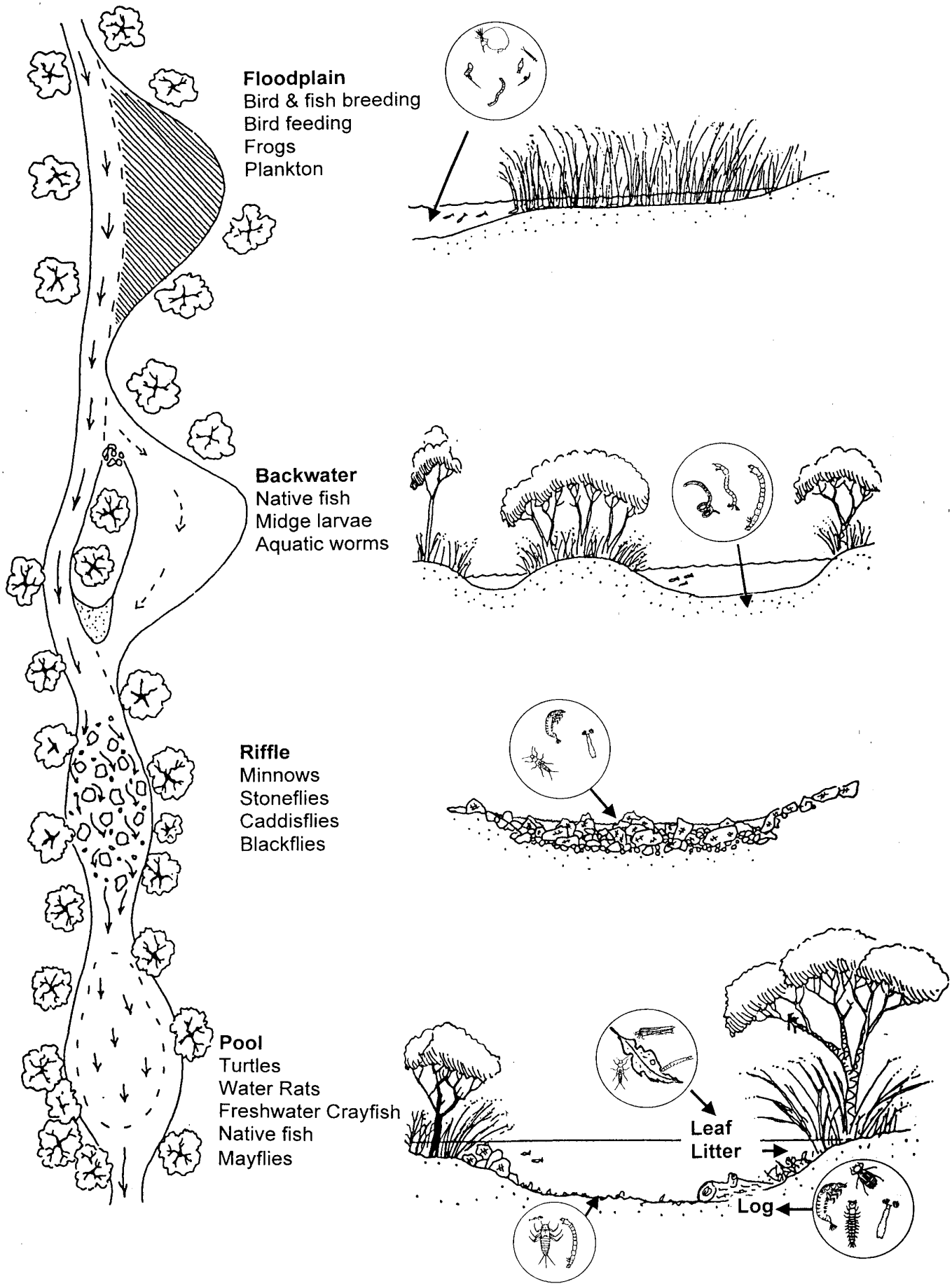
Conducting a habitat survey

It is possible to make intensive studies of the habitat value of streams by surveying the plants and animals that occur in these systems. These surveys provide interesting exercises in themselves, but may require time, equipment and expertise that are beyond the reach of the average person or community group. A simpler approach is to document the types and condition of the various habitats that occur in a system and to use these as an indicator of habitat value. In general the more natural habitat that occurs in and adjacent to Western Australian stream systems, the more native species that will occur there.

To determine the habitat value of your stream, examine it for each habitat component as listed in the Stream Habitat Record Sheet provided. For each habitat component, circle the number above the description that best fits its condition. If your stream is small, you may wish to do this over the entire length of the system or otherwise you can break it up into smaller sections and conduct the survey for each section.

What can be done to improve habitat?

In many streams and rivers in Western Australia, the habitat value has been lost and they have become little more than drains. This is particularly true for streams draining urban areas and farmland. It is possible to restore stream habitat without impeding water transport. Fencing[iii] stream lines may be appropriate where grazing pressure occurs and animals are likely to graze any new vegetation. Replacing fringing vegetation along streamlines where it has been removed or lost will markedly increase the habitat value of



Important habitats in waterways and some of the animals that occur there.

In-Stream Habitat Record Sheet

Name of monitoring group: .....

Person conducting the survey:.....Date of survey:.....

Length of stream examined:.....Location (grid reference):.....

Habitat component	Excellent	Good	Moderate	Poor	Very Poor
Emergent Vegetation	(5) Undisturbed native vegetation along both sides of stream. No signs of alteration.	(4) Mostly native vegetation. Some introduced species. Minimal signs of recent disturbance.	(3) Adequate vegetation cover, but a mixture of natives and exotics. Localised signs of disturbance.	(2) Predominantly introduced species in either understorey or overstorey or one side of the stream is cleared, the other undisturbed.	(1) Sparse cover of introduced species or concrete lined channels.
Mid and Upper Bank Vegetation	(5) Undisturbed native vegetation on both side of stream. Verge is more than 30 m wide.	(4) Moderate corridor (15-30m) of mostly native species.	(3) Moderate corridor (15-30m) with a mixture of natives and exotics or one side cleared and the other undisturbed.	(2) Narrow corridor (<15m) of native or introduced vegetation.	(1) Bare cover or introduced grass cover such as pasture land.
In-stream habitat	(5) Frequent logs, snags or boulders with extensive areas of instream aquatic, bankside and overhanging vegetation.	(4) Abundant snags or boulders present and/or occasional areas of in-stream or overhanging vegetation.	(3) Moderate number of snags or boulders present. Little or no in-stream or overhanging vegetation.	(2) Only slight cover. Stream is largely cleared. Few snags and no overhanging or instream vegetation.	(1) No cover. No snags or boulders, submerged or overhanging vegetation. Sites may have rock or concrete lining.
Flow conditions	(5) Wide variety of flow conditions. Broken, as well as still water. Meander bends present. Variety in depth.	(4) Variety of flow conditions. Broken, as well as still water. Meander bends present. Little variability in depth.	(3) Some variety of flow conditions. Occasional riffle or bend. Little variability in depth.	(2) Only slight variety of flow and depth.	(1) No variety in flow conditions or depth; Uniform and straightened stream.

For each habitat component, circle the condition that best suits your stream.
Add up the circles for a total score.

TOTAL = _____

Assess your stream's habitat value by comparing your total score to the ratings in the table below.

Score	Rating	Condition
17-20	Excellent	Site in virtually natural condition with excellent habitat value
14-16	Good	Site is in natural condition with some weed invasion, localised disturbance or habitat infilling as a result of sedimentation
10-13	Moderate	Some alteration from the natural state, moderate habitat value
7-9	Poor	Significant alterations from the natural state, reduced habitat value
4-6	Very Poor	Very degraded. Little available habitat

STREAM HABITAT RATING =

_____

a stream. In-stream restoration works, including the replacement of large woody debris[iv] and re-establishment of the riffles, pools and flood zones will further improve habitat. To a large degree, our native fauna is resilient and will return to areas when their habitat requirements have been restored.

Where to next?

After assessing the results of your habitat survey you may be ready to begin the process of identifying actions towards improving habitat. You can attempt this by yourself, particularly if you are simply interested in a small river section on your own property. However, due to continuous nature of rivers, there is often more than one person or group that have a vested interested their management. You should consult with local land-owners, Local Government and state agencies to determine their concerns and issues regarding the waterway that you are interested in.

A team effort is often the best way to implement actions to improve waterways. The sharing of expertise and development of a cooperative approach among interested groups and individuals is the key to identifying and implementing solutions to problems in waterways. A positive step towards resolving waterways issues is to participate in an action-planning workshop that may involve local community groups and land-owners, Local Government, state agencies. Action planning workshops generally involve groups highlighting issues relating to streams or rivers that are important to them and then agreeing on a plan of action to resolve those issues. You will need to convey the results of your habitat survey in this forum with the view to developing a cooperative approach to improving the habitat value of a stream.

Possible steps towards improving habitat

Bring together all interested parties including relevant land-owners. Identify the issues associated with habitat in your waterway by asking:

- What is the habitat condition?
- Should it be better (compare with more natural waterways in the region)?
- How did the waterway become degraded?
- Has the cause of the degradation subsided or is it on-going?
- Whose responsibility is it to overcome these problems?
- Are approvals required for activities within the stream and from whom are these required?

Finding solutions

Finding solutions to problems associated with habitat in waterways needs to be done in collaboration with relevant state agencies, local government, individuals and land-owners. Each action towards improving habitat should specify exactly what is going to be done, where it is to be undertaken, by whom and under what time-frame. The Water and Rivers Commission is able to provide technical expertise relating to waterways protection and restoration.

Further Reading

Available from the Water and Rivers Commission

Water note WN11 *Identifying the riparian zone.*

[i] Water note WN12 *The value of riparian buffers.*

[ii] Water note *Stream sediment: Its origin, transport and effects* (in production).

[iii] Water note *Livestock management: Fencing* (in production).

[iv] Water note WN13 *The management and replacement of Large Woody Debris.*

Water facts 4 *Living streams.*

Available from other sources

Gippel, C. Finlayson, B. & O'Niell (1998). *Managing Snags in Rivers*. Land & Water Resources Research & Development Corporation, Canberra.

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This Water Note is intended to be a general guide only and is not a comprehensive document. For further information on any particular issue please contact the Restoration & Management Section at the Water and Rivers Commission.