FRESHWATER INSECTS

Aquatic macroinvertebrates (freshwater insects) are found in almost every body of freshwater around the world. Most are simply the juvenile life stage of terrestrial flying insects (c.f. aquatic mosquito larvae "wrigglers" and their terrestrial adults) (Fig. 1/.). Apart from their importance in the ecosystem's concerned food web (Fig. 2/.) where they are a vital link making lower level energy sources, such as algae and detritus, available to higher levels such as fishes; they also provide us with an idea of the water and habitat quality of the water body. By definition, "pollution" is a contaminant that kills life within the system in which it is received; clearly therefore the best place to look for a impact then is at the level of the organisms themselves.

The pollution sensitivity of different macroinvertebrate groups varies…

Insects

Stoneflies (Plecoptera); very sensitive
Mayflies (Ephemeroptera); sensitive
Caddisflies (Trichoptera); sensitive
Beetles (Coleoptera); fairly sensitive
Two-winged flies (Diptera); tolerant

Crustaceans (e.g. koura/ freshwater crayfish); fairly tolerant

Molluscs (e.g. water snails); tolerant

Worms (oligochaetes); extremely tolerant

An absence of "sensitive" species such as mayflies may imply that the site is degraded. This is even more likely if the only species that are present are the pollution tolerant ones e.g. oligochaete worms. However; the absence of the sensitive species may either be due to the presence of a pollutant *or* general water and habitat quality. Therefore, noting water temperature, degree of siltation, testing for specific pollutants, etc. and finally the observer's experience all play further important roles in the final analysis. These factors will also all consequently figure in the decision-making process when methods and options for rehabilitation are being determined.

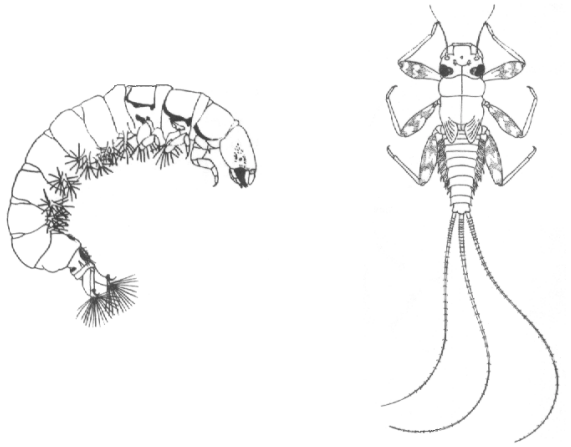

Fig 1/. *Aoteapsyche* caddis fly larvae (left) and *Zephlebia* mayfly larvae (right). From Pendergrast & Cowley (1966).

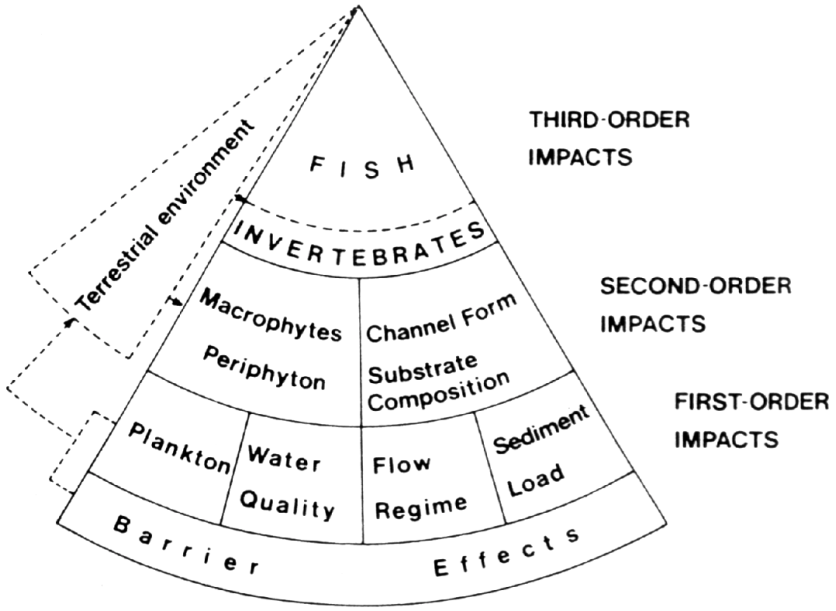

Fig. 2/. Ramifications of lower scale effects on higher level responses. From Petts (1984).

NATIVE FRESHWATER FISHES

- Only about 34 species –very low for a country of this size
- Few families (only 7) represented in our fauna
- High degree of endemism (most species found nowhere else)
- Only one extinction (the Southern grayling) –so far…
- More than 60% are diadromous (have a marine life stage) (Fig 3/.)
- Many probably arrived in NZ by dispersal via the sea
- Few native species are commercially exploited
- By far most are largely unknown by New Zealanders, and many are still poorly understood even by the experts

So why don't we see them more?

- ♦ Many have secretive habits e.g. some species are nocturnal
- ♦ They normally have cryptic colouration
- ♦ Few are of a great size –most are around 100 mm
- ♦ Some have localised/ specialised distributions or habitat requirements - this factor demonstrates the importance of native forest cover
- ♦ Their habitats may also be geographically remote
- ♦ Many are simply quite rare now due to historic impacts, even in areas without present significant human impact

Some New Zealand fishes are also found in other remnants of ancient Gondwanaland (such as the inanga, *Galaxias maculatus*, in Australia and South America). Most, however, are endemic such as the banded kokopu (*Galaxias fasciatus*) which is found nowhere else in the world. Some of these may be of very primitive forms (e.g. the galaxiids) indicating their presence in New Zealand for a very long time, whilst other (e.g. the bullies) are of more recent evolutionary origin, with a more highly developed form and features. New Zealand has a very small freshwater fish fauna, being approximately half that of another country of comparative size. This may be explained in part through the extremely long period of time that New Zealand has been isolated from other countries by the barrier of the sea.

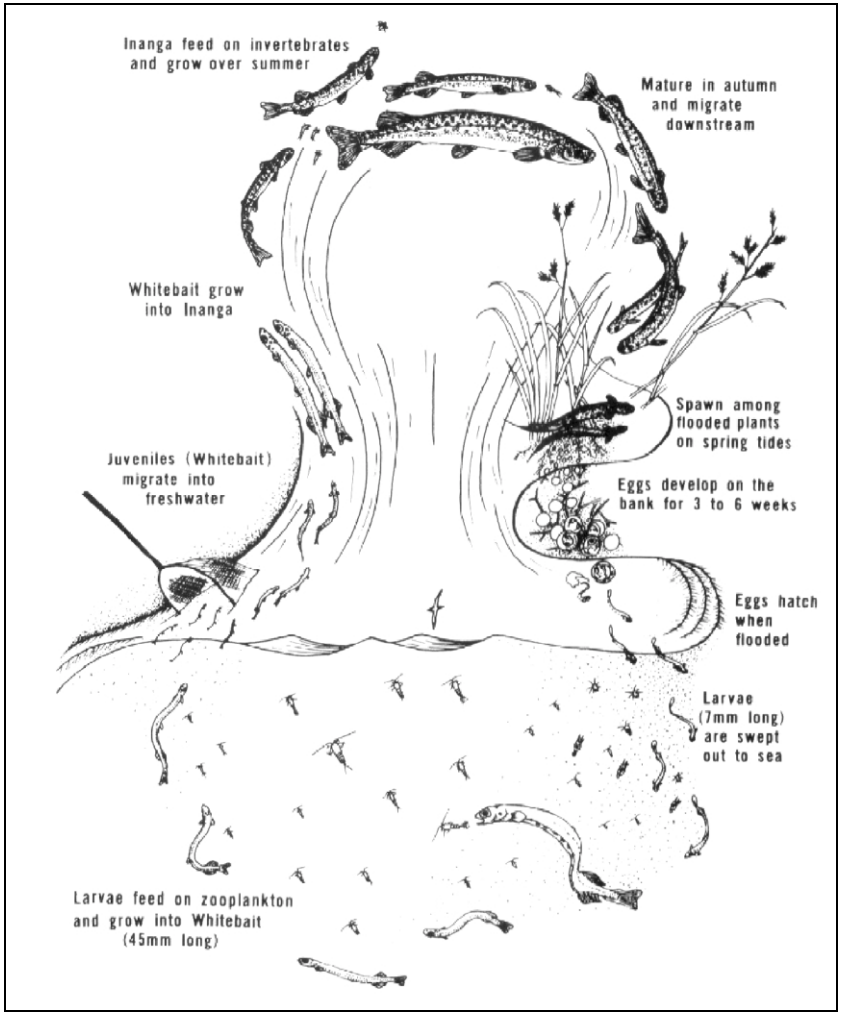

Fig. 3/. Diadromous (catadromous) migratory lifecycle of most New Zealand fish e.g. galaxiids such as inanga. From Mitchell & Eldon (1990).

Major freshwater fish families

Family: Galaxiidae (Galaxiids) e.g. kokopu, inanga, and other whitebait.

- Gondwana distributed (Australia, South America etc.)
- Smooth, scaleless bodies
- 12 species described with more on the way
- Very primitive morphology
- Largely nocturnal

Family: Eleotridae (Bullies) e.g. common & redfinned bullies.

- Benthic (bottom-dwelling) with a reduced swimbladder (they sink)
- Some species migratory, others not
- Some can be either e.g. common bully in lakes or in coastal streams

Family: Anguillidae (Eels)

- There are species of eels found around the world
- Three species are known in New Zealand; one endemic (longfinned eel)
- Adults migrate to marine trenches off Tonga to spawn
- They form a major export freshwater fishery for New Zealand
- May often be very long lived (up to 70 years)
- Long-finned eels may grow to 2 metres long!

Threats to Native Freshwater Fish

Habitat Destruction…

- Deforestation; direct loss of habitat (streams straightened, waterways weed choked, channelled and piped
- Compromised habitat; loss of natural riparian vegetation causing direct sunlight effects on upstream (heating, algal blooms), increased sedimentation levels smothers insect food sources
- Draining of wetlands; less than 9% of New Zealand's wetlands remain - watertables cross property lines!
- Reduced summer low flows through piping of rainfall to stormwater

Migration Barriers…

- Culverts and dams; prevent migration of most native fish: juvenile galaxiids, bullies, eels etc.
- Waterways upstream slowly become dead to these species through lack of recruitment e.g. the Waikato River's 8 hydroelectric dams!
- "Good" culverts vs. "bad" culverts; with undercutting preventing passage

Pollution…

- Point sources; pulp and paper mills, power stations, sewage
- Diffuse sources; agriculture, horticulture, urbanisation, erosion

Introduced Fishes…

- "Coarse" fish; koi carp, catfish, rudd, perch, tench
- Rainbow & brown trout are significant competitors and direct predators
- Other introduced fishes; especially mosquitofish

WHAT CAN WE DO THEN TO PROTECT OUR WATERWAYS AND THEIR NATIVE INHABITANTS?

- ✓ Where possible "retire" the riparian strip alongside waterways
- ✓ Plant the riparian margins with trees and/ or thick grass to protect from direct sunlight and overland sediment flow
- ✓ Treat direct pollution inputs before discharge e.g. use of artificial wetlands, sediment ponds, land-based disposal
- ✓ Maintain woody debris in channels for habitat diversity (e.g. pools)
- ✓ Don't allow introduced aquatic plants and animals into waterbodies
- ✓ General disturbance: where possible keep roads and tracks away from the actual waterway margins (also protects bank-stabilising vegetation)
- ✓ General pollution: stormwater intakes drain to our streams, rivers and lakes; what chemicals go down these drains comes out in their homes!
- ✓ Involve as much of the watershed for restoration as possible; the small headwaters are disproportionably very important to the whole system

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NEW ZEALAND NATIVE FRESHWATER FISH SOCIETY.

http://www.nzfreshwater.f2s.com