

# Sustainable drainage management

## Best management practice

By Henry R Hudson



## 11 Whitebait (inanga)

Complexity			Environmental value			Cost		
Low	Moderate	High	Low	Moderate	High	Low	Moderate	High

### Definition & purpose

Protect inanga habitat, especially spawning areas, during critical periods to halt/reverse the decline in the whitebait fishery.

### Location

- Spawning occurs along vegetated stream banks in estuarine areas, above normal water levels up to the area flooded at extreme tides (spring tides).
- Inanga live in slow moving channels in low altitude, low gradient waterways; with most fish found at altitudes of less than 20 m and less than 10 km from the coast.

### Work window

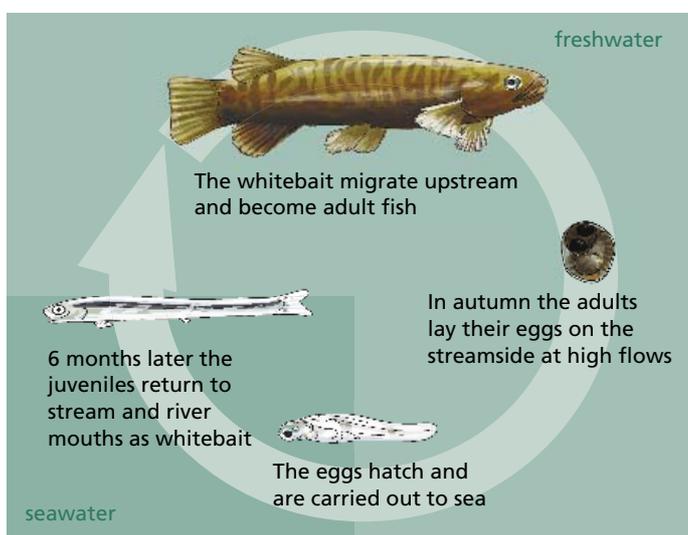
- Spawning occurs in late summer and autumn, mainly February to April inclusive. The eggs are laid near the spring high tide, and develop out of the water. They usually hatch soon after being resubmerged on the next series of spring tides. The larvae are washed out to sea.
- Whitebait (juvenile inanga) migrate from the sea into river mouths in spring. Over the summer they grow to maturity. In autumn they migrate downstream to spawn in estuaries.
- Mechanical clearing or spraying of stream sides in late autumn, winter or early spring is preferable.



Inanga eggs in streamside vegetation. Photo: DOC.



Inanga. Photo: DOC.



Life cycle of inanga. Illustration: Greater Wellington.

### Treatment objectives

Inanga are the most abundant of the species collectively called whitebait. Mortality is extremely high. Management strategies that improve spawning habitat and increase survival of adult fish further upstream are likely to substantially benefit the fishery.

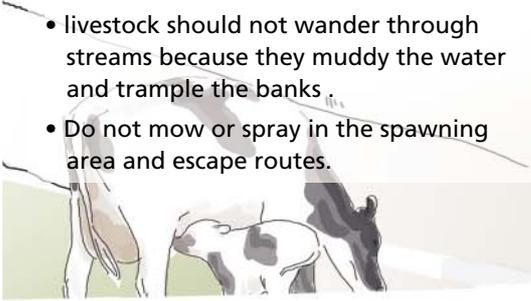
### Before you start

- Consult with Department of Conservation or Regional Council staff to identify spawning sites.
- Consult with District/Regional Council staff – they will provide advice and there may be help to fence and plant. Resource consent may be required.
- Consider streamside planting and making the streamside corridor wider.

## Procedures

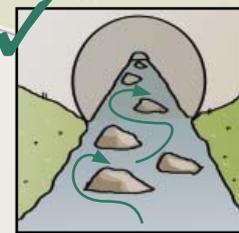
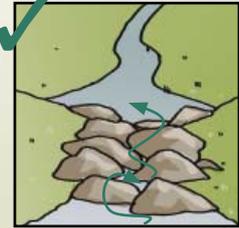
The Inanga eggs develop out of the water between extreme tides:

- livestock should not wander through streams because they muddy the water and trample the banks.
- Do not mow or spray in the spawning area and escape routes.



Floodgates are often obstacles because they are normally closed when the tide is flooding to prevent saltwater intrusion. This stops whitebait flowing in with the tide - they have to swim against the ebbing tide to get to their spawning grounds when the floodgates open. Gates can be modified or manipulated to allow easier passage.

Fish bypasses could be constructed to facilitate whitebait passage. These may be simple gravel ramps.



Livestock should be fenced out of spawning areas at least a couple of weeks prior to the main spawning period to allow lush grass growth and to stop destruction of the spawning area.

Spawning sites should be identified, marked out, and preferably fenced off. The same sites are used year after year.

Streambank vegetation is important, this includes pasture. Grass should not be mown down to the waters edge as short grass offers little protection to eggs and they usually dry out and die. A strip of longer grass should be left to overhang the water.

Stream banks can be reshaped (re-battered) and planted with native species, or grasses, to provide optimum habitat.

Native vegetation

Excessive aquatic weeds are a problem. Inanga live near the edges of weed beds and require clear patches of water for feeding. Mechanical clearing or spraying in late autumn or winter after inanga adults have moved back to the estuaries to spawn is preferable.

Cleared streams with a uniform bottom are a poor habitat (they are faster flowing and tend not to have the slow flowing pools inanga prefer).

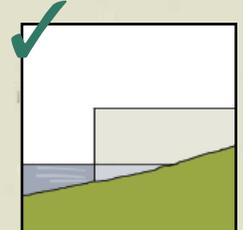
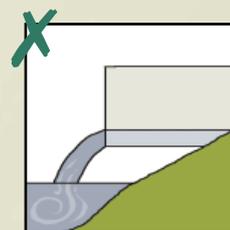
Instream cover, particularly woody debris is important. However, woody debris is generally considered incompatible with drainage management and is cleared before it becomes a problem.

Preferred sites for young and mature inanga are slow moving (3 to 7 cm/s for feeding) and relatively deep pools (>30 cm); usually with fine bed materials. Land use does not seem to be important.

Culvert

Culverts are also a problem. Small cascades and high velocities prevent access. Inanga are not strong swimmers and most whitebait are incapable of getting over a 5 cm high waterfall. Culvert replacement/repair should always be carried out so that the culvert is the same gradient as the reach and the culvert invert is the lesser of either:

- One third of the culvert diameter; or
- 300 mm below the existing bed level.



## Additional reading

Richardson, J.; Taylor, M.J. 2002. *A guide to restoring inanga habitat*. NIWA Science and Technology Series No. 50. (Reprinted with minor revisions 2004). [www.niwa.cri.nz/pubs/st/restoration.pdf](http://www.niwa.cri.nz/pubs/st/restoration.pdf)