Effects of Introduced Fish on Zooplankton – Fact Sheet

Linking lake restoration with end users for positive environmental outcomes

LERNZ
Lake Ecosystem Restoration New Zealand

Zooplankton

Zooplankton are small animals that feed on algae and bacteria in lakes, and are in turn food for small fish. Three major zooplankton groups exist in lakes; the cladocerans and copepods, which are both small crustaceans, and the rotifers (Figure 1). Like other animals, many zooplankton species have naturally distinct geographies, meaning New Zealand has species that are not known from other parts of the world. Many zooplankton species are sensitive to changes in water quality and fish introductions.

Introduced Fish Effects

Zooplankton can be affected by the introductions of non-native fish species into lakes. The juvenile forms of many non-native fish prey directly on larger zooplankton, altering species composition and reducing the efficiency of algae being removed from the water by zooplankton grazing. Adult fish may also be responsible for increases in nutrient and suspended sediment concentrations in the lake, altering algal composition and thus affecting the food quality or feeding abilities of zooplankton, respectively. Finally, zooplankton composition can be changed through the release of new zooplankton species, which may be introduced in association with the movement of non-native fish.

Calanoid copepod

Cladoceran: *Daphnia galeata*

Rotifers: Left to right *Lecane* sp., *Keratella* sp. and *Mytilina* sp.

Figure 1. Common zooplankton species found in New Zealand.

Case Study 1: Introductions of Non-native Zooplankton with Fish Releases

The number of non-native zooplankton species in New Zealand lakes has increased over the last twenty years. *Skistodiaptomus pallidus,* a North American copepod species (Figure 2), was initially recorded in New Zealand in 2000. During regular zooplankton monitoring of Lake Kereta, near Auckland, *Skistodiaptomus* was first observed in the lake at a time coinciding with the release of grass carp for weed management. The introduction of the species led to major shifts in zooplankton species composition within the lake. *Skistodiaptomus* has since been found within ponds on grass carp farms. While permitted transfers of grass carp are legal, future spread of other non-native fish from these waterbodies may spread these zooplankton, and other unwanted incidental species.

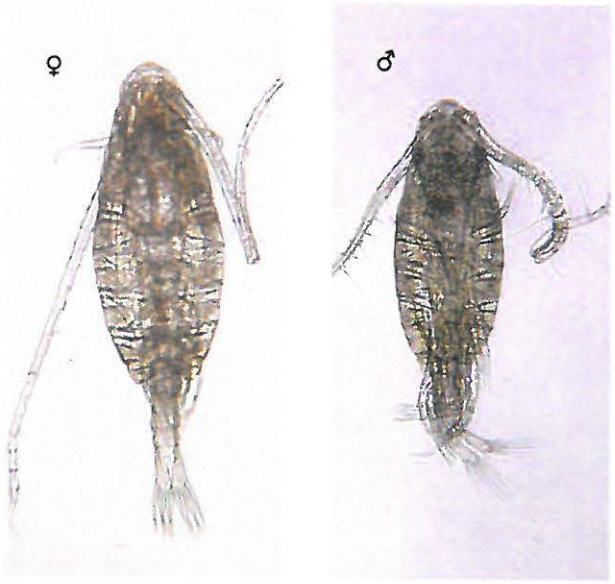

Figure 2. Female and male forms of *Skistodiaptomus pallidus*, a North American copepod species thought to have been distributed with grass carp in New Zealand.

Photos: .glsc.usgs.gov/greatlakescopepods

Case Study 2: Upper Karori Reservoir Trout Removal

In early 2011, brown trout (*Salmo trutta*) (Figure 3) were removed from the Upper Karori Reservoir (Figure 4) using rotenone. Prior to the removal of brown trout the reservoir was dominated by crustaceans, large zooplankton that are highly efficient at removing algae from the water column. Brown trout often prey on smaller native fish species such as banded kōkopu (*Galaxias fasciatus*) (Figure 5). When brown trout were removed from the reservoir, predation pressure on the resident population of banded kōkopu was removed, allowing the native population to significantly increase. As the larger crustaceans are the preferred prey of banded kōkopu, this caused the zooplankton population in the reservoir to change from crustacean dominated to rotifer dominated (Figure 6). It should be noted that the effects of a deliberate removal or release of non-native fish species on zooplankton communities will likely be more direct, through direct predation by the fish on the large crustacean species.

Figure 3. Brown trout (*Salmo trutta*).
Photo: Brendan Hicks

Figure 4. Karori Reservoir, Wellington

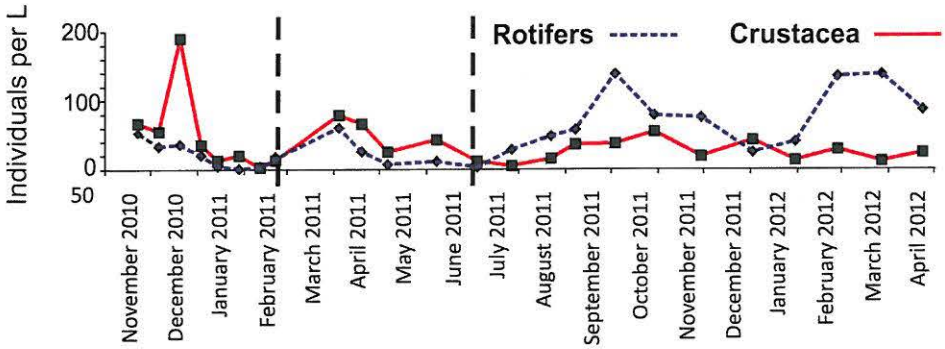

Figure 6. Seasonal dynamics of total crustacean and total rotifer abundances in Upper Karori Reservoir. The left vertical dashed line indicates timing of trout removal and the right vertical dashed line estimated entry of galaxiid larvae into the reservoir.

Figure 5. Banded kōkopu (*Galaxias fasciatus*)
Photo: Brendan Hicks