NIWA
Taihoro Nukurangi

Kanakana

sniffing out a place to spawn

Although kanakana are a taonga species and prized delicacy for many Māori communities around New Zealand, we know very little about their biology and the freshwater habitats they like to live and spawn in. Some exciting new research is helping us to learn more about this unique and very secretive fish.

Entrance to Lake Wairewa.

PIT antenna to monitor movements of tagged kanakana.

A tagged kanakana found under this rock.

Background

NIWA is leading a new six-year research project that seeks to increase our understanding of kanakana/lamprey, using Mātauranga Māori, social science and biophysical science approaches.

Even though kanakana are an important customary fishery, very little is known about their biology and this research seeks to address a number of key knowledge gaps. The objectives of this research include:

- Increasing our understanding of the historical abundance, distribution, timing of spawning migrations and the location of spawning and rearing areas.
- Determining when spawning migrations currently occur, the location of spawning sites, and the habitat associated with various freshwater life stages.
- Evaluating whether pheromones (chemical cues released to signal other members of their species) can be used to identify kanakana populations and spawning streams, and the ability of pheromones to attract kanakana to areas with depleted populations as well as developing technologies to improve the upstream passage of adult kanakana.
- Providing options to restore and enhance kanakana populations in Aotearoa.

Research completed in 2013 focused on identifying the pheromone cue used by migratory kanakana to select spawning streams, and locating the spawning nests. This work was carried out in both the Oreti River catchment and the Okuti River catchment.

Cindy Baker holding a spawning male kanakana.

A migratory kanakana.

Figure 1: Choice-chamber flume to test kanakana attraction.

Figure 2: Migratory adult kanakana.

Figure 3: PIT tagging adult kanakana. Inset: 12 mm PIT tag.

Figure 4: Adult kanakana sniffs out larvae held in the mesh bag.

Stream selection

The Northern Hemisphere kanakana, the sea lamprey, is well studied and provides a good starting point for investigating stream selection in New Zealand kanakana. The sea lamprey are known to select spawning streams based on a mixture of pheromones released by their larvae living in rivers and streams (Table 1). Also, mature female lampreys will choose streams and locate a nest site based on the sex pheromone released by mature male lampreys (Table 1).

Pheromone	Abbreviation	Released by	Role
Petromyzonol sulphate	PS	Larvae	Attract migratory adult fish into streams
Petromyzosterol disulfate	PSDS	Larvae	Attract migratory adult fish into streams
Petromyzonamine disulfate	PADS	Larvae	Attract migratory adult fish into streams
Allocholic acid	ACA	Larvae	Attract migratory adult fish into streams
LW1 – 973	LW1	Larvae	Attract migratory adult fish into streams
3-keto Petromyzonol sulfate	3k-PS	Mature males	Attract mature females to nests and tributary streams
3-keto Allocholic acid	3k-ACA	Mature males	Attract mature females to nests and tributary streams

These migratory and mating pheromones are not just used by sea lamprey, a range of other Northern Hemisphere lamprey species also use them to select spawning streams and locate nests. If stream and spawning habitat selection by New Zealand kanakana are based on the same pheromone cues as the sea lamprey, these cues could be used to increase the distribution of kanakana and attract migratory adults into areas where populations are presently in low densities or maybe even in places where they have disappeared completely.

Methods

In October 2013, NIWA and visiting researcher Tyler Buchinger from Michigan State University (MSU), used a choice-chamber flume set-up alongside the Oreti River to look at whether New Zealand kanakana are attracted to sea lamprey pheromones during their migration into freshwater (Figure 1). Jane Kitson supplied the adult kanakana (Figure 2), which were tagged with 12 mm PIT tags (Figure 3) so their movements in the flume could be monitored remotely. We tested the odours of larval kanakana (Figure 4) along with a mixture of sea kanakana pheromones (Table 1). Some of the sea lamprey pheromones were also tested individually.

Figure 6: Hand-held PIT detector for monitoring tagged kanakana.

Figure 7: Kanakana spawning nests.
7(a): Eggs laid underneath a large boulder.
7(b) & 7(c): Boulders with kanakana nests underneath.

Results

Adult kanakana showed a preference towards their own larvae as well as towards the sea lamprey pheromone mixture (Figure 5). The main components of the sea lamprey larval pheromone (PS) and mating pheromone (3k-PS) were also tested individually but neither were attractive to adult kanakana (Figure 5). The other compounds were unable to be tested individually this season because of both time constraints and a high proportion of kanakana becoming sick with the Lamprey Reddening Syndrome (LRS).

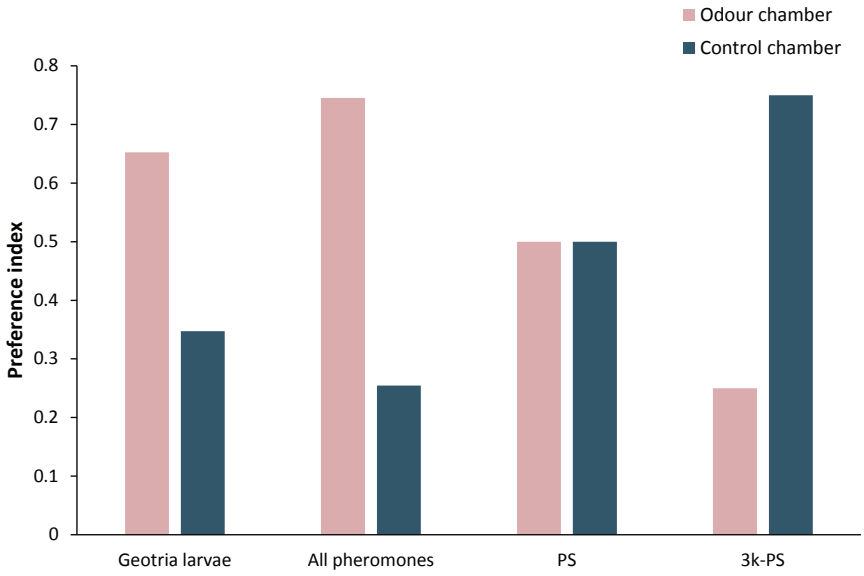

Figure 5: Response of adult kanakana to different odour cues. All compounds were tested at 5x10-10 (0.0000000005) grams/litre of water (or the equivalent of one teaspoon in 4,000 Olympic size swimming pools), except the 'Geotria larvae' where 45 larval kanakana were held within a bag in the odour chamber (see Figure 4).

Further work

So far our research suggests that during their freshwater migration, adult kanakana may select spawning streams by following one of the five sea lamprey pheromones that are released by their own larvae. NIWA and MSU are still analysing water and liver samples from both larval and adult kanakana to determine exactly which of the five pheromone compounds are released and in what quantities. We hope to carry out further flume tests during 2014 to conclusively determine the attractive pheromone(s) released by larval kanakana.

Spawning nest sites

During 2012, NIWA PIT tagged 145 adult kanakana in the Okuti River catchment, on Banks Peninsula. Using a hand-held detector we have monitored tagged fish movements as they mature in the river (Figure 6).

In late October 2013, we located several kanakana spawning nests (Figure 7). This is the first time that kanakana spawning nests have ever been observed in New Zealand. In the Okuti River, male and female kanakana pair up underneath large boulders and their eggs are attached in a large clump to the underside of the boulder. Both male and female kanakana were still at their nest sites when we found them (Figures 8 and 9), but the females were very weak and lifeless so we expect that they die relatively quickly after spawning. At one nest, a kanakana is guarding the eggs, – we believe this is the male who is watching over the developing eggs until they hatch. At present, we are still monitoring the

Figure 8: **Spawned female**: Arrow points to the rope on her back which is the male sex trait in Northern Hemisphere sea lamprey.

Figure 9: **Spawned male**: a) Collecting pheromones b) Showing his pouch (arrow).

nest and kanakana. New Zealand kanakana are the first lamprey species in the world to be observed guarding their nests.

The nest sites found in 2013 are the first kanakana spawning sites found within the Southern Hemisphere (Figure 10) and this knowledge is critical in helping us protect kanakana populations by ensuring their key spawning habitat is retained within our rivers and streams.

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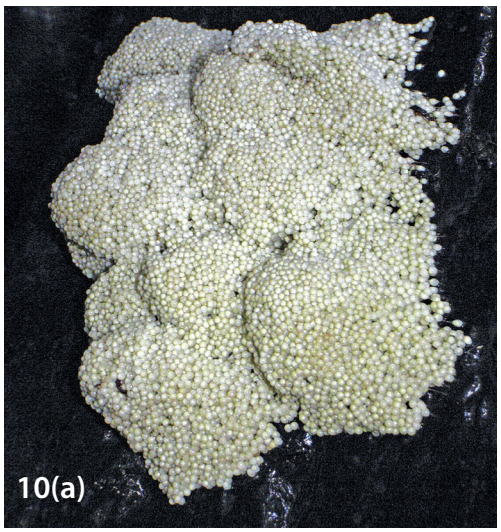

Figure 10 (a), (b) and (c): **Success!** After 15 months of hard work tracking the movement upstream of adult kanakana, these nests were found in a tributary of the Okuti River in October 2013. This is the first time that kanakana spawning nests have ever been observed in New Zealand.