LERNZ
Lake Ecosystem Restoration New Zealand

LERNZ NEWSLETTER 7 / February 2008

Koi carp radio tracking

Figure 1: Associate Professor Brendan Hicks (middle) and PhD students Grant Tempero (left) and Adam Daniel (right)

FRST-funded PhD student Adam Daniel is now half way through an 18 month field telemetry study on the movements and habitat use of koi carp on the lower Waikato River. The project is designed to detect migration routes, spawning locations, and aggregations of koi carp to aid in their eventual removal. This study is the first of its kind in New Zealand that compares both radio and acoustic transmitters. Adam, university staff, and volunteers captured and implanted 72 adult koi with transmitters. Of the implanted fish 20 were fitted with radio transmitters and 52 were fitted with acoustic transmitters.

Carp fitted with acoustic transmitters are monitored by passive listening stations that Adam downloads every three months. Initial downloads have shown large upstream and downstream movements, including a fish that travelled a total of 212 km (up and downstream) in 150 days. Study fish fitted with radio transmitters have been tracked weekly by boat and monthly by plane. To date we have contacted 18 of the 20 implanted fish for a total of 181 locations. This includes 30 boat/vehicle outings that resulted in 114 contacts and 5 flights that yielded 67 contacts. Radio telemetry data has revealed the location of several large spawning aggregations and has also shown migrations of over 100 km. Both radio and acoustic monitoring will continue until November of 2008.

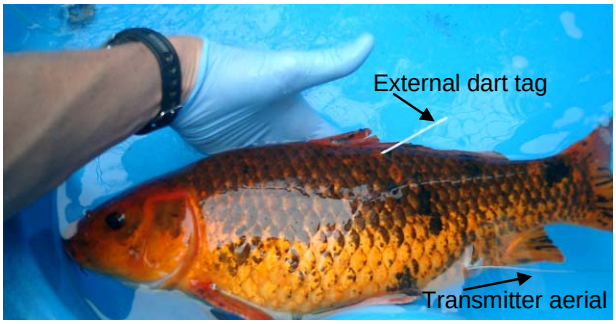


Figure 2: Adult koi carp (*Cyprinus carpio*) with implanted radio transmitter and external dart tag.

Transmitter retention by koi carp

Adam Daniel recently completed a year-long tank study to determine the rejection rate of surgically implanted transmitters by koi carp. Up to 60% of transmitters were expelled from koi carp at 20-24°C. Implantation at lower water temperatures was therefore used for the movement study. Neither polymer transmitter coating and physical attachment of transmitters to the pelvic girdle of fish increased the retention of transmitters in test fish. Transmitter expulsions were likely caused by infection and this has led to a new tank study involving an antibiotic, which should begin in early February of 2008. Adam will present the results of this trial in February 2008 at the International Symposium on Advances in Fish Tagging & Marking in Auckland.

Laser ablation determines movement of rainbow trout and common smelt in Rotorua lakes

Matt Riceman will complete his MSc on otolith microchemistry of rainbow trout and common smelt in late Feb., 2008. The study aim is to test the feasibility of using laser ablation (LA-ICP-MS) to discriminate natal habitats fish movement between lakes Rotorua and Rotoiti. Both fish species are lake-locked (i.e., do not have access to the sea), but can move between the lakes via the Ohau Channel. Otoliths from juvenile rainbow trout from six spawning tributaries were analysed and compared with the otolith nucleus for adults of unknown origin. Otoliths from common smelt from distinct beach habitats around each lake were similarly analysed.

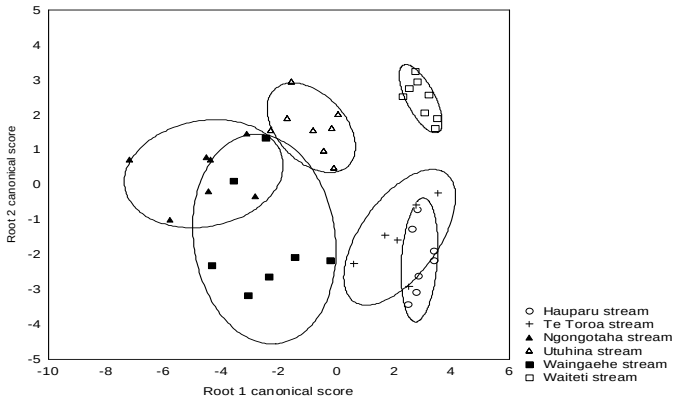


Figure 3: Canoncal scores from a discriminant function analysis (DFA) of juvenile rainbow trout otoliths. Ellipses are 63% confidence bands around scores calculated from unstandardised DFA coefficients. Hauparu and Te Toroa are Rotoiti tributaries; other streams flow into L. Rotorua.

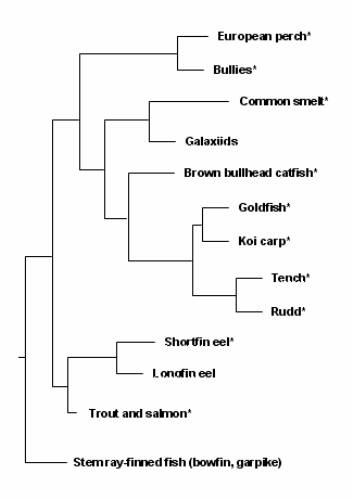
Using Mn, Zn, Rb, Sr, and Ba standardised to Ca, a discriminate function using juvenile trout as the training set could determine lake of origin with 97% accuracy. Tributary stream of origin could be determined with 100% accuracy for three tributaries, and 71-90% accuracy for a further four tributaries. Using the same methods, determination of lake of origin for common smelt was less successful, i.e., 61-75% accurate. These results show that otolith LA-ICP-MS holds considerable promise for determining movement of rainbow trout between lakes Rotorua and Rotoiti. These methods could be applied to other lakes in New Zealand.

This work is a funded contract to Environment Bay of Plenty secured through Matt's supervisor, Associate Professor Brendan Hicks.

Chinese scientist Associate Professor Guangwei Zhu, from the Nanjing Institute of Geography & Limnological Sciences (NIGLAS), visited Waikato University from 13 Jan. to 4 Feb., 2008, under sponsorship International Science and Technology (NZ) programme. Guangwei administers the water quality monitoring programme of NIGLAS in Lake Taihu, which is the third largest freshwater lake of China, with an area of 2338 km^2, and with 37 million people within its catchment.

Last October, Gaungwei collaborated with Prof. David Hamilton and Chris McBride to set up a wireless monitoring buoy in Lake Taihu similar to one in Lake Rotorua. The sensors include dissolved oxygen, chlorophyll *a*, turbidity and a weather station. The data from the buoy in Lake Taihu are logged through the iQuest system at 10 min. intervals. The main purpose of Dr Zhu's visiting was to exchange experiences with buoy maintenance and lake management. He participated in the monthly Biofish investigation of five Rotorua lakes and the annual meeting of the Lakes Water Quality Society held on 28 Jan.

Pest fish detection using DNA



In a FRST-funded study by Matt Knox, Ian Hogg, and Brendan Hicks, a DNA-based detection system for invasive fish species was tested. A 250-base pair region of 16S rRNA was amplified and sequenced from white muscle, faecal material, and slime, but failed to show sufficient sequence variability to distinguish fish species. However, a 700-base pair region of cytochrome oxidase I (COI) mitochondrial DNA successfully delineated a variety of native and introduced fish species using fish-specific primers. * shows species we sequenced cf. Genbank data.

DNA extraction from slime or faecal material was successful in about 50% of cases, and yielded good quality sequencing results. In one case, fish COI mDNA was extracted and amplified from tank water containing goldfish. Sequencing results matched with our previous goldfish sequences. This research holds promise for transfer to environmental samples, which is our next goal.

Restoration of a threatened endemic fish species

Andrew Hayes releases black mudfish in a wetland pool at Lake Kaituna under the watchful eye of Mike Lake from DOC

A translocation of the threatened black mudfish (*Neochanna diversus*) to a community-based ecological restoration project near Hamilton shows some promise after the discovery of baby mudfish this year. The project, which formed a major component of the MSc research of Amy McDonald (now at DOC) in 2006, involved the release of 135 mudfish adults and juveniles to a wetland at Lake Kaituna (on Andrew Hayes' property at Horsham Downs).

Follow-up monitoring over spring and summer has revealed juveniles from successful spawning by the released fish in the 2007 winter breeding season. The monitoring also revealed invasion of the wetland by shortfinned eels and mosquitofish during winter floods. Both of these species prey on mudfish. Further releases of mudfish are planned to augment the adult population that appears to have been depleted by predators, and monitoring will continue over the next few years to judge the long-term success of the translocation project.

New Zealand Freshwater Sciences/Australian Society for Limnology Conference

Queenstown, New Zealand December 2007

New Zealand Freshwater Sciences/Australian Society for Limnology Conference was held on the 3rd to 7th of December at Queenstown, New Zealand. David Hamilton, Nick Ling and other staff and students from University of Waikato attended the conference and gave presentations as follows:

(all are cited as: New Zealand Freshwater Sciences/Australian Society for Limnology Conference, Queenstown, NZ, 3-7 December, 2007)

Aldridge, B.M.T.A., B.J. Hicks, and K.J. Collier. 2007. Restoring habitat and giant kokopu populations in urban streams, Hamilton City, New Zealand.

Butterworth, J., D. Hamilton and N. Phillips, 2007. Lake Rotokakahi: The kakahi (*Hyridella menziesi*) in a general framework of lake health.

Hamilton, D., K. O'Brien, C. McBride, J. Brooks, L. Luo and M. Burford, 2007. The importance of the deep chlorophyll maximum to management of deep Rotorua lakes.

Ling, N., M. Landman, D. Hamilton, D. Trolle and J. Brijs, 2007. Koura: biomonitors of lake chemistry.

McBride, C., D. Hamilton, G. Zhu, M. Cook, L. Luo, R. Buick and T. Meinke, 2007. Real-time, high frequency sensor data from lake buoys: new insights into lake ecosystem dynamics.

O'Brien, K., D. Hamilton, C. McBride, M. Burford and J. Brookes, 2007. The impact of physical processes on seasonal dynamics of chlorophyll in deep Rotorua lakes.

Özkundakci, D. and D. Hamilton, 2007. The impact of sediment treatment on porewater chemistry in a eutrophic lake.

Pouwells, A. and D. Hamilton, 2007. Use of lake sensor data in student education.

Prentice, M., D. Hamilton, S. Wood, K. Calder, B. Hicks, I. Duggan, A. Rueckert and S. Cary, 2007. Temporal and spatial variations in cyanobacteria populations in Karori Reservoir, Wellington.

Tana, R. and B.J. Hicks. 2007. The influence of an open and closed river system on the migration patterns of two northland populations of banded kokopu (*Galaxias fasciatus*).

Trolle, D. and D. Hamilton, 2007. Temporal trends of nutrients in sediments of twelve New Zealand lakes.

Now that's a bloom!

Lake Taihu in August last year

For more information visit www.LERNZ.co.nz

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