FISH SURVEYS IN NORTHLAND

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June 1993

ISSN 1171-9834

Reference to material in this report should be cited thus:

Mitchell, C., 1993.
Fish surveys in Northland.
Conservation Advisory Science Notes No. 31, Department of Conservation,
Wellington. 8p.

Commissioned by: Northland Conservancy.
Location: NZMS

BRIEF

1. Set conservation objectives for fish survey in Northland.

2. Identify specific situations in which there is likely to be high fish diversity and/or threatened species of fish present.

3. Advise on fish survey methodology in different habitats.

4. Advise on framework for dealing with water consents e.g. survey requirements, need for fish passages.

OVERVIEW

Apart from dwarf inanga (*Galaxias gracilis*) and the presence of populations of landlocked inanga, there are no unique freshwater fishes in Northland. However, estuarine habitats and an associated fauna of brackish and warmwater fishes are considered to have greater importance in this region than for any other in New Zealand.

Development has the potential to place considerable pressures on the freshwater resource and hence on native fish populations. Water abstraction for dairy pasture irrigation and the implications of exotic forestry are seen to be major threats.

Fish pass design and an understanding of the impacts of exotic forestry in Northland on native freshwater fishes, are seen as priority study areas.

FOCAL POINTS FOR NATIVE FISH STUDIES

1. Study/training areas: Where staff can see, catch and identify a range of native fishes in training exercises.

2. Pristine areas: Where an understanding of the original fish communities of Northland rivers can be gained. Pristine areas need to include forest, swamp and estuarine habitats.

3. Impact areas: Sites where fish populations are under threat from development. The process of evaluating water right proposals will identify these sites.

KEY NATIVE FISH SPECIES IN NORTHLAND

It is suggested that dwarf inanga, black mudfish, giant and short jawed kokopu are the main threatened fish species to focus upon. It is considered that the rankings in Molloy and Davis (1992) are misplaced. Banded kokopu, koaro and blue-gilled bully are unlikely to be nationally threatened and do not merit a C ranking, whereas dwarf inanga should have an A ranking.

METHODOLOGY

DoC needs to develop a knowledge of the distribution of freshwater fish in Northland. The number of records for freshwater fish are low. Two databases are suitable for use; one is the Sites of Special Biological Interest (SSBI) database. This database is well established in

Northland and is universally consulted and inclusion of freshwater fish records would ensure this group is not overlooked. The other database is the New Zealand Freshwater Fish database administered by NIWAR. DoC staff have computerised access to this database. A New Zealand wide perspective is possible, together with access to the records of other agencies.

It is recommended that information on freshwater fish be entered into both databases.

FISH SURVEY METHODOLOGY FOR DIFFERENT HABITATS

Northland rivers can be subdivided into a series of zones. These zones are sections of the river where gradient, water velocity and substrate size combine to provide habitat suitable for a characteristic range of fish species.

1. Estuaries

Estuary habitats are dominated by the effects of saltwater intrusion, tidal effects and soft substrates. Water temperatures are almost subtropical in Northland. Apart from migrations and early rearing of many "freshwater" species, marine fish move into these habitats and must also be considered.

Parore, juvenile snapper, yellow-eyed mullet, kahawai and yellow-belly flounder frequent the lower rivers. Grey mullet, black flounder, stargazer, giant bullies and triple-fin blennies penetrate varying distances upstream. Mosquito fish are a seawater-tolerant exotic freshwater fish capable of reaching high levels of abundance in these habitats.

Fisheries studies must consider the role of salinity in controlling fish distribution. Plant zonation allows a preliminary evaluation of salinity effects and this should be followed by conductivity profiles to establish the pattern of salinity. Diversion and water abstraction may have marked effects upon salinity and thus the fish community of river estuaries.

2. Lower Reaches of Rivers

A community of midwater swimming fish (inanga and smelt), bottom dwelling fish (common and crans bullies) and eels (both short-finned and long-finned) are typical of this zone. The presence of obstacles such as weirs and waterfalls quickly simplifies the fish community.

Essentially every river of any size in Northland has had the lower reaches cleared for pastoral farming. Depending upon bank stability and the intensity of land use, the fish community will be further simplified by silt loadings and loss of riparian cover. Exotic fishes are often also present. Rivers such as the Wairua, intensively farmed and above waterfalls, essentially support only abundant populations of catfish and goldfish, together with the resilient eels.

3. Upper Tributaries and Smaller Catchments

Loss of riparian vegetation and the impact of farming can be less marked on these smaller streams. Many areas of Northland, particularly on the eastern coast, have

small streams flowing through catchments of such poor agricultural potential that shrub and native forest cover still remains. A more diverse and abundant fish fauna will be present.

A progression of fish species can be expected, moving upstream into small headwater tributaries. Lower gradient, larger streams will hold giant kokopu together with short and long-finned eels, crans and common bully. Riffle and rapid areas provide habitat for torrent fish and juvenile eels. Further upstream banded kokopu and red-finned bullies dominate. Short jawed kokopu and even blue-gilled bullies can also be expected in these streams. The smallest headwater tributaries will still carry banded kokopu, long-finned eels and then, finally, only koura (freshwater crayfish).

An efficient approach to fish survey should consider this likely distribution of fishes and then select methods suitable for each river zone and the species anticipated.

Table 1 lists 9 different techniques for surveying fish populations, together with the advantages and disadvantages of each technique. Field trips were made to demonstrate fish sampling techniques. The risks of dispersing exotic aquatic weeds on nets was discussed.

The next point for any survey proposal is to consider the level of accuracy intended for the survey. The first level of accuracy is a simple species list. Most fish surveys consider only presence/absence of fish. This information is relatively quickly gained and, combined with knowledge of fish distribution and life history strategies (available from text such as McDowall 1990), can be sufficient. However, the question is often asked, "How many fish will remain/are present after this development proceeds?". It must be emphasised that although this question is easily asked, quantitative information on fish populations is difficult and expensive to obtain. Accuracy is low and the information is often relevant for one year or even one particular season. Quantitative fish surveys should not be considered without specialist advice and assistance.

TIMING OF FISH SURVEYS

Timing of fish surveys can make a considerable difference to the result. Summer is the best season to undertake fish surveys. There are more fish in freshwater owing to the life cycle strategies of native freshwater fish. Most native fish migrate to and from the sea to complete their life cycles. For example, annual fishes such as inanga are essentially absent from freshwater over the winter months, downstream migration for spawning depletes their numbers over autumn.

Weather is more stable in summer and flows are less. Equipment will be at less risk and techniques such as night spotting will be more successful with higher water clarity. Although eels may still feed in Northland during winter freshes, higher summer water temperatures will result in active feeding and a better response to baited traps.

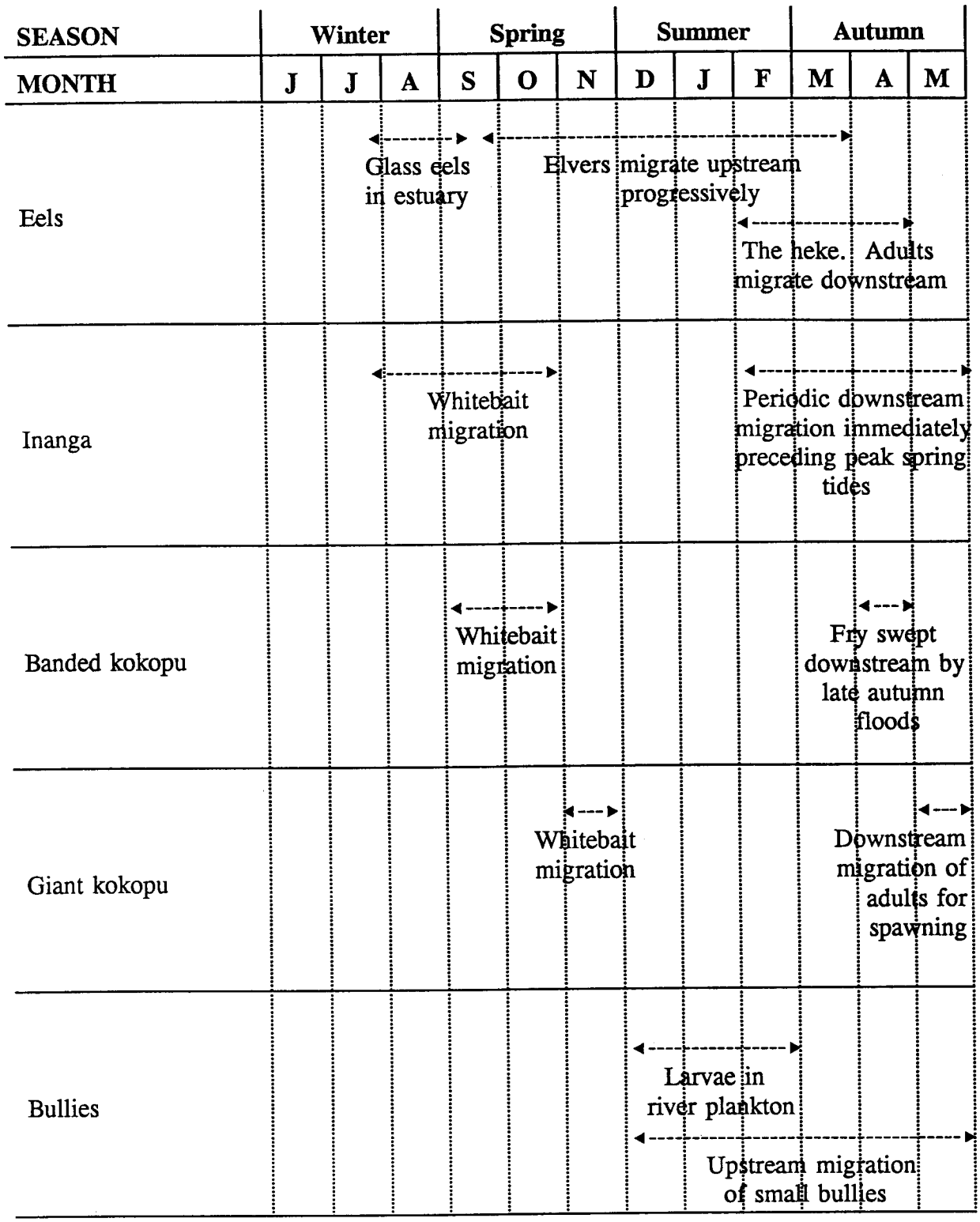
Table 2 lists the migration timing for upstream and downstream movements of the more common native freshwater fishes. Of the freshwater fishes found in Northland, nearly all must migrate to and from the sea with the exception of crans bully, lake populations of common bullies, *Galaxias gracilis* and the landlocked populations of inanga.

Table 1: METHODS OF SURVEY

		Advantages	Disadvantages
1.	Electric Fishing (U)	Work riffles and fast water Status Existing data set Can be quantitative	Certificate needed 2 people minimum Small/shallow streams Conductivity sensitive Species selective
2.	Fyke nets (L)	Eels 24 hour fishing Nocturnal fish Cover wide area - set traps and move on Bait Swamps, muddy water (e.g. giant kokopu habitat) Salt and freshwater	Size selective (mesh) Species selective Stolen gear Clear at dawn (eel damage)
3.	Gee minnow traps (U, L)	Still water Good for bullies Cover wide area - set traps and move on Bait Comparative data	Unsuited to riffles, shallows Species selective
4.	Other traps (Mitchell) (U)	Portable	Not standardised
5.	Seine netting (L)	Quantitative - a known area can be netted	Smooth beds Shallow (unless use purse seines)
6.	Gill netting (L)	Mullet fishing Flounder fishing	Species selective
7.	Spotlighting (U)	Quantitative - a known length of stream can be spotted High densities	Shallow Clear Narrow Rapid identification
8.	Stomp netting (U)	Riffles Turbid water - where only electric fishing can compete	Shallow water Miss fast swimmers (mullet, smelt)
9.	Drift diving (L)	Minimal equipment.	Need clear water

U = upper river, L = lower river

Table 2: **MIGRATION TIMING OF SOME NATIVE FRESHWATER FISHES**



Bully larvae will be found in the river plankton over the summer months and an ongoing upstream migration of small bullies can be expected over summer/autumn. Freshwater shrimps also migrate upstream and shed larvae into the river, to rear in the estuary.

WATER CONSENTS

Rapidly increasing demand for irrigation water has arisen in Northland. "Hot" spots for water use consents include: Kaihu River, Awanui-Victoria Rivers, Northern Wairoa River, Mangakahia River, the Kaipara Harbour flats and southern Northland. Abstraction almost invariably includes a weir across the stream. Up to eight consecutive weirs have been proposed across the lower reaches of some rivers.

Advice on the likely impacts upon freshwater fishes needs to be more readily available to both proponents/users and the Northland Regional Council. A major difficulty is the time constrants (20 day response time) imposed on resource consent applications. Fish surveys, followed by site specific recommendations, will not normally be feasible. It may be possible to develop guidelines based on habitat criteria, site location and altitude.

It is recommended that appropriate fish passage be required for any proposed instream structure. This is a fundamental tenement of the fish pass regulations. A management goal for Northland rivers could be to maintain the fish species composition of every river catchment.

A primary requirement is that low cost fish pass designs be developed. All users of the water resource need to consider fish passage and should face equal treatment. Even if fisheries values are low, provision of fish passage allows fish populations to recovery should habitat quality improve. It is difficult to justify a "no development" stance on many Northland streams with the exception of near pristine habitats such as in the Waipoua Forest.

Two distinct fish pass designs are envisaged as necessary -

1. Lowland Fish Pass

Weirs across lowland rivers block a wide diversity of species, including fishes such as inanga and mullet, which have poor climbing ability. Therefore these weirs should be faced on the downstream side with rocks and boulders. The facing should form an artificial riffle with a slope no greater than 10° from the horizontal. Where the stream is wide, costs may be reduced by emplacing these artificial riffles on the margins only.

Studies have shown that both inanga and grey mullet are capable of swimming over small weirs where a low gradient "artificial" riffle has been built on the downstream slope.

Gabion mattresses are one method for ensuring the stability of these riffles under flood conditions. Artificial riffles have additional benefits for weir strength and permanence. They will buttress the weir and reduce scour.

2. Upland Fish Pass

The fish population in the upland reaches of Northland rivers is pre-adapted to climbing obstacles such as waterfalls and rapids. Wetted concrete slopes of weirs can be quickly climbed by these fishes. However, when dam structures 10 metres and higher are proposed, specific fish passes need to be considered. Designs are available for these fish passes and the concepts have been proven on dams in New Zealand in

excess of 30 metres. Fish passes for climbing fish are economical to construct and use very little water. The Regional Council should seek advice to develop a basic range of 3-4 fish pass designs suitable for the majority of weirs and dams.

Fish can be used as indicator species to show the impact of damming and water abstraction. The various kokopu species, and in particular the banded kokopu, are good indicators of adequate water quality in upland systems. Inanga is suggested as an indicator species for lowland systems.

Apart from the blockage of migration, dams and weirs have other environmental impacts. Concerns such as hypolimnetic drainage, resulting in iron and sulphide rich anoxic water have to be addressed. Other problems include localised impacts of impoundments having a daily "tidal cycle" of water abstraction (particularly as much native fish migration occurs at night). Impoundments will become silted, rich in nutrients and will grow macrophytes and algae. Summer time water temperatures are likely to be high and oxygen levels low. Provided lowland fish such as mullet and short-finned eels can still gain access and avoid impingement during drawoff periods, these warmwater fish will be less affected than inanga and other Galaxias species.

Pump intake screens need to be designed so they avoid impingement of fish. This includes 3 mm or less screen openings, and water velocities of 0.3 m s^{-1} or less (Mitchell 1987).

Downstream migration of adult eels and the larvae of *Galaxias* species is seen to be less of a problem than upstream migration. Downstream migration occurs in autumn and is linked with flood events. At these times the relative volume of abstracted water as against natural flow, is least.

EXOTIC FORESTRY

The impacts on fish of converting catchments into pine forest, is not well understood. Few studies have been made in New Zealand and none in Northland. Preliminary work suggests that buffer strips along stream margins will be critical (Hanchet 1990). Clear examples on the benefits of riparian strips are needed. Information is required on the widths of buffer strips and their importance to headwater streams. Studies should be made in Northland using the wide range of examples available from past plantings. A study area with streams flowing through all the phases of forestry: establishment; growth; thinning and logging would be particularly valuable.

Different impacts on water quality can be expected at each phase with establishment likely to be most damaging to stream ecology, particularly if regenerating shrubland is the major land type targeted for conversion to pines. Obviously the full cycle of exotic forestry will occur at every site although the time scales involved would make full term monitoring impractical. Sedimentation, reduced water yield, chemical leachates, a poor food supply for aquatic invertebrates are all potential impacts to be expected.

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