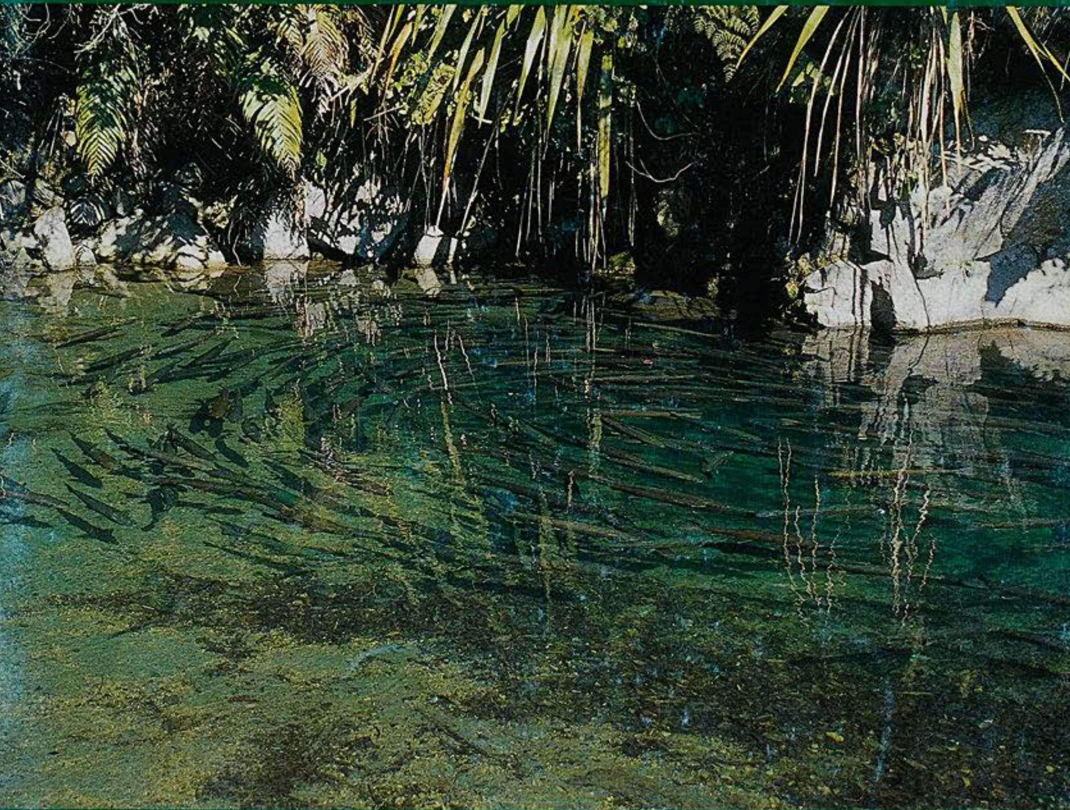
TARGET TAUPO

A newsletter for Hunters and Anglers in the Tongariro/Taupo Conservancy

DECEMBER 2001, ISSUE 38



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Front cover: Spawning trout in the Whitikau River.
Photo Glenn Maclean.

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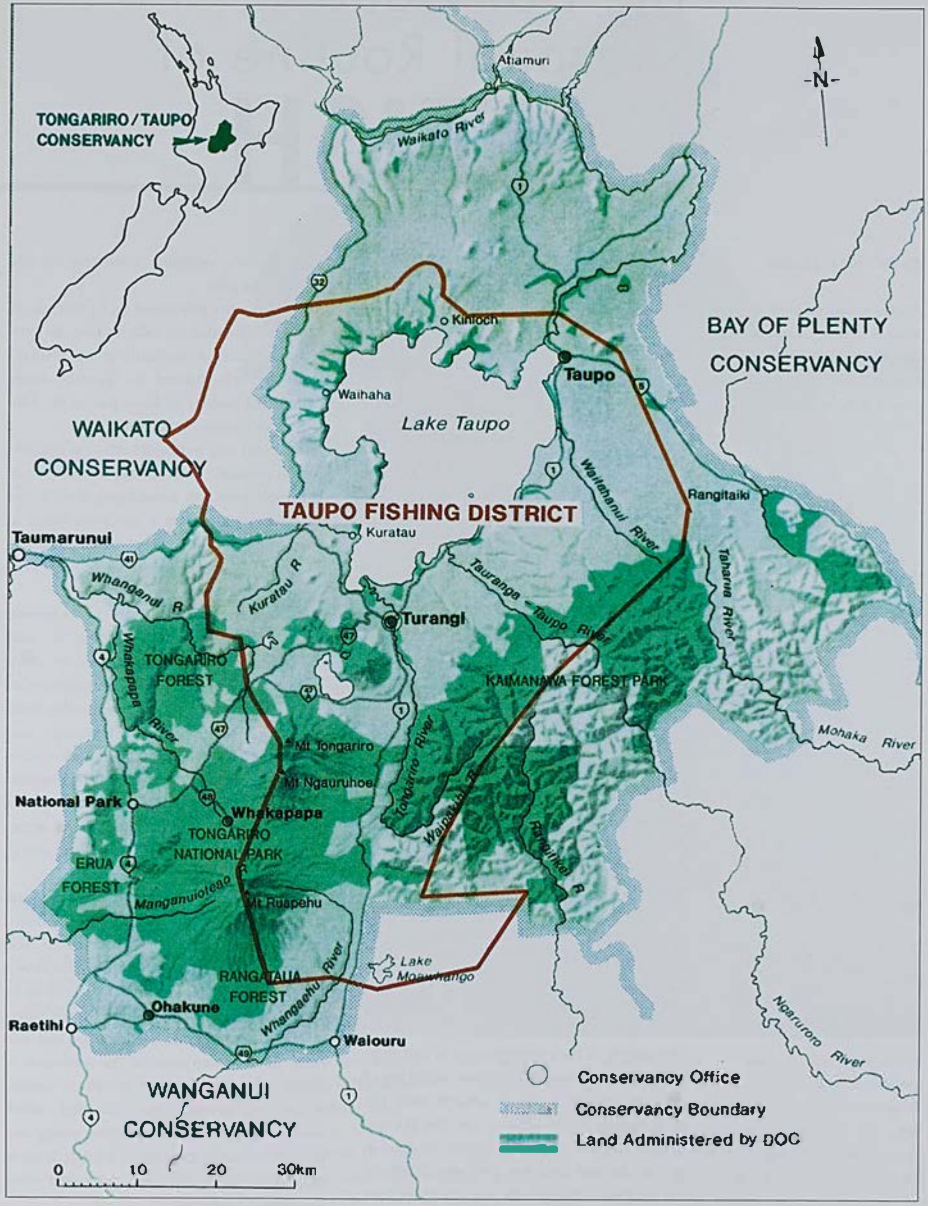


The Daily and Seasonal Routine of CATFISH

By Dr Michel Dedual

Michel is the Fishery Area Scientist. Hailing originally from Switzerland, Michel is also a very enthusiastic

Introduction

Catfish in New Zealand have no legal status. They are an introduced species but are classified neither as a desirable species nor as an unwanted species. Catfish are often described as a pest fish but it can be difficult to define what makes a fish species a pest. Is it simply because it is introduced (non native) or because it has some negative impacts on the ecosystem where it lives. Furthermore a species can have certain habits in its country of origin but behave quite differently under other conditions. Therefore the first thing to do with any new species is to describe its biology under New Zealand conditions. This first step is itself a big job.

There are several thousand species of catfish around the world, mainly in tropical freshwaters, but the only catfish species present in New Zealand is the brown bullhead cat fish (*Ameiurus nebulosus*) introduced from California in 1877. The Americans refer to it as the "brown bullhead" but New Zealanders simply as catfish. Catfish have been reported present in Lake Taupo since 1985.

It is unclear how they arrived in the lake, however given the hardiness and resilience of this species, they could quite easily have been introduced by accidental transfer. For example, a possible route is via the frame of a boat trailer used a day or two previously in the lower Waikato River.

The effects of the establishment of catfish in Lake Taupo remain obscure but catfish are of concern to local Maori, anglers and the Department. Maori report that the population of koura which they collect for food is on the decline and they believe catfish are the culprits. Anglers are apprehensive that catfish could seriously affect trout, both directly by preying on them as juveniles and indirectly by consuming smelt that are the trout's main prey.

These concerns prompted us to investigate the status of catfish in Lake Taupo. In 1996 Grant Barnes, a student from Waikato University, was funded to describe some traits of the biology of these fish in the lake with an emphasis on their diet.

Grant found that bullhead catfish in shallow, weedy or rocky habitats did not eat trout, that smelt were only a small part of their diet and that craylish were a rare item found in their stomach. The lack of trout in catfish stomachs brought some relief but the concerns didn't evaporate completely.

One concern was that Grant hypothesised that catfish were still spreading in Lake Taupo. To verify this hypothesis we have been monitoring the trend in abundance of catfish by setting nets on a bimonthly basis in shallow water in Waihi, Motuoapa and Whakaipo Bays. To assess the abundance we record the average number of fish caught in each net per night (CPUE). We also monitor the length distribution of catfish to detect any trend in the population structure and in the condition of the fish.

The monitoring showed that during the summer of 1997/98, catfish for unknown reasons vacated the shallow, weedy and rocky habitat. Subsequent underwater observations revealed large catfish shoals of up to 1000 fish in mid-water above barren sandy bottoms along the "drop-off" of the lake and close to the river mouths. The presence of catfish in this type of habitat was in contradiction the preconceived idea that catfish were only to be found in shallow, weedy and murky water. The ecology of catfish in these habitats remains unknown but raised some immediate questions:

- Is the diet of catfish in these habitats different from that in the shallow margins?

Fishery Ranger Harry Hamilton lifts a fyke net as part of routine monitoring of the catfish population.
Photo Glenn Maclean

• How deep do catfish go in Lake Taupo?
• Do catfish make seasonal and daily move ments within the lake?

A diet analysis of catfish caught in deep water (reported in *Target Taupo* issue 35) indicated catfish prey upon koura to a greater extent than in shallow waters. However, catfish needed to be larger than about 275mm in length to deal with koura and then they took only small and medium sized koura. We will discuss later the significance of these results. However, the concern that catfish could prey on juvenile trout as they reach the lake is unfounded since no trout or trout remains were found in the stomachs of catfish, including in samples taken close to the Tauranga-Taupo River

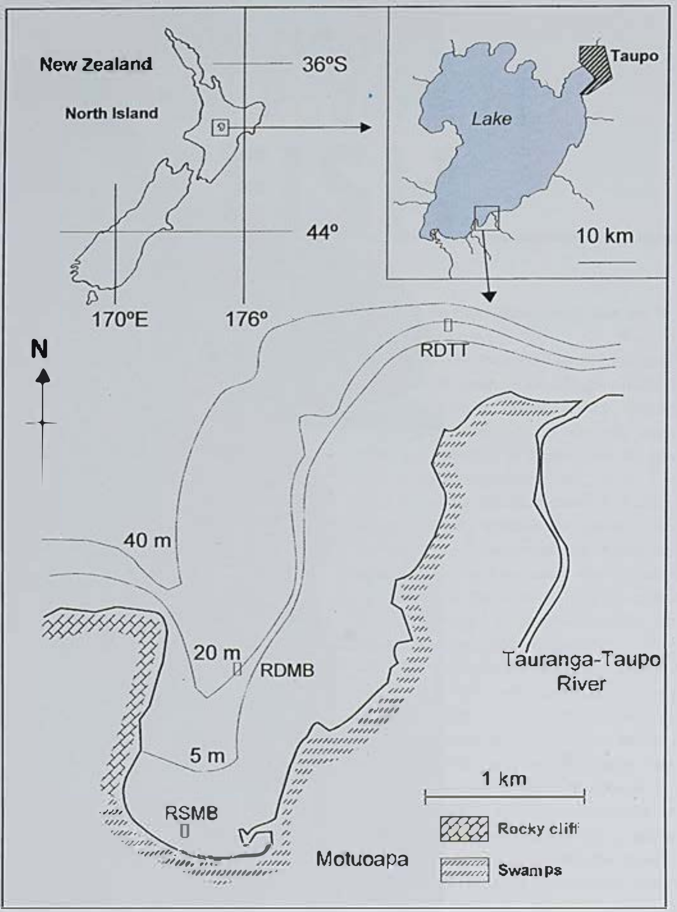


Fig. 1 Motuoapa Bay study area and Lake Taupo. The contours represent the 5m, 20m, and 40m isobaths. The position of the receivers. RSMB = Receiver Shallow Motuoapa Bay, RDMB = Receiver Deep Motuoapa Bay, and RDTT = Receiver Deep Tauranga Taupo.

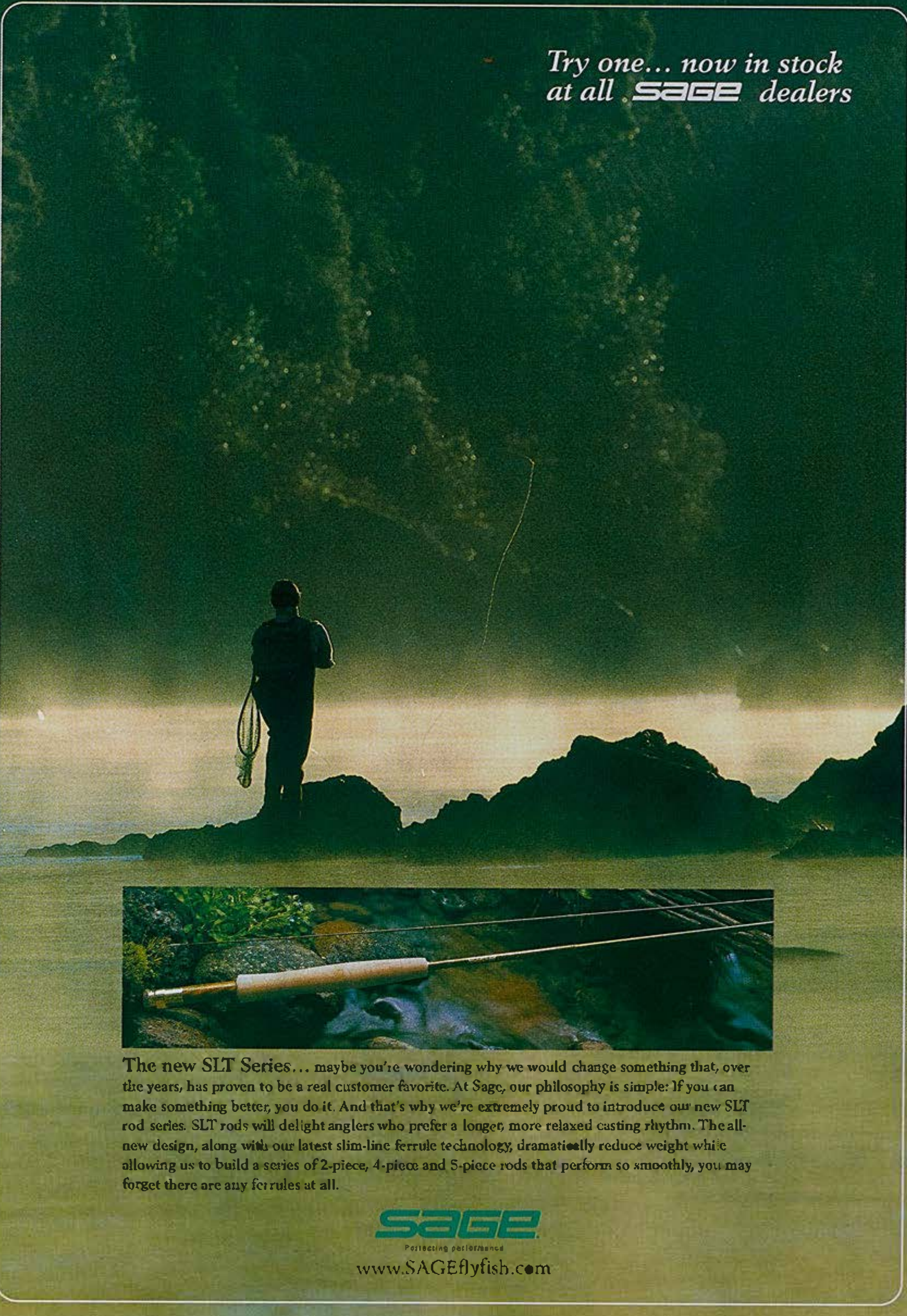
mouth.

The significance of the seasonal movement of catfish out of the shallow margins intrigued us and as a consequence we undertook a major project to better understand the patterns of movement of Taupo catfish. The aims of this article are to summarise the results of this project and describe the daily and seasonal routine of catfish in Lake Taupo. We then discuss potential ways of controlling their abundance and especially any negative impact on the ecology of Lake Taupo.

How was it done?

Acoustic transmitters fitted with a pressure sensor were surgically implanted in 12 large catfish between November 1998 and May 1999. The transmitters were 62mm long, 16mm in diameter and weighed less than 3% of the body weight of the catfish. The transmitters sent individually coded sound signals every 90 seconds, day and night, with information about the depth at which the fish was swimming.

The signals were picked up by three automatic receivers strategically positioned on the lake bed which each scanned a radius of 700-800m (figure 1). Two receivers were placed inside Motuoapa Bay. The first one scanned for fish in the shallow and inshore part the bay (RSMB) and the second one placed 15m deep along the drop-off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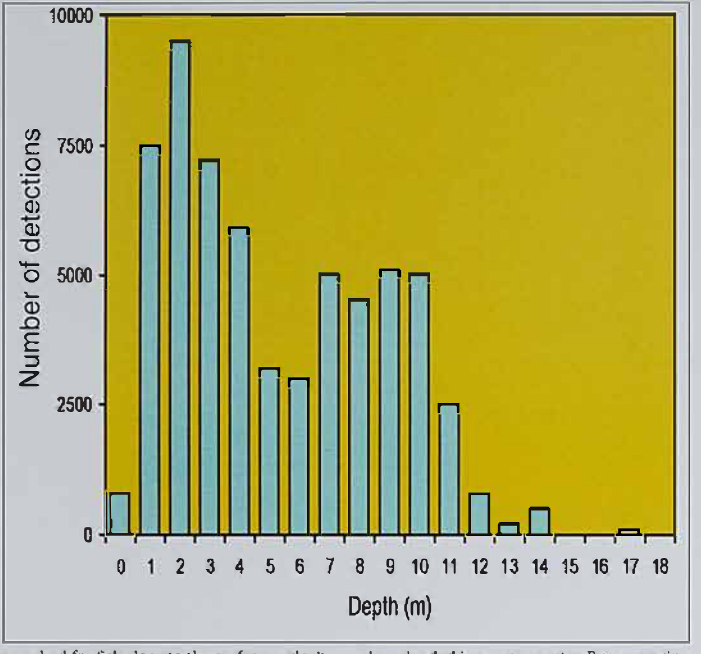


Graph 1 Total number of acoustic signals sent from catfish swimming at different depths between November 1998 and November 1999 in Lake Taupo

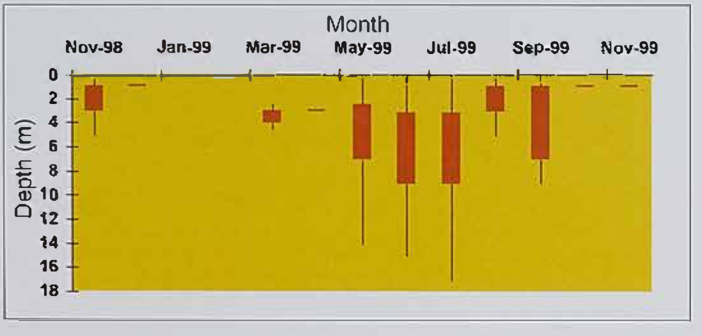
searched for fish close to the surface or deep in the offshore part of the bay (RDMB). The third receiver was positioned outside Motuoapa Bay in the vicinity of the Tauranga-Taupo River mouth (RDTT) to record signals sent by fish that had vacated the bay to the north. The traffic in and out of the bay was used to describe catfish seasonal movement.

Each receiver was bolted to a steel post driven into the sand by divers, and scanned for fish swimming above the weed beds. The receivers recorded the date, time and depth at which individual fish were detected. The data collected was automatically logged and downloaded into a computer. By comparing which receivers logged the fish and at what depth we could then determine the approximate position of the catfish.

How deep do catfish swim?

In Lake Taupo catfish generally swim within the top 10m of water though they occasionally use water as deep as 17m (graph 1). The intensive use of the first 3m of the water column is typical of catfish and has also been observed overseas and more particularly in North America where Taupo catfish come from.

The maximum depth used was 17m. This is



Graph 2 Monthly distribution of swimming depth of brown bullhead catfish in Lake Taupo. The red bars represent the depth range where 50% of the fish were swimming and the black bars, the total spread recorded

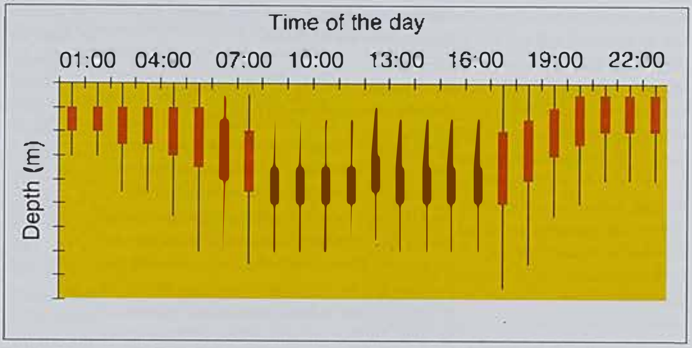
2m deeper than the maximum depth weed beds can grow in Lake Taupo However the low number of records from deep water indicates that catfish favour the presence of weed beds in their habitat even though they can swim deeper.

Where the lake bottom is rocky, such as on the western side of Motuoapa Peninsula, no weed beds can grow. During scuba diving surveys in these types of habitat we have observed catfish sheltering in rocks and cliff crevasses down to 22m. However, the density of catfish in these rocky habitats is very low. This suggests that catfish concentrate in the first 10m of water along the littoral zone where weed beds are present and that they are unlikely to colonise the offshore part of Lake Taupo where no shelter is available.

Do catfish swim at the same depth all the year around?

Catfish show clear seasonal preferences for different swimming depths. From late spring to mid-summer they use shallow water close to the shore inside Motuoapa Bay, swimming 1m to 3m below the surface (graph 2). As autumn approaches they move into deeper water inside the bay and by winter they swim mainly between 3m and 9m deep. With the return of spring, catfish once again move in shallow water and swim closer to the surface.

This seasonal change in swimming depth likely reflects the spawning migration and the distribution of the food supply of catfish. We know that catfish spawn between spring and summer but we haven't been able to witness the spawning event itself, despite



Graph 3 Daily distribution of swimming depth of catfish in Lake Taupo

looking hard. Overseas research reports that catfish construct a nest amongst weed or other substrate depending on what is available. When the eggs are laid the fish will protect the nest against all intruders.

At this time the eggs of catfish are vulnerable to predation by other fish. In Lake Taupo the most likely predators are bullies which are found in similar habitat as the catfish. It is therefore possible that bullies benefit from the presence of catfish by having access to a seasonal abundance of a new food source in the lake. It would be interesting to study the relationship between catfish and bullies. Furthermore, if bullies are doing well then in turn they will provide food for catfish and trout, especially brown trout that like patrolling around the shallow weed beds. This simple interrelation between two or three species highlights the difficulty of identifying the "bad" and the "good" impacts that the introduction of a new species may have on the existing fauna.

Do catfish swim at the same depth throughout the day?

While catfish were detected throughout the day between 0m to 17m deep an obvious pattern appeared (graph 3) in which they used the top 2m to 3m of the water column during the night but swam deeper as the day progressed. Through the day they preferred to swim 7m to 10m down before progressively returning to their night habitat closer to the surface in the late afternoon. Furthermore, snorkelling surveys above the weed beds during the day indicate that catfish are mostly inactive at this time, remaining hidden away in the cover of the weed beds.

There are several possible explanations for the daily shifts in the vertical distribution of catfish. One relates to predation by shags and sea gulls, which is the only significant threat to adult catfish in Lake Taupo.

To be able to dine on a catfish is not an easy task for these birds. They cannot just grab and swallow a catfish because of the three nasty spines on the first rays of the dorsal and pectoral fins. Catfish can "lock" these spines when threatened, though it takes some time for the spines to harden and small catfish can be easily gobbled up by birds. When dealing with a large catfish the birds have first to kill the fish. I have observed a sea gull that was "hammering" the catfish's head with its beak until the fish was dead (that took a while). Even when the fish is dead it still has its spines locked wide, requiring that it is processed further. The bird will literally skin the fish from head to tail with a bit of the skin still attached to the tail. Only now is the well earned dinner ready, the bird picking the carcass clean a bit like we would eat fish using chop-sticks. The remains of sea gull and shag catfish dinners can be found on the grass around Motuoapa Bay and the Tokaanu Tailrace.

Thus catfish probably avoid shallow depths (0.4m) when light intensity and/or water clarity is high, as a precaution against bird predation. Since the water clarity in Lake Taupo will degrade for the next 20 years regardless of what we are doing now (see *Target Taupo* issue 35) we may expect to see catfish becoming more active for a longer period during the day.

The shallow distribution of catfish from dusk to dawn may also reflect the daily shifts in prey distributions or prey type. We have seen that catfish consume an increasing amount of fish and freshwater crayfish as they grow. Freshwater crayfish are more active at night when they move into shallow water close to the shore. However, feeding at night is not a problem for catfish which are well equipped to cope with murky conditions.

In the 1910s biologists noted that catfish displayed different responses to metallic and non-metallic rods placed in the water near them, suggesting that catfish could detect the electric field produced by the metal in contact with the water. During the 1930s Japanese scientists observed that catfish responses were enhanced several hours before the onset of earthquakes, presumably as a response to induced electrical disturbances caused by changes in the earth's local magnetic fields owing to the seismic disturbances. However, the organs responsible for the electric detection were discovered only in the late 1950s. These are small pit organs scattered over much of the body surface which are called "ampullary electroreceptor organs". These can sense infinitesimal electrical currents, often not more than a few nano ampere (0.000000001 ampere).

These organs provide catfish with the ability to detect and locate their prey even during the darkest part of the night by using their electrosensory system alone. We will see later that these organs can be used for other purposes as well. We have watched catfish feeding at night using these organs. The catfish feed close to the bottom and when they sense prey close by (in many cases almost touching the catfish) they lunge forward, trying to pin the item against the sand. Quick moving fish like smelt easily dart out of reach, frustrating the catfish, but bullies and small koura are much more susceptible. Large koura though are too staunch for the catfish and simply rock back on their haunches with their nippers raised, the catfish soon losing interest.

Do catfish display any unusual swimming behaviour?

A conspicuous behaviour displayed by all catfish was an occasional brief dive and/or ascent. Catfish would ascend or dive 2m or more for periods of less than 10 minutes before returning to their original depth. Other fish species display similar behaviour. For example, biologists report that Atlantic salmon in Norwegian fjords also make the same characteristic dives, especially when the fish change their swimming direction or at narrow passages in the fjords, where the horizontal movement of salmon becomes erratic.

The rapid vertical movements of catfish follow a consistent daily pattern. Catfish start their ascent and diving routine in late afternoon when they start moving from their deep day habitat into the shallow night habitat. The ascents are especially marked during the hours of reduced daylight at dusk. During the bulk of the night catfish remain at the same depth or change depth only very slowly. With the approach of dawn they again start their routine but this time the initiation of the diving behaviour is more marked. It is interesting to note that the average duration (5.35 minutes) of dives was almost identical to that of the ascents (5.28 minutes). The average depth of the dives was 2.4m and the average ascent 2.6m.

The low number of ascents or dives during the middle of the day combined with the low number of signals during the same period indicates that catfish are less active during periods of high illumination, remaining hidden in the weed bed.

Catfish have complex social interactions and a social hierarchy organised via signals mediated by a variety of sensory cues. For example, electric fields are generated by a wide variety of sources in the aquatic environment, and these fields are potentially a rich source of information to catfish. The convergence of two layers of water of different temperature generates hydroelectric fields. Thus the brief dives and/or ascents observed in this study may reflect the presence of a temperature gradient used by catfish to gather electrosensorial stimuli.

The study highlights that catfish don't always try to swim in the warmest water available (close to the surface) where they could take advantage of the thermal regime for feeding and digestion.

Do catfish move around the lake?

Movement depends on the season.

Spring

Half of the catfish tagged in late November in Motuoapa Bay left the bay between 16 and 21 December and were detected close to the Tauranga-Taupo River mouth. By 22 December these catfish had also left the Tauranga-Taupo River mouth area and didn't return to Motuoapa Bay, indicating that they moved further north. This shows that in spring some catfish move more than 4km. To assess the maximum distance that catfish move around the lake would require an extensive array of receivers deployed all around the lake. However from our tagging-recapture experiment we know that some catfish make substantial migrations in Lake Taupo. For example, during the catfish monitoring programme we caught a fish in Motuoapa Bay that was tagged in Waihi Bay. Assuming that catfish migrate along the shore this would represent a journey of about 15km. This is a lot in comparison with other species of catfish which never move more than 1.6km but small compared to Mississippi River catfish which can swim more than 160km.

The limited battery life of the transmitters used in this study prevented checks of whether or not tagged catfish came back into Motuoapa Bay later in the year. However, the results of the mark-recapture experiment show that catfish vacate Motuoapa Bay early in summer and that some of them return to this location the following spring. Thus it appears that catfish have an annual migration pattern in Lake Taupo.

The reasons for the increased movements in and out of Motuoapa Bay in spring are unclear but they may reflect pre and post spawning movements Grant Barnes during his Master's study concluded that catfish in lake Taupo spawn between September and December when the average water temperature is 12°C. In this study the catfish left Motuoapa Bay in December, coinciding with the end of the spawning period. We believe that catfish in Lake Taupo make a migration to the shallow habitat in places like Motuoapa Bay for spawning. Most of the bay is less than 2m deep with an extensive weed bed which creates favourable habitat for spawning. Motuoapa Bay and the shallow swampy margins also provide rearing habitat for juvenile catfish and until now all the observations and reports of juvenile catfish have originated from the swampy areas at the southern end of Lake Taupo.

Autumn

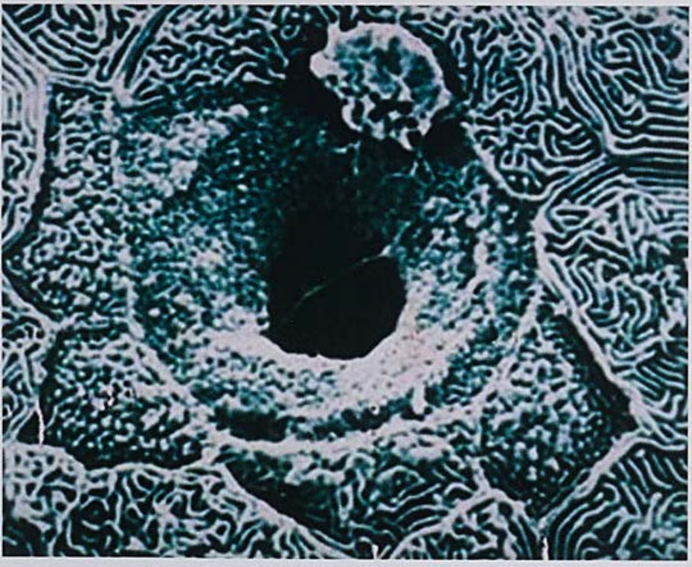
The second lot of catfish tagged in May had a different pattern of movement. None of them was ever detected around the Tauranga-Taupo River mouth but they were all detected by the second receiver set in deep water inside Motuoapa Bay. Contrary to the first group of fish, they were picked up on several different occasions and made only short excursions in the deep area of Motuoapa Bay. The fact that none of these fish was detected at the mouth of the Tauranga-Taupo River indicates that during late autumn and winter catfish roam in Motuoapa Bay but don't leave it.

The sedentary behaviour of catfish during winter in Lake Taupo parallels that of catfish species elsewhere. Channel catfish and blue catfish have been reported to concentrate in deep water where they remain sedentary over winter.

Conclusion and management implications

Extermination of catfish from Lake Taupo using a poison like Rotenone is not a practical option (*Target Taupo* issue 33). Indeed even if it were it is likely catfish would be the most resilient of all the fish species present because of their distribution through the swamps and the difficulty in poisoning every last pool.

So far the only negative impact we have identified that catfish have on trout is through competition for koura as food supply. However, we have seen that catfish need to grow to at least 270mm before being able to catch koura. This means that large catfish are the threat and if removed from the system the negative impact of catfish on koura would be substantially reduced.



Scanning electron micrograph of the opening of the pore of an ampullary electroreceptor organ in the catfish. The opening is about 0.05mm wide.
Photograph Cees Eigenhuis and Jan van der Linden)

During the past six years of monitoring we have used fyke nets to catch catfish. This method has proved to be very efficient in shallow water and easy to use. Furthermore it is very selective; for the entire period only three trout were caught, a few goldfish and occasional koura. Therefore catfish control through commercial harvesting using fyke nets is a possible option. The efficiency of this measure could be improved by taking advantage of the migration route taken by catfish in spring. A line of fyke nets set perpendicular to the lakeshore on the northern side of Motuoapa Bay (and probably in any other areas of Lake Taupo having similar configuration) would intercept many catfish during their migration, especially in December. Through the rest of the year fyke netting is not as effective because the swimming depth of catfish in autumn and winter is too deep for using these nets. Gillnets set inside Motuoapa Bay in 3m to 9m of water could be used instead. However, rainbow trout in Lake Taupo use this layer of water intensively, especially in autumn, and their presence in the by-catch would defy the purpose of controlling catfish to protect the rainbow trout fishery.

The total number of catfish should reasonably indicate the extent of their potential impact. The size of the catfish population is dependent on, amongst other things, the number of juvenile catfish produced. We know that juvenile catfish are mainly found in very shallow water and in the swampy margins of the lake. It may be possible to regulate the population by preventing access for spawning catfish to these areas by manipulating the lake level. Interestingly our monitoring indicates that the catfish population has remained stable, if not declined over the past two years, which coincides with much lower spring lake levels than in the preceding few years. However before embarking on such a control measure it would be wise to further assess just how serious the catfish threat is to the Taupo rainbow trout fishery and lake ecology versus the impact of such a control measure on the swamp environment around the lake. In the meantime we will shortly complete the tag recapture experiment at the southern end of the lake, which will enable us to estimate the total population size in this area. This will not be an indication of the population density across the whole lake, for as this study has shown the catfish do not favour the open waters or areas deep within the lake. It will however be an estimate of the numbers likely in those limited areas of highly favourable habitat. Will the number add up to the 50 million which has been quoted as if it has some factual basis. We very much doubt it!

Harry Hamilton inspects the catch for any tagged catfish. The catch in the bin is typical for a single fyke net set overnight in spring/summer

Species Segregation in Deer

A Central North Island Example

By Cam Speedy

Cam co-ordinates animal pest and threatened species management for the Tongariro Taupo Conservancy. Cam and his team also oversee weed management and habitat monitoring

Segregation - *enforced separation of different racial groups in a community - Concise Oxford Dictionary*

Those of you who hunt the central North Island will appreciate that both red and sika deer can be found sharing the same landscape. While the two species are related and will hybridise, they are essentially different animals, and though they may both be encountered in a single hunt, general behaviour and range utilisation of the two are quite different. An understanding of the sometimes subtle differences in how these species use their habitat, and what they require from it, forms an integral part of the information arsenal required by both successful hunters and wildlife managers alike. The following article looks at how sika and red deer coexist in the central North Island and how "species segregation" occurs. Sika and red deer have a number of behavioural, anatomical and physiological differences related to their respective evolutionary histories within their native environments. While the history of colonisation has had a huge influence on habitat utilisation in a New Zealand context, these more basic traits, physical characteristics and instincts remain rooted in the lifestyles of their ancestors. Lifestyles that evolved under very different conditions in different parts of the world.

To understand species segregation in sika and red deer in the central North Island we need to first look at a situation where similar animals coexist naturally. In northern China and south-eastern Russia, the local races or sub-species of "spotted" (sika) deer and Asian wapiti (the red deer equivalent of our local situation) have co-evolved over many thousands of generations, together with their local mountain landscapes, forests and a wide range of other life including bears and wolves.

In that part of the world, wapiti are masters

Heavy cover in the sheltered low country provides an important aspect of preferred sika habitat. Photo from the DoC photo library Turangi

Happy to live in the open, red deer are found across the extensive tussock river valleys and alpine tops of the central high country. Photo from the DoC photo library Turangi

of the montane (mountain) forest and alpine habitats of the high country. The smaller spotted deer are dwellers of the sheltered valley forests. At a very basic level, it is the physical environment that separates the species. The latitude in this part of the world is greater than southern New Zealand so snow is a major climatic factor in winter. This has a major bearing on the habitat selection of the two species. Wapiti are large and therefore have a small surface area to volume ratio and so are able to keep warm efficiently. The requirement for maintenance energy increases with physical size, but the advantage of large size is it allows them to exploit habitat which is climatically more severe. Their continued survival over time suggests this must have had a worthwhile "cost benefit".

On the other hand spotted deer are small. The benefits of being smaller come from needing less food to run the body's vital functions, so the maintenance energy requirements are reduced. But the cost is that because you are smaller, you need to stay sheltered from the severe climate since small animals lose body heat very easily. You also have to be a bit more careful of the wolves!

In south-east Russia, up to 50% of the spotted deer die as a result of a heavy snow winter. Wapiti on the other hand cope significantly better. They are large, tall and can negotiate deep snow drifts more easily, giving them an ability to move some distance to seek shelter or food, while their size allows them to hold body heat more efficiently in extreme conditions.

Predation is also an issue. Between 5% and 30% of spotted deer are taken by wolves in any given year. Secretive behaviour, wariness, escape cover, and perhaps even enhanced social behaviours such as vocalisation are good traits for these deer to develop (ring any bells for central North Island sika hunters?). In contrast, the larger, taller wapiti can run faster, for longer, and are a higher risk proposition for a pack of hungry wolves. Predation is therefore not such an issue for wapiti. Access to winter food supply tends to be more important in weeding out the old, the weak and the surplus, even if the wolves probably benefit from this scenario too in the long run, since nothing ever goes to waste in nature.

So predation and climate provide two examples of the types of factors that help separate different species in their native land. These examples also help us focus on the environmental factors that might influence the habitat selection of their New Zealand cousins. They're not totally the same, but the basic principles still hold.

In the central North Island high country of New Zealand, sika deer prefer lower altitude, warm, especially north-facing habitat with plenty of dense cover surrounding sheltered feed areas. Red deer are more common where the habitat is fragmented between forest and open country, especially above 1200 metres altitude where montane forest gives way to a mosaic of alpine shrublands, tussock grasslands and herb fields. Unlike sika, red deer are quite happy out in the open. That is not to say that you will not find both species scattered, at least seasonaly, throughout most habitats in the central North Island, but where sika deer are most common, red deer density will generally be low, and vice versa.

In our New Zealand situation, the ecological role of wolves is filled by man the hunter. Between 5% and 30% of deer are harvested by hunting of one form or another each year. However, the impacts of wolf and human deer harvesting regimes are very different. The red deer's feeling of freedom out in the open may make him harder to approach and run down for a wolf pack, but it makes him significantly more vulnerable to predation by humans, especially humans with high-powered rifles or helicopters. Conversely, the sika deer's desire to be close to cover makes him more secure from that same human predator. Without doubt, the heavy escape cover that makes up such an important part of preferred sika habitat helps them maintain a strong hold on particular habitat types in our New Zealand scenario. Indeed, red deer have been severely reduced in the Kaimanawa Mountains these past two winters by helicopter venison recovery operations as a result of strong venison prices and increased access for commercial recovery following legislative changes. The main reason for this reduction is that red deer are so much more accessible in their preferred open alpine habitat, while sika are more difficult to recover from their

preferred heavy cover. The fact that they are also bigger (an average carcass this winter of 38kg) means they are a far better commercial proposition than the smaller (often less than 20kg carcass) sika from the same areas.

To fully understand the segregation of the two species in the central North Island, we need to also understand the colonisation process which resulted in the presence of deer in this habitat in the first place. Habitat which, while having historically been subject to the various and no doubt significant browsing regimes imposed by a menagerie of birds, had evolved in the total absence of deer.

Red deer colonised the central North Island from numerous liberations in the region between 1883 and 1922 so in ecological terms, have been here only a very short time. As such the range is still going through a rapid, chaotic ecological re-adjustment. These liberations included releases in: both eastern and western flanks of the northern Ruahine Range and at Moawhango to the south; Hawkes Bay to the east; Tongariro National Park and Tokaanu to the west; and perhaps even Galatea to the north. The first reports of red deer from the central Kaimanawa Ranges were from shepherds mustering sheep for Ngamatea Station in the head of the Ngaruroro River (Boyd Lodge area) about 1903. By the early 1920s red deer were commonly mustered among the sheep and by about 1930 numbers are thought to have peaked with significant depletion of forest understoreys throughout the range and a corresponding, significant decline in animal size and condition.

Sika deer colonised their current 8000 square kilometre central North Island range from a single liberation in 1905, at Merrilees Clearing (Poronui) on the eastern boundary of what is today the Kaimanawa Recreational Hunting Area. This liberation involved three stags, three hinds and a fawn born en route from Woburn Abbey in England, although some authors believe one or even two of the stags may not have survived the journey. Surprisingly, their rate of dispersal was similar to that of red deer, despite red deer having established themselves at habitat damaging densities in most surrounding areas by the time sika numbers had built up to any significant level around their liberation point. By 1940, sika deer were extremely numerous and extending their range well into areas which had already been occupied by red deer for some time.

It is this colonisation of previously occupied and severely depleted red deer range by sika deer which is of most interest in trying to understand the current range and distribution of the two species in the central North Island. Red deer have not colonised the area surrounding the initial sika liberation point to anywhere near the same degree. The reason for this is a vital component of how the two species segregate, and again lies partly rooted in the lifestyles of their respective ancestors, and partly in influences within the local environment.

Not only are sika deer smaller than red deer, therefore requiring lower maintenance energy, they have a slightly different gut anatomy and digestive physiology which allow them to utilise poor quality feed more efficiently. As a result, sika can survive in habitat that is no longer able to support red deer. As red deer density peaked in the central North Island following their initial colonisation, over-browsing began to compromise habitat quality and hence herd health. To make matters worse, the leached, volcanic pumice and ash soils of the central North Island have extremely low fertility and lack many important minerals and trace elements. Therefore the range depletion which followed uncontrolled growth of the red deer population set up a situation where the smaller and more browse efficient sika deer had a major competitive advantage in terms of surviving and reproducing in marginal habitat. Then, as sika began to replace red deer over much of the seriously depleted forest and shrubland habitat, a booming venison industry began to significantly reduce deer density. A small improvement in habitat quality resulted but this regime, aided by the fact that sika prefer heavy cover while red deer prefer open country, also selectively removed greater proportions of red deer from the range. This enhanced the competitive advantage of sika and accelerated the replacement process. It has little to do with sika being more "aggressive" than red deer as many believe.

Today, sika still retain their competitive advantage in the depleted habitats owing to their size and digestive efficiency, but they cannot cope with the extremes of climate that still give red deer almost exclusive use of the alpine habitats. As a consequence sika remain limited to the warmer, more sheltered country. While both species are heavily targeted by recreational hunters, the preference for cover and the secretive disposition that historically helped sika survive the predatory influence of commercial helicopters (and probably wolves in their ancestral range) continue to give them a major advantage in the region. Red deer retain a certain level of vulnerability from their inherited desire to be free on the tops and are unlikely to ever recover to levels much above current densities except where they are offered protection from hunting. However, unless major habitat recovery occurs in the depleted forest and shrubland habitat, red deer will continue to struggle against sika in these habitats anyway.

By looking at some of the factors that have shaped the modern lifestyles of these two transplanted deer species, we can start to understand patterns of habitat selection and distribution, and more accurately interpret trends in deer density and habitat quality. This type of understanding not only helps hunters increase contact rates and hunting success but is vital to managers in ensuring they design management regimes that will achieve desired management outcomes, whatever those might be on the land in question.

Tongariro Power Scheme Resource Consent Appeal

The Department of Conservation is seeking to restore some of the lost quality of the world-famous Tongariro River trout fishery and the ecology of the Moawhango River.

Genesis Power Limited was recently granted resource consents to continue its operation of the Tongariro Power Scheme. The Department accepts most of the consent decisions which reflect many years of constructive consultation by Genesis, but has lodged an appeal with the Environment Court on two aspects of the scheme.

There are concerns about the flow regime proposed for the lower Tongariro River and its effects on the fishery. Natural seasonal variability of flows is vital for the maintenance of river ecosystems including New Zealand's most important trout fishery. The Department is seeking an annual flow pattern based around the naturally occurring minimum flows in the lower Tongariro River.

In relation to the Moawhango River, the Department is seeking that adequate monitoring is undertaken to ensure that in future reviews of the consents, the residual flow has met the management objective of the river beneath the dam. This would mean that the type of invertebrate community in the river would resemble that which might occur in a healthy lake fed river ecosystem.

The Department recognises the importance of the Tongariro scheme to energy production and wants this to continue. However DOC scientists believe the outcomes being sought through the appeal would result in significant improvements to the Tongariro River, which is the cornerstone of the whole Lake Taupo fishery.

New Executive Officer for Trout Centre Society

By Bob South

The Tongariro National Trout Centre Society, which oversees the running of the Trout Centre complex just south of Turangi on the banks of the Tongariro River, has appointed Taupo resident and keen angler Gordon Stevenson as its Executive Officer.

Gordon is a retired New Zealand Army officer and father of three who brings a diverse range of qualifications to the new position.

Educated at Wellington College and a graduate of the Officer Cadet School in Portsea, Australia in 1964, Gordon became a career officer of 23 years in the New Zealand Army, enjoying a diverse range of appointments, including administrative logistics and foreign affairs. His postings included active service in South Vietnam and with the United Nations (UNMOGIP) in India and Pakistan. He retired as Major in 1985.

His qualifications also include being an associate of the New Zealand Institute of Management, a member of the Fundraising Institute of New Zealand, the National Fundraising Manager for Epilepsy New Zealand, and Chief Executive of the National Child Health Research Foundation. Among his fundraising achievements was his personal management and raising of an $850,000 endowment fund in 1996 from Rotary Clubs throughout New Zealand, recognising the Child Health Research Foundation's 25 anniversary.

While in the Army, Gordon was Director of the QEII Army Memorial Museum at Waiouru from 1982 to 1985. Following retirement from the military, he became Director of the Auckland

Minister of Tourism and local MP Mark Burton (right), presents a Tourist Facility grant of $50,000 to society chairman John Milner

Maritime Museum from 1985 to 1988, before moving into his work with the National Child Health Research Foundation (1988 to 1998) and Epilepsy New Zealand (1999 to 2000).

For the past year, Gordon has run a consultancy from his Taupo home, specialising in charitable financial management. In his new role he will be instrumental in fundraising for the Tongariro National Trout Centre Society, increasing its membership, and facilitating the development of a $260,000 auditorium and advocacy and interpretive display centre at the Centre.

The tenders have closed for the building of this auditorium and advocacy centre and it is hoped construction will be completed sometime around March. Part two of the project involving planning for the new displays is now underway.

The Society is continuing its membership drive. Recently, the executive resolved to increase the membership fee from $5 to $25. The new rate is for an individual or family membership. The Society wants to encourage more family participation. Members will receive regular newsletters and share in special membership incentives. Any new member immediately goes into a draw for a $200 gift voucher from Turangi's Sporting Life. Larger donations will be graciously accepted.

Membership fees or donations should be sent to:
The Tongariro National Trout Centre.
PO Box 73, Turangi

Target Taupo Mailing List

Only those of you who purchase a Taupo Adult Whole Season fishing licence each year are placed on the *Target Taupo* mailing list. This mailing list is compiled during the current season and used to send out three issues of *Target Taupo* the following season. For example if you purchase a 2001/02 season licence you will receive your copies of *Target Taupo* over the 2002/03 season.

Remember to put your full home address and suburb, if applicable, and not a holiday home address. Numerous copies of *Target Taupo* were returned after the last mail out, especially from holiday home addresses and in particular those with an RD 1 etc address (many of them are marked "Not a Boxholder"). If you purchased a season licence last season and did not receive your July 2001 issue of *Target Taupo* please contact Mandi Goffin at this office.

The Search is On

A nation-wide search to locate populations of pest fish is on.

By Nic Etheridge and Natasha Grainger

Nic is Technical Support Officer Biodiversity for pest fish/freshwater issues, mainland island restoration projects, quality conservation management (QCM) with animal pests, and surveying and monitoring of forest birds within the conservancy. A nation-wide search to locate populations of pest fish is on.

Natasha is a Freshwater Technical Support Officer in the Northern Regional Office who specialises in pest fish issues at a national level.

(Above) Tokaanu Bay at the Southern end of Lake Taupo would provide ideal habitat for many pest fish species. Photo Glenn Maclean

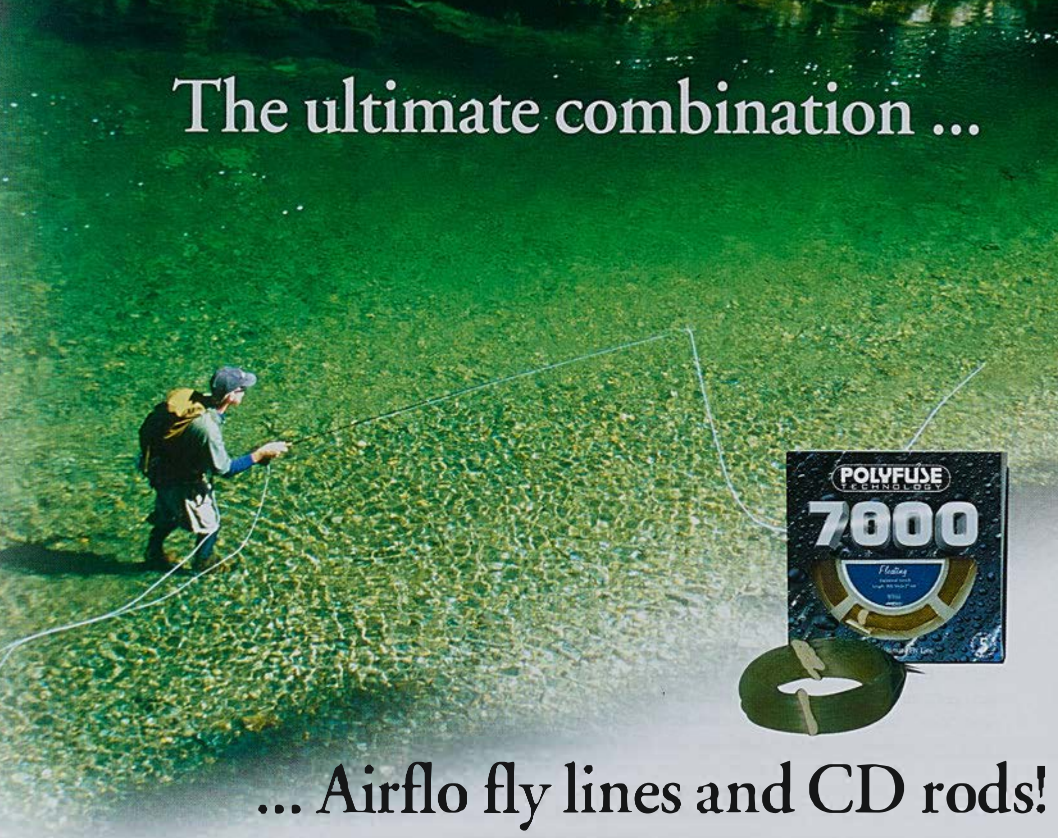
There is a long and active history of exotic animals and plants being introduced to New Zealand. The changes made by introducing these species have been extreme. Our freshwater environment is certainly no exception, with introduced fish comprising over a third of all freshwater fish species found in New Zealand. We are no longer a primeval paradise, however we can learn from our past actions and prevent further modification of our freshwater systems.

There are many threats to freshwater ecosystems, including habitat modification and destruction, water abstraction and pollution to name a few. Introduced plants and animals are also a threat. However, some undesirable species have not yet completely colonised New Zealand and it is important to try and prevent them from establishing new populations.

Fortunately the Tongariro/Taupo region is largely free of species such as koi carp, Gambusia (formerly known as mosquito fish) and rudd, the species of greatest concern. We have an array of introduced fish, some very highly valued like trout, but thankfully, the species listed above are not thought to be present above Huka Falls. They are a problem we could certainly do without. Hence the search is on to confirm this is still the case and to ensure that it remains so.

This summer, surveys will be undertaken to determine whether these pest fish species have made it to the Tongariro/Taupo Conservancy and if they have, the extent of their distribution. We know koi carp have moved up the hydro lakes towards Lake Taupo. Preventing them from getting here is vital. What would happen if these species reached the lake? Would our water quality decline? How would the trout compete? Because we don't have the technology to eradicate koi from such a large water body, it is essential we restrict their access in order to avoid having to address these questions.

The survey in Tongariro/Taupo is part of a nation-wide survey to determine the limits of the distribution of pest fish species. In recent years these species have increased their range and in some cases quite considerably. Koi carp and *Gambusia* were found in the South Island for the first time last year. This was considered to be a serious internal biosecurity breach and triggered the need for the Department to more clearly define the current range of these species. When all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this information has been gathered the Department will be able to ascertain the magnitude of the issue (or not) and a management framework will be developed.

The North Island survey team will consist of four people working their way up the North Island over the summer. They will be searching priority sites and following up on reports from the public.

Which species are we concerned about?

New Zealand's freshwater systems contain 21 species of introduced fish and 38 native species. Of the introduced species, eight have highly restricted distributions, two are unlikely to breed and 11 have the potential to spread and impact on a wide variety of freshwater habitats.

Like all introduced plants and animals the extent of their impact depends on the particular environment to which they are introduced. For example we view catfish in Lake Taupo as a problem but not a calamity. However the same species in a shallow lowland lake rich in invertebrates could have more serious consequences. Koi carp, *Gambusia* and rudd (outside the Auckland/Waikato Fish and Game region) are causing the greatest concern on a national basis and have formal pest classifications. In this area perch also pose a very significant threat, particularly to the trout fishery. The distribution of catfish is also of interest for while they are widespread through the Waikato River system and Lake Taupo there are only a few other populations around the country.

There is a range of values placed upon various introduced fish species. These are largely human values which often cause debate amongst freshwater ecologists. Each species is classified under various legislative statutes according to its impact and its value as a resource. For example, salmonids (which include trout and salmon) are classified as sports fish throughout New Zealand. They have a high recreational value and are managed as such. They do impact on native species but they are highly valued recreationally and economically important.

Perch and tench (and rudd in Fish and Game Auckland/Waikato region only) are also classified as sports fish. Grass and silver carp are classified as restricted species, while catfish and goldfish have no status. The group we refer to as invasive or "pest fish" is primarily koi carp, *Gambusia* and rudd and nationally these are the species of most interest to DOC. Koi carp and rudd are classified as noxious fish under the Freshwater Fisheries Regulations 1983 and koi carp and *Gambusia* are also classified as "Unwanted Organisms" under the Biosecurity Act 1993.

Koi Carp

Koi carp is an ornamental strain of the common carp *(Cyprinus carpio)* native to Asia and Europe. The species was introduced to New Zealand accidentally in the 1960s as part of a goldfish consignment.

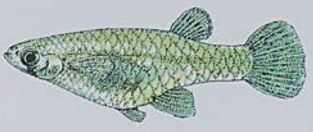
Koi carp resemble goldfish except they have two very obvious pairs of barbels (feelers) at the corners of their mouth. They are highly variable in colour, often with irregular

Koi carp.

blotchings of black, red, gold, orange or pearly white. Koi carp are long-lived fish and grow to about 75cm in length.

Gambusia

Gambusia affinis are small fish introduced to New Zealand in the 1930s from the Gulf of Mexico to control mosquito larvae which, ironically, they are not very good at. This erroneous reputation has led to their being released in many countries around the world only to become pests. They are very aggressive and will attack fish much larger than themselves. This has led to their being nicknamed "killer guppies".



Gambusia (female).

For such an aggressive fish they are not very big. Mature females grow to 6cm and males to 3.5cm. Greenish with a silvery sheen in colour, they mature at six weeks old and are unusual because they give birth to live young. This means that only one pregnant female is needed to start a new population. These features allow *Gambusia* populations to build up to large numbers very quickly.

iii) Rudd

Rudd were introduced illegally into the upper North Island in 1967 and spread rapidly in the Waikato-Auckland region.

Rudd are stocky, deep-bodied fish with a golden olive back, paling to silvery green on the sides. The snout and lips are a rosy-pink colour and the fins are bright red. They normally grow to 25cm long and about half a kilogram in weight.

Where are they found?

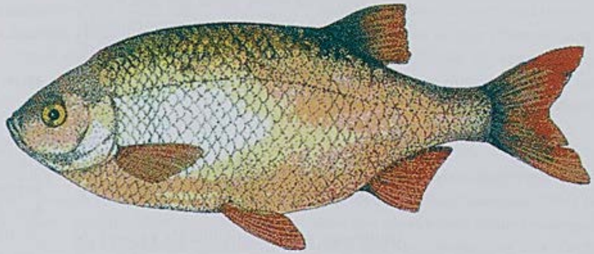
Koi carp prefer still waters in lakes or backwaters in rivers. They are very tolerant of poor water quality and contribute to further declines in water quality by stirring up the bottom and increasing the turbidity.

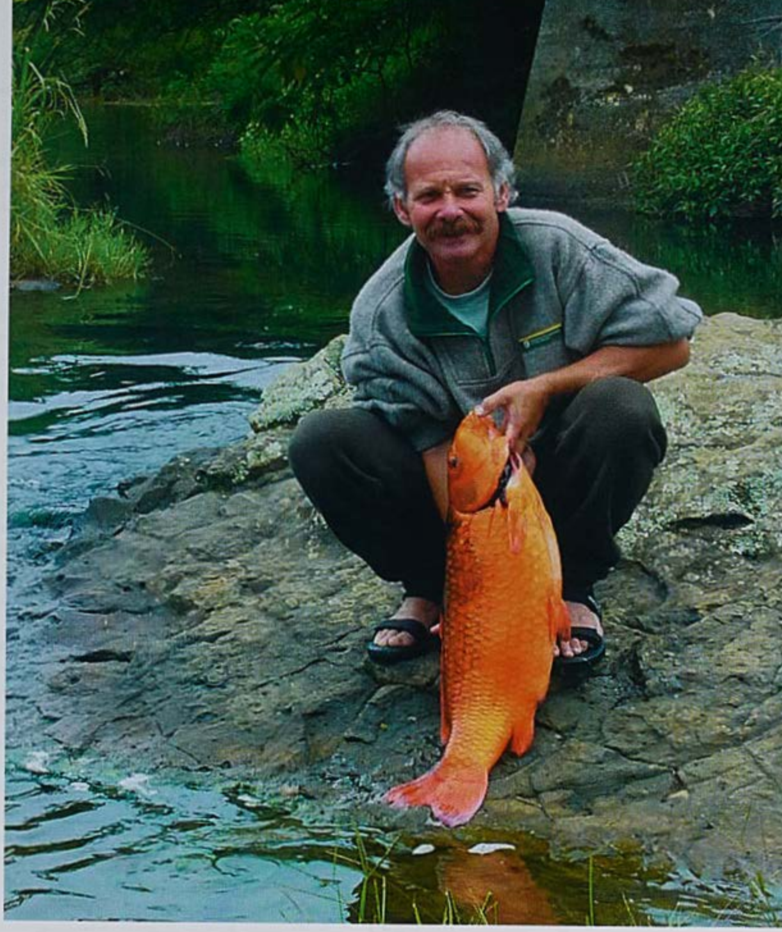
Koi carp are widespread in Auckland and Waikato. They are spreading into Northland and have been found in isolated places in Wanganui, Hawkes Bay and Wellington. Last year they were recorded in the Nelson region for the first time (where they were promptly eradicated).

Gambusia prefer the shallow margins of slow-flowing ponds, wetlands and streams especially around aquatic plants. They can tolerate poor water quality and a wide range of water temperatures. *Gambusia* are widespread throughout Northland, Auckland, Waikato and Bay of Plenty. Isolated populations have been found in Hawkes Bay, Wanganui and Nelson, although eradication has been attempted here.

Rudd prefer ponds, lakes and slow-flowing streams. They are widespread in Auckland and Waikato with isolated populations in Northland, Wanganui, Wellington and Christchurch.

Rudd.





(Right) DOC officer Mike McGlynn holds a giant koi carp from Northland. Photo Shelly Clendenon

Why are pest fish a problem?

Koi carp feed like a vacuum cleaner, sucking up everything and then blowing out what they don't want. This stirs up the bottoms of ponds, lakes and rivers, muddying the water and destroying native plant, fish and waterfowl habitat. Koi carp are opportunistic feeders eating insects, eggs, juvenile fish of other species and a diverse range of plants and organic matter. Aquatic plants are dislodged in the process and are often unable to re-establish. The increases in turbidity also reduce the light and the depth to which plants can grow.

Gambusia populations quickly expand to outnumber other species. They attack native fish by nipping at their fins and eyes and prey on their eggs. Whitebait and mudfish species are especially vulnerable to *Gambusia* as they inhabit similar habitats.

Rudd eat other fish, including native species and trout, compete with them for food and can damage native fish habitat. Rudd are also a nuisance to flyfishers, as they will readily take a dry fly.

How are they spreading?

Humans have throughout recorded history been involved in the transfer and transplantation of animals and plants for diverse purposes. Although perhaps less easily transferred than other animals, fish have for centuries been transported from country to country, and even continent to continent. The reasons for this include aquaculture, the establishment of wild populations for recre-

(Above) Koi carp.
Photo Shelly Clendenon

ational, commercial and subsistence fisheries and the provision of forage fish, for biological control and for ornamental purposes.

It is not known in a lot of cases how many of the introduced species came to be in the places they are. There were certainly people who liberated species in the early days thinking it would be for the good of all. Had they known some of the effects these species would have, they would perhaps have been more reluctant. In the same vein there are those who don't think of the consequences of their actions and pay no attention to the potential risks.
People are the most likely and effective vector for fish spreading between catchments, though not the only pathway.

Pest fish may be spread:
- Accidentally, on boats, trailers and fishing gear
- Deliberately by illegally establishing new populations to develop course fisheries
- By gardeners moving them around their ponds either for ornamental reasons or thinking they will help with mosquito control. (These species are occasionally illegally sold at garden centres and pet shops)
- Through escape of live koi carp and catfish which are being sold at markets
- When people get sick of their pet goldfish or they grow too big for their bowl or pond. In this instance it feels better to dispose of them in a nearby stream, thinking this will be nicer for the fish. This is the reason goldfish are so widespread in the wild. Goldfish are considered low risk but some other aquarium species can cause serious problems.

While pest fish are just one threat to fresh water ecosystems, they are currently not widespread throughout the country. It is therefore important to try and prevent them from spreading further. There are few effective tools available to remove fish from waterways once they are present and it is easier to prevent them from establishing in the first place.

It is illegal to release freshwater fish to any new waters (Conservation Act 1987). In addition the Freshwater Fisheries Regulations 1983 and the Biosecurity Act 1993 have provisions which restrict the movement, breeding and releasing of certain species of fish.

Unfortunately legislation alone is not sufficient to prevent the spread of species and it is essential that the threats these species pose are understood. It can be expected that an introduced fish placed into a river or lake where it has not been before will cause some disruption to the existing ecosystem and may well have some damaging consequences.

If you do want to release fish into your ornamental or farm pond, contact your local DOC office. They will give you all the information about appropriate species and how to safely make any release.

What you can do to help

It is essential that any further moves to widen the range of introduced species are made only after careful consideration of the likely impacts and potential costs and benefits. With regard to introduced pest fish, it is essential their range is not expanded at all and that we ensure they are contained within their current locations. Avoiding unthinking and frivolous releases into waters that do not already contain stocks of such species is one of our key goals.

You can assist by:

- Not liberating any fish into freshwater without first obtaining the appropriate approvals
- Washing all fishing and boating gear down at the end of the day and before you go to a new place, and encouraging other anglers to do the same thing
- If you see people releasing fish, contact your local Fish and Game or DOC office as soon as possible. Take details of the person and vehicle registration
- Encouraging friends and gardeners not to spread *Gambusia* around. Native frogs, whitebait, bullies and insects are more effective, environmentally friendly mosquito controllers
- Emptying your aquariums into the garden, not drains or streams.

Nearly all river systems and most lakes of any size now carry populations of introduced fish. There are few biologically unmodified aquatic ecosystems left in New Zealand and those that remain are very valuable. The protection of our waters from the invasion of alien species is possible, but only if there is general public awareness of the resources at risk and a public willingness not to make releases without due consideration and proper approvals. That's where you can make the biggest contribution! We all value different aspects of freshwater ecosystems but the introduction of new species will threaten all of these, including your favourite trout fishery.

If you want more information

Contact your local DOC office or check out our website: www.doc.govt.nz

(There are two links to pest fish http://www.doc.govt.nz/cons/pests/fish.htm

;

http://www.doc.govt.nz/cons/biosecurity/fish.htm)

Lake Angling Seminars

This summer we will again be running two angling seminars designed to improve the success of anglers fishing Lake Taupo. The seminars provide information on trolling techniques and where and when to go, along with a few tips to hopefully increase your success. Staff are also available to answer any questions you may have.

Each session lasts approximately two hours, so bring a deck chair, sunscreen and hat. There is no charge for the seminars and no need to book.

The first seminar will be held at Wharewaka Point on 2 January 2002 at 10 a.m., the second on the Omori Reserve at 10 a.m. on 5 January 2002. If it is raining phone the Summer Programme Information Line on 025 604 7301 in case the seminar has to be postponed.

For more information contact
Mandi Goffin
Department of Conservation
Phone 07 386 9243

Intersexual Rainbow Trout Caught at Taupo

By Dr Michel Dedual

Most fish are either male or female throughout their life. In scientific terms they are "gonochoristic". However, very occasionally intersexual salmonids with both testes (male) and ovaries (female) have been reported. A team of researchers including the National Institute of Water and Atmospheric Research (NIWA) in Christchurch have reported 29 published and unpublished records world-wide of intersexuality in trout, salmon, and char occurring in both wild and farmed populations. On top of these we found another two cases of fish intersexuality when researching the topic. One, a trout of unspecified species but most probably a brown trout, was discovered on 24 May 1933 in the Waitati Hatchery in Otago, and the other was a rainbow trout that was caught at Lake Wendouree in Victoria (Australia) in April 1935. Of these 31 records only two refer to rainbow trout and neither of these were obtained in New Zealand.

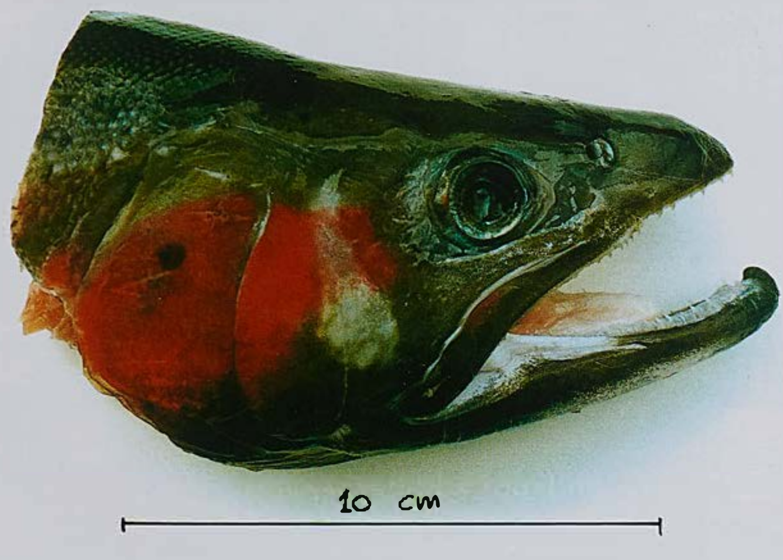
That was until the 25 June 2001 when Jon Ibbotson caught an adult rainbow trout while fishing the Tongariro River. The trout was 510mm long and weighed 1.5kg. As Jon was gutting the fish he noticed that something was weird. He cut the head off the fish and froze the flesh and as a precaution the guts, the gonads, and the head. Jon then contacted Bob South, the editor of *Fish and Game New Zealand* to advise of his "rogue" fish. Bob in turn contacted us about the fish, which sounded intriguing, and we asked for the head and guts from Jon for further analysis.

From the external appearance of the head it looked like a male trout. The bottom jaw was terminated by a hook or "kype" typical of a mature male. The overall coloration of the head indicated that this fish was going though the sexual maturation process and was on its way to spawn.

However, by looking at what was inside, it was impossible to say if the fish was a male or a female because it had both testes and ovaries. The testes of the fish were identical in size and similar to those of a "normal" male of similar size. No milt was running out of the testes, indicating that the fish had not completed maturation.

The female portions of the gonads were present in two separate parts and were different in size. The female gonads appeared to be distinct and not embedded into the male gonads. The eggs were apparently normal in size and still attached in clumps, as they are when they are not completely

Head of the rainbow trout showing the kype or hooked jaw typical of a male fish. (Note the obvious spawning coloration of the opercula)



The testes at the top are normal and the ovaries at the bottom are somewhat reduced in size but the individual eggs are normal

mature. It is puzzling to guess what that fish would have done when reaching the spawning ground. It had plenty of options though! Would it have fertilised another female with its sperm?, laid its eggs that would have been fertilised by another male?, laid its eggs and fertilised them itself?, did a bit of it on its own and then some more with another female and/or another male? Unfortunately these secrets of nature will not be unveiled just yet and will haunt the nights of sleepless scientists.

The exact process of physiological disturbances producing intersexuality is not well understood. It appears that it can arise spontaneously in some individuals both in wild and farmed environments, but it can also be induced by contact with chemicals present in the environment.

Studies in the United Kingdom have shown that a large number of sewage treatment plant effluents leach substances that are able to turn male fish into females. These substances are hormones, particularly sexual hormones or steroids similar to those used by certain athletes to boost their muscle mass. There are two types of steroids, those that we produce ourselves (natural hormones) and those that we absorb one way or another (synthetic hormones). Regardless of the type they will invariably end up in the environment via our urine. Hormones generally are very difficult and expensive to treat in sewage plants, so often the concentration of hormones in the treated water builds up.

Experimental findings in British rivers indicate that elevated concentrations of certain natural steroids are sufficient to account for male rainbow trout placed downstream of sewage water treatment-effluent discharges to turn into females. Furthermore, the concentration of synthetic hormones derived from contraceptive pills has also been shown to have the same effect. Thus, it appears that natural and synthetic female hormones excreted by people are often responsible for the "feminisation" effects observed in fish.

A large number of the roach (a

small fish) examined from each of the surveyed rivers also showed a high incidence (locally up to 100%) of intersexuality. These findings are further indication of the widespread effect of female hormones on wild fish populations in the UK The observed reproductive disturbances are consistent with experimemal findings and show an association with discharges of water treatment plants that are proven to contain these substances. It appears however, that low background prevalence of intersexuality in roach can be found anywhere in the United Kingdom, but it is not known whether this is due to natural factors or to the absence of completely pristine freshwater habitats.

In another study, fish caught near Swedish pulp mills frequently showed physiological disturbances including reduced sex hormone levels, reduced gonad growth and delayed sexual maturity, suggesting exposure to substances disrupting the maturation process. These effects were attributed to the chlorine bleaching process used to make the paper white There are a vast number of chlorinated organic chemicals, many of unknown structure. As a result of these studies, the chlorine bleaching process in Sweden was successively abandoned. Changes of secondary sex characteristics of fish from exposure to effluents from pulp mills have also been demonstrated in the USA and Canada.

It is however unlikely that the presence of intersexual trout in Taupo is the result of contact with contaminated water There is a minor amount of sewage and no pulp mill effluents in the catchment upstream of the outlet of lake Taupo. Secondly, if intersexuality were the result of water contamination, intersexuality would be more the norm as observed in the UK rather than the exception.

Most documented occurrences of intersexual trout have been made during systematic processing of fish such as during aquaculture or hatchery operations. During such procedures every intersexual fish has a good chance of being detected. However, in Taupo there is no such systematic handling of fish by the same person, so most cases are probably not detected and the level of incidence of intersexuality is probably more widespread than realised. Research has estimated the incidence of intersexuality in rainbow trout to be one in every 2000-5000 mature fish. It is possible that several anglers have handled intersexual individuals without recognising them. Indeed, they may have mistaken the testes for the lumps of fat that can accumulate around the guts of the fish, especially when the fish are in peak condition just before starting their spawning migration. Lake anglers also are more likely to miss the occurrence of intersexual trout. Many fish in the lake are still immature and any difference in sexual organ structure or position will be difficult to detect.

We thank Jon for providing, via Bob South, the trout specimen. Without Jon's careful observation and concern for the fish's wellbeing, the intersexuality of Taupo trout would have remained undocumented.

We also thank Dr Martin Unwin from NIWA in Christchurch for his assistance in tracking down the historical reports of intersexual salmonids.

Taupo Ranger Position Changes Hands

It was with some regret that we had to bid Taupo Ranger Chris McMillan farewell last month. Chris will be well known to many of you. In the 14 or so months he spent in the job, he formed strong working relationships with key fishery interest groups as well as meeting many hundreds of anglers in his ranging capacity. Rumour has it that Chris also made a significant impact on the local golfing circuit. Chris leaves us to return to the green pastures of Southland and a new career with the Regional Council. We wish him well.

As one door closes, another opens and we welcome David Hart to the team in the Taupo Ranger's position. David will commence duty on 26 November.

We will profile David in the next issue of *Target Taupo*.

Spring/Summer Hunting Prospects

By Cam Speedy

With spring well sprung, you may be thinking about where you might find this year's Christmas venison. Four major factors will influence recreational deer hunting prospects, and therefore choice of hunting area, in the Tongariro/Taupo Conservancy area of the central North Island this summer. On the up side for hunters these factors include:

- The outstanding autumn growing conditions, based on regular afternoon rain storms, warm temperatures and high humidity from February right through to May. This resulted in exceptional growth across the full range of habitats throughout the central North Island this year. In turn this allowed deer to attain good body condition, and fawns good size, going into winter. The unusual season also contributed to what I believe will be a mast (seed) year for many plants and trees this summer, kick starting another period of intense biological productivity in the region. Beech trees all over the central high country are starting to flower as they last did in November 1998, and prior to that, November 1986. Cabbage trees, Clematis and rangiora are also showing sign of heavy production this season and if this flows through to our podocarp habitats we could see major benefits to a wide range of wildlife. This is not something that happens every year!
- The exceptionally dry winter (check out the level of Lake Taupo), which will also have helped deer retain body condition through the colder months, increasing deer survival generally, but most significantly, minimising winter fawn mortality. The good condition of deer going into spring in many areas will mean most breeding hinds will successfully raise a fawn this season, stags should put plenty of spring growth away in the form of antler, and there will be lots of independent yearlings around from last year's fawn crop.

However, on the down side for hunters, the factors also include:

- High venison prices, fuelled by the low New Zealand dollar and issues such as "foot and mouth" and "mad cow disease" in Europe, which never dropped below $6.00 per kg all winter and have now hit an all-time record of $7.50 per kg. This has resulted in intense harvest pressure by commercial operators. Accordingly, the added competition for recreational hunters will make things tough in the more open environments. Although Wild Animal Recovery Operation (WARO) success rates were down on last year in both the Kaimanawa and Tongariro recovery zones, deer quality was well up and with the good prices, WARO concession activity remained viable. (Note: Authorised WARO activity in this conservancy ceased at the end of October until after the rut).

- A winter of intense, large-scale possum control utilising aerial application of 1080 poisoned baits, which has also affected huge areas of the conservancy. While these operations were specifically targeting possums – NOT DEER deer by-kills have been recorded in all operations. You should check your Pesticide Summary for details of these operations.

So what does all this mean when looking to get some meat for the Christmas barbecue? Firstly don't completely write off the areas where possum control has occurred. While a lot of dead deer carcasses have been found, live deer have been seen in all areas since these operations were completed, and pig populations remain virtually unaffected. It just might be that the reduced hunting pressure owing to an exaggerated perception of the impact possum poisoning has had on game animals will make areas like Tongariro Forest well worth a look. Watch your dog in any area where 1080 has been used though! My picks for this season are the beech forests in the upper Tongariro River area between Kaimanawa Road and Rangipo Dam and in the Kaimanawa Recreational Hunting Area. These are both areas where no aerial 1080 possum control occurred. The great autumn and winter conditions will mean plenty of prime venison for the careful hunter in such areas as the Tongariro River trench, the upper Oamaru River, Jap Creek and the Kaipo River. The Kaipo especially will be as good as ever this year following a successful groundbased possum control operation within a 3km buffer along the Poronui boundary last summer. Focus your hunting above the 1050m asl (above sea level) contour on northerly aspects to maximise your encounter rate. Early indications from these areas are that there are plenty of deer being seen – and the deer are fat! Try to get in there before the third week in December though, as once the hinds sneak away to drop their fawns, things will become a little

The heavy scrub country of the upper Mohaka, with its dense cover and scattered forest patches, offers some of the highest deer densities to be found anywhere in New Zealand. While it is difficult country to hunt, success can be dramatic for those prepared to put in the effort and the small size of the deer makes them easy to carry!
Photo Cam Speedy

lean for six weeks or so.

If you have the wherewithall to hunt the heavy scrub country on the private (Air Charter/Lakeland Helicopters/Heli-Sika) blocks further down the Mohaka, these are well worth the effort too. Hunting pressure of any type is generally ineffective at keeping on top of deer in this habitat and numbers remain high (>15 deer/sq. km). The recent favourable environmental conditions mean this area will produce great eating deer for those with patience and perseverance although be prepared to lose a bit of gravy (and a lot of skin!).

Places probably worth giving a miss this summer include:

The Pihanga/Tihia block of Tongariro National Park

That part of Kaimanawa Forest Park behind the Tongariro Prison Farms and

The northern slopes of Mount Tongariro.

While much of the red deer hunting in the central and southern Kaimanawa alpine zone will be a bit leaner this summer after a serious surge by the helicopters over the past two winters, an interesting observation of increased sika activity about the tops suggests it won't be a total loss. If you are in this area, focus on the bush edges and scrubby gullies rather than the expanses of open country - and be looking for Japs!

While there is certainly some bad news in this report for local hunters, it's not all bad. So long as a summer drought does not have a major impact on the growing season, 2001/02 should be a cracker in northern parts of Kaimanawa Forest Park, setting autumn 2002 up to produce some great heads Should the predicted mast year eventuate, spring 2002 may well provide another "year-of-the-mice", which I guess is of most interest to anglers targeting big mouse-munching browns. But more importantly such a phenomenon will provide a large pulse of beech seed to hopefully re-start a much-needed recovery in some of the more stressed forest habitats of our local high country. Only time will tell, and the only way you can find out is to get out there yourself!

Measuring the Number of Trout in Lake Taupo

By Glenn Maclean

No single piece of monitoring data that we collect provides us with a complete picture of the state of the Taupo fishery. However, when the results from the various programmes are combined they fit together to provide a comprehensive summary of what is going on.

One of the key pieces of information is the number of large trout in the lake each November. We have been measuring this since 1988 and recently purchased a new $120,000 echo-sounder to improve the accuracy of this estimate.

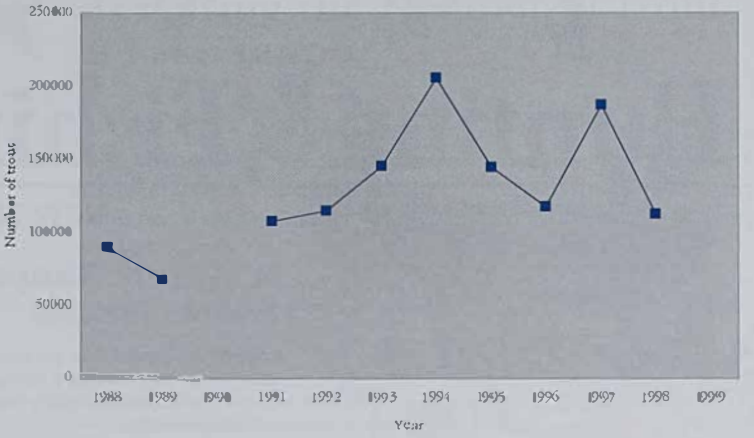
Each autumn the bulk of the new year class of juvenile trout enter the lake where upon they grow at a rate of approximately 1mm per day. By the following spring these fish are close to the minimum legal length of 45cm. In fact the whole reason the size limit is set at 45cm is so that these fish are protected for several months through the high catch rate and harvest period that occurs in spring. An estimate of the number of large fish in the lake in November therefore indicates the size of the population that will support the following summer's lake angling and winter river angling. It is not the total number of fish available over the course of the year because juvenile trout are continually trickling into the lake as a consequence of the extended spawning period at Taupo. Furthermore not all adult trout are counted as some are still up the streams spawning and there are continually fish dying or being caught. A useful analogy is that of a sink with the plug out and the tap wide open, which remains half full of water.

Less than 1% of all the trout eggs laid survive to maturity. Nearly all of this mortality occurs before the trout reach 35cm in length. Prior to this point our monitoring gives us indications of the likely survival but the estimate in November is the first opportunity to quantify the strength of the subsequent adult population. This estimate is obtained from an acoustic survey and is essential information in the management of the fishery. It is at this point and on the basis of this information that management measures can be implemented to manipulate the harvest to ensure the sustainability of the fishery.

The surveys were first undertaken in 1988 by Dr Martin Cryer as part of a three year study to quantify the trout production from Lake Taupo. As part of the study he designed a smaller ongoing monitoring programme to estimate the number of trout in the lake each year. This involved using a sophisticated Simrad echo-sounder to count the trout. In many ways this sounder is similar to the one you use when you go fishing except that it has the ability to determine where the fish is within the acoustic beam and to then adjust the fish's recorded size. This is necessary because as the acoustic beam goes deeper it spreads out and loses strength, and a fish on the edge of the beam will show as having a smaller target strength and hence size than the same fish on the central axis immediately below the transducer. To overcome this problem this sounder has a split beam which is essentially four different beams within the overall beam. By comparing which beams detect the fish and the differences in the timing of detection the machine can work out the location of the fish within the overall beam. Internal logic then adjusts the fish's target strength to account for the distance it was from the central axis and its depth. It all sounds reasonably simple but this technology came with a price tag in 1987 of in excess of $80,000.

An echogram (what you see on the screen) is produced by the transducer sending out a continuous stream of pings and recording the characteristics of the return echo. The echogram is recorded on a screen, as a print-out and on a computer as a series of data triplets. Each triplet consists of the ping number, the depth of the target and the target strength. Target strength is proportional to fish size and on the screen different colours are used to indicate this. A fish is recorded as a series of consecutive or nearly consecutive pings showing a similar depth and target strength related to the size of the fish.

To estimate the trout population a series of 42 one-kilometre transects was undertaken randomly across the lake. Some transects fall in close to trolling runs whereas others are right out in the



Graph 1. Number of large trout (larger than 35cm) in Lake Taupo, November 1988 to 1998

Our old machine involved the display unit that Wayne Boness's hand is on, a keyboard, the computer to the right, the black box at his feet and the colour printer on top. Our new machine is a small transceiver carried in one hand and a laptop computer. Photo Glenn Maclean (1995).

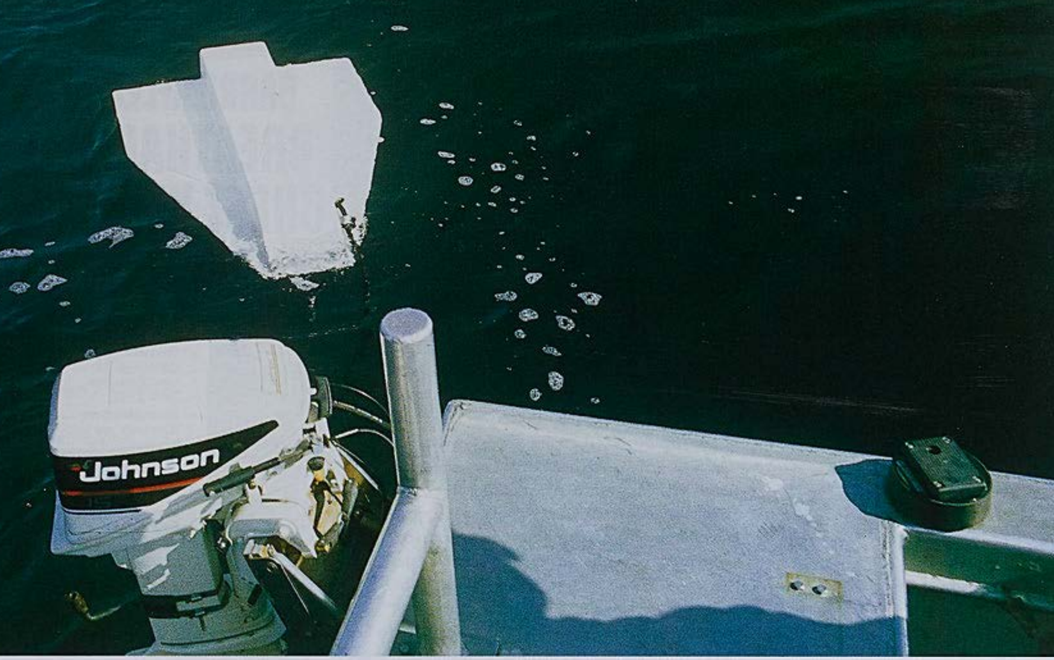
wide blue yonder Each transect was then analysed and the depth and size determined of the fish recorded. Trout were deemed to be large if the target strength was larger than that which corresponded to fish of 35cm in length, which was the legal length until 1998. The number of fish counted was then converted to a density and through several statistical steps a count was derived for the whole lake. Estimates were undertaken this way from 1988 to 1998 and are presented in graph 1.

These counts were a huge step forward in the management of the fishery but there are several issues with them. Firstly the actual analysis incorporated a degree of subjectivity; is a trace a fish or not and so counted. Many traces are very obvious but if a trace occurred within the smelt or bully layer it could be much less so. Whilst an individual smelt or bully is too small to show a return echo on the settings used, when they occur in dense schools the combined effect can be to show a trace. If the school is very dense this can show as a solid band of colour at the depth of the school and any trout trace within is hidden. Smaller, less strong or colourful trout traces are most prone to being hidden which is why this technology is not used to count juvenile trout in Lake Taupo.

To overcome the hidden traces the computer file was analysed to look for series of pings where the depth and strength of the target remained relatively constant, which is usually indicative of a trout passing through the beam. Secondly the sounder can not be used to count areas shallower than 20m as the beam is so narrow that unless the trout is immediately under the centre of the beam it will not be hit by sufficient pings to show as a fish trace. There is also the problem in shallow water that fish may actively avoid the boat or towed transducer. The transducer is towed in a large "fish" rather than fitted on the hull of the boat as the fish is much more stable and unaffected by surface waves. However it does make it quite a task to lift the transducer into and out of the boat at each transect.

To overcome the problems in the shallow areas around the lake, these were removed from the survey and trout numbers estimated instead by divers towed on manta boards along defined routes. However, there is a risk with this method that trout are disturbed by the boat towing the diver and leave the area before they are seen by the diver and counted.

Finally the equipment used was relatively new technology in 1988, but by 2000 was bulky, not



The transducer is towed in a special "fish" which swims just under the surface
Photo Glenn Maclean

very robust and relatively basic.The lack of robustness meant we had to be very careful about where and when we used it and more than one survey was affected by gear failure at a critical time, including those of 1990 and 1999.

In 1999, when faced with the need to upgrade some components of our acoustic equipment, we decided to investigate other options to overcome these problems. In recent years there has been some limited use of horizontal sonar (directing the beam sideways rather than vertically) to survey shallow lakes, particularly in experimental or one-off situations However this method still presents problems in covering the area close to the bottom or the surface, in calculating the area covered by the beam and in developing a practical set-up for use in large lakes. For example, simply standing on one side of the boat and causing the boat to lean slightly will have a big effect on the direction and hence area covered by the beam.Therefore at this stage horizontal sonar is still not a practical option for routine survey of large lakes.

To overcome the problems counting in shallow water, this November we are trialing using a selfpropelled underwater scooter to tow a diver along an underwater transect.We expect that the diver will be able see any trout before they take fright but the trials will confirm whether this is in fact the case.

Another solution would be to undertake the survey in late summer when nearly all the trout are deep in the lake and therefore able to be effectively counted using our acoustic equipment.We intend to undertake a survey next March as confirmation of our November estimates but on its own such a survey is much too late to implement any management measures to reduce the harvest if a problem in recruitment is detected.

The other problems have been overcome by upgrading our acoustic sounder to the new Simrad EY500 scientific sounder.This sounder operates in a very similar way to our old machine but, reflecting the technological advances of recent years is much smaller, compact and much more robust. The big advances have not been so much in the underlying operation but in the computer software to analyse the returning echoes.Whereas with our old machine the only computer output was a series of simple data triplets, a huge amount of information can be collected by the EY500.For example, in excess of 50 megabytes of data may be collected over a single transect of 1km in length. One advantage of this is that it allows us to replay the transect with different settings to highlight different aspects of interest. For example, we can set the target strength threshold low to highlight the extent of the smelt layer and then replay the transect with the threshold set higher so that just the trout traces are shown.

Another very valuable tool is an analysis package which can be set to automatically identify and count the trout traces and to calculate the overall trout density. A key function is trace tracking, which highlights the fish trace within the echogram, displays the associated data triplets and displays the passage of the fish through the beam (figure 1). This passage through the beam is a further check that the trace is indeed from a fish. The initial identification of a fish trace is based on locating a series of consecutive or nearly consecutive pings which record a strong target strength at a consistent depth. If masses of targets are being detected, for example because the smelt layer is very dense, it is possible for a series of single and unrelated target detections to meet the criteria of a fish. However these spurious traces are readily apparent when their passage within the beam is viewed. Real fish do not swim from one side of the boat to the other at 10m per second or faster and then back again. In this case clearly what has happened is that two or more unrelated targets of sufficient strength coincidentally occurred at the same depth, albeit in quite different areas under the boat.

One difference between the two machines is that the new sounder has a narrower acoustic beam. The narrower beam has several technical advantages but does scan a smaller area. This requires that we run longer transects to increase the likelihood of recording at least one trout. It is the transects on which no fish are recorded which blow out the confidence intervals associated with our estimate of the total number of trout.

The new machine was used in November 2000 to obtain an estimate of 70,000 large trout. This was the second lowest count recorded, which as explained in *Target Taupo* issue 36 reflected the effect of the July 1998 floods on spawning success. The implications of this are discussed in more depth in "Winter Fishing Follows Predicted Pattern" on page 54.

As you read this story this survey will once again be being undertaken. This year we have modified the design to increase the number of kilometres of lake surveyed so as to reduce the width of the confidence intervals. In light of the ideal rearing conditions in 1999 and 2000 and our monitoring to date, we expect the count to be substantially higher than last year. We will report the results in the next issue of *Target Taupo*.

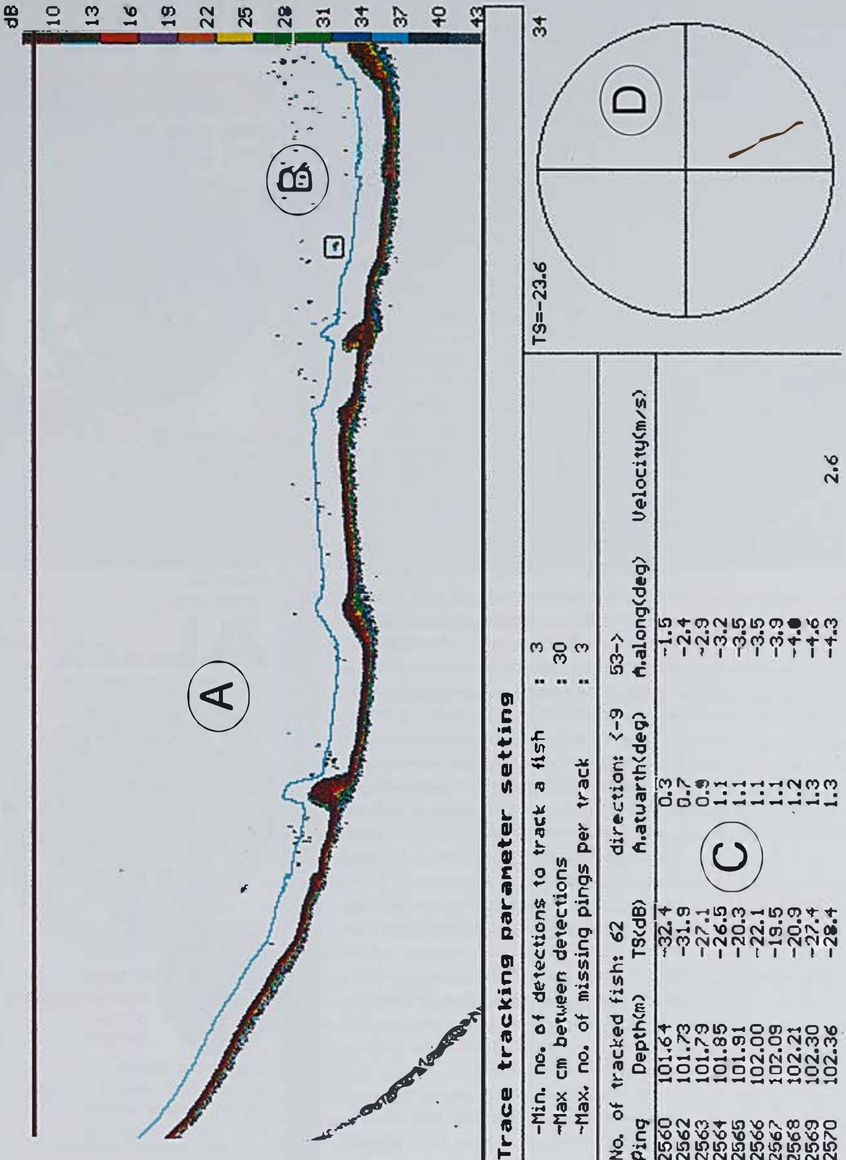


Figure 1. Trace tracking analysis produces a compressed echogram on which any fish are highlighted (B) along with the fish data (C) and the position of the fish within the beam. (D) In this case the fish is to starboard of the boat.

Department of Conservation
Te Papa Atawhai

26 October 2001

Private Land Access Kaimanawa Forest Park

People planning a trip into the Kaimanawa Forest Park this summer are reminded to check private land details and gain appropriate permits before they leave.

The Department of Conservation manages much of Kaimanawa Forest Park, however large areas of private land including East Taupo Lands, the Waipahihi and Ohaoko blocks adjoin the forest. Anyone wanting to use a route that will cross private land must get prior permission from the respective landowner.

In the past many people have mistakenly believed that some form of public right of way existed across private land. East Taupo Lands in particular have a long history of apparent unrestricted public access whereas people crossing this area were in fact trespassing.

Earlier this year an overseas interest attempted to buy the licence to the East Taupo Lands. This resulted in an increase in the licence fee paid by Air Charter Taupo who presently hold the lease. It is generally agreed that if Air Charter (the lessee) had not retained the lease, the land would almost certainly been closed to the public.

This has put additional pressure on the lessee to increase revenue generated off the land, which comes mostly from selling exclusive rights to a block of land to recreational users, mostly hunters.

Rather than preventing the public from crossing East Taupo Lands, the lessee instigated a permit system. Permits cost $30 per person and are valid for ten days. The permit allows people to continue to use the following routes:

Kiko Road to Ngapuketurua to Cascade
Cascade to North Arm to Boyd
Waipakihi to Ignimbrite Saddle to Ngapuketurua

Permits to cross East Taupo lands can be obtained from Air Charter Taupo, Lakeland Helicopters and the Turangi and Taupo Visitor Centres.

The Department of Conservation has updated a large number of Kaimanawa Forest Park maps to show the areas of public land and an updated Kaimanawa Forest Park brochure which gives contact details for access over private land is also available. Signs, advising people that they are about to enter private land are situated at all entrances to East Taupo Lands

Maps can be sent to Lianne Fraser PO Box 525 Taupo for updating.

More information: Dave Lumley Tel: 07 3868607 or Lianne Fraser Tel 07 378 3885 Wk or 025 525 456A/H

Harvest Survey Update

We had hoped to have the results of our survey of the number of trout caught by Taupo anglers over the 2000/01 season available in this issue. However, the demands of addressing the numerous consent applications which the Resource Management Act required to be lodged by 1 October 2001 has unfortunately delayed this analysis. Hopefully we will make more progress with the return of Fishery Ecologist Rob Marshall from overseas in early November.

The results will be reported in *Target Taupo* and a more formal report summarising the three surveys to date prepared in association with Rob Pitkethley of Fish and Game Eastern Region. Rob was responsible for overseeing our previous year-long surveys in 1990/91 and 1995/96 before his move to Rotorua.

Taupo Fishing Regulations Review Update

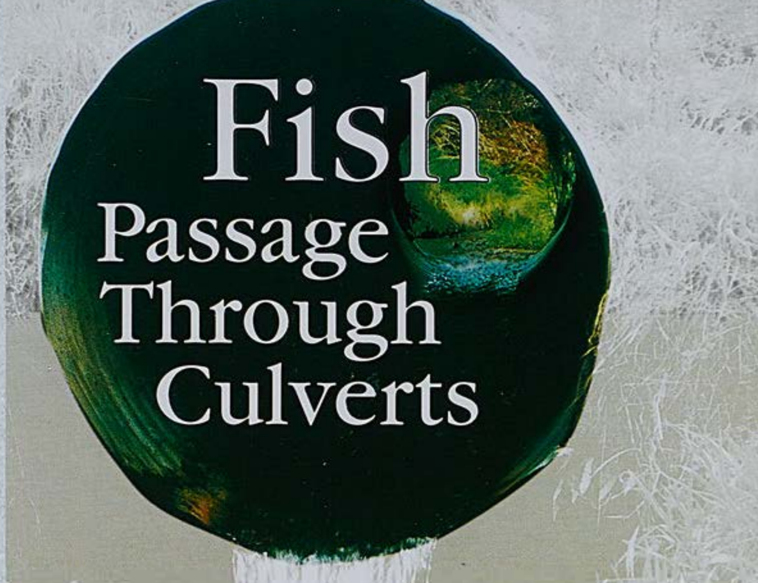
Since the last edition of *Target Taupo* we have received 15 more submissions from anglers on a range of issues and regulations. The timetable to complete the review has been finalised and is as follows.

Formally call for submissions	March 2002 edition *Target Taupo*
Public submissions close	Mid April
Collate and summarise all submissions received	May 2002
Consult with Taupo Fishery Advisory Committee and Tuwharetoa Maori Trust Board	May - July
Propose amendments (draft regs) and commence formal process for change	August

This timetable means that it is unlikely there will be any changes in place before the start of the 2002/03 season.

In the meantime, please continue to send your submissions on any change you think should be made to the Taupo Fishing Regulations to:

The Taupo Fishery Area Manager
Department of Conservation
Private Bag
Turangi



Fish Passage Through Culverts

By Jon Palmer

Jon is the Programme Manager Service/Scheduling for the Taupo Fishery Area and also assists Errol Cudby with habitat management for the fishery. Jon is also working two days a week for the conservancy as Assistant Recreation Planner, and is currently writing a recreation strategy for northern Tongariro National Park.

In the article describing the removal of the log jam in the Whitikau grotto on page 64, the need to maintain access for trout to prime spawning grounds is discussed. In this article I talk about manmade obstacles and the associated facilities that are put in place to ensure fish have continued access to their spawning grounds.

We are usually aware when we are travelling along a road when we cross over a bridge. Road bridges are not usually an issue for fish passage because they rarely pose any obstacle to the natural flow of the stream.

Roads crossing smaller streams however, often use culverts or fords instead. Poorly designed, constructed or maintained culverts can very easily prevent fish migration and the use of the stream for spawning and juvenile rearing. You may think that such small streams contribute very little to the annual recruitment of trout to the Taupo fishery. However, it is surprising just how many trout are produced in seemingly only a trickle of water. Cumulatively all the small streams within the Taupo Fishery Area contribute significantly to the recruitment of young fish to the fishery. Therefore it is very important that effective fish passage is maintained to these streams.

In considering legislation governing the management of fish passage facilities, the Freshwater Fisheries Regulations 1983 prohibit the construction of any culvert or ford in any natural stream or river in such a way that the passage of fish would be impeded. There is also a requirement that the occupier of any land maintain culverts or fords in such a way as to allow the free passage of fish.

Most activities involving crossing or damming a stream require a resource consent from the regional council, and provision of fish passage will also be a major consideration in issuing any consent.

There are several factors which may cause obstructions to fish passage at culverts.

The first problem often encountered occurs when the outlet of a culvert is "perched". In other words the exit of the perched culvert is above the water level of the stream and often extends out over the stream. Fish tend to accumulate under the pipe rather than at the outfall and cannot get up into the culvert. This situation results from the way the culvert was initially installed or from subsequent erosion below the culvert. One way to solve this problem is to install weirs

A classic example of a perched culvert which clearly prevents upstream trout migration. Photo David Moate

downstream of the outlet so as to raise the water level to a sufficient depth that it flows up into the pipe. Weirs can be constructed with blue gum timber, concrete, or with rocks. Several weirs may be required to provide pools for the fish to gain height and rest if the outlet is significantly higher than the stream bed. Several of the culverts we manage have weirs combined with baffles within the culvert to ensure that there is sufficient water depth throughout the approach and inside the culvert.

Another way to address this problem is to reinstall the culvert to a lower depth. We also encounter culverts that have a concrete apron or spillway at the outlet These are installed to prevent erosion of the stream bed immediately downstream but may have the undesired effect of spreading the outflow, thus reducing water depth. In these cases it is often best to install a weir and create a plunge pool. This acts as a shock absorber for water flows to reduce erosion and also provides an area for fish to rest before negotiating the culvert.

Another common problem is the flow conditions within the culvert itself. By this I mean the effects of the slope, construction material, and the width of the culvert barrel relative to the average stream bed width around the culvert. These factors may contribute to increased water velocities and/or shallow water depths within the culvert. The increased velocities often exceed the swimming capabilities of the fish so they are unable to move through the culvert. A reduced water depth on the other hand may mean there is simply insufficient water for the fish to negotiate the culvert. In addition uniform conditions of gradient, roughness and depth within the culvert may lead to an absence of low-velocity zones where fish can rest and recover after swimming to exhaustion.

To remedy these problems it is common practice to install baffles within the culvert. Baffles are simply low barriers installed at an angle to the water flow. They are mostly constructed from eucalyptus species which are naturally resistant to rot, or concrete, although in some cases well placed rocks will suffice. They may either extend right

The same culvert following installation of a downstream weir to build up the water level. Photo David Moate

across the width of the culvert or be staggered up each side of the culvert. Baffles extending across the width of the culvert are most effective if they have a slot cut in them so there is an area of deeper water for the fish to pass through. They usually only need to be 150mm to 200mm high to be effective for trout passage. These devices not only deepen the water, especially in times of low flow but also reduce water velocity and create areas of low velocity suitable for fish to rest between bursts of active swimming through the culvert.

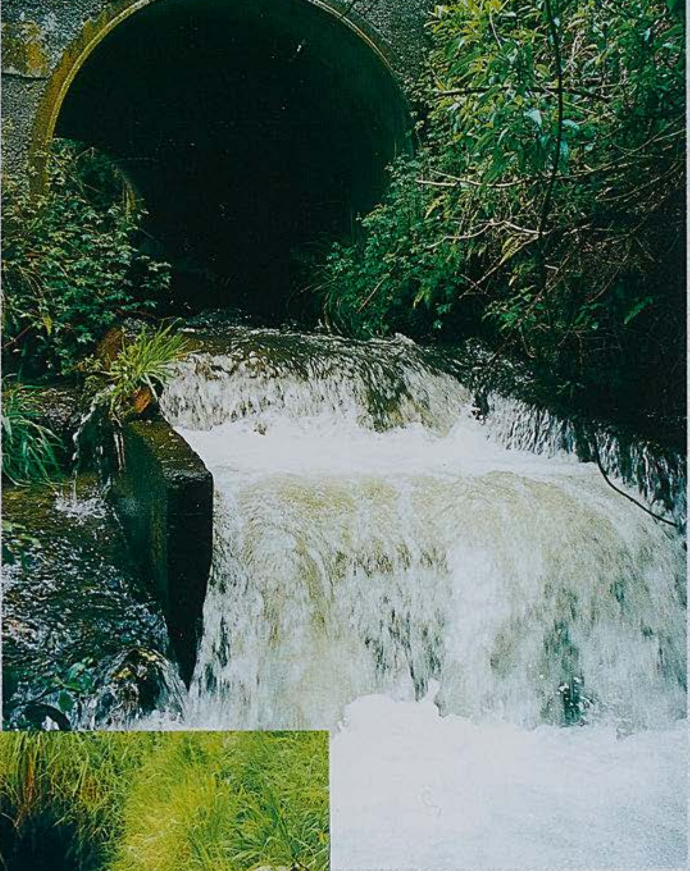
One of the advantages we have in the Taupo fishery is that we are usually working with rainbow trout rather than brown trout. Rainbow trout on their spawning migration are much more driven and athletic and easily able to negotiate obstacles which would prove impassable to brown trout.

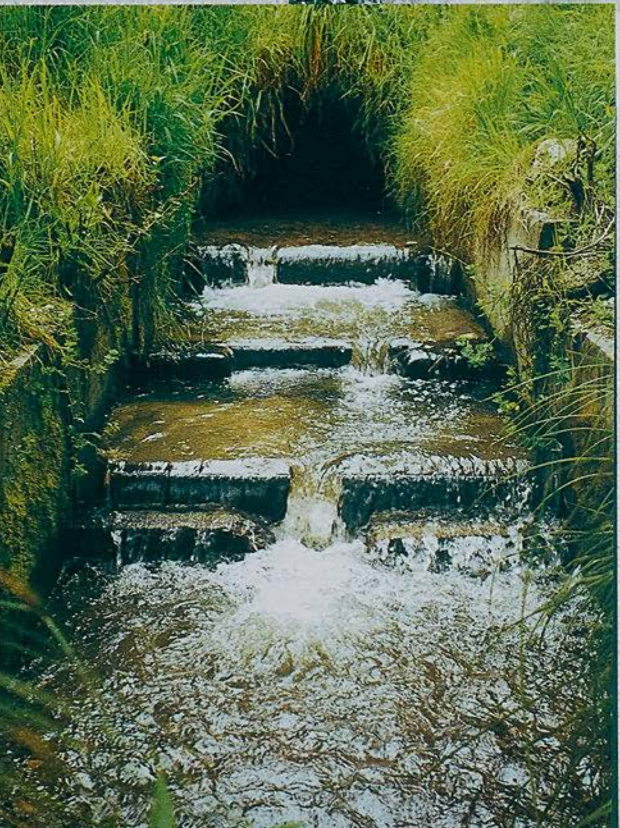
Only recently has an inventory of all culverts in the Taupo fishery (that affect spawning streams) been completed to aid in managing these important facilities. Now all these culverts appear in the Department's Visitor Asset Management System (VAMS) *Target Taupo* issue 36. This database allows detailed records to be kept for each culvert including diagrams and photos, and records any work completed on these facilities. The system also ensures that we are reminded when inspections need to be done, and in completing those inspections allows any remedial work required to be entered. Reports are generated monthly (along with all other visitor assets) to guide us in planning and prioritising work to ensure that these facilities remain in good operational order. Inspections are also done prior to spawning in April to check that the way is clear, in summer (the best time to check for the effects of low flows), and after major rain events in order to clear any debris and check for damage.

If you wish to see a fish pass in action visit the Tongariro National Trout Centre where there is a fish pass at the dam on the Waihukahuka Stream (feature number 5 in the brochure).

Reference:

Boubee, J.; Jowett, I.; Nichols, S.; Williams, E. 1999. Fish Passage at Culverts A review, with possible solutions for New Zealand indigenous species. Department of Conservation, Wellington, New Zealand.





Two examples of slotted weirs used to lift spawning trout up into a culvert.
Photo Jon Palmer

Above: Wooden baffles used to constrict and deepen the flow through a culvert.
Photo Jon Palmer

Rainbow trout can negotiate some impressive obstacles without help. Here a trout jumps a small waterfall in the Whitikau grotto.
Photo Glenn Maclean

Life as a Trainee Ranger in DOC

By Adele Meyer

Adele is a trainee ranger in her first year of a two-year traineeship with the Tongariro/Taupo Conservancy.

In June last year I began a course at the Nelson/Marlborough Institute of Technology called the National Certificate in Conservation (Trainee Ranger). The year that followed stands out as being one of the most enjoyable and beneficial of my life.

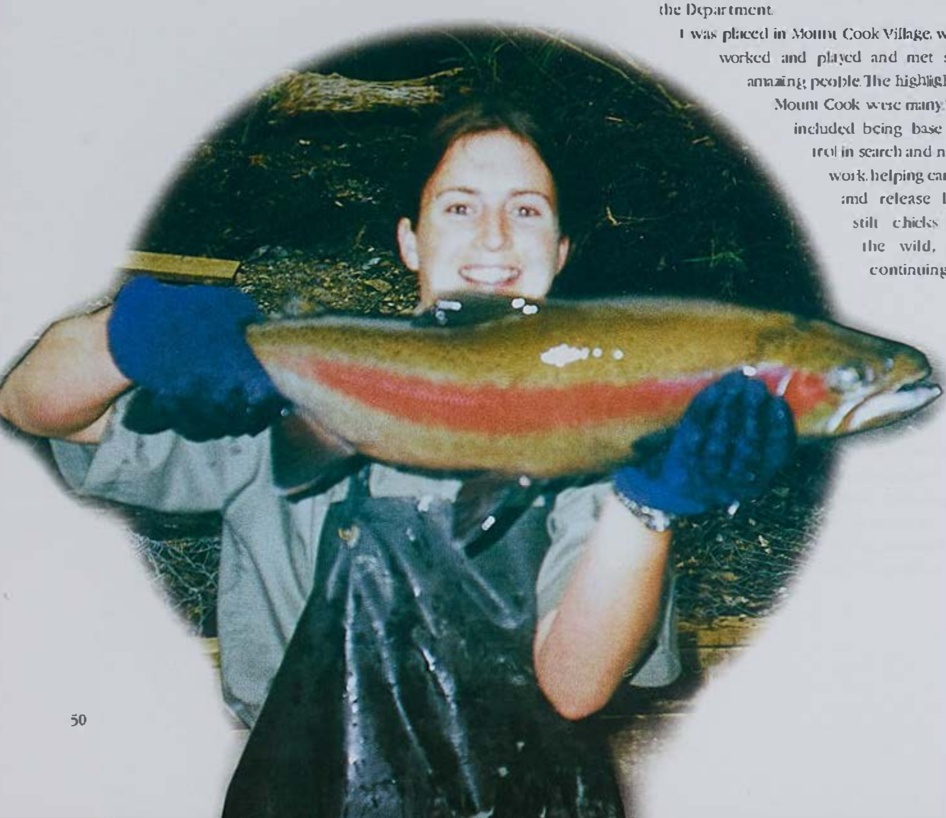
The course is the only one of its kind in the country. It is designed, with the full support of the Department of Conservation, to produce graduates with the skills and training to move into trainee ranger positions within the Department.

One of the main criteria for acceptance into the course is to have a demonstrated interest the outdoors and conservation. I had attended the Conservation Corps the previous year, which in turn had led me into three months' employment with DOC working and living up Mount Taranaki. All these things were likely beneficial to my acceptance.

There were 21 students accepted in my year. Being the only course of its kind in the country, we came from far and wide. There was one Nelsonian and the rest of us were as diverse as the areas we came from. The oldest in our class was a 40-year-old grandfather who had spent the past 20 years working in a freezing works. The youngest was 18 and had just competed school. Needless to say strong friendships evolved and continue to develop.

During the first semester, which ran from June to October we learnt many varied skills such as fire fighting, bush craft, mountain radio use, fencing, small motor use, chainsaw use and repair, riding all terrain vehicles, attended a Te tiriti o Waitangi workshop and much more. Following this semester, we had our summer placements from October to February. This is a period of paid employment for DOC anywhere in New Zealand, from Northland to Stewart Island, where you get to put into practice what you have learnt that semester. It is great hands-on experience, and gives you a great perspective of what it's like working for the Department.

I was placed in Mount Cook Village, were I worked and played and met some amazing people. The highlights at Mount Cook were many. They included being base control in search and rescue work, helping care for and release black stilt chicks into the wild, then continuing to



to be their sole carer for two weeks, running a predator-trapping programme, using gin traps to catch stoats, taking helicopter flights which dropped us off at a hut high in the Southern Alps, and learning about the love/hate relationship with the kea, after losing one workboot!

From February to June we returned to campus, where we swapped stories like excited school children about our summer placements, everyone had amazing experiences and stories to share. We widened our knowledge of New Zealands natural history, obtained our boatmaster's qualification, production horticulture, business processing, weather, hard landscape, interpersonal communications, photography, agriculture, biology and conservation.

We were all successful in graduating, which in turn made us all eligible to apply for one of eight Trainee Ranger positions. The successful applicants for these eight positions were allocated a two-year traineeship within the Department. They were chosen by a competency-based interview. Although the interviews were nerve-racking, we all felt positive (and relieved!). After the interviews everyone began socialising with the quiet demeanour that students are famous for.

One week later the phone calls began. I was thrilled to find out I had made it through. I had two years' employment in the Tongariro/Taupo area.

I am now approaching my fourth month here in Turangi. I have been working with the Taupo Fishery Area for these first months, which I have thoroughly enjoyed. I have spent time out on the trap where we monitor the fish both up and downstream, met many anglers while doing anglers' surveys out on the rivers and lake, worked in the office processing licences and helped with Kids fishout days at the Tongariro National Trout Centre. The team here has a wealth of knowledge and experience, and have all been extremely helpful in teaching me new skills. I am now about to spend time with the Turangi/Taupo Area. At the end of my two-year traineeship I will seek a permanent position with the Department.

I thoroughly recommend this course to anyone who has an interest in conservation, as it provides you with excellent work and life skills. The list of qualifications is endless and can be used in many fields.

To find out more about the course, you can phone the:

Richmond Campus
(03) 544 7796
or free phone
0800 422 733.

Michel Dedual Attends International Conference on Fish Telemetry

In late June this year Taupo Fishery Scientist Dr Michel Dedual visited Trondheim in Norway to present the results of telemetry studies relating the movement of trout in Lake Otamangakau and the daily routine of catfish in Lake Taupo (see page 4 of this issue.) Michel attended the same conference in 1999, which highlighted a desperate call from third world fishery agencies for access to telemetry equipment and expertise to address some of the major problems facing fisheries relied on for subsistence by many thousands of people. It was pleasing to see that with the oversight of the United Nations, good progress has been made during the past couple of years and at this conference western scientists presented telemetry research carried out in collaboration with several poorer countries, especially in Africa.

This year a complete U-turn was suggested on the general direction that telemetry research should take. The conference identified that a majority of the marine fish stocks in the world are overexploited despite being managed by highly skilled people. Obviously something doesn't work. One way (but not the only one) to correct this trend is to improve our knowledge of the underlying mechanisms that govern marine fish populations, and quickly before it's too late to reverse the situation. That's where results obtained from telemetry studies can significantly assist in reaching these goals. However, to achieve this, it is essential that the research has some direct management application. For example marine migration studies that include identification of spawning areas can be used to protect spawning populations.

As a fishery manager Michel was pleased that studies carried out in Taupo reflect this trend where the "need to know" prevails upon the "nice to know". However recreational fisheries management as occurs in New Zealand is quite foreign to many countries dependent on stocking. This again highlights the value of New Zealand research and the importance of presenting the results overseas.

Michel proposed to the conference organisers that they focus the next telemetry conference around presenting examples and illustrations of what has been or what could be achieved by using data obtained from telemetry research. In other words, how did the data collected influence the direct management of the fish studied?

Telemetry is rapidly becoming a basic tool of fishery management (and others). Currently we are planning two telemetry projects, one to index the Waipa trap run to the total Tongariro spawning run and the other to follow the movement of rainbow trout in Lake Taupo over the course of a year. As well as having important management implications, the results of these projects will be of special interest to anglers. These projects will be described in detail in future issues of this magazine.


YAMAHA
225
Four stroke
Four stroke

Winter Fishing Follows Predicted Pattern

A major component of our fishery management effort is monitoring trends in the trout population so as to maximise angling opportunities whilst ensuring the sustainability of the fishery. Many different aspects are measured including spawning success, juvenile production, angling success and the number of fish in the lake. When combined, these aspects hopefully provide us with a consistent and full picture.

Our monitoring programme continues to develop and it is very satisfying that in recent years we have reached the point where we are sufficiently confident in our assessment of what is going on to make and publish detailed predictions for the upcoming fishing season and for these to subsequently prove accurate. Circumstances leading into this winter were complex as a consequence of the effects of extreme floods in July 1998, but the fishing followed the predicted pattern.

Overall it was not an outstanding season. Early in the winter the runs were small and dominated almost exclusively by fish making their second or more spawning migration. This component of the run was unusually large, a legacy of the exceptional spawning runs in 2000 and the subsequent high survival of these fish owing to favourable spring conditions in the lake. This is just as well as otherwise things would have been very lean, and highlights the value of previous spawners in the trout population as discussed in *Target Taupo* issue 35. Many of these fish had recovered so well that it was difficult to tell them apart from maiden trout, and being of large size they were readily appreciated by anglers this winter.

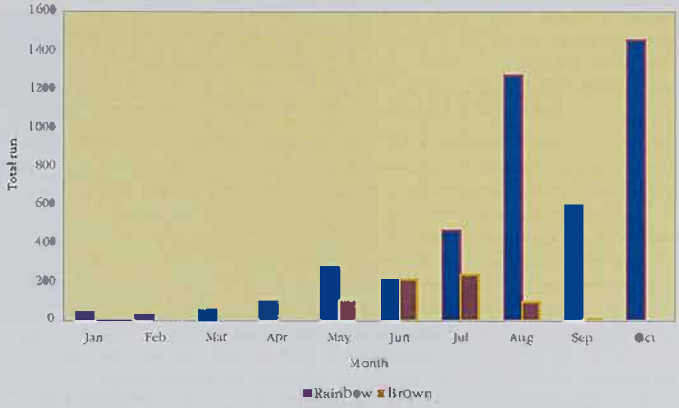
The floods led to the destruction of the early spawning and the indications were that the maiden fish in the lake were several months younger than usual for the time of year. We expected that this would result in maiden fish maturing slightly later than usual and the major spawning runs therefore occurring later in the winter. It was also possible that some of the maiden fish would not mature at all this winter. Graph 1, recording angling success on the Tongariro and Tauranga-Taupo Rivers, and graph 2, showing the monthly run through the Waipa trap, both illustrate that this in fact occurred.

It is readily apparent that the fishing was generally poor through to July. However, catch rates through August and September are very high by Taupo standards. Traditionally many anglers give away the winter fishing at the end of July but these anglers missed out on some exceptional action this year. The average catch rate this season of 0.25 fish per hour (one fish every four hours) on the Tongariro and 0.28 fish per hour on the Tauranga-Taupo reflects that overall the season was only average by Taupo standards.

It is apparent also that a number of maiden fish in the lake have indeed not matured this year.

Graph 1 Average catch rate by month of anglers fishing on the Tongariro and Tauranga-Taupo Rivers winter 2001

Graph 2. Monthly totals by species through the Waipa trap 2001



Nadine Gibbs with a maiden trout typical of many which have not matured this year. With another seasons growth these will be very good fish! Photo John Gibbs

Lake anglers are reporting catching maiden trout between 50cm and 55cm and 2kg to 2.5kg that are extremely unlikely to spawn this year. These fish with another six to nine months growth will be something to look forward to next year.

The average size of the rainbow trout through the Waipa trap, which is situated on a tributary of the Tongariro River, to the end of September was similar to 1999 and 2000 (table 1). However the brown trout were significantly bigger.

Species and sex	1999	2000	2001
Rainbow female	1.77	2.04	1.99
Rainbow male	1.70	1.87	1.79
Brown female	2.60	2.75	2.90
Brown male	2.57	2.84	3.08

Table 1. Average weight (kilograms) of trout by species and sex through the Waipa trap to the end of September 1999 to 2001

At Lake Otamangakau the spawning run of both rainbow and brown trout this winter was the highest recorded since trapping began in 1994 (graph 3).

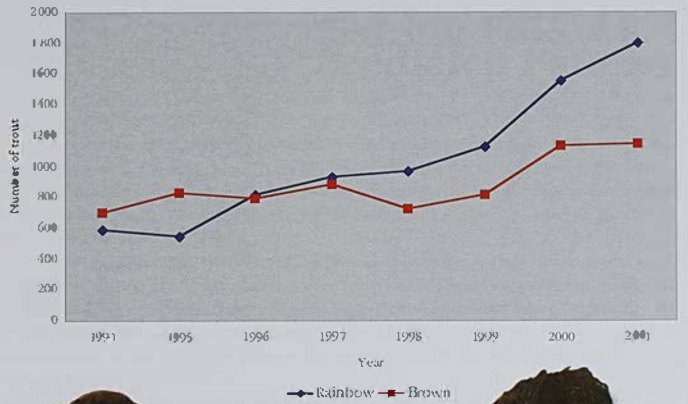
Only four rainbows exceeded 10lb or 4.45kg the largest a 5.3kg (11.7lb) male. However 11 brown trout and 71 rainbow trout of 3.6kg (8lb) or larger were recorded. Despite the very large run the average weight has also increased over the past two years (table 2).

Species and sex	1999	2000	2001
Rainbow female	2.10	2.18	2.62
Rainbow male	1.90	2.21	2.71
Brown female	1.90	1.87	2.13
Brown male	2.32	2.23	2.55

Table 2. Average weight (kilograms) by species and sex of trout through the Te Whaiau trap 1999 to 2001

This suggests that trout growth in lake Otamangakau is not inversely related to the total population size (see "Dredging of Lake Te Whaiau and Canal" on page 62). We are optimistic that with another good summer's growth some of these large rainbows will reach the magical mark of 10lb (4.45kg).

Graph 3. The total spawning run by species through the Te Whaiau trap 1994 to 2001.



Kahia Morehu (right) from Hatepe with a 5.6kg (12.3lb) rainbow caught while wading the lake edge one night in August. A grand fish but not as big as the 8kg fish caught by his father Bob (left) in 1941. Photo Rob Hood

This summer we expect the fishing in Lake Taupo to be very good, reflecting the strong spawning in 1999 and reasonable conditions for juvenile rearing since. In addition those maiden fish which did not spawn last year will be prime fish of approximately 3kg or more. The rivers are simply loaded with fry at present and if the settled conditions continue then juvenile survival should be very good in the long term. However, the black cloud on the horizon (please excuse the pun) is that if you believe that the rainfall eventually balances out then there is an awful lot of rain to come. Let's hope it is not in one hit, for the flood and its effects will be extreme.

Hearing Held for Hinemaiaia Consents

The hearing of TrustPower Limited's applications for resource consents to operate the Hinemaiaia Power Scheme took place in Taupo in early October. The Department contested two aspects of these applications with respect to the operation of the bottom or HB dam and station.

In our evidence we argued that the daily fluctuation of the flows below HB station had a significant adverse effect on trout spawning and juvenile production. This was reflected in the lack of spawning in the main stem as compared with the bypass, in the very narrow spawning period compared with other Taupo tributaries and the lack of juvenile fish over-wintering in the river.

We also highlighted that prior to the construction of HB dam trout had access to spawning tributaries further upstream and that these were intensively used.

The bottom line was that solely as a consequence of the construction of HB dam the winter fishing limit had been implemented at the State Highway 1 bridge, a loss of approximately 5.5km of highly valued angling opportunity.

A number of other submitters, including the Taupo Fishery Advisory Committee (TFAC), supported our concerns or raised other issues. For example the Hatepe Residents' Association highlighted serious concerns over the effect of the fluctuating flows on accelerating the bank erosion in the lower river.

In the decision just released, the Environment Waikato Hearing Committee has granted consents to TrustPower. However flows through HB station are only able to vary ± 25% of the natural flow above HA or top dam. TrustPower is also required to build a fish pass over HB dam within three years. The parties now have 15 working days to appeal the decision to the Environment Court.

An improvement in the Hinemaiaia fishery would enable us to move this sign upstream from the State Highway 1 bridge

Kuratau Consents Next on List

King Country Energy has applied for consents to operate its station on the Kuratau River. This station is operated in a similar way to the Hinemaiaia HB station, with daily fluctuations in the flows, and the effects on the fishery are also similar. However, one major difference is that the loss of angling opportunity is less significant. This is because of three factors:

- Only limited angling ever occurred in the lower river owing to the difficult access and because the river, along with all of the other western rivers, closes to angling from 1 June to 30 November each year.
- The creation of Lake Kuratau as part of the power scheme has created a lake highly valued by a small group of anglers.
- The recruitment of fish from Lake Kuratau which are swept downstream into Lake Taupo helps address the loss of production from the lower river.

To address the ongoing effects of the operation of the scheme the Department has discussed with King Country Energy some possible ways to improve the angling opportunity in the area. These include exploring the feasibility of a walking track up the lower river with local landowners, improving the boat ramp and parking on Lake Kuratau (only for small boats), ensuring a legal access way to the lake, weed control around the margins of the lake and implementation of a long-term monitoring plan to provide information about the flow regime and changes in the character and nature of the river for use in future consent applications.

These discussions are continuing and we are hopeful of reaching a satisfactory solution for both parties.

Major Repairs to Tongariro Bridges

By Errol Cudby

Errol is Programme Manager Visitor Assets and is responsible for visitor facilities including tracks and signs, habitat maintenance and the day-to-day operation of the Tongariro National Trout Centre within the Taupo Fishery Area.

The Major Jones Bridge recently underwent extensive renovations including the fitting of a whole new deck and bolts. The Red Hut Bridge was also repaired and its nuts and bolts inspected closely.

Both swing bridges span the Tongariro River near Turangi and are well used by anglers, runners, mountain bikers, walkers and dogs to get to and from the river and the Tongariro Walkway on the right bank.

Inspection of the Major Jones Bridge for the Department's Visitor Asset Management Programme (*Target Taupo* issue 36) revealed rusted and worn components which were checked by the DOC regional engineer. "Like for like" replacement was recommended and a plan and specifications for the job supplied.

Work started after the school holidays and the peak of the river fishing season. Scaffolding was hung off half of the bridge and the decking was lifted and replaced along with the handrail and transom fastenings. When the work progressed to halfway

Bridge builders Paul Clark (left) and Gordon Hydes (right)
Photo: Errol Cudby.

The scaffolding being shifted out over the water. A few of the 1250 new bolts, 1100 washers and 250 Bowmac brackets are evident! Photo: Errol Cudby.

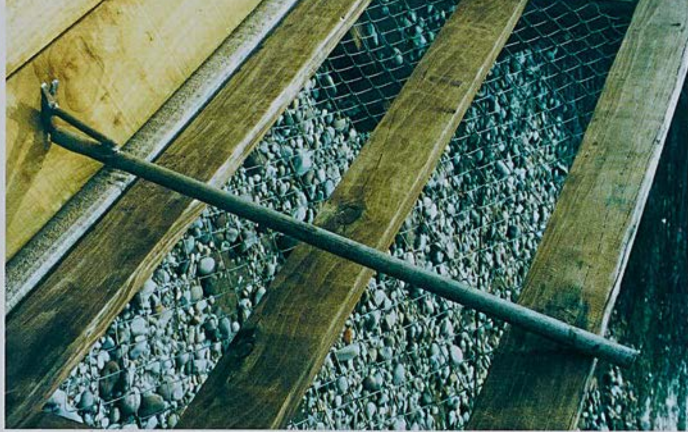
the scaffolding was moved out over the water.

It was not an easy job. The weather was damned unkind on occasions but the work continued. Over the past 50 or so years the old bridge timbers had formed a close attachment with the bolts and so had the nuts. Nothing came apart easily. After bending his crowbar into the shape of a paper clip on the first couple of spikes, Gordon Hydes modified it with a piece of pipe and bracing which had to be rewelded and strengthened three more times, such was the force applied. Gordon reckoned Toyota would have rewritten its "buggar" ad if it had used one of its 4WDs to pull up that decking!

The public was generally considerate, and respectful of the "Closed" signs. If they asked and there was no danger at the time, they were permitted to cross the bridge. One woman, though, came up the right bank from State Highway 1 and insisted on crossing – even though there was a four-to-five metre gap with no decking on it. She had a bad hip and was definitely not retracing her steps so Gordon and Paul stopped their work, found some planks and laid them out for her to cross.

Compared with the Major Jones, the Red Hut Bridge was an anticlimax. One of the bridge supports or droppers had loosened and slipped on the top wire to the point where it supported nothing. However, it was one of the longest droppers on the bridge and required the special skills of DOC's Harvey Steeds (*Target Taupo* issue 37) to go up a rope to reposition and tighten the top fastenings. While there we checked the timber

The Red Hut Bridge - Fishery Ranger Rob Hood sends a bag of tools to Harvey Steeds at the top of the girder.
Photo: Errol Cudby.



The modified crow bar used to pull the 160mm bridge spikes from the old decking.
Photo: Errol Cudby.

The finished job.
Photo: Errol Cudby.

fastenings for future maintenance requirements.

Short of another flood of the magnitude of that in 1958 these bridges will continue to provide access across the Tongariro River for many years to come.

We sent out a news release to warn people about the bridge closure and a local paper (vis) printed the following "*The Major Jones Bridge across the Tongariro River is closed to all users between 9am-4pm on weekdays, October 8-19, while work is being done on the bride...*"
We hope we fulfilled her dreams.

Dredging of Lake TeWhaiau and Canal

The cutter suction dredge operating in Lake TeWhaiau

Genesis Power Limited has commenced dredging Lake TeWhaiau and TeWhaiau canal down to the delta in Lake Otamangakau. This dredging repeats work undertaken in 1996 and involves using a cutter suction dredge to remove sediment, which is pumped into settling ponds and stockpiled.

Genesis proposed similar operating conditions for its resource consent to those under which it operated last time. These conditions were quite tight but proved practical and monitoring at the time indicated only a slight increase in turbidity levels downstream of the work. We supported these conditions but asked that Genesis also avoid working close to the delta over the peak fishing months of January to March.

Environment Waikato has issued a resource consent to undertake the dredging which incorporates these conditions. As part of the monitoring conditions the Department is undertaking a joint project with Genesis to measure light levels in Lake Otamangakau. The aim of this project is to determine both whether the dredging has any effect on the light levels within the lake (which is not expected to occur) and the natural patterns of fluctuation in light levels. The depth to which light is transmitted is called the euphotic depth and reflects the limit for aquatic plant growth. Aquatic plants are the key to the productivity of lake Otamangakau and the greater the euphotic depth the more extensive the weed beds are likely to be.

This is the first part of a project by the Department to investigate the productivity cycles in Lake Otamangakau and whether

these influence the trophy trout fishery. Compared with the mid 1990s there are currently many fewer trophy size fish and the general condition of the fish has also been lower (though still high by Taupo standards). Several options have been suggested to explain this, including that it reflects a downturn in the natural productivity of the lake and that the trout population has reached such a size that it is now slightly food limited. If the former is correct we expect the trophy fiishery to mirror the productivity cycles whereas the latter should cause the trophy fiishery to fluctuate inversely to the trout population size as measured through the Te Whaiau fish trap.

It is likely to be several years before any pattern becomes obvious. It is difficult to manipulate the natural productivity but options exist to manage the trout population size should this be shown to be necessary to ensure the production of trophy fish.

Rob Hood prepares to measure the light levels at half metre depth intervals in Lake Otamangakau

It was necessary to abseil down to the blockage. Note the fish trying unsuccessfully to jump the fall.
Photo Adele Meyer

Log Jam Cleared

By Rob Hood and Glenn Maclean

Rob is one of the Taupo Fishery Area operations staff who undertake many of the field activities involved in managing the Taupo fishery.

Glenn is the manager of the research and monitoring programme in the area and is editor of Target Taupo.

Taupo trout are wild fish and there must be a successful breeding season each year to sustain a healthy and plentiful population. The level of spawning success is largely influenced by the occurrence of natural events such as floods and the amount of suitable spawning habitat available. For example, occasionally obstructions occur within a spawning stream which prevents fish from accessing otherwise suitable habitat. One method we use each winter to assess the likely success of spawning is escapement counts (drift dives), where we count the number of spawning fish in sections of each of the major eastern tributaries (excluding the Tongariro and Waitahanui Rivers).

One of these sections is a 3km length of the Whitikau River above the grotto (a narrow gorge within the Rangipo and Hautu prisons). In this section we usually count between 600 and 800 rainbow trout. There are approximately 9km of excellent spawning and rearing habitat available to trout above the grotto and it is a very important area for the fishery. However, our escapement counts undertaken on this section of the Whitikau River this year indicated a gradual decline in the numbers of spawning trout counted each month. This is in contrast to the typical pattern we expect where spawning numbers peak in September or October.

This decline in the counts indicated that there was a problem with fish passage in the grotto, especially as considerable numbers of fish were observed during September at the downstream end of the gorge. The anomaly was even greater in that in most years brown trout, which are less athletic than rainbow trout, are unable to negotiate the grotto and are rarely seen above this point. However, from May through July this year we counted up to 24 brown trout on each survey, indicating passage through the grotto was particularly favourable at this time.

Previous experience has shown that parts of the grotto become easily blocked with log jams. However, this seemed unlikely given the low flow conditions which had prevailed all winter which would have been unlikely to wash a large log into the grotto. However, because of the numbers of fish involved and the importance of the habitat upstream we decided to investigate the cause of the problem.

During the early part of September, Rob Hood and Norrie Ewing swam upstream from the bottom of the grotto. Normally this is not possible but the low flows this winter had reduced the current and after swimming for about 50m and past several thousand fish, they discovered a small fall 1m high. Norrie and Rob climbed this and found trout upstream so continued on until they discovered a second fall. This fall was 2.5m high and in some situations rainbow trout may have been able to jump it, but in this case the way the log jam lay caused the water below

Looking over the fall down a section of the Whitikau grotto.
Photo Glenn Maclean

the fall to be extremely aerated.

This created problems for the trout and Rob and Norrie. The aerated water made it very difficult for the trout to swim and jump, as they were unable to get enough "push" or "drive" because of the amount of air in the water. Fish were observed attempting to jump the blockage but were not jumping any higher than 1m out of the water. The problem for Rob and Norrie was that they were unable to approach the log jam from downstream because the aerated water provided very little buoyancy. However, at least the cause of the fish passage problem was confirmed and it was decided that the log jam would have to be removed.

Accessibility to the site was very difficult. The only practical way to get equipment and staff to the site was to abseil from the cliff top immediately above it, requiring the cutting of a temporary access track. The task required additional experience and expertise to that amongst the fisheries team and so Tongariro/Taupo Area staff Harvey Steeds (abseiling) and Tom May (explosives) were added to the team.

On the 20 September staff assembled on site and after a safety briefing moved the equipment to the cliff top. Glenn Maclean and Tom May abseiled down into the gorge just

Tom May (left) and Glenn Maclean prepare to lay the charge. Photo Rob Hood

upstream of the log jam. Initially they used strong poles to shift part of the debris in an attempt to expose a suitable site to lay explosives with which to shift the offending log However, it soon became apparent that this log was not the main problem. Simply moving some of the rocks very quickly left the log hanging, as the bed which had built up upstream started to rumble and scour owing to the current created under the log. What had seemed a five-minute job took several hours as Glenn and Tom kept moving more rocks and encouraging the bed to scour down further and further As they did this the fish began to sense the change in flow and to attempt unsuccessfully to jump what remained of the log jam

The main problem slowly became evident as did the reason why the blockage had occurred during low flows. One major log was wedged across the base of the shute and a series of other logs criss-crossed above. Initially most of the logs would have been above the water level at normal flows but during the winter more and more stones had become wedged in the blockage building up the bed height above the jam. In the early stages the flow pattern created must have actually made it easier for trout to get past as attested by the number of brown trout upstream. However as the winter progressed and the fall increased it became impassable. Finally it was possible to excavate a single suitable position to lay a charge in an attempt to remove the underlying log. Glenn and Tom decided to "put all their eggs in one basket" and use one large charge, much to the delight of everyone assisting All the other staff retreated to the safety assembly point and then the charge was connected and detonated.

As can be seen from the photo the charge was able to blow one end off the log and fish immediately began to swim past. No fish were killed because they were shielded from the blast by setting the charge upstream of the log. Within a few minutes we could see fish streaming past in their quest to reach the now available spawning grounds. The success of the operation can be clearly seen in the jump from our September escapement count of 162 fish upstream of the grotto to 923 fish in October.

This summer we will return to the grotto and chainsaw up what remains of the problem log along with several other logs which have the potential to cause blockages in the long term. That should resolve the problem until the next big flood brings more logs down.

Success! The original level of the fall buried the top of the log and is indicated by the sticks lying on the rocks
Photo Rob Hood

Jim Maniapoto

Tihei mauri ora,

E nga mana e nga reo, nga karangatanga maha i roto i tera kokonga, tera rohe huri runa te motu, tena koutou rau rangatira ma. Nga mate huhua, haere koutou ki te kainga tuturu, ki te Hawaiikitanga, haere, haere, haere.

Tatou nga uri o ratou ma tena koutou, tena tatou katoa.

I was born and bred at Te Rangiita, educated at Tauranga-Taupo School, Tokaanu District High School and St Stephen's College.

I'm married to Anne and we have two daughters and four grandchildren.

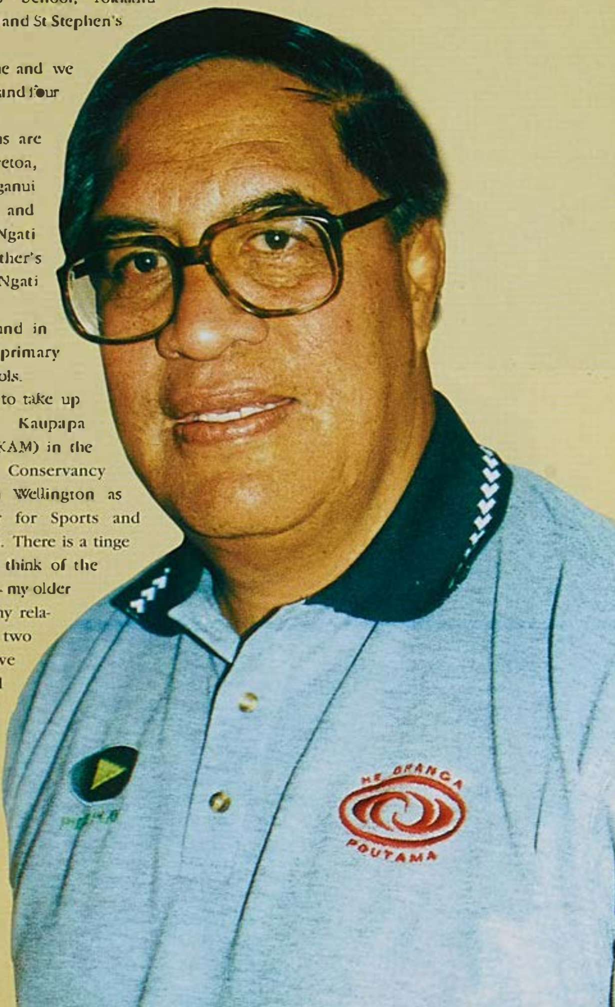
My tribal affiliations are Ngati Tuwharetoa, Raukawa and Whanganui on my dad's side and Tuhourangi and Ngati Pikiao on my mother's side, and through Ngati Pikiao to Tainui.

I have a background in teaching in both primary and secondary schools.

I have come home to take up the position of Kaupapa Atawhai Manager (KAM) in the Tongariro/Taupo Conservancy after six years in Wellington as Manager/ Director for Sports and Recreation of Maori. There is a tinge of sadness when I think of the two previous KAMs - my older brother Huri and my relation Heemi Kingi, two people who gave their best to tribal and conservation matters. They have set such a high standard that it will be quite difficult to achieve. However, there is plenty of work to be done on the mountains, lakes, land, rivers, in the bush and with tribes, hapu and whanau.

I am looking forward to the challenge and would like to end with this saying, "We are only but caretakers of the land for our children, their children, their children's children. Let us leave this land in pristine condition".

Kia ora



Nic Etheridge

I started work with the Tongariro/Taupo Conservancy office in late April, initially as a contract researcher monitoring the impacts of the possum control operation in Tongariro Forest on non-target species, in this case tomtits. This initial job has now become part of my current Technical Support position. The position is within the biodiversity field and principally involves providing support and technical advice about pest fish/freshwater issues, mainland island restoration projects, quality conservation management (QCM) with animal pests, and surveying and monitoring of forest birds.

My family has had a bach in Turangi for 14 years. I have had many holidays in Turangi over that period and now it seems I am finally residing in the bach permanently.

I originally started working with the Department in 1991 as a hut warden in Tongariro National Park. I spent many long, wet days hanging out in Mangatepopo hut. When that got too much I headed to the Outdoor Pursuits Centre, where a little more action was to be had.

I decided furthering my education would be a good idea if I wanted a career chasing birds and playing in the forest, so I headed to Massey in 1994. There I completed a Bachelor of Science degree, in which I did a double major in Zoology and Environmental Science.

For the past three and a half years I have been living in Nelson Lakes National Park, working on one of the Department's six official mainland islands, the Rotoiti Nature Recovery Project. Despite the majestic beauty of the mountains and lake, not to mention the wonderful brown trout fishing on my back doorstep, the temptation to go back to my family and Tongariro has won for now.

I enjoy a multitude of disciplines ranging from fly fishing, running, mountain biking and skiing to yoga and the arts. However, my number one topic and primary commitment is to contribute to the restoration and protection of Aotearoa's native heritage. I am interested in all the components of the system and believe that's what makes this place as special as it is!

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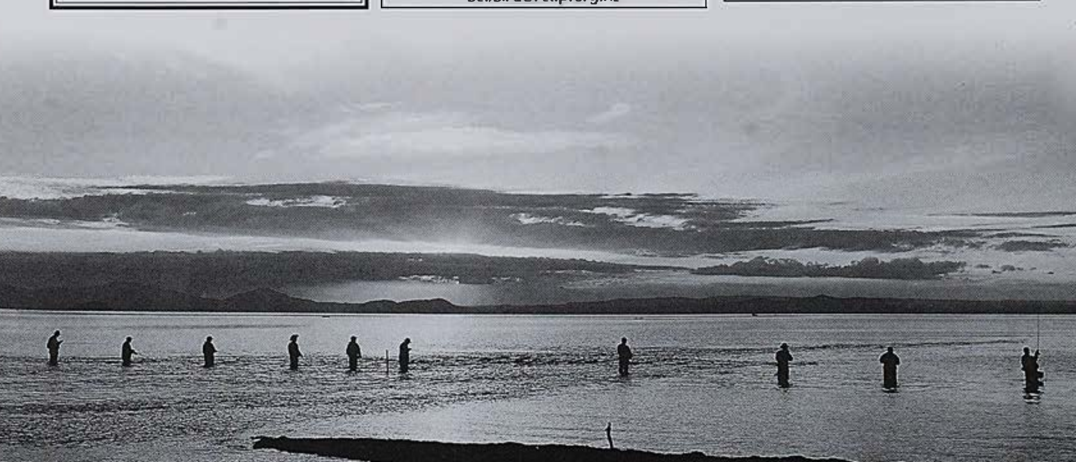

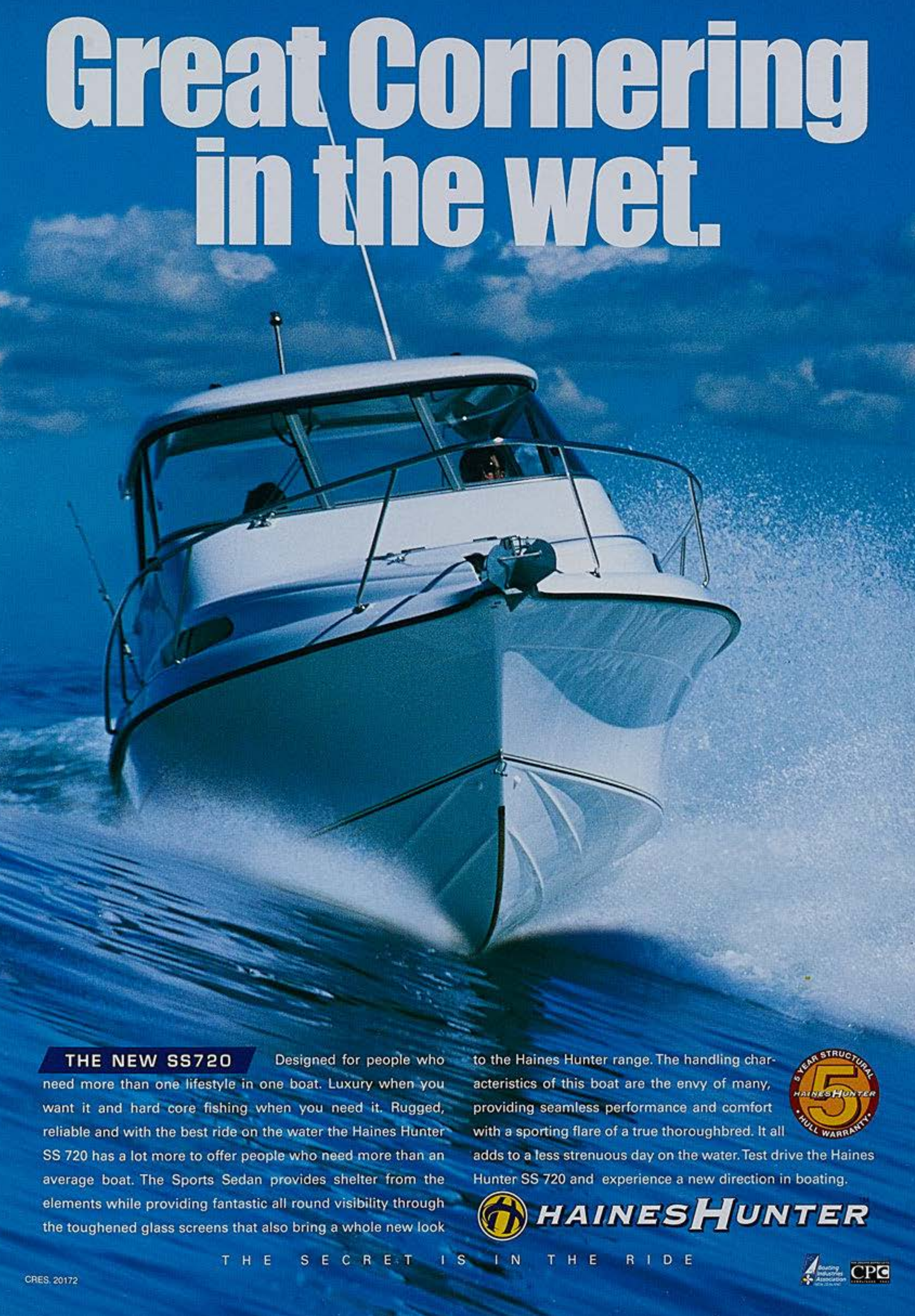

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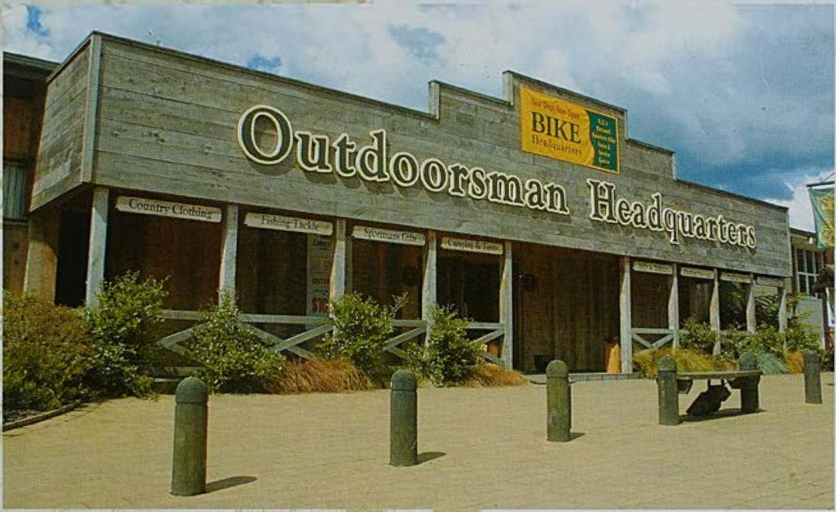

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