INLAND FISHERIES COMMISSION
NEWSLETTER
VOLUME 24 NUMBER 1 – FEBRUARY 1995 SPECIAL EDITION

Carp in Lake Crescent

The original press release starts the story:

On 30 January 1995 the Inland Fisheries Commission received an incomplete specimen of a fish that had been found on the shores of Lake Crescent.

Commission staff immediately conducted surveys of this water and can confirm that there is an established population of European carp, *Cyprinus carpio*, in the lake. At least three year classes appear to be present with fish of about 1kg captured and larger specimens seen.

It is likely that these fish have become established in the lake following the release of live bait. It is also likely that these were brought in by mainland anglers as there is no other known population of this species in Tasmania. They have probably been in the lake for some four to five years judging by the population structure.

The likely effects of these fish on the trout fisheries of this system cannot be predicted with any certainty. They are suspected of causing damage to macrophyte beds in other areas where they occur and as such could be a serious threat to the ecosystems of the lake.

The Commission will consider all appropriate management options.

The present problem...

Distribution

As far as is known at this stage (10 February 1995), the carp is confined to Lake Crescent, with specimens being collected at several sites in the lake. Lake Sorell was surveyed by backpack electrofishing at several sites but no carp have yet been detected. However, strong rumours have been received that suggest that they are in fact in that lake. The Clyde River has also been surveyed between Bothwell and Lake Crescent with no carp being detected.

This survey is by no means comprehensive, and the scale of the Clyde River catchment means that considerable additional sampling will be necessary before we can reliably say exactly where the carp are.

Many other reports of carp from other lakes and streams are also being received. Whilst many of these have so far proven to be misidentifications they will be followed up, so please do not hesitate to let us know.

Life History

The population structure of the sample of fish collected so far indicates that several year classes are present. However, there does not appear to be a juvenile year class from 1994 in the samples collected so far.

The gonad development seen in specimens collected so far indicates that the fish have not yet spawned this season. If the weather remains cool from now on, then there may not be a spawning at all this summer. This means that we may have a period of grace in which to attempt control measures aimed at adult fish, without having to concern ourselves with the problem of egg, larval or juvenile dispersal. If, however, the carp spawn this summer, then these early life stage dispersal problems will need to be dealt with. This includes the possibility that humans, stock, waterfowl and boats could transport eggs to Lake Sorell on aquatic plants or other material. Also, with the gradual filling up of the lake in the winter, downstream dispersal is possible. ■

Potential problems linked to carp

Carp have been blamed for many of the problems encountered by fishery and water resource managers. These include:

- destruction of fragile aquatic macrophytes;
- increases in turbidity;
- damage to stream beds, irrigation channels, etc;
- nutrient enrichment of waterways leading to algal blooms;
- competitive interactions with desirable fish species;
- introduction of new parasites and diseases to desirable fish species.

There has been some scientific debate over the extent to which the carp has been responsible for these problems in natural water bodies on the Australian mainland.

The Victorian carp program did not find any major impact on turbidity at biomass densities of less than 450kg/ha. (For Lake Crescent this would equate to 11 250 tonnes of carp in the lake).

Other controlled experimental research conducted by CSIRO has found major impacts on turbidity and macrophyte damage after only eight days at these biomass densities.

Recent disquiet emanating from irrigators in New South Wales has blamed carp for significant damage to irrigation channels.

Recent electrofishing surveys of the main channel of the Murray River by the Victorian Freshwater Ecology Section of DCNR has found that over 90% of the population of fish in the river are carp.

Carp have also been introduced into prime trout waters in Victoria where they have established self maintaining populations. Two of these lakes (Eildon and Dartmouth) are at relatively high elevations and are likely to have similar climatic characteristics to Tasmanian lakes.

Carp are known to carry several parasites, but whether any of these are present on the carp in Lake Crescent has not been determined. The parasitic copepod *Lernaea cyprinacea* is the most likely problem species, although two branchiurans are also known from carp. ■

Backpack shockers are being used for stream surveys

Background of the carp

The biology of carp

The European carp is in fact a native of Asian waters which has been widely distributed around the world. The biology of the species has been examined in detail overseas and on the mainland. A brief dot point summary of some of the pertinent details is included below.

Physiological tolerances

- Temperature: 5-32+°C.
  Optimum temperature range: 15-32°C
  Lower critical range: 0-15°C
  Upper critical range: 34-41°C
- Oxygen: very low oxygen tolerances.
- Salinity: tolerant of a wide range of salinities (up to 18‰).

Habitat

- Still or slow flowing waters and fast flowing waters.
- Prefers muddy substrates and dense aquatic vegetation.
- Able to tolerate high levels of turbidity.
- Able to survive in poor quality water in which other species cannot survive.

Movement

- Able to negotiate torrential flows and jump obstacles over one metre in height.

Diet

- Adults are omnivorous – consuming crustaceans, insects, molluscs, worms and algae either directly or by filtering mud and silt.
- Juveniles eat algae, rotifers and crustaceans.
- Adults feed on the bottom of water bodies, in mid-water and take from the surface.
- Feeding intensity appears to depend on temperature with intensive feeding occurring around 20°C. Below 8°C feeding may be greatly reduced.

Reproduction

- Males mature at two to four years of age.
- Females mature at three to five years of age.
- In Australia reproductive maturity has been reached in 12 month old specimens, although overseas maturity has been recorded in fish at three months.
- High fecundity, ie able to produce very large numbers of eggs (eg 0.9kg = 100 000 eggs, 4.0-5.0 kg = 1 000 000 eggs).
- Spawning occurs in spring and early summer, although studies in South Australia indicate spawning may occur more or less all year round with peaks in spring and autumn.
- Spawning requires temperatures of 17-25°C. However, the threshold temperature may be 14°C (other reports indicate 17°C).
- Spawning occurs in shallow water, usually < 0.5m but up to 2m.
- Spawning occurs over several weeks with females shedding eggs at regular weekly intervals, although up to 80% of eggs may be shed in the first spawning.
- Spawning is conducted in small aggregations consisting of one female and several males.
- Long migrations are not undertaken for spawning although small, random movements may occur.

Behaviour

- Most active at night.
- May seek shelter in deeper waters during severe winters.
- Mid-sized fish frequently are found in schools of up to 100 fish.
- Studies in Murray-Darling River system showed that carp do not move over 100km. However, studies in USA have recorded movements of over 1 000km.

Age

- Specimens held in captivity have been aged at 40 years old.
- Commonly reach 12-14 years of age.
- Young fish resemble adult form at approximately 22-25mm.

Early life history

- Eggs are 1.0-1.5mm in diameter.
- Eggs are adhesive and are laid on the bottom substrate, aquatic plants, logs or other submerged debris.
- Egg development is temperature dependant. However, typically eggs hatch between 2-8 days.
- Newly hatched larvae are 4-6mm long and attach themselves to submerged objects.
- After a further several hours to three days they swim to the water surface and ingest a bubble of air after which they are able to swim freely and to commence feeding.

From the literature it is readily apparent that carp are a very versatile species able to survive in a wide variety of conditions.

Australian mainland experience with carp introductions

Stock Structure

The history of introductions of carp in Australia has been well documented. It was first introduced into Australia in 1872 with several additional introductions since then.

Three stocks are recognised:

- The Prospect stock which has been confined in Prospect reservoir since 1908.
- The Yanco stock which is widespread in the Riverina and other parts of the Murray-Darling drainage.
- The Boolara stock which was introduced into Victoria in the 1960's and has since spread throughout Victoria and the Murray-Darling drainage.

Hybrids between the Boolara and Yanco stock have also been recognised.

Eradication History

The history of the spread of the European carp on the mainland has been interspersed with several eradication attempts.

A major eradication attempt in a portion of the Latrobe River catchment was conducted by the Victorian Fisheries and Wildlife Department. This attempt apparently failed to eradicate carp from a reservoir at Yallourn. Further details of these eradication attempts are being sought.

A second large scale eradication occurred in South Australia.

Eradications from farm dams in New South Wales and Victoria have been successful using rotenone.

Investigations of alternative methods of eradication and/or control have been carried out by the Victorians and others in the late 1970's early 1980's.

The two main alternatives examined were:

- Genetic manipulation of the populations to create generations of sterile offspring
  The conclusions from the study were that the chromosomal manipulations required were well beyond the available technology, and that even if technically possible, would only work in a confined population with no chance of recolonisation. In this situation it was considered that physical removal was a more cost effective option.
- Introduction of viruses which are specific to carp
  A virus with some potential was examined – the spring viraemia virus. An introduction of the virus could not be contemplated without a full assessment of its potential impact on desirable fish species in Australia, both native and introduced. The Victorians in fact established a testing

facility in England and tested many native species of fish for susceptibility to the virus, before abandoning the project in 1981. A virologist with the Victorian Department of Agriculture has recently examined the literature for any new developments with this virus and concluded that the problems with the virus which led to it being dismissed as a control measure by the Victorians in the early 1980's remained.

These include:
- loss of effectiveness at high temperatures (>20°C);
- the episodic nature of its impact in Europe (ie it only infrequently surfaces as a major disease of carp naturally);
- the extremely expensive nature of the testing procedure.

The Tasmanian experience

A series of eradications of carp was performed by the Inland Fisheries Commission in the north west of the State in the 1970's.

Details of these eradications, and the declaration of carp as a noxious species are given in the Annual Reports of the IFC from 1975, 1976 and 1980.

The populations were apparently established illegally in the early 1960's with fish from the Boolara stock.

The eradications were apparently successful. The major populations were poisoned with rotenone in 1974. A follow up poisoning in 1975 revealed no further carp infestation, and so a complete kill was achieved.

Several smaller populations were eradicated in different dams in the same area (Stowport) in 1980.

No further sightings of carp in Tasmanian waters have been confirmed since then until the current outbreak.

It is unlikely that the current outbreak has any connection with the fish which were introduced in the 1960's. ■

Options for tackling the carp in Tasmania

At this stage the viral and genetic options of control are not considered viable, neither technically nor economically.

Poisoning

Poisoning with rotenone has been costed out using the best available information. For a single treatment the following is our best estimate:

- full supply level: $2.6 million;
- minimum supply level: $1.2 million.

It is expected that two treatments would be necessary. There is no point in attempting eradication if you are not prepared to do it properly.

The availability of large quantities of rotenone is under examination. About 60 000 L of rotenone per application would be needed. This is not expected to be available inside three months by which time temperature conditions would be unsuitable for its use.

Application methods also need to be examined, including methods to rapidly mix the emulsion throughout the water column in order to minimise avoidance behaviour by the fish. Possibilities include aerial application with mechanical mixing of the water with outboard motors. Application via high pressure hoses from a large tank on a punt or barge. For greatest impact it may be necessary to apply the rotenone at night to avoid UV breakdown of the active ingredient. Spot treatment of pockets of water left behind in the marshes after a drawdown will also be necessary.

As indicated above, at least two applications of rotenone will be required to give a high probability of a complete kill. Control of water releases will be necessary between the two applications. Construction of a canal between Lake Sorell and the Clyde River would allow for this.

The use of other chemicals would also be considered with some herbicides offering viable alternatives. They would certainly be cheaper than rotenone.

Containment

Should eradication not be an option, then various containment strategies will need to be employed.

Upstream movement

Barriers to movements on the canal between the two lakes and Kermodes cut will be necessary. Alternatives include drop structures, electrical barriers, mesh screens. The critical factor will be their effectiveness at stopping small fish from leaving the lake.

Downstream movement

A fine filtration type structure (less than 2mm pore size) is the only way of ensuring no transfer down the Clyde River of either live fish, larvae or eggs.

The possibility of transfer of eggs or live fish by birds or other animals, either accidentally or maliciously by humans, cannot be controlled in either an upstream or downstream direction.

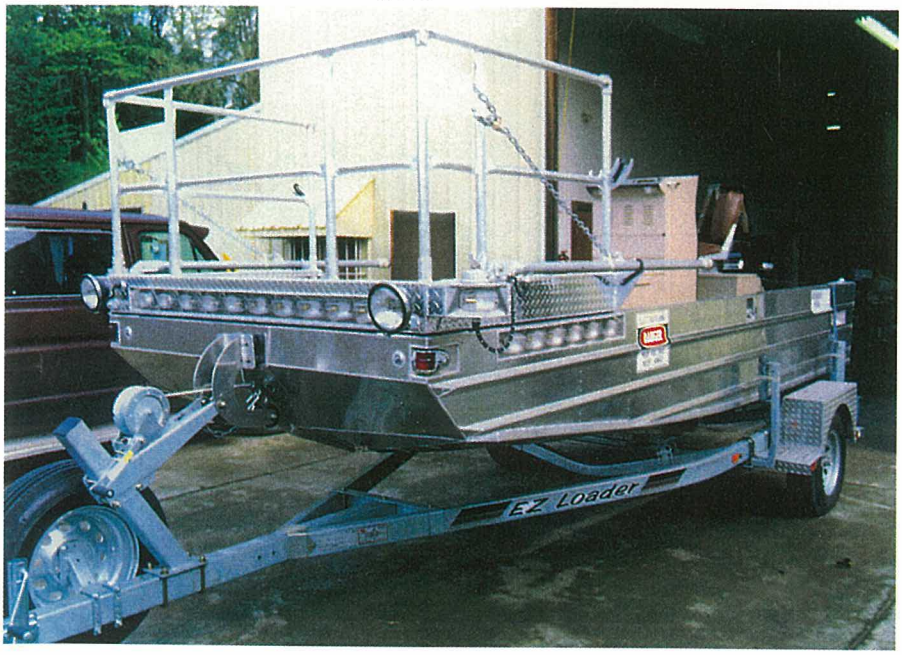
Control of numbers

The Victorian Carp Program suggested that the environmental effects of carp were minimal even at quite high biomass densities (450kg/ha). It is unlikely that the Tasmanian public would tolerate carp at densities anything like this. However, it may be necessary to set some biomass density target for management of the populations if eradication is not feasible. With such a target, regular monitoring could be used to assess the state of the carp population and control measures instigated whenever necessary. Boat based electrofishing in conjunction with lake level drawdown is probably the best means of conducting this regular assessment. The types of control measures which may be used include:

- Targeting breeding populations:
  The spawning behaviour of the species suggests that they may be vulnerable to targeted removal from the shallows. Water level manipulations after spawning may also influence recruitment success. These options will need to be evaluated further following an assessment of the hydrological limitations on manipulation of water levels in Lake Crescent and further observations on the behaviour of the species here.
- Reduction of population numbers by netting or electrofishing:
  These methods will definitely enable a reduction of carp biomass in Lake Crescent to be achieved provided sufficient fishing effort and facilities are available.

At this stage it is important to stress that the option chosen depends largely on where the fish occur. ■

An electrofishing boat will be purchased for survey work



OFFERS OF ASSISTANCE

The Inland Fisheries Commission has received many offers of help and advice since the problem became widely known to the public. A register of offers will be maintained for future reference.

I would personally like to thank all those persons who have called and assure them that if their help can be effectively used at any stage we will be pleased to take up the offer.

Wayne Fulton
COMMISSIONER

Future strategy

The central question that must be answered is – what is the distribution of the carp?

An action plan cannot be formulated until we can reliably answer this question as the various strategies are dependent on how widespread the species is.

The proposed course of action is as follows:

- Maintain and reinforce Lake Crescent closure
  The flow of water into and out of the lake has been closed off. By the powers contained within the Fisheries Act to deal with Noxious Fish, all recreational and other use of Lake Crescent has been closed until further notice.
- Determine the distribution of carp
  – in the Clyde River;
  – in Lake Meadowbank;
  – in Lake Sorell.
  In order to do this, boat mounted electrofishing gear has been loaned by fisheries agencies in both New South Wales and Victoria. A unit has also been put on order for the IFC.
- Examine the population structure and numbers in Lake Crescent
  Once the extent of the carp outside Lake Crescent (if any) is known, the structure and life history of the population within the lake can be examined.
- Prepare contingency plans for
  – eradication from Lake Crescent;
  • containment screens for Lake Crescent;
  • construction of diversion canal/s around the Lake Crescent catchment;
  • biomass reduction programs for infested sites.
  Planning for the various eventualities can be undertaken during the assessment phase so that there is no delay in taking whatever action is necessary once the extent of the problem is known. ■

Identification of *Cyprinus carpio*

As this species is not widely known in Tasmania it is frequently misidentified. Other species with which it is readily confused include wild goldfish and tench, both of which are in the 'carp' family. The redfin perch is also occasionally confused with it.

The main distinguishing features are the two pairs of barbels (like whiskers) present around the mouth of carp. It is red-golden red in colour with large prominent scales. The dorsal fin has a long base with a strong spine at the front. Goldfish may be similar but do not have the barbels. Tench do not have prominent scales and the base of the dorsal fin is quite small. Redfin have very spiny dorsal fins and usually have dark bars on their sides.

● **European or Common Carp**
Cyprinus carpio

● **Goldfish**
Carassius auratus

● **Redfin Perch**
Perca fluviatilis

● **Tench**
Tinca tinca