Carp in NSW: Assessment of distribution, fishery and fishing methods

7. FISHING GEAR TRIALS

7.1. Introduction

As discussed in Section 4, there are a number of environmentally friendly methods available for the commercial harvesting of carp but their use is dependent on the economic viability of the fishery. However, government and non-government organisations frequently contact NSW Fisheries about relatively small-scale carp control in public and private waterways. While there is potential for commercial methods such as seining or splash-meshing to help control carp numbers in open and clear waterways, smaller gear such as longlines or suitably modified traps may be better suited to more restricted waters which are often littered with fallen branches and trees and have difficult access.

Preliminary fishing trials were conducted with several types of small gear in Botany Pond and the Lane Cove River, two locations known to contain carp. The larger, commercial-sized envirotraps (see Section 6) were fished in Eagle Creek in the southern Riverina near Barham, the Lane Cove River, and South Creek near Penrith.

7.2. Small-scale gear

7.2.1. Gear and methods

Fishing trials were conducted with small baited traps, eel fyke-nets, and a small long-line. The trials were done in Botany Pond and the Lane Cove River. Initial trials were in April and May, 2002, and further fishing was done in September 2002.

Two types of traps were tested: i) round 1.5 m diameter collapsible traps covered with small-mesh polyethylene netting (designed for small fish), and ii) small rectangular (80 x 50 x 50 cm) wire lobster traps. All traps were fitted with netting escape-tubes to the surface to allow air-breathing vertebrates to survive. The traps were baited with a mixture of bread, dry dog-food and corn contained in a porous bait-bag, and set near the edges of the pond under overhanging trees or adjacent to aquatic vegetation such as reeds.

Fyke-nets (1 m diameter) with 5 m wings were fished in shallow water (< 2 m depth) near the bank or reed beds in Botany Pond; the wings were staked about 10 m apart, and the back-end (cod-end) of the net was floated or staked above the water surface to provide airspace for turtles.

The small longline consisted of a 48 ply nylon twine main-line, with 20 hooks about 4.0 m apart on monofilament snoods; hook sizes were 3/0, 4/0 and 5/0. The long-line was anchored at each end, and to keep the line near the surface, small floats were located at 20 m intervals. Hooks were baited with corn, meat and fish, and the area around the line berleyed with corn; soak time for each set was about two hours.

7.2.2. Results and comments

Initial daytime trials (April-May 2002) with small traps caught no fish but five short-necked turtles. During subsequent fishing in September 2002 when the gear was used to collect turtles for BRD experiments (see Section 6.), the traps and fykes were set overnight and checked each morning. Three fyke nets and four traps were used over a period of three weeks; total soak-time for each gear

type was: 54 trap-nights, and 31 fyke-nights. The long-line was set four times during the day, and once overnight.

Although carp were seen in the areas where the different gears were set, none was caught by any method. The only fish captured were two estuary catfish (*Cnidoglanus macrocephalus*) and one longfinned eel (*Anguilla reinhardtii*), all taken in the fyke-nets. About 60 turtles (short and long-necked) were also caught in the traps and fyke-nets.

Large carp were seen at both fishing locations during the periods the gear was deployed. While the size of the available carp may have inhibited their entry into the relatively small traps, the most likely reason for the zero carp capture was the lack of appreciable water movement or current in either Botany Pond or the Lane Cove River. Historically, traps (drum-nets) used in the NSW inland fishery were invariably set in flowing water, and large traps subsequently deployed in Eagle Creek (see below) caught few carp when the creek stopped flowing. It seems likely that current is required to spread the bait-odour, or to activate feeding movement by the carp. The fine-mesh covered collapsible traps were expected to catch small carp as these traps had been successfully used for the capture of juvenile estuarine fish. That no small carp were caught suggests that juveniles were either in low numbers or absent from the fishing sites. However, the easy capture of turtles in traps and fyke-nets emphasised the necessity to incorporate escape apertures for air-breathing vertebrates in fully submerged gear.

7.3. Trials with large fish traps

7.3.1. Gear

Envirotraps were fished in Eagle Creek, the Lane Cove River, and South Creek; a large collapsible box-trap, based on the design of the Hyde box-trap (Figure 4.7), was also fished in Eagle Creek. The 1.7 m x 90 cm diameter drum-shaped envirotrap (Figure 6.1) is fully described in Section 6.2. The box-trap (Figure 7.1) was 2.3 m x 1.5 m x 0.8 m, constructed of 20 mm square steel tubing bolted at each corner, and covered with black 36 ply polyethylene trawl netting. The single funnel-shaped side entrance was shaped from netting to give an opening similar in size to the envirotraps. All traps were baited with a mixture of bread and dry dog-food pellets contained in porous (onion) bags hung inside the traps.

7.3.2. Trapping in Eagle Creek

Eagle Creek is a permanent watercourse that provides irrigation water to the dairy and citrus farms, and market gardens along its length. To maintain supply, water from the Murray River is pumped into its headwater near Barham, usually each weekend, giving rise to flow for a few days each week along much of its length. Following a request by the Eagle Creek Pumping Syndicate (ECPS) to NSW Fisheries for advice on carp control, trapping trials were conducted in Eagle Creek during 4-12 December 2002. The request by the ECPS provided an opportunity to test the envirotrap and box-trap in the field. The main objectives of the trials were to determine whether carp could be trapped in small waterways such as Eagle Creek, demonstrate the utility of the two trap designs, and test the effectiveness of the turtle BRD under field conditions (no platypus inhabited the area.)

For a detailed description of Eagle Creek, fishing sites, methods and results, see Appendix 5. Methods and results are summarised below.

7.3.2.1. Methods

Envirotraps were set fully submerged in relatively narrow parts of the creek; two traps were rigged with netting wings to each bank and were set from a small punt. The third envirotrap was fished without wings beneath a small bridge. The box-trap was set in relatively shallow water with 10-20 cm of the trap above the surface. All traps were cleared between 6 a.m. and 8 a.m. each day; the envirotraps were also inspected in late afternoon (6-8 p.m.) to compare day and night catch rates. Bait bags were renewed every 2-3 days. Length, weight and reproductive data were recorded from all captured carp.

7.3.2.2. Results

Trapping was for eight days across a full cycle of the creek's normal flow regime, from Wednesday evening (4 Dec.) to Thursday morning (12 Dec.). The total catch was 194 fish weighing 210 kg, comprising 181 carp (203 kg), 4 goldfish (*Carassius auratus*), 5 carp/goldfish hybrids, 2 redfin perch (*Perca fluviatilis*), and 2 bony bream (*Nematalosa erebi*). No air-breathing vertebrates were caught in the traps, although a long-necked turtle was found unharmed clinging to one of the trap wings when the gear was retrieved from Site 2 at the end of the trials.

The average catch from all traps for the 8 fishing days was six carp (7 kg) per day, but the mean catch ranged from about 3 carp/trap on the two Thursdays, to 10 carp/trap on Sunday. Catches in all traps increased markedly during the weekend, coinciding with the beginning of pumping on Friday evening and the onset of flow in the creek (Figure 7.2). Catches were greatest in the envirotrap (with wings) at Site 2 (see Appendix 4) where the flow was strongest and most consistent. The maximum catch at Site 2 was 18 carp weighing 28 kg (Tuesday) and, across the 8 days, averaged 11 carp (15 kg) per day. Other sites were less productive: the average catches of the envirotrap fished without wings (Site 3) and the box-trap (Site 4) were less than half that of Site 2 (about 5 carp, 5 kg per day). The other envirotrap was fished at two sites (Site 1: 5 days; Site 5: 2 days) but caught relatively few carp at either location. About 75% of the total carp catch was caught during the night; of the catch taken during daylight hours, almost all was taken during Saturday, immediately after the onset of pumping.

The catch comprised almost equal numbers of male (97) and female (84) carp. Sizes ranged between 22 cm and 58 cm FL (Figure 7.3) with an even spread of males and females between 20 and 50 cm; most carp larger than 50 cm were females. Individual weights of carp ranged from about 200 g to 4.6 kg (Figure 7.4). Most males and females of all sizes had developing or mature gonads. About 60% of males had well developed testes and another 20% were 'running-ripe'. The ovaries in more than half of the females (55%) were close to or were mature, but only two were running-ripe.

7.3.2.3. Comments

With good access to the creek bank, there were no problems with the transport and deployment of the traps. Two people easily handled the envirotraps and, at suitable sites, it is likely that one person could manage these traps. The box trap was light to handle, but its shape required a smooth bank and creek bed so that it could easily slide in and out of the water. In contrast, the more robust construction and shape of the envirotrap make it the preferable option in areas where access is difficult, and fishing sites confined.

Both the envirotrap and box-trap effectively caught carp but the scope of the trials did not allow direct comparisons between traps or the effectiveness of wings. With no knowledge of carp abundance along the creek, the differences in catch rates may have reflected local density rather

than a better trap or trap set-up at any particular site. However, it was clear that catches were related to water flow. Carp catch rates at all sites increased immediately after the onset of pumping, and the highest catch rates were at Site 2 where the water flow was greatest and continued for the longest.

The size range of the carp catch seemed to be typical for the region. Although carp up to 10 kg are relatively common in southeastern Australia, fish between 50 g and 5 kg are more common (Koehn *et al*. 2000). As there was no physical barrier to larger carp entering the traps, it was probable that very large specimens were absent from the trapping areas. The age-length key in Koehn *et al*. (2000) shows that the peak in abundance between 25 and 30 cm FL comprise carp about 2 years old, and most of the catch were probably less than 6 years old. Several of the large females were close to spawning or had recently spawned which is consistent with the main spawning period of October-December (Stuart & Jones 2002).

Only one turtle was seen, and none was caught, so the effectiveness of the BRD in the envirotraps could not be determined. It was possible that some turtles did enter the envirotraps and subsequently escaped. However, it seems more likely that no turtles actually entered any trap as none was caught in the box trap. (This suggestion is supported by subsequent field trials in the Lane Cove River where significant numbers of turtles failed to escape from envirotraps during extended soak times; see below). As only two native fish (bony bream) and no air-breathing animals were caught, potential bycatch of protected species in fully submerged traps would appear to be minimal in Eagle Creek. However, if freshwater turtles were subsequently found to be a problem during more extensive carp trapping in Eagle Creek or other similar waterways, box traps or modified envirotraps could be utilised. Box-traps can be set at a depth where sufficient air-space is maintained above the water surface for turtles to breathe. Alternatively, fully submerged traps can be fitted with a netting codend or escape tube staked or buoyed above the water surface, in the manner required for eel fykes or yabby traps.

7.3.3. Trapping in Lane Cove River

Large carp are commonly seen above the Lane Cove River weir in the Lane Cove National Park, Chatswood West. Local residents have expressed concern about their presence to NSW Fisheries, and the Park Rangers (National Parks & Wildlife Service) were also keen to cooperate in any action that may lead to a reduction in carp numbers. The initial exploratory fishing in the Lane Cove River with small baited traps and a longline were unsuccessful (see above) but it was felt that larger traps may be more effective.

The Eagle Creek trials demonstrated that envirotraps were effective for carp capture but the turtle BRD was still untested under normal fishing conditions with extended soak times. While the experiments testing the BRD had shown that most turtles readily exited the trap through the escape aperture, a small number remained after each four-hour treatment (see Section 6.4). The Lane Cove River, inhabited by both carp and turtles, provided an accessible and suitable site to field test the envirotrap and its BRD.

7.3.3.1. Methods

Three sites were selected where traps could be deployed directly from the riverbank; one site was adjacent to the weir, and the other two were about 200 m and 300 m upstream on the southern bank. Much of the Lane Cove River is relatively deep and, at each location, the traps were able to be fully submerged about one metre below the surface close to the bank. The traps were tethered with ropes to railings or trees on the bank; by using the ropes and a long pole, the traps were oriented with the entrance facing down-stream and the large float kept the BRD uppermost. No netting wings were attached to the traps.

The baited traps were fished for seven days and nights (weekdays only) between 10 March and 20 March 2003, and inspected twice daily (8-9 am, and 5-6 pm). Captured fish were weighed and measured, and turtles measured; the fish and some turtles were then released back into the river. On an opportunistic basis, some very active turtles were put back into the traps to test the BRD; they were also released (if still present) when the trap was next inspected.

7.3.3.2. Results

River conditions varied during the trapping period. Heavy rain during the first fishing night put the river into minor flood with increased flow, turbidity and debris load for two days. The river was relatively normal for the remaining time with little flow, and calm, clearer water conditions.

No carp were caught; non-target catch comprised 4 Australian bass (*Macquaria novemaculeata*), 7 long-necked turtles and 18 short-necked turtles (see Appendix 6 for capture details and measurements). Ten turtles (7 short-necked and 3 long-necked) were caught overnight, the remaining 15 during the daytime. All turtles caught during the day were active when the traps were inspected but four turtles (2 short-necked, 2 long-necked) caught overnight were moribund when the traps were lifted; they recovered when removed from the traps.

Fifteen 15 turtles (10 short-necked, 156-244 mm CL; 5 long-necked, 150-213 mm CL) were placed back in the traps after initial capture but only two long-necked turtles (171 & 214 mm CL) escaped; the others were inactive or moribund when the traps were retrieved, but all eventually recovered and were released.

7.3.3.3. Comments

No carp were caught at any of the three trapping locations in the Lane Cove River, although carp were observed in the vicinity of the weir where visitors to the park frequently feed ducks and other water fowl. The envirotraps were set without wings which may have reduced their effectiveness, but failure to catch carp was probably more likely because of the lack of flow and nature of the river. Carp normally feed along the shallow edges of water bodies and the relatively deep water adjacent to the banks of the Lane Cove River may change the feeding habits of the local carp. They appear to be attracted to the duck feeding area by the weir. So it is possible that carp numbers could be reduced in the Lane Cove River with more targeted trapping by first attracting fish into a relatively small area with berley, and then into a large baited trap (see Section 4.2.3).

Mesh-netting and electro-fishing are other possible methods that could be utilised but the depth of the river above the weir, bottom snags and the likely impact on turtles and other inhabitants, make those methods less appropriate. The Lane Cove River runs through the Lane Cove National Park and any large-scale fishing for carp in this popular recreation area would attract the attention of the public. Fully submerged traps like envirotraps are the most convenient and least obtrusive means of reducing carp numbers. It is possible that there are other locations in the river or different water conditions when traps would successfully catch carp. However, if traps were left unattended for longer than 12 hours, they would need to be fitted with totally effective BRDs, such as surface codends, to prevent turtle mortality.

The observations on the efficacy of the BRD were not from a fully quantitative and designed experiment, and there was no measure of the number of turtles that may have entered and exited the traps during the soaktimes. However, that only two of the 15 turtles placed back into the traps escaped suggests that, in practice, the BRD was not totally effective. The observations indicated that turtle mortality may occur if envirotraps were fished fully submerged for prolonged periods.

While the turtles trapped overnight slowly recovered, it was apparent that they were unlikely to survive soaktimes longer than about 12 hours.

7.3.4. Trapping in South Creek

7.3.4.1. Background

Greening Western Sydney (GWS) is a project partnership between PlanningNSW and Greening Australia (NSW). Since 1992, GWS has been rehabilitating open-space corridors and Regional Parklands in western Sydney, a project that has grown into the largest urban vegetation management and restoration project in Australia (D. Williams, GWS, personal communication). Included in this project is restoration work along the riparian zone of South Creek. In connection to this, GWS is also looking at the feasibility of long-term native fish restoration program for South Creek and adjoining waterways as part of the overall habitat enhancement. It was thought that the proliferation of carp in these waterways would inhibit any restoration of native fish populations. Following a request from GWS to NSW Fisheries for advice on carp control in South Creek, it was agreed that South Creek was an appropriate location for further evaluation trials of the envirotrap. A section of South Creek was inspected in late March 2003, and carp were seen at several places in the creek. Three sites were selected and traps were set during the nine day period April 7-16.

The principal objectives were to investigate whether carp could be effectively caught in traps in waterways such as South Creek, and to further test the effectiveness of the turtle escape chutes built into the carp traps.

7.3.4.2. Location and description of trapping sites

Traps were set in a section of South Creek west of Mamre Road, St Clair. The locations were several hundred metres apart with differing characteristics.
Site 1: a relatively large, wide pool with clay substrate; depth in middle 1-2 m; water turbid; creek partly shaded (Figure 7.6).
Site 2: a narrow shallow (max. about 1 m) section of creek with sandy/muddy substrate; water relatively clear; creek almost fully shaded (Figure 7.7).
Site 3: a relatively wide and deep section of the creek; estimated depth 1-3 m; dense *Casuarina* trees along the banks; creek bed matted with *Casuarina* needles; surface ‘scum’ evident (Figure 7.8).

During the period of the trials, the creek level was very low with very little or no water flow. Traps were set near the centre of the creek.

7.3.4.3. Gear and methods

The original Enviro-Trap (Figures 6.1, 6.3) and two modified envirotraps (Figure 6.2) were used. In response to observations made during the BRD experiment (Section 6.4) and the trapping trial in the Lane Cove River (above), alterations were made to the mesh platforms and the inner lining along the tops of the envirotraps designed to improve the ability of turtles to access the escape platforms. During the BRD experiment, turtles had been observed continually poking their heads through the outer mesh covering the trap while moving along the interface between the black liner and the mesh. As the liner extended below the level of the platform entrance, many turtles had moved past the entrance to the BRD and accumulated at the back of the trap. Modifications were:

Escape platforms: the lateral edges of the platform in the original Enviro-Trap were bent upwards at right-angles and secured to the upper frame of the trap forming a chute (see Figure 7.5). The

platforms in the two envirotraps were flattened and the edges secured laterally to the sides of each trap. In both the original and modified traps, the gap between the platform and the top of each trap was about 85 mm at the centre (Figure 7.5).
Upper surface: in one envirotrap, the lateral edge of the smooth plastic flute-board near the escape platform was tapered inwards above the platform and towards the escape ring (Figure 7.9). In the second trap, the flute-board was removed and replaced with fine plastic mesh; this small mesh lined the complete upper half of the trap, eliminating any interface with the outer large mesh in the top of the trap (Figure 7.10). Both modifications were designed to better guide the turtles directly onto the BRD.

Traps were baited with bread and dry dog-food pellets contained in onion bags. Each trap was submerged near the centre of the creek, and set facing down-stream. Traps were set over a period of nine days; they were retrieved on each of six mornings after soaking for 24 hours, and on Monday 14 April, after 72 hours' soak over the weekend. Water temperature was recorded at each site on three mornings. Any fish caught were measured (fork length, FL) and weighed; native fish were then released. Turtles were also measured for carapace length (CL).

7.3.4.4. Results

The few captures are listed in Table 7.1. Across the three sites, water temperature ranged between 16.2 and 19.2 ^{o}C; the greatest variation (almost 3^{o}C) was at Site 2, the shallowest of the three sites.

A single small carp (195 mm FL; 545g) was caught at Site 1. Five Australian bass, ranging in size between 250 and 365 mm FL (350-800 g) were caught, three at Site 1, and one at each of the other sites. Single, small long-neck turtles were captured at Sites 1 and 2. The turtle (139 mm CL) found in the Site 2 trap after the weekend (72 hour soak) was moribund but recovered; it was assumed that this turtle entered the trap the previous night as previous observations suggested that turtles are unlikely to survive more than about 12 hour's entrapment. The second turtle (170 mm CL) caught in the Site 1 trap after an overnight soak was very active and was replaced back in the trap. It was still present the next morning in a moribund state but subsequently recovered and was released back into the creek.

7.3.4.5. Comments

Although medium sized carp were seen in the creek prior to the trapping trials, the only capture was a small juvenile. Water levels in the creek were unusually low (D. Williams, GWS, personal communication) and there was little to no flow. As demonstrated in the Eagle Creek trials, carp trapping is more effective in flowing water when carp actively move and feed into the current. In addition, water temperatures at the three sites were between 16 and 19^{o}C, whereas carp feed more actively in water temperatures greater than about 20^{o}C.

The capture of several Australian bass confirmed their presence in the creek. As the restoration of the riparian zone along the creek proceeds, water quality should improve which, in turn, should result in a healthy bass population.

That only two turtles were caught was probably a result of the relatively low water temperature and it seems that few were actively feeding. Whilst it could not be determined whether any turtles went in and out of the traps during these trials, the two turtles that were caught did not escape from the traps during prolonged soak times and would have drowned if not released. The small number of turtles precluded any quantitative evaluation of the trap modifications.

7.4. General discussion

Trapping provides an alternative, or additional, means of harvesting carp, and field trials in Eagle Creek demonstrated that traps could capture a broad size range of carp from a small waterway, particularly during periods of significant water flow. The unsuccessful trapping in the small waterways around Sydney was probably attributable to the lack of water flow and relatively low carp density. Carp trapping can be successful in still-water locations but is usually preceded by sustained berleying to first habituate and concentrate carp to the vicinity of the trap (see Section 4.4).

Field trials to test the effectiveness of the inbuilt BRD in the envirotrap were inconclusive. Under experimental conditions, about 80% of turtles escaped through the BRD in less than four hours (Section 6.4). In the field, insufficient turtles were caught to conduct quantitative tests. However, it was apparent in the Lane Cove River and South Creek trials that some turtle mortality would occur if envirotraps were fished unattended for periods greater than about 12 hours. Unless the envirotrap turtle BRD can be modified to be totally effective, fully submerged traps should require the fitting of properly shaped netting tubes or codends that are buoyed or staked at the surface. In areas of high turtle density, escape codends would need sufficient capacity to prevent overcrowding leading to turtle mortality.

The carp trap tested here, or other styles of trap fitted with an escape chute, may have a role in commercial fishing. It is more likely, however, that traps would be used in carp control operations, particularly in areas where conventional fishing methods, such as mesh-netting or seining, are not possible. The complete eradication of carp in even relatively small water bodies by commercial fishing is not feasible. This is because, as the carp densities decline in the fished areas, the diminishing economic returns force harvesting operations to move on, usually leaving small carp populations behind. However, the deployment of traps, with their relatively low capital cost, may be sufficient to control carp at a local level. The National Strategy for Carp Control stresses the need to assess carp management within the context of the regional or local catchment management plans. The main role for carp traps may be to provide conservation and carp control groups operating at the catchment level with a viable, cost-effective, low-impact method to control local carp populations.

Table 7.1. Water temperature, fish and turtle captures at the three sites in South Creek.

	Site 1			**Site 2**			**Site 3**		
April	Water Temp (^oC)	Fish	Turtle	Water Temp (^oC)	Fish	Turtle	Water Temp (^oC)	Fish	Turtle
8	-	-	-	-	bass	-	-	-	-
9	-	-	-	-	-	-	-	bass	-
10	-	bass	-	-	-	-	-	-	-
11	17.2	carp	-	16.2	-	-	17.4	-	-
14	19.2	bass (2)	-	19.0	-	long-neck	18.6	-	-
15	18.0	-	long-neck	16.5	-	-	17.0	-	-
16	-	-	-	-	-	-	-	-	-

Figure 7.1. Box-trap with carp catch from Eagle Creek.

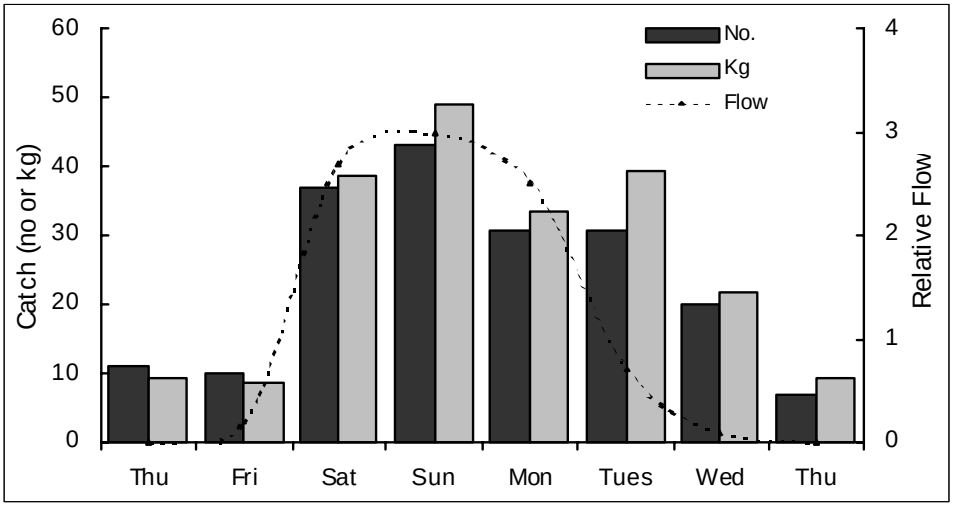

Figure 7.2. Daily carp catch from Eagle Creek (no. and kg; combined for all traps); the dotted line represents relative flow in the creek.

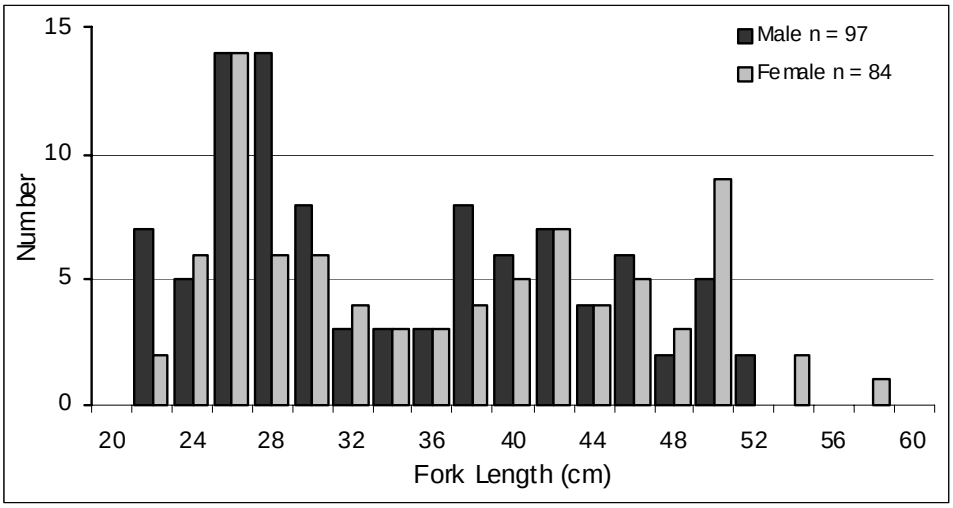

Figure 7.3. Length frequency distribution of carp from Eagle Creek.

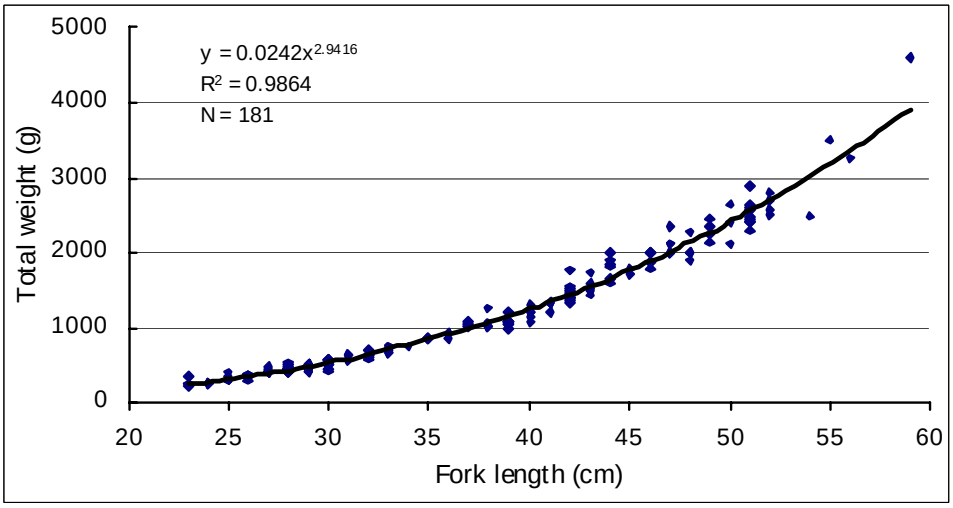

Figure 7.4. Length-weight relationship (sexes combined) for carp from Eagle Creek.

Figure 7.5. Diagrams of upper sections of envirotraps showing escape chute modifications. A = original Enviro-Trap; B = modified chute in envirotraps; in both chutes, the distance between the floor and the top of the trap was 85 mm.

Figure 7.6.
South Creek trapping site 1.

Figure 7.7.
South Creek trapping site 2.

Figure 7.8.
South Creek trapping site 3.

Figure 7.9.

Trap 2 (modified envirotrap) showing the shade board tapered inwards to the exit hole; the rust-coloured platform is seen beneath.

Figure 7.10.

Trap 3: the top half of the trap is lined with small-mesh plastic netting.

8. CONCLUSIONS

Carp continue to spread throughout inland NSW and are now present in several coastal catchments. Despite the widespread distribution and abundance of carp, a number of factors combine to inhibit any expansion of the commercial carp fishery in the near future. The general remoteness of the main carp resource, combined with the lack of market demand and hence low price for any product, make commercial fishing for carp largely unprofitable.

Electro-fishing, hauling, meshing and trapping, with appropriate modifications and deployment procedures, can safely be used for commercial carp fishing with minimal effects on bycatch species. Should the economic viability for carp improve, fishers will be in the best position to adapt and develop the most effective gear for harvesting carp. For government and non-government organisations which frequently contact NSW Fisheries about carp control in public and private waterways, any of the above methods can be adapted to help control carp numbers in relatively small waterways and streams. However, any gear or methods used to catch carp must be environmentally safe and conform to any legislative conservation requirements.

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