

The past and present freshwater fishery in New South Wales and the distribution and status of the *Platypus Ornithorhynchus anatinus*

T. R. Grant

Mt King Ecological Surveys, Oberon, NSW 2787
and

School of Biological Science, University of New South Wales, P.O. Box 1, Kensington, NSW 2033

ABSTRACT

The use of small mesh size gill and drum nets in the inland fishery until around 1950 probably had a considerable impact on platypus populations in most New South Wales rivers. The prohibition of nets in the capture of introduced salmonid species by the *Fisheries Act*, 1902 and the current fishing regulations have provided a good deal of protection to the species in most water bodies of the State. However, it is probable that the present overlap of commercial (and illegal) fishing operations with the distribution of platypuses in the lower Murray and Murrumbidgee rivers, and their affluent streams, are suppressing platypus numbers. An experiment indicated that the legal drum nets used in the industry are less of a threat to platypuses than the use of gill nets and the illegal nets used by poachers. Banning of gill nets from the industry and stringent law enforcement would largely protect platypus populations in the inland rivers. The current regulations of the eel fishery in New South Wales should minimize the impact of this fishery on the platypus.

INTRODUCTION

Until the turn of the century, platypuses were hunted for their skins in a considerable, but mainly local, fur industry (Grant and Denny 1991). At the same time, many must have been drowned by the netting activities of the early freshwater fishery. By an amendment to the *Bird Protection Act*, 1901, the platypus was given protection from the fur industry in New South Wales. A year later, the prohibition of the capture of the introduced salmonid species, except by rod and line, by the *Fisheries Act*, 1902, provided further protection to the platypus in the streams and rivers of the tablelands of the State, as well as in the cooler streams of the coastal region and upper western slopes. This paper discusses the history and current operations of the freshwater fishery in relation to platypus distribution and conservation in New South Wales.

During exploration of the interior of the continent the size and abundance of the Murray cod *Maccullochella peelii*, became legendary. Both John Oxley (1820) and Charles Sturt (1838) supplemented their supplies by fishing for this species, which was apparently so easily caught that Sturt's men grew tired of eating it. As settlement continued,

colonists created local fishery operations (Woods 1883). As early as 1880, professional fishermen were using nets to catch fish on the Murrumbidgee River at Wagga Wagga and the Murray River at Echuca and Albury (Anon. 1880) for the markets of Sydney and Melbourne. With the establishment of rail links to these cities, a large fishery was created. The fishery was based mainly on the Murray and Murrumbidgee rivers, but extended into many of the other inland river systems, including the Darling, Lachlan, Macquarie, Namoi and border rivers (Fisheries of New South Wales Annual Report¹). Eastward-flowing rivers such as the Richmond, Clarence, Manning, Hunter, Shoalhaven and Clyde, were also commercially fished (Thompson 1893). The fishery was initially based on the Murray cod and later on other species of native fish, especially the golden perch or callop *Macquaria ambigua*. The history of the establishment and subsequent decline of the industry has been traced by a number of authors, including Dannevig (1903), Dakin and Kesteven (1938) and Rowland (1989). An impression of the extent of the fishery is given for the period of 1920–30 in terms of numbers of fishermen, boats and nets in Table 1. During the early fishery there would have been considerable overlap between

¹These reports are variously titled (e.g., "Report of the Commissioners of Fisheries for N.S.W."; "Fisheries of N.S.W. Report of the Board") but are all annual reports and contain the words "Fisheries of N.S.W." in their title, so that they are referred to, and indexed under this title. There is no evidence in any of these reports of the capture of platypuses during netting operations in any rivers in New South Wales.

Table 1. Fishermen and fishing gear used in the Murray, Murrumbidgee, Darling and Lachlan Fisheries between 1920 and 1930. Source: Fisheries of New South Wales Annual Reports. * Total nets = types of nets not specified in Annual Reports in 1929 and 1930. — information not available in these Annual Reports.

Year	Murrumbidgee/Darling/Lachlan				Murray/Riverina to SA border			
	Fishermen	Drum nets	Gill nets	Boats	Fishermen	Drum nets	Gill nets	Boats
1920	75	—	—	—	400	2 000	—	300
1921	70	217	—	25	600	5 000	—	500
1922	70	350	—	40	400	7 000	500	450
1923	200	2 000	—	186	300	4 000	500	300
1925	—	—	—	—	600	6 000	1 000	500
1928	—	—	—	—	1 300	13 000	2 000	1 000
1929	800	9 000 Total nets*		700	750	8 500 Total nets*		700
1930	900	9 000 Total nets*		800	—	—	—	—

fisheries operations and the distribution of the platypus, especially in the eastward-flowing rivers and the upper reaches of westward-flowing river systems of the State.

Today the fishery is restricted to the Murray River downstream of Albury, the Murrumbidgee River below Darlington Point, various tributaries between these rivers (including the Edward and Wakool rivers), the area west of the Darling River and a few inland lakes, including lakes Urana, Cowal, Brewster and Cargelligo. There were around 200 licensed inland commercial fishermen in 1982, only about 25 of whom worked in the industry on a fulltime basis (McDonall 1982). Currently there are 48 licensed fishermen in the State (NSW Fisheries, pers. comm., July, 1993). Methods of fishing are also now closely regulated and the minimum mesh size used in both drum and gill nets is 130 mm (5 in.). The Victorian Murray River fishery is administered from New South Wales. Currently there is only a small area of overlap of inland fishery practices and the distribution of the platypus (Fig. 1).

As well as various types of line fishing, gill nets and drum nets have been in use since the early days of the industry (Dannevig 1903; Roughley 1951). Gill nets consist of netting hung, by a weighted bottom line, from a top rope fitted with floats (Fig. 2a) and are used most frequently in still or slowly-flowing waters. Figure 2b shows the construction of a drum net, which consists of netting material fitted tightly around two or three hoops, and with mesh wings to direct fish into the "drum" through a one-way valve. These nets are set between three stakes driven into the river bottom or slope of the bank as shown in Figure 2b.

The early fishery had few regulations, although the *Fisheries Act* of 1881 imposed a net mesh size of 3 in. (76 mm) and the *Inland Waters Fisheries Act*, 1887, provided for closures of waters to netting (Thompson 1893). In

spite of recommendations from the honorary inspectors and by fishermen themselves for a mesh size of 4 in. (Wiltshire 1887; Dannevig 1903), to reduce the catch of smaller fishes in the population, both drum and gill nets of between 2.5 and 4 in. (64–100 mm) (Stead 1903) were used until 1915, when regulations made the legal mesh size 4 in. (102 mm) for both types of nets (Anderson 1915). This mesh size for both drum and gill nets (except in the Namoi River and for the wings of drum nets which had to be 6 in.) was current from 1933 until at least 1944 (Anon. 1933, 1934, 1936, 1937, 1939, 1944), but by 1951 this regulation had been changed to a minimum mesh of 5 in. (130 mm) (Roughley 1951), as is used today (McDonall 1982).

Although Langtry (pers. comm., 1990) could not remember what mesh sizes were used, he recalled capturing platypuses in both gill and drum nets in his 1949–50 fish surveys in the lower Murray and Murrumbidgee rivers. Llewellyn (pers. comm., August, 1993) also caught platypuses in 4 in.-mesh drum nets in the Murrumbidgee River, during his fisheries research from 1966–70. This indicates that the use of small mesh nets in the early fishery had considerable potential to wreak havoc on platypus populations in the rivers of New South Wales, due to the overlap of the fishery with the distribution of the platypus in areas both east and west of the Great Dividing Range. However, this impact would have been considerably reduced with the closure to netting of waters containing introduced salmonid species after 1902, and the further restriction of commercial fishing operations in inland waters by around 1960 (Bill Brinsley, Chief Inspector, NSW Fisheries, pers. comm. to Grant and Denny 1991).

Critical questions examined below are:

- Did the early fishery reduce the distribution of the platypus in New South Wales?
- Are the current fishing practices having an impact on platypus populations in the State?

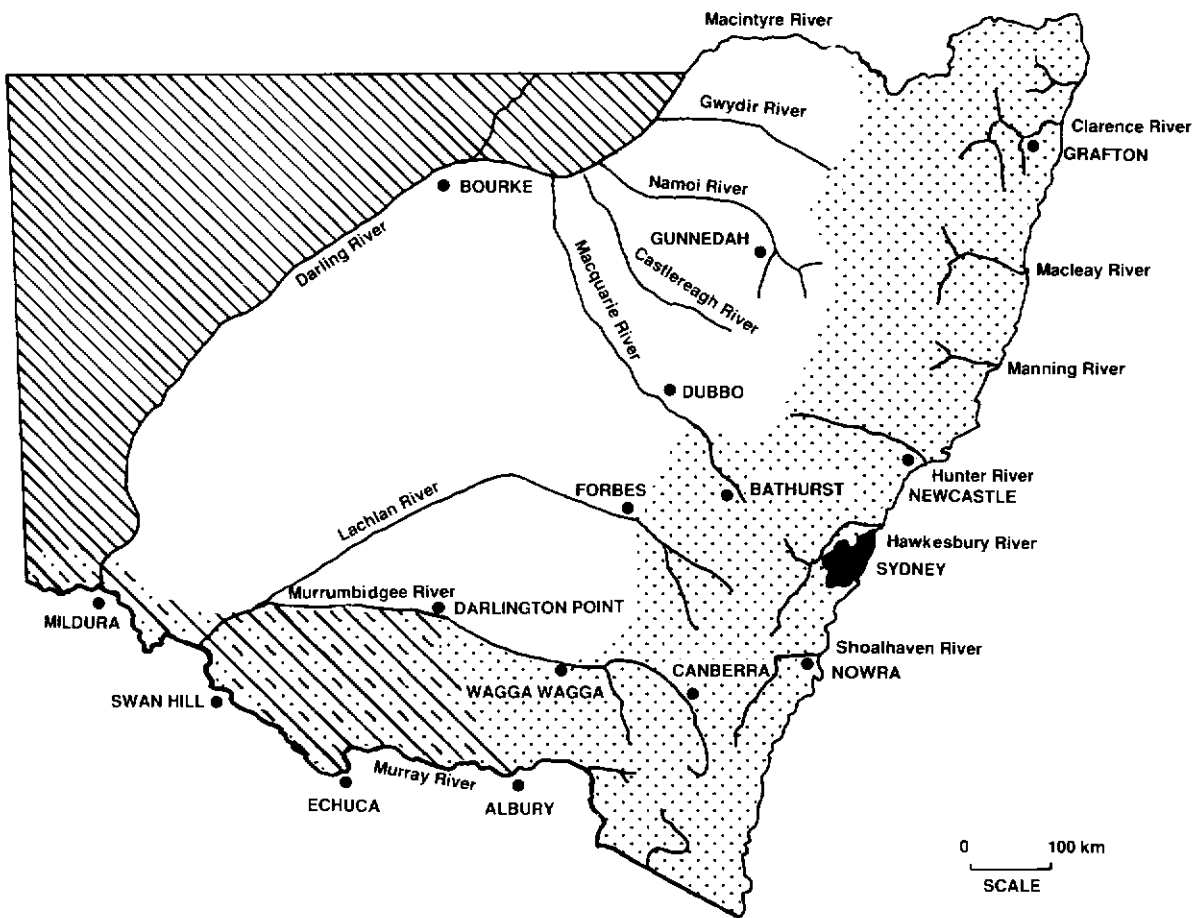


Fig. 1. Distribution of the platypus in New South Wales and the areas currently included in the inland fishery. Stippling shows the distribution of platypuses outside the inland fishery; cross hatching indicates the area of the inland fishery; stippling combined with cross hatching shows the area where the fishery and platypus distribution overlap. Distribution data from Grant (1992).

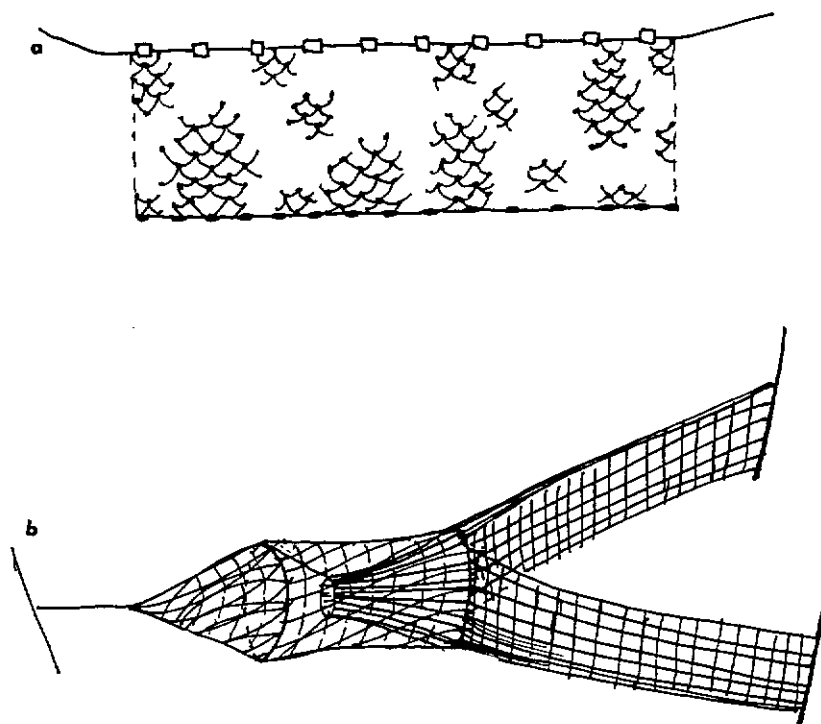


Fig. 2. Gear used in the inland fresh-water fishery.

a. Gill Net — netting is suspended from the surface of the water by a rope with floats attached and is held down by lead weights along a bottom line of rope. Used mainly in still or slowly flowing waters. Current legal mesh is 130 mm.

b. Drum net — two stakes driven into the river bottom or sloping bank are used to spread the directing “wings” of the net, which is stretched back to another stake attached to the end of the “drum”. The “drum” section consists of mesh stretched over two hoops, with the first supporting the one-way valve, which prevents fish (and platypuses) from escaping. Current legal mesh is 130 mm for the “drum” section and 153 mm for the “wings”.

Both of these types of nets are normally laid from small boats and are hung below the surface of the water in lakes, river channels and billabongs.

METHODS

The current and historical distribution of the platypus was investigated using established data base information, questionnaire surveys, interviews and correspondence, museum records, literature searches and field verification (Grant and Denny 1991; Grant 1992). During this project these sources were also used to assess the possible effects of the historical and present freshwater fisheries operations on the platypus.

An experiment was carried out in the Shoalhaven River in December 1991 to determine if platypuses could escape from the most used professional fishing gear, the drum net, which was introduced into the industry around 1880, and is apparently the most efficient method for the capture of native species of fish (Dannevig 1903; Rowland 1989) (Fig. 2b).

Eight platypuses were individually released inside two nets, one of the legal 130 mm mesh and one of slightly smaller mesh (114 mm or 4.5 in.). These nets were laid so that an airspace was left above water level to enable animals to surface for air if necessary.

The plural *platypuses* is used in this paper. The author has been informed that the word *platypus* is anglicized from Greek and therefore should have the English plural ending “-es” (Editor, *Physiological Zoology*, pers. comm., 1978). This plural has also been accepted and specified in the instructions to authors for a recent review publication on monotremes (Augee 1992).

RESULTS AND DISCUSSION

1. *Effects of the Past Inland Fishery*

(a) *Eastward-Flowing Rivers*

Although the early inland fishery was widespread it appears that platypus distribution has not been affected in the eastward-flowing rivers of the State as the species now occupies all 22 river systems east of the Great Dividing Range (Grant 1992). The headwaters of many of these rivers are trout habitat and so were protected against netting from 1902.

(b) *Westward-Flowing Rivers*

Border rivers and Darling, Gwydir, Namoi and Castlereagh rivers.

The Namoi River appears on lists of catches of freshwater fish and crustaceans in the Fisheries of New South Wales Annual Reports until at least 1950. Actual locations and fishing effort are not given for this river, although

Gunnedah and Narrabri are mentioned as towns from which fish was freighted to Sydney in the 1898 and 1900 reports respectively. No information was available for the border rivers, Gwydir or Castlereagh river fisheries, although it is likely that all of these rivers were fished when there was sufficient water, as were the Darling River to Bourke and the Barwon River to Walgett and Brewarrina.

It seems unlikely that fishing eliminated the platypus from these rivers as they still occur in the headwaters (protected from net-fishing since the *Fisheries Act*, 1902) of all of the systems but have not colonized the lower reaches. This is in spite of the absence of commercial fishing for over 30 years, and more constant flows of water in many of the rivers due to releases of impounded waters for irrigation (Laurie *et al.* 1979). Information from Aboriginal literature (Grant and Denny 1991; Grant 1992) seems to substantiate the notion that platypuses have probably never occurred, except perhaps as transient individuals, in these rivers where they flow through the north western plains.

The Macquarie-Bogan River System

Catches from the Bogan and Macquarie rivers are reported in the Fisheries of New South Wales Annual Reports until at least 1957 and 1960 respectively, and the towns of Bathurst, Orange, Wellington, Dubbo and Nyngan are noted as places of shipment of fish to Sydney around the turn of the century. The Cudgegong River was also fished, and fish shipped to Sydney from Mudgee (Fisheries of New South Wales Annual Report 1916). The upper reaches of the Macquarie River system were recognized as trout waters by the turn of the century (Fisheries of NSW Annual Report 1900).

Again it seems unlikely that the early fishery eliminated the platypus from the plains areas of the Macquarie River. The species is found today between Bathurst and Wellington and in tributaries like the Cudgegong River, where fishing occurred. If its distribution was affected, it seems to have recovered in the upper reaches of the river. There has also been no commercial fishing in the lower Macquarie River for at least 30 years and environmental releases of water are provided for the Macquarie Marshes area from Burrendong Dam. (Anon. 1990), so it would seem unusual that the species has not re-occupied this area if it had ever been part of its normal distribution. The Wiradjuri peoples of the Dubbo-Mudgee area had the word *billadurong* for the platypus. However, the Wiradjuri extended into the

headwaters of the system where the platypus is still common (Grant and Denny 1991).

There is no evidence that the platypus ever occurred in the Bogan River (Burrell 1927), presumably because of its intermittent flow.

Lachlan River System

Because of the nature of records, it was again impossible to determine the exact nature of the inland fishery in the Lachlan River. However, the river was fished until at least 1960 as far upstream as Forbes (Fisheries of New South Wales Annual Reports 1960), which is downstream of recognized trout waters.

For the same reasons as discussed above for the Macquarie and the rivers of the north western plains, it seems unlikely that the early fishery affected the western distribution of the platypus in this river system. The Aboriginal peoples of the Willandra Creek area did not include the platypus in their vocabulary and assurance has been given (Donaldson, pers. comm. to Grant and Denny 1991) that this is because they were not familiar with the animal.

Most platypus sightings in the Lachlan River system today occur in the upper reaches above Forbes (Grant 1988; Grant and Denny 1991; Grant 1992), where netting has been illegal since 1902.

Murrumbidgee River System

During 1949–50 J. O. Langtry carried out fisheries investigations on the Murray and Murrumbidgee Rivers (Cadwallader 1977). Unfortunately much of the netting activities were done by contracted local fishermen and so little was reported concerning capture of wildlife, and nothing of platypuses, except from the recollections of Langtry himself (pers. comm. to Grant and Denny 1991). Langtry regularly captured platypuses in both his drum and gill nets in the Murrumbidgee River on "Bringagee" station, downstream of Darlington Point. Such were the number captured, that he stopped netting in the area on some occasions. He reported that the son of the then station owner/manager slept under a platypus skin rug! Several platypuses were sighted in this part of the river during the winter of 1992 and early 1993 (Ron and Colin Armstrong, pers. comm. April 1993) but until now have been seldom seen or captured, in spite of professional fishing operations (Grant 1988; Grant and Denny 1991; Grant 1992).

In 1944 two platypuses were drowned by a professional fisherman in the Murrumbidgee River at Balranald. The species is rarely

reported in this part of the river today (Grant 1988; Grant and Denny 1991). The river is now closed to professional fishing upstream of Darlington Point (McDonall 1982) and has been closed for around 30 years (Bill Brinsley, Division of Fisheries, pers. comm. to Grant and Denny 1991). During his fisheries research from 1966 to 1970, Llewellyn (pers. comm., August 1993) "captured numerous platypus[es] between Darlington Point and Berembred Weir in drum nets". Berembred Weir is on the Murrumbidgee River between Narrandera and Wagga Wagga, upstream of Darlington Point (Fig. 1). Grant (1988) reported many recent records of platypuses from the current eastern limit of commercial fishing to Yass, a stretch of the river included in the previous commercial fishery.

Platypuses are now commonly seen from this area down to Narrandera (Grant 1992). It would seem an obvious conclusion that the species has recovered from any adverse effects of fishing in this area in earlier times. The fact that the species has continued to inhabit this part of the river, or re-occupied it after commercial fishing has ceased, further indicates that the lower reaches of the Lachlan and Macquarie Rivers and those of the rivers of the north/western plains have probably never supported resident platypus populations. It also suggests however, that the current fishery (both legal and illegal) may be suppressing recovery of the species in the lower reaches of the Murrumbidgee River, where they were commonly captured by Langtry and are still occasionally seen or captured. Aboriginal peoples from the Narrandera area used the word *dhummbirrity* for the platypus, although these peoples also extended their range into the headwaters of the Lachlan River, where platypuses are now numerous. There is also a tentative identification of a word for the species in the MutiMuti language of the Balranald Plains (Grant and Denny 1991).

The Murray River System

The Murray river was the focus of the cod fishery in South Australia, Victoria and New South Wales. Local fishermen (Grant and Denny 1991) in the three States and Langtry (1949–50, pers. comm. 1990) both reported none, or only a very few captures of platypuses in the Lower Murray River between Mildura and Lake Alexandrina. This area was extremely heavily fished after the introduction of drum nets to the fishery around 1880 (Dannevig 1903; Dakin and Kesteven 1938; Rowland 1989; Pierce 1990), and it is possible that platypuses were reduced to low numbers,

or suffered local extinctions at that time. However, there is no historical evidence to support this suggestion, and the lack of Aboriginal and palaeontological information from this area (Grant 1992; Grant and Denny 1991) probably makes it unlikely that the species was ever common here.

There are no Aboriginal references to platypuses from the peoples of the Benanee area, between Mildura and the junction with the Murrumbidgee River, except for the MutiMuti peoples of the Balranald Plains, who extended down to the Murray River near Boundary Bend. There are, however a number of references to the species between there and Echuca, an area where it is not currently common (Grant 1992). The WatiWati word for Swan Hill is *martyrocuert*, which is their word for the platypus (Grant and Denny 1991). It is possible that platypus distribution and numbers have been reduced in this area by the fishery.

Langtry (1949–50, pers. comm. 1990) also captured platypuses in reasonable numbers around Barmah, upstream of Echuca. From here to Albury (the current upstream limit of commercial fishing), platypuses are more commonly encountered and are still drowned by the few professional fishermen working this part of the river (Grant 1988; Grant and Denny 1991). Fishing once extended upstream of Albury and the whole of the Murray-Riverina area was very heavily fished (Table 1). In the Albury district in 1928 there were 1 300 fishermen, using 1 000 boats, 13 000 drum nets and 2 000 gill nets in the area (Fisheries of New South Wales Annual Reports). Platypus populations either persisted through this extreme fishing pressure, or recolonized from upstream, despite some current commercial fishing between Albury and Echuca.

Considering the extreme fishing pressure, using gear which is known to capture platypuses, it is almost certain that considerable reduction of platypus populations would have occurred during the early fishing operations in the Murray-Riverina (Albury to Swan Hill), including the tributaries of the Murray, such as the Edward and Wakool rivers, and in the Murrumbidgee River. Although not numerous, platypuses occur in these areas today. Areas of importance include the Murray River downstream of Echuca, the lower reaches of the Edward and Wakool rivers, and below Wagga Wagga on the Murrumbidgee River (Grant 1992; Grant and Denny 1991). It is therefore likely that these areas supported more platypuses before the start of the net

fishery in the late 1800s and that their numbers, and distribution, have fluctuated with the intensity of the fishery (Dakin and Kesteven 1938; Rowland 1989).

2. Effects of the Current Inland Fishery

The area in both the Murrumbidgee and Murray River systems where platypuses are found, but are not numerous, are in the areas where commercial fishing currently operates (and illegal fishing pressure is known) (Grant and Denny 1991). This applies to the Murrumbidgee River downstream of Darlington Point and the Murray River and its affluent streams, especially below Cobram. There are no details of fishing pressure in various parts of the river, but it appears from interviews with fishermen that there is less commercial fishing upstream of Cobram (which is approximately midway between Albury and Echuca) on the Murray River than below it. This is possibly due to the difficulty of access to river channels and the high incidence of common carp *Cyprinus carpio*. There is some evidence that this is also the part of the river, within the region of commercial fishing, where platypuses are most numerous (Grant and Denny 1991).

Most fishermen interviewed in the study by Grant and Denny (1991) complained of the amount of illegal netting activity in the Murray-Riverina area and lower Murrumbidgee River. This was confirmed by the Fisheries Inspector at Deniliquin (Grant and Denny 1991). The use of illegal drum and gill nets is probably more detrimental than those used by commercial fishermen, as they are often of mesh sizes smaller than the regulation 130 mm mesh. Illegal fishing and its control has been the bane of the fishery since its early days. In the 1904 Fisheries of New South Wales Annual Report complaint was made that "during the closed season for Murray cod, illegal netting was continually carried on in the Murray River by residents on the Victoria side, who, on the approach of the police in this state, hauled their nets on to Victorian soil, in the belief that they were outside the jurisdiction of this (the NSW), department". During 1921, 300 illegal nets were confiscated by New South Wales inspectors (Fisheries of New South Wales Annual Reports 1921).

3. Capture of Platypuses in Nets Currently in Use in the Inland Fishery.

An experiment demonstrated that eight animals could escape through the mesh (114–130 mm) which was held tightly over the hoops of the two drum nets used. The mesh size

proved an impediment to only the male animal (1 300 g), but even then a small twist of the shoulder girdle permitted it to pass through.

It can be concluded that platypuses can escape from drum nets currently in use by licensed professional fishermen in New South Wales. However, it must be pointed out that only small platypuses were used in this brief study. During the experiment only one adult male animal was captured and used in the net trials. This 1 300 g male was quite small when compared with some adult males of the species. Adult males average 1 700 g and may be as large as 2.5 kg (Grant 1989), especially in westward-flowing rivers of the State (Grant and Temple-Smith 1983). Fishermen interviewed in the Echuca-Barham area admitted to occasionally drowning platypuses in drum nets (Grant and Denny 1991) and one indicated that the only individual drowned by him was a "large male". Certainly small males and most females should be able to escape from drum nets of the current legal mesh size. Both of the drum nets used in the experiment were lent by the NSW Fisheries. These had been confiscated from illegal fishermen, hence the smaller than legal mesh size in one net. As drum nets are set completely below the water to catch fish, the use of nets with smaller meshes would certainly drown platypuses.

Gill nets of 130 mm have been used previously by the author and have been found to catch platypuses. Unlike drum nets, the meshes of gill nets entangle animals and do not permit them to pass through. Some animals can survive by bringing the net to the surface so that they can breathe. However, if not frequently checked, gill nets can still result in mortality, and drowning is common when weights, snags or fish prevent netted platypuses from reaching the surface. *Illegally set gill nets are more lethal in this respect, because they are normally set with the top lines below the water level to avoid detection.*

4. The Eel Fishery

Unlike Tasmania, Victoria and Queensland, New South Wales does not have a fully-fledged eel fishery. The New South Wales Fisheries has established a policy for the fledgling eel fishery, which restricts eel fishing to farm dams, estuaries and certain artificial impoundments, using wingless baited traps. Taking of eels in freshwater streams is prohibited (NSW Fisheries Memo F89/0969). Permits allow licensed fishermen to take eels in freshwater impoundments and farm dams. At present there are 45 permits held for these waters in

New South Wales (NSW Fisheries, pers. comm., July, 1993).

According to Queensland authorities (John Beumer, Fisheries Division, Queensland Department of Primary Industries, pers. comm. to Grant and Denny 1991), similar regulations have minimized platypus mortality as a result of eel fishing in that state. The use of traps with no wings reduces drowning of platypuses, and prevents mortality of small forage fish species, which are often captured by "gilling" in the wings of fyke nets. A fyke net is an elongated type of drum net with two or more separate sections separated by one-way valves. These are permitted in specified inland waters of Tasmania and Victoria for the capture of eels, but are illegal in the inland freshwaters of Queensland and New South Wales. Experimental trials with fyke nets to capture eels in freshwater streams in NSW have resulted in drownings of platypuses (Llewellyn, pers. comm. 1990). A number of modifications by fishermen to permit captured platypuses to escape from submerged fyke nets, or to prevent their entry, proved unsuccessful (Grant and Denny 1991; Grant, unpublished). Platypuses seldom use the deep waters of major impoundments, but will use their headwaters and are found in lakes behind smaller dams and weirs (Grant 1988). The use of wingless traps, combined with their restriction to deep impounded waters should minimize impact of eel fishing on platypus populations in New South Wales, but this should be closely monitored by fishery and wildlife authorities. While impoundments and farm dams are the only fresh waters which can be commercially fished, any illegal encroachment by fishermen into streams or rivers close to these should be prevented by strict policing, and any capture of wildlife species will need to be monitored. In all other states in which an eel fishery has operated there has been conflict between the fishery and platypus conservation (Grant 1988; Grant and Denny 1991). During the expansion of the fishery in New South Wales, *conflict should be prevented by strict implementation of the current regulations.*

5. Other Fisheries

There is a small yabby *Cherax destructor* fishery in New South Wales, involving eight professional fishermen, fishing waters west of the Great Dividing Range (Paul O'Connor, pers. comm., in Grant and Denny 1991), as well as numerous amateurs, who are permitted to use up to five yabby traps and hoop or lift nets in waters other than notified trout waters, and hand-hauled nets in ground tanks, bore

drains or lagoons, but not in streams, lakes or dams (Munroe 1988). Yabby fishing poses little threat to platypuses, although they are occasionally reported being drowned in non-regulation wire traps, probably set to catch yabbies (Grant, unpubl.).

The *Fisheries Act* of 1881 permitted the use of nets by private citizens in any rivers of New South Wales. After the release of trout into various eastward-flowing rivers and the headwaters of westward-flowing streams closures of streams to netting during trout spawning periods came into force from around 1898 (Fisheries of NSW Annual Reports). Under the *Fisheries Act*, 1902, netting became illegal in waters supporting introduced salmonoid species, by making it unlawful to capture trout or salmon species except with a rod and line. Illegal netting of trout streams still occurs, resulting in the death of platypuses, but Fisheries officers maintain that law enforcement has reduced these activities considerably in recent years (several regional staff, pers. comm. to Grant and Denny 1991). Platypuses are currently common occupants of most trout streams in New South Wales (Grant, unpubl.).

Although the inland fishery was dependent on native fish species, these were not given the priority of protection afforded introduced salmonids. Although there were numerous closures of parts of rivers in the State at various times, as attempts to preserve the native fishery, it was not until the introduction of various salmonids (especially brown, *Salmo trutta*, and rainbow, *Oncorhynchus mykiss*, trout) that total closures of rivers to netting were made. Undoubtedly platypuses benefitted from the measures taken to preserve these introduced fishes.

Individual platypuses are occasionally captured on fishing lines, including set live-baited lines, artificial flies and even artificial spinners (Grant, unpubl.). This may lead to the death of these animals if they swallow the hook (resulting in internal injury), if fishermen cut the line, leaving the hook in place (possibly resulting in difficulty feeding) or if the animal is killed through ignorance and fear of being spurred and injected with venom by the male (Grant 1989).

CONCLUSIONS

Fisheries regulations, particularly those designed to protect the introduced salmonids, have protected platypuses over much of their distribution. However there is still an overlap of commercial and illegal fishing operations which is of concern to platypus conservation.

It is probable that the commercial fishery and illegal fishing activities in the Murray-Riverina area and the lower Murrumbidgee River have reduced the distribution and abundance of platypuses in these areas, and suppressed their recovery.

The species has probably always been a rare inhabitant of the lower Murray River and possibly Benanee areas, as well as the lower reaches of other westward-flowing rivers in New South Wales. There seems to be no evidence that the early and current fishery has had significant lasting effect on the distribution of the platypus in most areas.

As gills nets of the mesh currently used by commercial fishermen drown platypuses, consideration should be given to their use being restricted to areas outside the current distribution of the platypus. Although the mesh size now used in drum nets seems to permit the escape of many platypuses, a more comprehensive study should be carried out to assess the effect on large animals. The effects of any restrictions on gill nets, and possibly the mesh size of drum nets used in the industry, should be assessed by field studies. Such restrictions could result in the increased occupation by platypuses of the Murray River from Echuca to Swan Hill, its associated streams (e.g., Wakool and Edward rivers) and the Murrumbidgee River between Darlington Point and Balranald.

Consistent effort of law enforcement against illegal netting activities must continue, especially in these areas of special concern, including the lower Murray and Murrumbidgee river systems.

Eel fisheries utilising fyke nets have had detrimental impacts on platypuses and other wildlife species. It is pleasing to see that the New South Wales Fisheries has adopted an informed management strategy for the developing fishery in this State by applying a policy which should result in minimal impacts on platypus populations, assuming that these operations are closely policed and monitored.

It should be possible to reduce mortality by education of fishermen in handling and identifying male platypuses, and by banning stainless steel hooks (which do not readily corrode) in inland waters.

An information pamphlet produced by the National Parks and Wildlife Service, for distribution through fishing gear outlets and NSW Fisheries, would be beneficial.

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REFERENCES

- ANON., 1880. *Fisheries Inquiry Commission. Report of the Royal Commission to inquire into and report on the actual state and prospect of the fisheries of this colony.* Thomas Richards, Government Printer: Sydney.
- ANON., 1883–1998. *Fisheries of New South Wales Annual Reports.* Various titles.
- ANON., 1990. *Macquarie Marshes Nature Reserve Draft Plan of Management.* National Park and Wildlife Service: Sydney.
- ANON., 1933, 1934, 1936, 1937, 1939, 1944. *Fisheries Gazette. Being a Digest of the New South Wales Fisheries Laws.* Issued by the Chief Secretary, New South Wales. David Harold Paisley, Government Printer: Sydney.
- AUGEE, M. L. (ed.), 1992. *Platypus and Echidnas.* The Royal Zoological Society of New South Wales: Sydney.
- BURRELL, H., 1927. *The Platypus.* Angus and Robertson, Sydney.
- CADWALLADER, P. L., 1977. *J. O. Langtry's 1949–50 Murray River Investigations.* Fisheries and Wildlife Paper No. 13, Victoria.
- DAKIN, W. J. AND KESTEVEN, G. L., 1938. The Murray Cod (*Maccullochella macquariensis*) (Cuv. et al.). *New South Wales State Fisheries Research Bull.* 1: 1–18.
- DANNEVIG, H. C., 1903. *Murray Cod Fisheries. Summary of evidence regarding the Murray Cod Fisheries, with notes.* Government Printer: Sydney.
- GRANT, T. R., 1988. *The biology and management of the platypus (Ornithorhynchus anatinus) in New South Wales. Species Management Report No. 5.* NSW National Parks and Wildlife Service: Hurstville. Published 1991.
- GRANT, T. R., 1989. *The Platypus — A Unique Mammal.* New South Wales University Press: Kensington.
- GRANT, T. R., 1992. Historical and current distribution of the platypus, *Ornithorhynchus anatinus*. Pp. 232–54 in *Platypus and Echidnas* ed by M. L. Augee. The Royal Zoological Society of New South Wales: Sydney.
- GRANT, T. R. AND DENNY, M. J. S., 1991. *Distribution of the platypus in Australia with guidelines for management.* Pp. 1–168. Report to the Australian National Parks and Wildlife Service.
- GRANT, T. R. AND TEMPLE-SMITH, P. D., 1983. Size, seasonal weight change and growth in the platypus, *Ornithorhynchus anatinus* (Monotremata: Ornithorhynchidea) from the rivers and lakes of New South Wales. *Australian Mammalogy* 19: 117–23.
- LAURIE, MONTGOMERIE AND PETTIT PTY. LTD., 1979. *Benefits of Large Water Storages in New South Wales.* Water Resources Commission: Sydney.
- MCDONALL, V. C., 1982. *Commercial fisheries of New South Wales.* Government Printer: Sydney.
- MUNROE, A. T. (ed.), 1988. *Freshwater Guide.* Division of Fisheries, New South Wales Department of Agriculture and Fisheries.
- OXLEY, J. 1820. *Journals of Two Expeditions to the Interior of New South Wales 1817–18.* John Murray: London.
- PIERCE, B., 1990. *Chowilla Fisheries Investigation.* Report to Murray Darling Commission, Canberra, June, 1990.
- ROUGHLEY, T. C., 1951. *Fish and Fisheries of Australia.* Angus and Robertson: Sydney.
- ROWLAND, S. J., 1989. Aspects of the history and fishery of the Murray cod, *Maccullochella peelii* (Mitchell) (Percichthyidae). *Proc. Linnean Soc. New South Wales* 3: 201–213.
- STEAD, D. G., 1903. *The Murray Cod Fisheries. A Description of the Gear Used on the Murray; with Notes on the Natural Enemies of the Murray Cod and on the Various Fishes, Crustaceans etc. captured or mentioned.* Government Printer: Sydney.
- STURT, C., 1838. *Two Expeditions into the Interior of Southern Australia. Vols. I and II.* Smith Elder: London. Australian Facsimile Edition No. 4, 1963, Public Library of South Australia: Adelaide.
- THOMPSON, L. G., 1893. *History of the Fisheries of New South Wales.* Government Printer: Sydney.
- WILTSHIRE O., 1887. *Report of the Commissioners of Fisheries for New South Wales on the state of the fisheries in the Colony. Appendix K. Report on Inland Fisheries.* Government Printer: Sydney.
- WOODS, J. D., 1883. *Fish and Fisheries of New South Wales.* T. R. Richards, Government Printer: Sydney.