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AUSTRALIAN MARITIME COLLEGE

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SUMMARY

Gillnet fishing trials were conducted during 1999 off south-eastern and northern Tasmania to investigate the effects of different fishing practices, including night netting, and mesh size on catch and catch condition.

Mesh size represented an important factor in determining size and species composition and had an influence on catch rates. In general, increased mesh size resulted in reduced species diversity and lower catch rates (numbers of fish).

As indicated in the Scalefish Fishery Policy Document there is a proposal to increase the minimum mesh size for graballs to 114 mm. Catches were, however, too low to fully assess the impacts and potential benefits of increasing the minimum graball mesh size. On average, catch rates were slightly lower (but not significant statistically) for the larger mesh size and there was a slight increase in the size of fish caught. For bastard trumpeter and blue warehou, the major species taken using graballs, both 108 and 114 mm mesh sizes were effective in targeting legal sized fish.

Mullet nets (64 mm mesh) were selective for mullet, the majority of which were legal sized, but there was an associated by-catch of predominantly small (undersized) fish of other species.

The frequency with which gillnets were checked and cleared during the day had a minimal impact on catch rates. Day and overnight set comparisons indicated that, with the exception of mullet, there was little if any advantage based on catch rates (overall number of fish per set and number per net hour) of setting nets overnight.

The influence of fishing practices, ranging from the frequent clearing of nets to full day and unattended overnight sets was examined. As expected, catch condition generally declined with increasing soak time. Within the range of treatments examined several species were found to be very robust and thus the potential for wastage (due to poor condition) was low. This group included flounder, leatherjackets, gurnards, banded morwong, marblefish, stargazer, draughtboard shark, skates and rays. A second group, including bastard trumpeter, blue throated wrasse, sand flathead, boarfish, elephant fish and dogfish, tended to be in good condition for each of the day set treatments and had a relatively high potential for survival. The longer overnight sets tended to result in only moderate survival, with some 10-20% of the catch in poor condition. The third group, which included blue warehou, yellow eye mullet, cod, gummy shark, jack mackerel and short-finned pike, did not survive at all well in gillnets and while day set wastage rates were generally low (<10%), they tended to be much higher (30-40%) for overnight sets.

Gillnets set in the day time were effective for most of the species commonly targeted by recreational net fishers and the overall quality of the catch and potential for survival of any discarded catch was enhanced by regular checking of nets. Potential for wastage, due to deterioration in quality, predator damage and/or mortality, was higher in overnight sets, though not perhaps at levels suggested by some anecdotal reports. Excessively long soak times (around 24 hours or more), however, were not assessed in this study.

The effect of new management arrangements for recreational gillnetting will be to limit soak times and should go some way to reducing but not eliminating wastage. Notwithstanding regulations, fishers should be encouraged to clear nets regularly to ensure catch quality and minimise the overall impacts arising from wastage and mortality of any unwanted catch.

1 INTRODUCTION

The recreational use of gillnets is a popular activity in Tasmania. In 1983 it was estimated that almost 7% of Tasmanian households (excluding those occupied by commercial fishers) owned a gillnet and that an estimated 15,000 persons used a gillnet at least once a year (ABS 1984).

Recreational gillnet licences were introduced for the first time in 1995, with fishers allowed to license up to two graballs (mesh size of 100-140 mm) and one mullet net (mesh size 60-70 mm). During 1995/96 around 9,000 gillnet licences were issued, this number has increased to about 10,900 in 1999/2000. A complex suite of regulations applies to the usage of nets, including area closures.

For many years there have been general concerns expressed about the impact that recreational gillnet fishing has had on fish stocks and, in particular, levels of wastage arising from poor fishing practices, principally overnight netting. Schaap and Green (1988), for instance, provided evidence that on reefs subject to heavy gillnetting pressure there were reduced abundance's for many fish species, smaller average sizes for some and overall reduced species diversity.

A telephone survey of recreational licence holders in 1996 established that 42% of gillnet users 'mostly' left their graballs in the water overnight, a further 27% 'occasionally' set nets overnight while just 31% 'never' left nets set overnight (Lyle and Smith 1998). In terms of how frequently nets were checked, 52% indicated that they 'mostly' checked their nets once a day, 36% mostly twice a day and 12% three or more times a day.

In a more detailed survey of recreational fishing activity it was confirmed that night netting was a very common practice among recreational fishers in Tasmania, with over 75% of all gillnet sets between December 1996 – April 1998 being fished overnight (Lyle 2000). The same study demonstrated that recreational gillnet fishers frequently leave nets set more or less continuously for periods of several days, checking and clearing the nets once or several times each day. Unfortunately this survey did not permit direct estimation of soak time where nets were checked more than once on a given day. However, where gillnets were set in the morning and not checked or hauled until some time the following day, it could be inferred that effective soak times were in the order of 24 hours or greater. Significantly, at least one quarter of all gillnet sets fell into this category. Such excessively long soak times have considerable potential for wastage arising from deterioration and damage due to other predators and reduced likelihood of survival of any unwanted catch.

Motivations for overnight netting include:

- convenience - gillnets fish through the periods when many species are thought to be most active (dusk and dawn) without requiring fishers to be on the water;
- gillnetting is often linked with fishing with rock lobster pots - pots tend to be checked once a day (usually morning) and gillnets are checked at the same time, some or all of the catch being used to bait pots; and/or

- belief that certain species are best caught at night and/or catches and catch rates are higher in night sets.

Reflecting concern about poor netting practices, the Scalefish Management Plan included provisions to prohibit gillnetting overnight, with the exceptions of a small area off the west coast and gillnetting using a flounder net[1] (DPIF 1998). However, the Minister for Fisheries disallowed the night netting provisions because of concern over the safety of fishers who, in order to comply with these regulations, might have been required to retrieve nets in unfavourable sea conditions. The issue of night netting has since been the subject of a formal review and a new system designed to limit the time that nets are left unattended has been recommended. Under the new system, gillnets set during the day or set during the night are marked with different coloured buoys, ensuring that nets are at least checked (and cleared) in the early morning (for overnight sets) and afternoon/evening (for day sets). In practice, maximum soak times will be 14 hours during summer and 17 hours (reflecting the longer period of darkness) during winter. Subject to Parliamentary approval, these new arrangements will take effect from 1 November 2000.

In the Scalefish policy document the intention to increase the minimum mesh size for graballs from 100 mm to 108 mm in 2001 is flagged, with the possibility of a further increase to 114 mm at a later date (DPIF 1998). The primary rationale for increasing the mesh size is to decrease by-catch and select for larger fish, thereby reducing impacts of netting on non-target species and on undersized individuals of target species.

The present project was developed as a joint study between the Tasmanian Aquaculture and Fisheries Institute and the Australian Maritime College to investigate the effects of different gillnet fishing practices on catch and catch condition. The primary objectives of the study were to:

- determine effects of different fishing practices on the species composition, number, size and quality of fish caught in recreational gillnets
- assess the impact of different mesh sizes on catch composition, fish size and catch rates
- assess the impact of overnight netting on catch and catch quality

The findings of this study have been considered in the review of gillnetting and have contributed to the design and justification of the new system for recreational gillnetting in Tasmania.

[1] Under the plan a flounder net is defined as a graball net with mesh size of 125 -140 mm with height not exceeding 12 meshes.

2 METHODS

Gillnet fishing trials were conducted between January and April 1999 at a variety of sites around south-eastern Tasmania and in the Tamar Estuary off the north coast (Fig. 1). Each site was classified as being either rocky reef or soft bottom (sand/mud) based on visual and/or echo sounder observations. Soft bottom habitats were sampled off south-east and north coasts, reef habitats were only sampled in the south-east.

Four mesh sizes of monofilament gillnet - 64, 108, 114 and 133 mm stretched mesh - were trialed, each net being approximately 50 m in length with 6 to 7 mm diameter polypropylene rope for the headline and leadline. Other net specifications varied with mesh size (Table 1). Gillnets were constructed to closely match those used by recreational fishers.

Table 1 Gillnet specifications for the four mesh sizes used in the study

For the flounder net, droppers connecting the headline and leadline were used to restrict the net depth and produce a 'pocket' effect.

	Mullet net	4¼" Graball	4½" Graball	Flounder net
Stretched mesh size (mm)	64	108	114	133
Mesh drop (no.)	39	33	25	12
Hanging ratio (%)	50	50	50	50
Hung length (m)	50	50	50	50
Hung depth (m)	2.16	1.73	1.43	0.8
Monofilament gauge (mm)	0.47	0.52	0.38	0.38

Four treatments, simulating different fishing practices, were assessed for influences on catch rates, catch composition and catch condition. The treatments were as follows:

- D3 - gillnet set in morning, checked and cleared three times, at 2-3 hourly intervals, throughout the day.
- D2 - gillnet set in the morning, checked and cleared twice, at about 4 hourly intervals, during the day.
- D – gillnet set in the morning and not cleared again until late afternoon.
- N - gillnet set in the afternoon/evening and not cleared again until the following morning.

In essence, these treatments reflect fishing practices commonly employed by recreational anglers. It should be noted, however, that while a significant proportion of recreational gillnets remain unchecked for periods of around 24 hours (Lyle 2000), this practice was not simulated in this study.

Gillnets were set roughly perpendicular to the shore in depths ranging from 2- 25 m, with individual nets separated by at least 50 m. The order in which gillnets were deployed was randomised to control for boundary and other possible interaction effects and each treatment was replicated. On most sampling occasions both daytime and overnight sets were conducted consecutively and within the same general area.

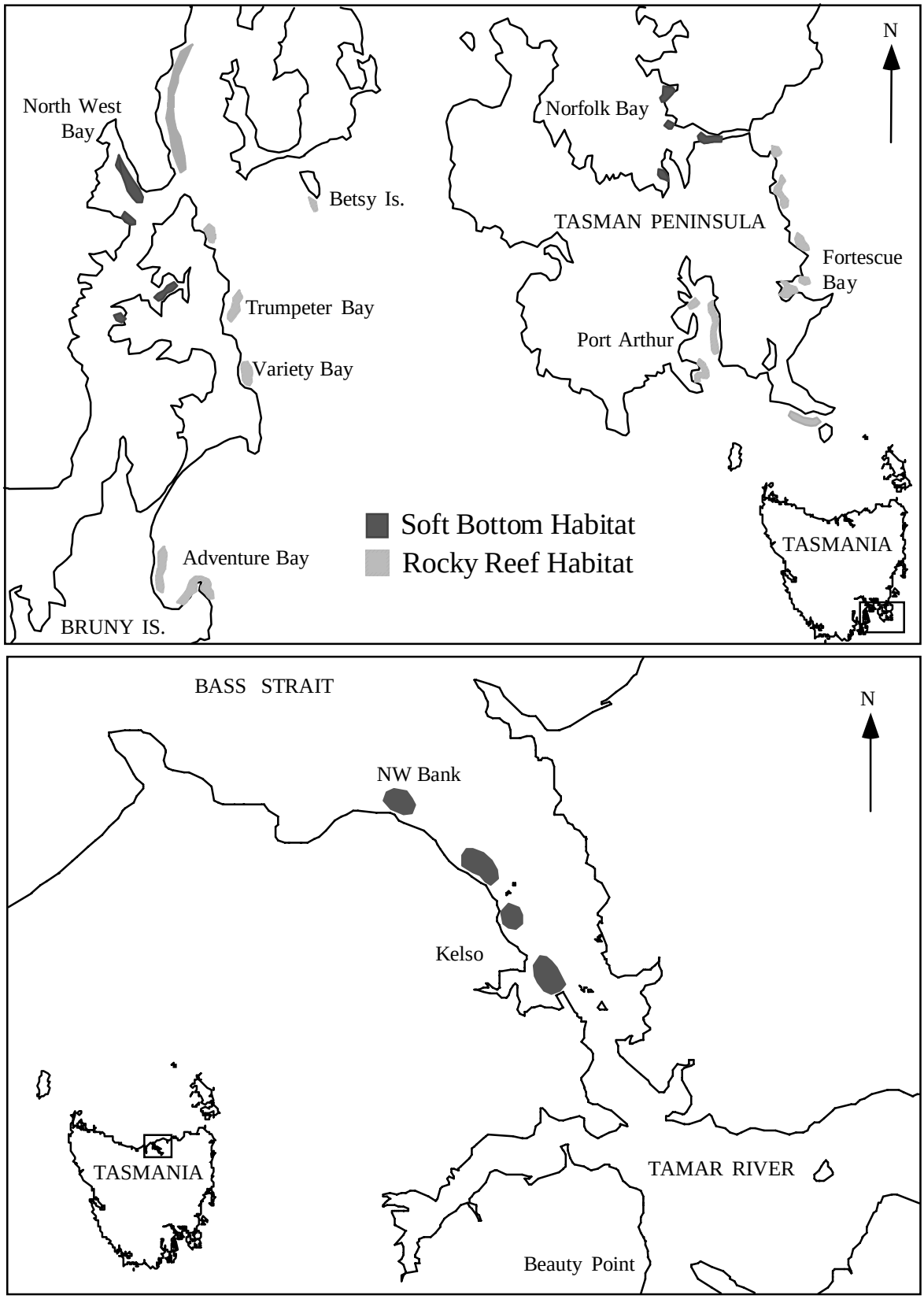

Fig. 1 Map of south-east Tasmania and the Tamar River (north coast) indicating the location of sites fished during the survey period. Dark shading indicates soft bottom habitats, light shading rocky reef.

The experimental design, comprising locality, habitat, mesh size and treatment, was implemented according to Table 2. An unbalanced model was adopted for logistic reasons. In practice, catches were generally low so it has been necessary to pool mesh sizes in the assessment of treatment on catch condition. For each habitat type, day and night set comparisons are possible by mesh size and mesh selectivity effects can be assessed independent of habitat and treatment.

Table 2 Experimental design matrix.
D3 – checked three times during the day, D2 – checked twice during the day, D – checked once during the day, N – set overnight.

Region	Habitat	Treatment	64 mm	108 mm	114 mm	133 mm
SE Tasmania	Reef	D3		✓		
		D2		✓		
		D		✓	✓	
		N		✓	✓	
	Soft bottom	D3		✓		
		D2		✓		
		D		✓		✓
		N		✓		✓
N Tasmania	Soft bottom	D2	✓	✓		
		D	✓	✓		✓
		N	✓	✓		✓

All fish captured in the nets were identified to species, measured and condition evaluated, using a combination of organoleptic criteria (Table 3) and the presence and extent of predator damage (Table 4). Lengths were measured from the tip of the snout to the medial caudal ray[2], with the exception of sharks that were measured for total length.

[2] For species with emarginate or forked caudal fins this measurement represented fork length (FL) whereas species with truncate or convex caudal fins this measurement was total length (TL).

Table 3 Quality criteria and descriptions used in organoleptic assessment.

	Score	*Feature*	*Description*
Alive	1	Lively	
	2	Sluggish	
Dead	3	Eye	Clear, black stands out from head, surface of eye convex
		Body colours	Colours bright
		Skin/gloss	Intact, slim transparent, high gloss
		Smell	No fish smell
		Gill colour	Gills bright pink/red, no slime
		Belly	Discolouration absent and firm
		Vent	Normal condition
	4	Eye	Beginning to cloud at edges, eye level with socket, surface flat
		Body colours	A little dull
		Skin/gloss	Intact, a little dull
		Smell	Slight fish or 'seawater' smell
		Gill colour	Gills darker red, a little slim (clear)
		Flesh texture	Flesh firm and a little elastic
		Belly	Slight discolouration, a little less firm
		Vent	Exudate present
	5	Eye	About 50% cloudy, slight sunken into socket, surface slightly concave
		Body colours	Dull
		Skin/gloss	Skin damage in areas
		Smell	Definite fish smell
		Gill colour	Gills brown, small/medium amount of slime (clear)
		Flesh texture	Flesh soft
		Belly	Moderate discolouration and soft
		Vent	Moderate exudate
	6	Eye	Eye opaque, sunken into socket, surface concave
		Body colours	Body colours very dull
		Skin/gloss	Areas of skin damage
		Smell	Strong fish smell
		Gill colour	Gills brown, large amount of slime (opaque)
		Flesh texture	Flesh soft
		Belly	Excessive discolouration and very soft
		Vent	Heavy exudate

Table 4 Predator damage (including sea lice) criteria.

Score	*Description*
0	No obvious external damage
1	Minor damage (<10% of edible flesh)
2	Medium damage (10-40% of edible flesh)
3	Extensive damage (>40% of edible flesh)

3 RESULTS

3.1 General

A total of 465 gillnet sets were completed during the survey period, 249 in south-east Tasmania and 216 off the north coast. Breakdown by habitat, treatment and mesh size is presented in Table 5. Daytime set duration (treatments D, D2 and D3) averaged 7-8 hours compared with around 15 hours for the overnight (N) sets. In the context of this study, 'soak' (as opposed to set) duration indicates the time between net checks. For the daytime treatments, nets that were checked three times were cleared on average every 2.5 hours, while nets checked twice were cleared after about 4 hours.

Table 5 Number of gillnet deployments by mesh size and treatment, with set and 'soak' (duration between each net check) times.

D3 – checked three times during the day, D2 – checked twice during the day, D – checked once during the day, N – set overnight

		No. net	*Set duration (h)*		*Soak duration (h)*		
Treatment	*Mesh size*	*sets*	*Average*	*SD*	*Average*	*Min.*	*Max.*
Reef – SE Tas							
D3	108	22	7.4	1.0	2.5	1.5	4.4
D2	108	25	7.3	1.2	3.7	2.7	5.9
D	108	24	7.2	0.9	7.2	5.5	9.3
N	108	44	15.4	1.2	15.4	13.4	17.8
D	114	26	7.1	0.9	7.1	5.4	9.0
N	114	42	15.5	1.1	15.5	13.8	17.6
Total sets		**183**					
Soft bottom – SE Tas							
D3	108	10	7.5	1.1	2.5	1.6	3.7
D2	108	10	7.6	0.9	3.8	3.0	4.5
D	108	10	7.4	1.1	7.3	5.5	8.6
N	108	16	15.2	1.1	15.2	13.7	18.0
D	133	10	7.6	1.4	7.6	5.3	8.7
N	133	10	14.8	0.8	14.8	13.5	15.8
Total sets		**66**					
Soft bottom – N Tas							
D2	64	8	8.5	0.8	4.2	3.8	5.1
D	64	43	8.7	0.9	8.7	7.5	11.4
N	64	48	14.8	1.0	14.8	12.7	16.2
D2	108	14	8.3	0.8	4.1	3.2	4.9
D	108	23	8.9	1.2	8.9	6.8	11.3
N	108	21	15.5	1.4	15.5	13.0	17.8
D	133	29	8.2	0.6	8.2	7.5	9.8
N	133	30	15.5	0.6	15.5	14.6	16.5
Total sets		**216**					

3.2 Catch composition

In general, catches were smaller than had been anticipated, influenced in part by the survey design which required nets to remain in position for the duration of each treatment, even when catch rates were poor.

A total of 2,500 individuals, representing 60 species of fish, cephalopods and crustaceans, were captured during the survey, with catch composition being influenced by mesh size and habitat (Table 6 and Appendices 1 & 2). Around half of the species were represented by fewer than ten individuals while three species, namely yellow eye mullet, bastard trumpeter and blue warehou, together comprised almost 60% of the total numbers. Not all species have significance for recreational fishers, for instance marblefish and several of the shark and ray species are almost invariably discarded by anglers or used as bait for rock lobster.

Bastard trumpeter was the most frequently caught reef species, representing around 30% of the total catch from the reef sets (Table 6). Blue warehou, blue throated wrasse, red gurnard perch and marble fish were of secondary importance, together accounting for a further 30% of the reef catch by number. The main differences in catch composition between the mesh sizes were the higher number of finfish species taken by the 108 mm mesh size (43 compared to 35 species) and the relatively higher representation of elephant fish and draughtboard shark in the 114 mm mesh catch.

Sand flathead, gummy shark and six-spined leatherjacket were relatively common soft bottom species in the south-east whereas yellow eye mullet, elephant fish and greenback flounder, in addition to sand flathead and gummy shark, were important in the north coast catches (Table 6). In both regions, species diversity declined with increasing mesh size. In the south-east, 30 species were recorded in 108 mm compared with just 14 for the 133 mm gillnet while for north coast catches, the number of species recorded in the 64, 108 and 133 mm mesh sizes were 18, 14, and 7, respectively.

The main differences in south-east coast catch composition was the absence of Australian salmon from the 133 mm catch and the greater proportions of six-spined leatherjacket, banded stingaree and flounder taken by the 133 mm mesh size. In the north coast, the 64 mm gillnet proved particularly selective for yellow eye mullet, this species accounting for about 85% of the catch for that net, compared to less than 30% for the larger mesh sizes. Elephant fish was the most frequently caught species (38%) in the 108 mm net while flounder was the dominant species (38%) in the 133 mm net.

Table 6 Catch numbers and relative composition by habitat and gillnet mesh size.

	SE Tas – Reef				SE Tas – Soft bottom				N Tas – Soft bottom					
	108 mm		114 mm		108 mm		114 mm		64 mm		108 mm		133 mm	
Species	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Yellow eye mullet	1	0.1	1	0.3					961	84.7	22	17.7	24	28.2
Bastard trumpeter	212	27.8	94	28.7	3	1.6			3	0.3	3	2.4		
Blue warehou	111	14.6	30	9.2					7	0.6	7	5.6		
Blue throated wrasse	64	8.4	24	7.3	3	1.6					1	0.8		
Sand flathead	3	0.4			34	17.8	6	10.5	40	3.5	6	4.8	1	1.2
Elephant fish	1	0.1	9	2.8	2	1.0			7	0.6	47	37.9	18	21.2
Greenback flounder	1	0.1			1	0.5	6	10.5	1	0.1	27	21.8	32	37.6
Red gurnard perch	36	4.7	25	7.6	3	1.6	1	1.8						
Red cod	22	2.9	5	1.5	5	2.6	1	1.8	23	2.0	1	0.8		
Marble fish	40	5.2	12	3.7										
Gummy shark	2	0.3	5	1.5	17	8.9	8	14.0			4	3.2	7	8.2
Jack mackerel	14	1.8	8	2.4	6	3.1	1	1.8	11	1.0				
Draughtboard shark	15	2.0	20	6.1	1	0.5	3	5.3						
Southern rock lobster	29	3.8	10	3.1										
Six-spined leatherjacket	7	0.9	5	1.5	12	6.3	13	22.8						
Long snouted boarfish	18	2.4	12	3.7	4	2.1	2	3.5						
Banded morwong	24	3.1	11	3.4										
Australian salmon					25	13.1			4	0.4				
Crabs	23	3.0	6	1.8										
Short-finned pike									25	2.2	1	0.8	2	2.4
Bearded rock cod	18	2.4	8	2.4	1	0.5								
King George whiting									20	1.8				
Tailor									16	1.4	1	0.8		
Striped trumpeter	14	1.8												
Banded stingaree			1	0.3	4	2.1	8	14.0						
Toothbrush leatherjacket	10	1.3	1	0.3										
White spotted dogfish	5	0.7	3	0.9	3	1.6								
Arrow squid	1	0.1			1	0.5			8	0.7				
Jackass morwong	7	0.9	1	0.3	2	1.0								
Eagle ray	2	0.3	2	0.6	4	2.1	1	1.8						
Brown striped leatherjacket	1	0.1			7	3.7								
Thetis fish			2	0.6	4	2.1	1	1.8						
Atlantic salmon					6	3.1								
Silver trevally	1	0.1	1	0.3					4	0.4				
Other	31	3.8	16	4.8	15	7.7	2	3.6	4	0.4	4	3.2	1	1.2
Total	762		327		191		57		1134		124		85	

Catch compositions for day and overnight sets are compared in Fig. 2, with more detail provided in Appendix 3. Bastard trumpeter dominated daytime reef catches (45% numbers) but accounted for only 15% of the overnight catch. A number of other reef species, including blue throated wrasse, marblefish and banded morwong, also featured more prominently in daytime compared to overnight catches. By contrast, blue warehou, gurnard, draughtboard shark, long snouted boarfish, cod and rock lobster were relatively more important in overnight catches.

Since catches from soft bottom habitats were generally low for south-east Tasmania, day and night catch comparisons may not be representative of differences in availability and/or vulnerability. Recognising this limitation, catches suggested that there were little differences in the relative contributions of sand flathead, flounder, skates and rays and boarfish between day and overnight sets. Gummy shark, leatherjacket and Atlantic salmon tended to be of greater significance to day catches while Australian salmon, jack mackerel and cod were more prominent in overnight catches.

Comparatively large catches were taken in the north coast fishing trials, especially in the overnight sets using the 64 mm gillnet. Yellow eye mullet accounted for the bulk of both day and overnight catches, being a relatively more important component of the overnight catch composition (78% compared to 62%). Short-finned pike and elephant fish tended to be relatively more abundant in daytime catches and flounder were consistently more important in overnight catches for the 108 and 133 mm mesh sizes.

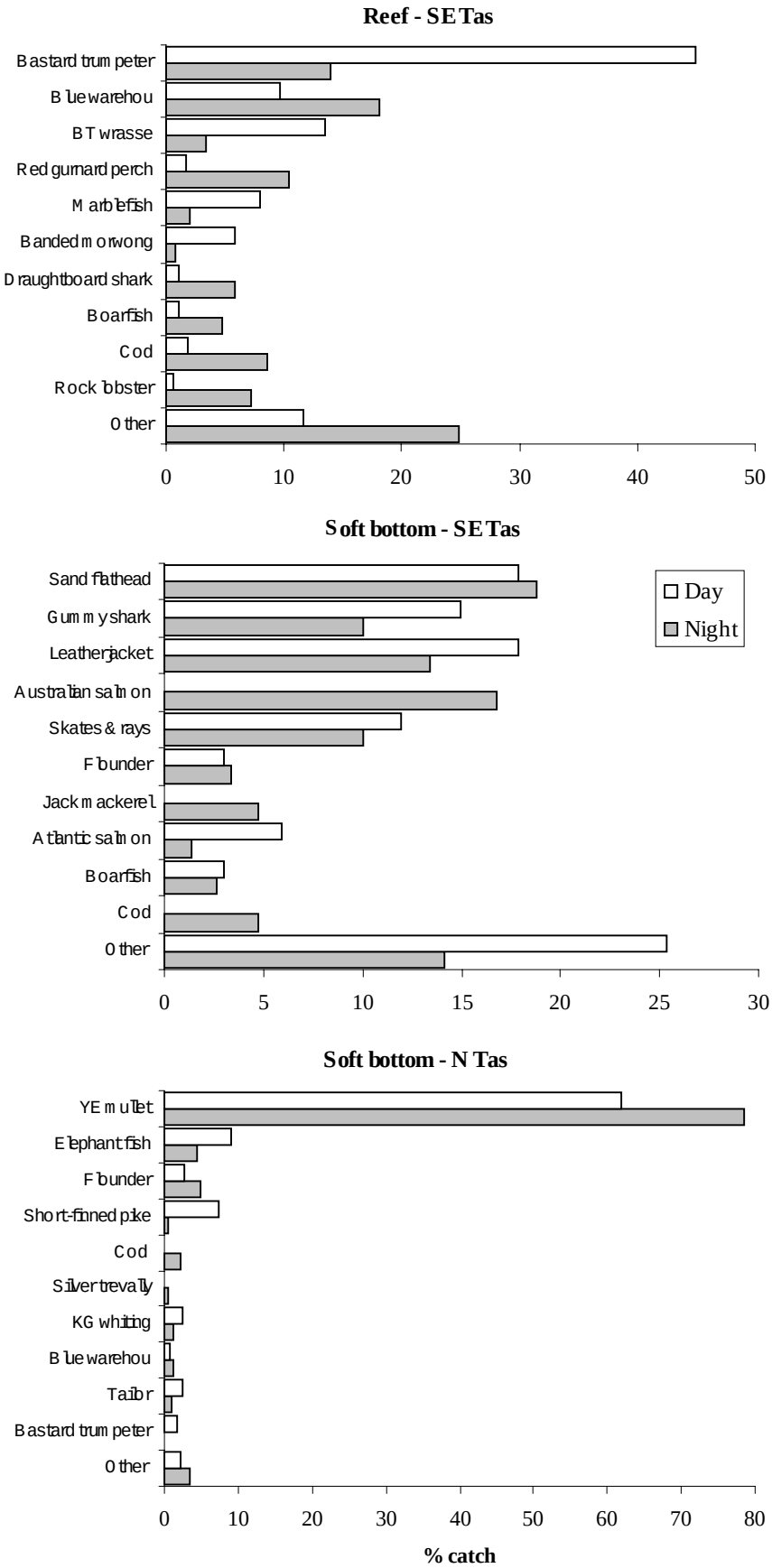

Fig. 2 Catch composition (% numbers) for day and overnight gillnet fishing trials by habitat and region (mesh sizes combined).

3.3 Catch rates

Catch rates are a more appropriate indicator of vulnerability to day or overnight fishing than catch composition. Catch rates can been expressed as number of fish per set or number per net hour, noting that, on average, overnight sets were approximately twice the duration of daytime sets. In relation to daytime treatments, catch rates for a given net have been based on the combined daily catch taken by that net, irrespective of how many times it had been inspected and cleared during the day.

Apart from yellow eye mullet, bastard trumpeter and blue warehou, catches were too low to justify calculating catch rates for individual species. Mean catch rates and standard error estimates have been calculated for each combination of habitat and treatment for these key species and the combined catch. However, given the variability in catches for individual sets and the high incidence of nil catches, standard errors tended to be relatively large and similar in magnitude to the mean. As a consequence the lower confidence intervals for virtually all treatments approached zero and thus overlapped, indicating no significant differences in mean catch rate based on treatment (and mesh size). For this reason error bars have been omitted from the graphical representation of catch rates.

Catch rates for key species and the combined catch are presented in Fig. 3. In general, the frequency with which nets were checked had little influence on mean catch rates for day sets. Similarly, there were only minor differences in mean day set catch rates for the 108 and 114 mm mesh sizes fished over reef bottom and for the 108 and 133 mm nets fished on soft bottom habitat. Day set catch rates for bastard trumpeter and blue warehou were not affected by mesh size (108 or 114 mm). By contrast, day time catch rates for the 64 mm mesh size were higher than either the 108 and 133 mm mesh sizes, due primarily to the higher catch rates for yellow eye mullet in the small mesh size.

Day and overnight catch rate comparisons for reef fish revealed only minor differences in the numbers of fish per set but, because of the longer set duration, catch per hour was lower for the overnight sets. This pattern was particularly evident for bastard trumpeter but less so for blue warehou. In the soft bottom habitat trials, higher mean catches were taken in overnight sets in the south-east although catch per hour was roughly similar for day and overnight sets. For the north coast, catch rates were markedly higher in overnight sets using the 64 mm net, reflecting the higher catch rates for yellow eye mullet. There was no evidence of catch rate differences between day and overnight sets for the larger mesh sizes.

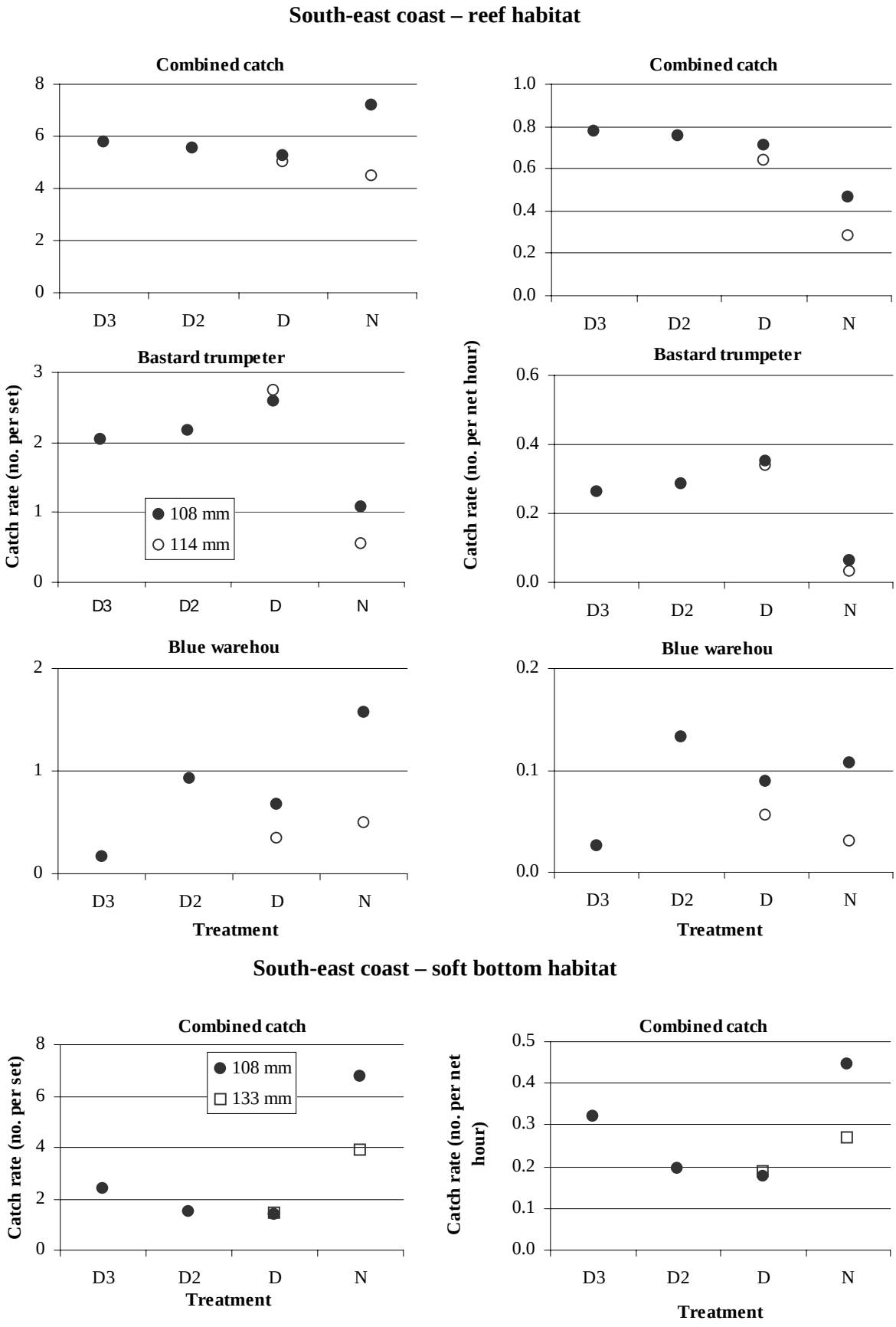

Fig. 3 Catch rates, expressed as number of fish per set and number of fish per hour, by treatment, mesh size and habitat.

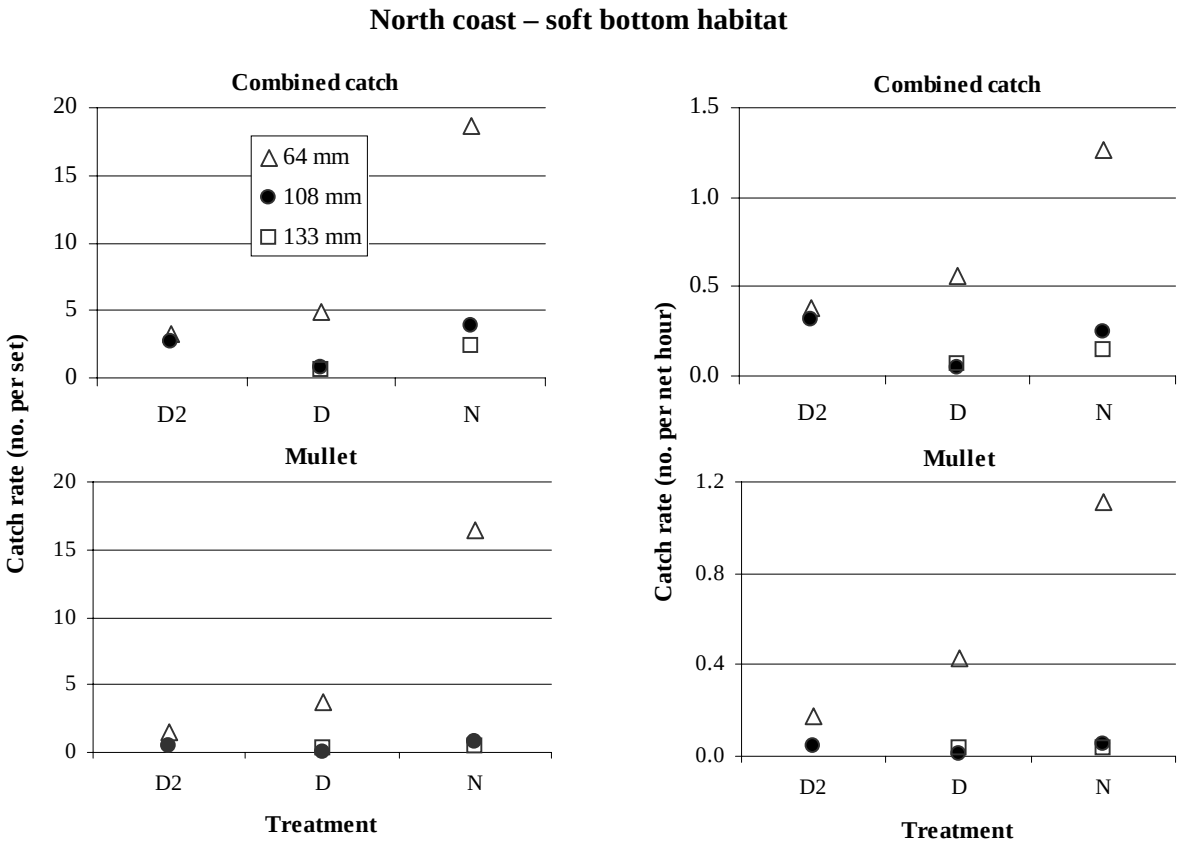

Fig. 3 Continued.

3.4 Size composition

Size information by habitat and mesh size is summarised in Appendix 2. Length frequency distributions have been generated for the more abundant species (Fig. 4).

Overall bastard trumpeter ranged between 28–44 cm fork length (FL), the majority of which were captured in the 108 and 114 mm gillnets. Size distributions for these mesh sizes were very similar, characterised by a single mode with a peak at 35-36 cm and the majority of individuals measuring 31-38 cm. A minimum size limit of 35 cm total length (TL), equivalent to about 30 cm FL, applies for bastard trumpeter. Our data indicate that these mesh sizes were effective in selecting for legal sized fish, with a minimal by-catch of undersized fish.

Blue warehou of 17-51 cm FL were taken by gillnets, with length frequency distributions indicating the presence of at least three modes, one at around 20 cm, another between 30-36 cm and a third between 40-50 cm. The legal minimum size for blue warehou is 25 cm TL, which is roughly equal to 23 cm FL. There was a minimal catch of undersized fish in the 108 and 114 mm mesh sizes but all of the 64 mm mesh catch was undersized.

Yellow eye mullet ranged in size from 17-34 cm FL with the length frequency distribution for the 64 mm mesh net comprised of a single mode with a peak at 27 cm

and the bulk of the catch between 24-30 cm. Based on the minimum size limit of 25 cm TL (around 23 cm FL), it is apparent that the 64 mm mesh size is appropriate for this species.

Sand flathead were taken across a range of mesh sizes, with over 55% of the catch for the 64 mm mesh being less than the minimum size limit of 30 cm TL. Around 40% of the 108 mm mesh catch was undersized and all fish taken in the 114 mm net were legal sized. The influence of mesh selectivity is clearly evident for this species.

Greenback flounder as small as 12 cm TL were recorded in the 64 mm net, while fish from 20-30 cm were relatively common in the 108 and 133 mm mesh sizes. Significantly, although the 133 mm mesh size is commonly used to target flounder almost 25% of the catch was undersized, the minimum size limit for the species being 25 cm TL. Almost 90% of the flounder taken in the 108 mm net were undersized, indicating this mesh size may be unsuitable for targeting flounder.

All leatherjackets (combined species) sampled exceeded the minimum 20 cm size limit, the smallest fish encountered being 27 cm TL. The majority of the cod (combined species) taken by the 64 mm mesh were between 20-30 cm whereas the 108 mm mesh catch was dominated by 30-46 cm fish. No size limits apply for this species group.

A wide size range of gummy shark was recorded, although catch numbers were generally low. Significantly, 32 and 47% of the gummy shark taken in the 108 and 133 mm nets, respectively, were smaller than the minimum size limit of 75 cm, TL.

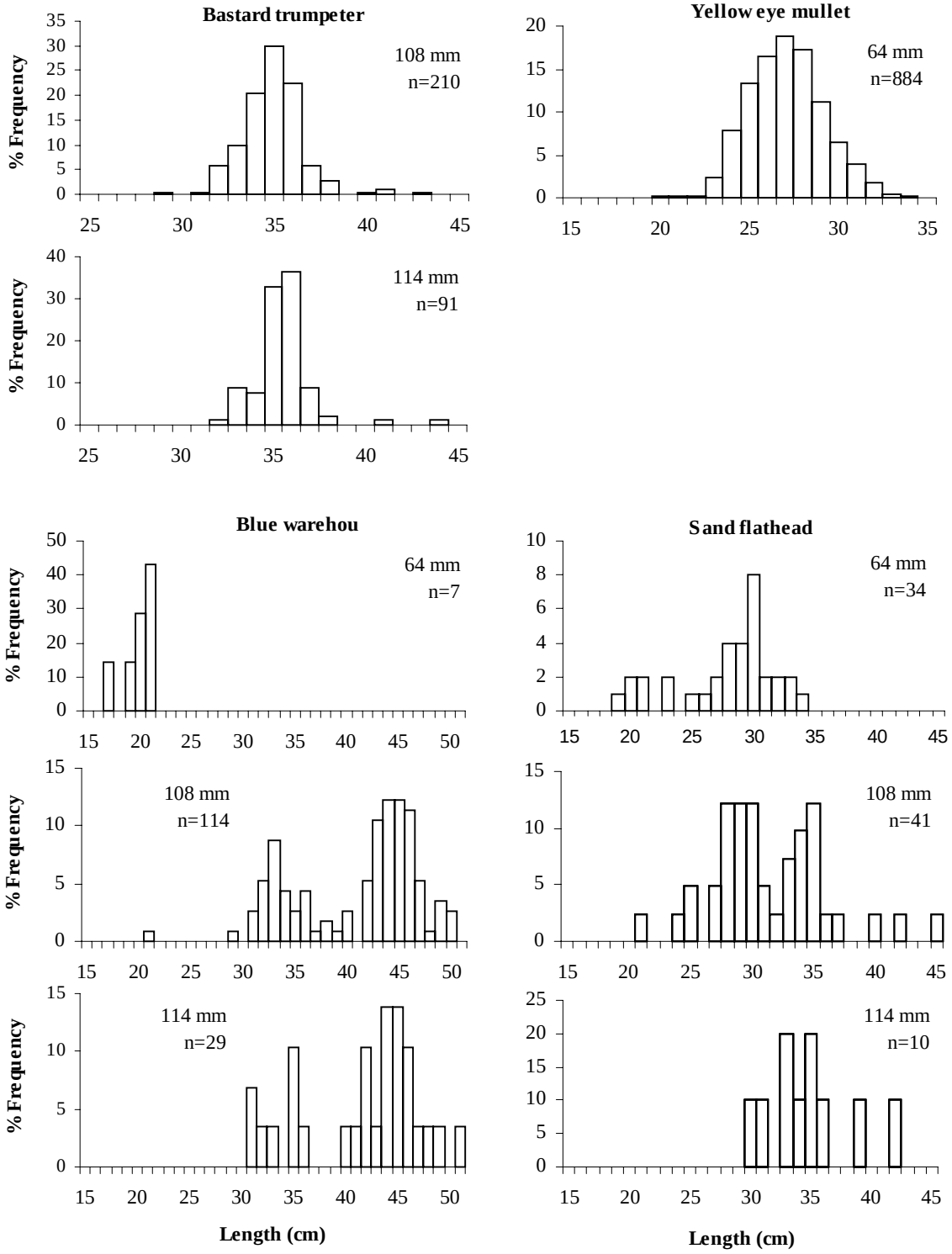

Fig. 4. Length frequency distributions for key species by gillnet mesh size.

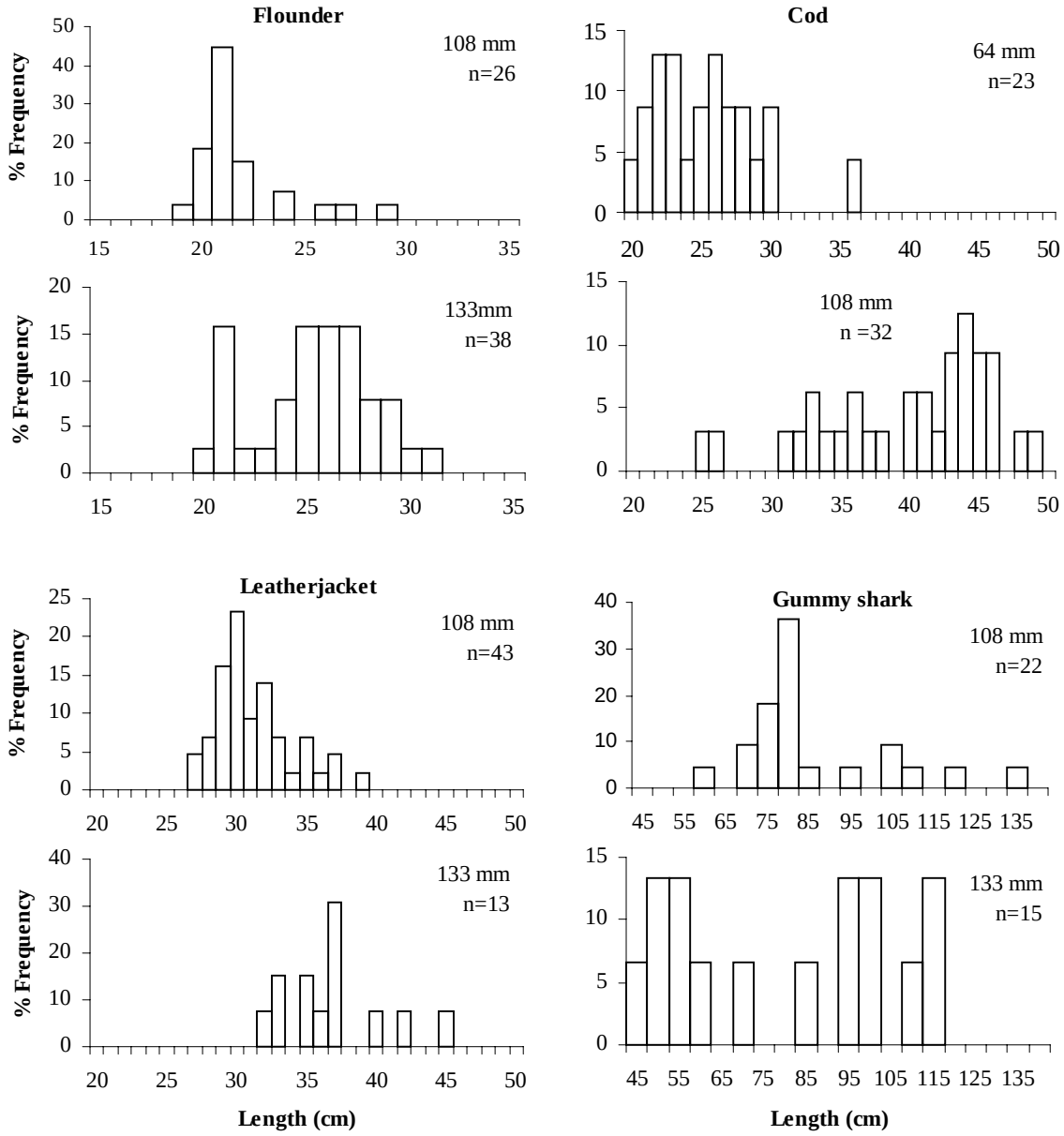

Fig. 4 Continued

3.5 Fishing practice and condition

3.5.1 Catch quality

Each fish was evaluated according to organoleptic criteria (Table 2), which included an assessment of whether it was alive or not and, if dead, the general degree of deterioration in quality. Indirectly, this assessment allowed the potential for survival, if discarded, to be appraised. That is, stage 1 and 2 fish were judged to have at least some possibility of surviving. Actual survival rates were not, however, assessed in this study.

Although sample sizes for the majority of species were small, it was evident that species could be grouped according to the proportion of the catch that was found dead in the gillnets (Appendix 4). For instance, flounder, banded morwong, stargazers,

leatherjackets (various species), marblefish, gurnards, skates and rays and draughtboard shark were particularly hardly and generally survived capture in gillnets, including overnight sets. The second group tended to survive reasonably well in each of the day set treatments, with relatively low mortality rates (< 15%), but with moderate mortality rates (around 20-40%) in the longer overnight sets. Bastard trumpeter, boarfish, elephant shark and dogfish fell into this category. Species with moderately high day set mortality rates (around 30-50%) included blue warehou, yellow eye mullet, cod (various species), blue throat wrasse and gummy shark. Overnight set mortality rates were around 50% for yellow eye mullet and blue throat wrasse and 80-90% for blue warehou, cod and gummy shark. Virtually all short-finned pike, jack mackerel and tailor caught in gillnets were dead, regardless of soak duration.

The situation for sand flathead was less clear. In the south-east coast fishing trials the species had very low mortality rates whereas in the north coast trials mortality rates were high (>50%) in all treatments. The influence of mesh size may explain some of these differences. That is, the bulk (85%) of the north coast sample was caught in the 64 mm mesh, with fish tending to be tightly meshed in the net and unable to maintain respiration. In the larger mesh sizes, used in the south-east, many fish were wedged in the meshes and thus better able to continue restricted respiration.

Since deterioration in general quality is most evident after death, it follows that the more robust a species, the less likely its quality will be affected by fishing practice, at least within the range of treatments examined in this study. Levels of spoilage in each of the day treatments were low, that is very few individuals of any of the species had deteriorated past stage 4 even for treatments where nets were left unattended for 7-8 hours. A small proportion (<10%) of the yellow eye mullet and blue warehou daytime catch had deteriorated beyond stage 4. Virtually none of the bastard trumpeter and blue throated wrasse had deteriorated past this stage.

As anticipated, the longer overnight sets tended to result in a greater proportion of the catches in quality stages 5-6. However, for most species including bastard trumpeter, blue throated wrasse, this represented only a small percentage (<5%), whereas for blue warehou and yellow eye mullet around 20 and 30% of the catch, respectively were stages 5 or 6. Of the other species, around 20% of the jack mackerel, sand flathead and elephant fish, just under 30% of the gummy shark and 40% of the cod indicated moderate to advanced deterioration in the overnight sets.

3.5.2 Predator damage

Damage due to predation by sharks, other finfish, squid and octopus and sea lice (generally over soft bottom habitats) was observed in a number of species (Appendix 4). Overall predator damage rates were, however, low (<10%) for both day and overnight treatments for most species, including blue throated wrasse, banded morwong, elephant shark, flounder, boarfish, gurnard, leatherjackets, skates and rays and draughtboard shark.

Damage rates for yellow eye mullet, cod, tailor, gummy shark and jack mackerel were relatively low (mostly < 10%) in the day set treatments but in overnight sets, greater

than 35% of catch for each of these species exhibited some degree of damage. Bastard trumpeter and marble fish catches also indicated higher damage rates in overnight sets (17% for bastard trumpeter and 20% for marble fish) compared to day sets (<5%). Relatively high damage rates (10-30%) were evident for blue warehou in both day and overnight sets.

Seal interactions with the gillnets were observed on a small number of occasions, though the extent of the seal predation could not be readily quantified as fish had generally been removed from the gillnets[3].

3.5.3 Catch condition and wastage

For the purposes of this study, overall catch condition has been considered to be influenced by two major factors, quality (organoleptic criteria) and damage. That is to say that even where fish are still of very high quality (category 3), the presence of extensive predator damage may result in it being judged to be in too poor condition to be retained and as such it may be effectively wasted.

A matrix factoring quality and damage criteria is presented in Table 7 with three subjective condition criteria recognised, i.e. high (H), medium (M) and poor (P). In order to evaluate potential wastage levels, all fish categorised as in poor condition have been assumed to constitute wastage, that is that part of the catch discarded because of its condition.

Table 7 Catch condition matrix involving quality and damage criteria.
H is high, M is medium and P is poor condition

	Damage			
Quality	0	1	2	3
1	H	H	M	P
2	H	H	M	P
3	H	M	M	P
4	M	M	P	P
5	M	P	P	P
6	P	P	P	P

The condition of the catches for each species is summarised by treatment in Appendix 5 and represented graphically for the key species in Fig. 5. Overall, the proportion of the catch that was in poor condition increased with soak time, with highest potential wastage in overnight sets. Within the range of treatments tested, however, some species were more prone to significant deterioration in condition than others.

Day sets resulted in virtually no fish in poor condition for bastard trumpeter and blue throated wrasse whereas in overnight sets slightly less than 10% of the catch numbers were in poor condition and thus representing potential wastage. For yellow eye mullet, just over 30% of the overnight catch was judged to be in poor condition, compared with less than 10% for the daytime catch.

[3] Seal interactions were evidenced by damage to gillnets and observations of seals consuming and 'throwing' fish presumably removed from the nets.

The situation for blue warehou and sand flathead was less consistent, with higher levels of fish in poor condition in some day set treatments, up to 18% for blue warehou and over 30% for sand flathead, compared to overnight sets (about 10%). This apparent inconsistency is almost certainly an artefact of the small sample sizes involved.

Over 10% of gummy shark taken in the full day set treatment and around 30% of the overnight catch was in poor condition. Around 15-20% of the jack mackerel and elephant shark and around 40% of the cod catch was in poor condition for overnight sets, the latter indicating a significant level of potential wastage from overnight sets. There was no evidence to indicate wastage was an important issue for species such as flounder, banded morwong, jackass morwong, boarfish, gurnard and leatherjacket catches within the range of netting practices investigated in this study.

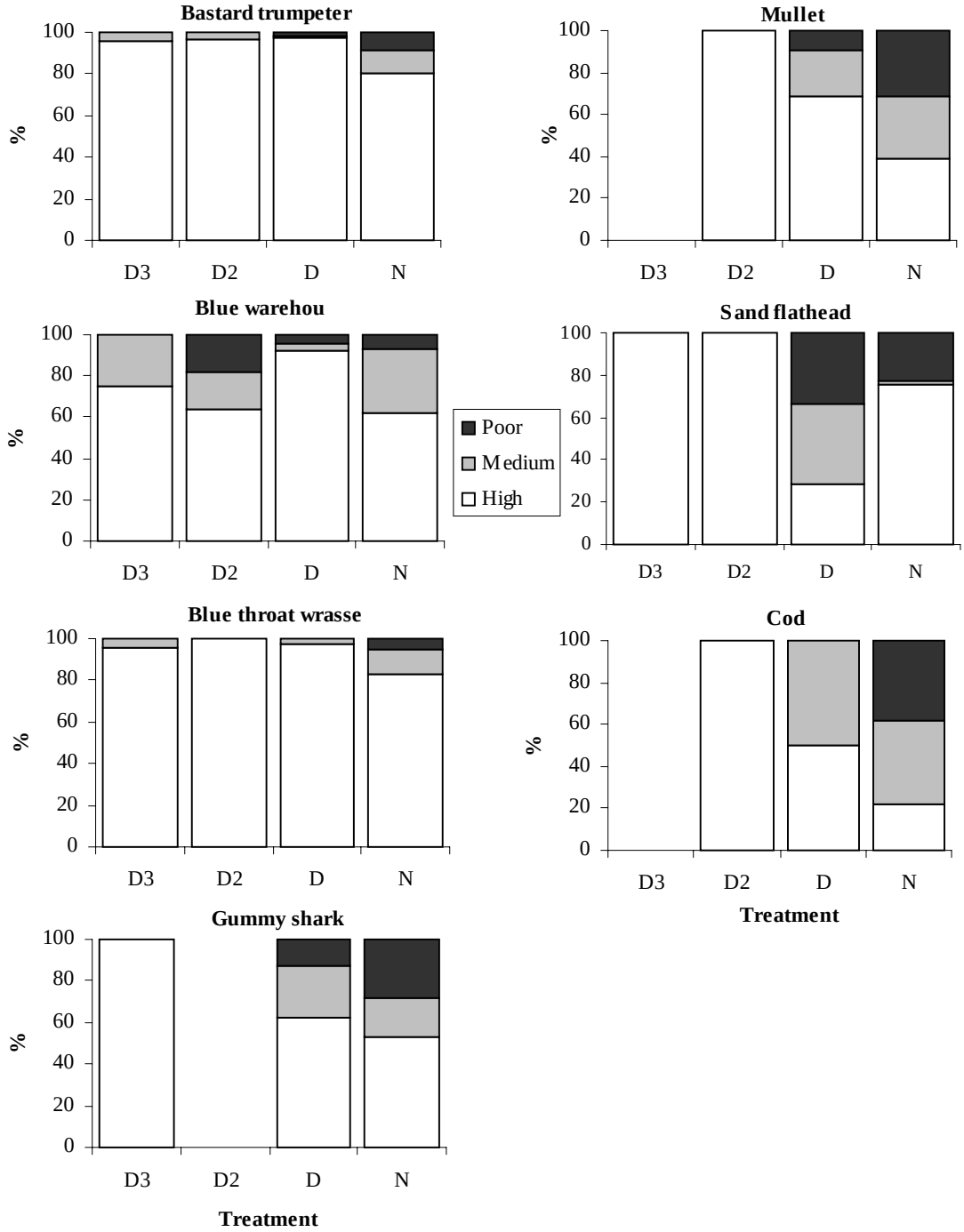

Fig. 5 Catch condition by treatment for the key species.

4 DISCUSSION

Previous studies have indicated that recreational gillnets are used to take a wide variety of fish species in Tasmania (Lyle and Campbell 1999, Lyle 2000). Reef fish such as bastard trumpeter and blue warehou constitute the major species taken by graball nets, with flounder an important catch from soft bottom habitats. Mullet comprise the bulk of the recreational catch from mullet nets.

In the present fishing trials the catch composition was generally consistent with that taken by recreational gillnet fishers, although the relative importance of some by-catch species varied, largely because the entire catch, rather than just the retained portion, has been considered in this study. As a consequence, species that are usually discarded, for example marblefish, draughtboard shark, skates and rays, will tend to over-represented when compared with retained catch compositions (refer Lyle and Campbell 1999, Lyle 2000).

Mesh size represents an important factor in determining size and species composition and has an influence on catch rates. For instance, Murphy and Lyle (1999) demonstrated that increased mesh size resulted in reduced species diversity in the catches and lower catch rates (numbers of fish). Generally similar findings were observed in this study for reef and soft bottom habitats.

Catch comparisons for 108 and 114 mm mesh sizes have relevance because of the intention to review the minimum mesh sizes for graballs (DPIF 1998). Mean catch rates were slightly lower (but not significantly) for the larger mesh size, an observation consistent with previous mesh selectivity trials (Murphy and Lyle 1999). Apart from lower species diversity in the 114 mm mesh size, the main difference was the relatively higher catch of gurnards and draughtboard shark compared to the smaller mesh. Murphy and Lyle (1999) also reported higher catch rates for draughtboard shark as well as banded morwong in the 114 mm mesh but found catch rates for bastard trumpeter, striped trumpeter and wrasse were lower for the 114 mm mesh size. The present study revealed only minor differences in catch rates and slight differences in the size of bastard trumpeter and blue warehou for the two mesh sizes. Our results indicate that both 108 and 114 mm mesh sizes were effective in targeting legal sized bastard trumpeter and blue warehou. Sand flathead, although caught in relatively low numbers, included a significant proportion of undersized fish in the 108 mm mesh size but were of legal size in the 114 mm catches. Overall, however, catches were too low to assess with confidence the impacts and potential benefits of increasing the minimum graball mesh size to 114 mm.

Flounder are an important species targeted using gillnets, generally with mesh sizes of 133 mm or greater (known as ‘flounder’ nets). The 108 mm mesh size tended to select for undersized fish whereas the 133 mm mesh was more selective for legal sized fish. In practice, flounder are very hardy and thus undersized fish are likely to survive if released.

The small mesh mullet nets (64 mm) proved highly effective for mullet, the species accounting for about 85% of catch numbers, with the vast majority being legal sized.

By contrast, this species accounted for less than 30% of catch numbers in the larger mesh sizes with catch rates substantially lower than for mullet nets. Many of the other species taken by mullet net were represented by small individuals which, for species with minimum legal sizes such as sand flathead, blue warehou, flounder, bastard trumpeter, were primarily undersized. Lyle (2000) found that, on average, catch rates for mullet nets (number of fish retained per set) were 3-4 times higher than for graballs, an observation supported by the present study.

The frequency with which gillnets were checked and cleared during the day had a minimal impact on catch rates. Day and overnight set comparisons indicated that, with the exception of mullet, there was little if any advantage to catch rates (overall number of fish per set and number per net hour) of setting nets overnight.

Lyle (2000) noted that recreational gillnet harvest rates for several key species were influenced by time of day. For species such as bastard trumpeter, striped trumpeter, Atlantic salmon, Australian salmon and jackass morwong, harvest rates (number of fish per set) were higher for day sets. The harvest rate for blue warehou was similar for day and overnight sets while flounder, cod, school shark, gummy shark and rock lobster were taken at higher rates in overnight sets. The present findings generally agree with these observations, with bastard trumpeter, blue throated wrasse, marblefish, banded morwong and short-finned pike relatively more important in daytime catches while flounder, boarfish, cod and rock lobster were of greater significance to the overnight catches. In contrast to Lyle (2000), however, our data indicated higher catch rates for mullet in the overnight sets. Notwithstanding these differences it is evident that, apart from perhaps flounder and mullet, day sets are effective in targeting the main species taken by recreational gillnets.

The influence of fishing practices, ranging from the frequent clearing of nets to full day and unattended overnight sets, confirmed that catch condition generally declined with increasing soak time. Within the range of treatments examined here, it was apparent that several species were very robust and thus the potential for wastage (due to poor condition) was low. This group included flounder, leatherjackets, gurnards, banded morwong, marblefish, stargazer, draughtboard shark, skates and rays. Significantly, apart from flounder and to a lesser extent leatherjackets and gurnards, the remaining species are of minor interest to recreational fishers and are frequently discarded. As each of these species tended to survive capture in gillnets for relatively long periods there was some potential for survival if released.

A second group that included bastard trumpeter, blue throated wrasse, sand flathead, boarfish, elephant fish and dogfish, tended to be in good condition for each of the day set treatments and had a relatively high potential for survival since over 85% were still alive even after soak times of up to 8 hours. The longer overnight sets (around 15 hours), however, tended to result in only moderate survival rates (60-80%), with some 10-20% of the catch in poor condition and representing potential wastage. The third group, which included blue warehou, yellow eye mullet, cod, gummy shark, jack mackerel and short-finned pike, did not survive at all well in gillnets (regardless of soak duration) and while day set wastage rates were generally low (<10%), they tended to be much higher (30-40%) for overnight sets.

Lenanton *et al.* (1996) examined the effects of attended and unattended night netting in Western Australia in relation to catch rates and the quality of the fish caught. They found that catch rates for target species were generally similar for attended and unattended sets but that the quality of the catch was higher, rates of damage lower and by-catch lower for attended rather than unattended netting. Such conclusions are generally consistent with present findings.

The actual levels of wastage from gillnet fishing would appear to be a function of several factors, which include soak time and species as well as environmental factors (habitat, sea conditions and water temperature). Poor catch condition does not, however, represent the only source of wastage; it also arises when non-desired species or undersized fish are discarded with little or no chance of survival (that is dead or near death in the net).

While there have been many anecdotal reports of high levels of wastage from recreational gillnets, it is not possible to estimate the extent of such wastage from the present study. Gillnets set in the daytime were effective at catching most of the species commonly targeted by recreational net fishers and the overall quality of the catch and potential for survival of any discarded catch was enhanced by regular checking of nets. Overnight sets resulted in increased potential for wastage, due to deterioration in quality, greater likelihood of predator damage and mortality. It needs to be stressed, however, that previous surveys have indicated that a significant proportion of the recreational gillnet effort (at least 25%) involved soak times 24 hours or greater, outside of the range of treatments examined here. As a consequence it can be assumed that such practices would result in substantially higher wastage than indicated in the current work.

Based on the observation that some species tend not to survive capture in gillnets there will always be wastage associated with gillnetting. The new management arrangements for recreational gillnetting will limit maximum soak times and will go some way to reducing but not eliminating wastage. In reality, the newly defined night set of up to 14 hours during the summer months and 17 hours during winter is likely to result in similar outcomes in terms of catch condition to that observed in this study. Notwithstanding these regulations, the fact remains that the more frequently a gillnet is cleared the better the quality of the catch and the lower the overall the level of wastage due to poor catch condition and mortality of any unwanted catch.

5 ACKNOWLEDGMENTS

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6 REFERENCES

ABS (1984). Household fish consumption and non-commercial fishing activities, Tasmania. Australian Bureau of Statistics, Hobart.

DPIF (1998). Scalefish fishery policy document. Tasmanian Department of Primary Industry and Fisheries, 83pp.

Lenanton, R.C., Allison, R. and Ayvazian, S.G. (1996). Assessment of the effects of a trial period of unattended recreational netting in selected estuaries of temperate Western Australia, between 1 January 1994 and 30 June 1995. *Fisheries Research Report No*. **104** (Western Australian Marine Research Laboratories).

Lyle, J.M. (2000). Assessment of the licensed recreational fishery of Tasmania (Phase 2). FRDC Final Report Project No. 1996/161 (Tasmanian Aquaculture and Fisheries Institute), 102pp.

Lyle, J.M. and Campbell, D.A. (1999). Species and size composition of recreational catches with reference to licensed fishing methods. MRFAC Final Report (Tasmanian Aquaculture and Fisheries Institute), 46pp.

Lyle, J.M. and Smith, J.T. (1998). Pilot survey of licensed recreational sea fishing in Tasmania – 1995/96. *Marine Research Laboratories Technical Report* **51**, 55pp.

Murphy, R.J. and Lyle, J.M. (1999). Impact of gillnet fishing on inshore temperate reef fishes, with particular reference to banded morwong. FRDC Final Report Project No. 1995/145 (Tasmanian Aquaculture and Fisheries Institute), 136pp

Schaap, A. and Green, R. (1988). Fish communities on reefs subject to different levels of fishing pressure. *Department of Sea Fisheries Technical Report* **31**, 44pp.

Appendix 1 Gillnet net catch composition by region and habitat type.

+ indicates occurrence in catches

		SE Tas		*N Tas*
Common name	*Specific name*	*Reef*	*Soft*	*Soft*
Southern conger eel	*Conger verreauxi*	+		
Bearded rock cod	*Pseudophycis barbatus*	+	+	
Red cod	*Psuedophycis bachus*	+	+	+
Rock ling	*Genypterus tigerinus*	+	+	
Silver dory	*Cyttus australis*	+		
Common seadragon	*Phyllopteryx taeniolatus*	+		
Red gurnard perch	*Helicolenus percoides*	+	+	+
Thetis fish	*Neobastes thetidus*	+	+	
Grooved gurnard	*Lepidotrigla modesta*	+		
Sand flathead	*Platycephalus bassensis*	+	+	+
Long-finned pike	*Dinolestes lewini*	+		
Jack mackerel	*Trachurus declivus*	+	+	+
Yellowtail kingfish	*Seriola lalandi*	+		
Silver trevally	*Pseudocaranx dentex*	+	+	+
Australian salmon	*Arripis trutta*		+	+
Common bullseye	*Pempheris multiradiatus*	+		
Sweep	*Scorpis lineolatus*	+		
Long snouted boarfish	*Pentaceropsis recurvirostris*	+	+	
Marble fish	*Aplodactylus arctidens*	+		
Magpie perch	*Cheilodactylus nigripes*	+		
Jackass morwong	*Nemadactylus macropterus*	+	+	
Banded morwong	*Cheilodactylus spectabilis*	+		
Striped trumpeter	*Latris lineata*	+		
Bastard trumpeter	*Latridopsis forsteri*	+	+	+
King George whiting	*Sillaginodes punctatus*			+
Short-finned pike	*Sphyraena novaehollandiae*			+
Tailor	*Pomatomus saltator*			+
Yellow eye mullet	*Aldrichetta forsteri*	+		+
Sea mullet	*Mugil cephalus*			+
Blue throated wrasse	*Notolabrus tetricus*	+	+	+
Senator wrasse	*Pictilabrus laticlavius*	+		
Purple wrasse	*Notolabrus fucicola*	+		
Common stargazer	*Kathetostoma laeve*	+	+	
Blue warehou	*Seriolella brama*	+	+	+
Long snouted flounder	*Ammotretis rostratus*		+	
Greenback flounder	*Rhombosolea tapirina*	+	+	+
Toothbrush leatherjacket	*Acanthaluteres vittiger*	+		
Mosaic leatherjacket	*Eubalichthys mosaicus*	+		
Velvet leatherjacket	*Parika scaber*	+		
Brown striped leatherjacket	*Meuschenia australis*	+	+	
Six-spined leatherjacket	*Meuschenia freycineti*	+	+	
Shaw's cowfish	*Aracana aurita*	+		
Globe fish	*Diodon nichthemerus*	+	+	
Toadfish	Fam Tetradontidae			+
Atlantic salmon	*Salmo salar*		+	

Appendix 1 cont.

		SE Tas		*N Tas*
Common name	*Specific name*	*Reef*	*Soft*	*Soft*
Thresher shark	*Alopias vulpinis*	+		
Draughtboard shark	*Cephaloscyllium laticeps*	+	+	
Gummy shark	*Mustelus antarcticus*	+	+	+
White spotted dogfish	*Squalus acanthias*	+	+	
Southern sawshark	*Pristiophorus nudipinnus*	+	+	
Common sawshark	*Pristiophorus Cirratus*	+	+	
Whitley's skate	*Raja whitleyi*	+	+	+
Thornback skate	*Raja lemprieri*	+	+	
Banded stingaree	*Urolophus cruciatus*	+	+	
Sparsely spotted stingaree	*Urolphus paucimaculatus*	+	+	
Eagle ray	*Myliobatis australis*	+	+	
Elephant fish	*Callorhynchus milii*	+	+	+
Octopus	*Octopus spp*	+		
Arrow squid	*Nototodarus gouldi*	+	+	+
Southern calamary	*Sepioteuthis australis*			+
Southern rock lobster	*Jasus edwardsii*	+		
Crabs	Various species	+		

Appendix 2 Number and mean, minimum and maximum lengths of species by mesh size. (a) Reef habitat south-eastern Tasmania.

	108 mm mesh					*114 mm mesh*				
			Length (cm)					*Length (cm)*		
Species	*No.*	*%*	*Mean*	*Min.*	*Max.*	*No.*	*%*	*Mean*	*Min.*	*Max.*
Bastard trumpeter	212	27.8	34.5	28.5	43.0	94	28.7	35.1	31.6	44.0
Blue warehou	111	14.6	40.6	20.5	49.7	30	9.2	41.3	30.9	50.2
Blue throated wrasse	64	8.4	37.8	23.0	44.2	24	7.3	38.0	29.3	44.1
Red gurnard perch	36	4.7	31.3	27.5	34.0	25	7.6	30.7	23.4	38.1
Marble fish	40	5.2	43.8	26.2	55.8	12	3.7	45.3	33.5	56.8
Banded morwong	24	3.1	35.8	22.7	53.5	11	3.4	34.5	25.2	50.8
Draughtboard shark	15	2.0	71.9	51.3	97.0	20	6.1	64.2	50.8	87.0
Long snouted boarfish	18	2.4	39.2	33.0	51.4	12	3.7	40.5	37.3	47.2
Red cod	22	2.9	39.2	25.8	46.0	5	1.5	34.2	29.0	44.7
Bearded rock cod	18	2.4	41.3	30.6	48.3	8	2.4	43.0	34.5	50.0
Jack mackerel	14	1.8	30.0	28.2	33.5	8	2.4	29.9	29.2	32.0
Striped trumpeter	14	1.8	37.7	36.3	39.2					
Six-spined leatherjacket	7	0.9	30.9	27.6	36.2	5	1.5	33.9	28.8	38.8
Toothbrush leatherjacket	10	1.3	30.8	28.5	38.7	1	0.3	30.0		
Elephant fish	1	0.1	86.5			9	2.8	79.8	71.0	90.0
Jackass morwong	7	0.9	29.9	28.2	31.8	1	0.3	30.6	30.6	30.6
White spotted dogfish	5	0.7	76.1	65.0	91.0	3	0.9	69.6	66.0	72.5
Gummy shark	2	0.3	73.3	71.2	75.5	5	1.5	105.8	95.0	118.0
Purple wrasse	4	0.5	28.5	24.6	35.5	1	0.3	39.8		
Velvet leatherjacket	4	0.5	29.0	27.9	29.5					
Eagle ray	2	0.3				2	0.6			
Common stargazer	3	0.4	48.0	33.0	70.0					
Mosaic leatherjacket	3	0.4	29.1	26.8	31.4					
Sand flathead	3	0.4	34.8	27.2	44.6					
Common bullseye	2	0.3	24.0	23.9	24.1	1	0.3	22.5		
Octopus	2	0.3				1	0.3			
Rock ling	1	0.1	71.0			2	0.6	79.5	71.0	88.0
Shaw's cowfish	1	0.1				2	0.6	16.5	16.5	16.5
Silver dory	2	0.3	23.8	22.5	25.0					
Globe fish	1	0.1				1	0.3	28.0		
Long-finned pike	1	0.1				1	0.3	27.2		
Silver trevally	1	0.1	31.8			1	0.3	46.0		
Yellow eye mullet	1	0.1	30.5			1	0.3	34.0		
Thetis fish						2	0.6	35.6	34.8	36.4
Thornback skate						2	0.6			
Arrow squid	1	0.1								
Brown striped leatherjacket	1	0.1	26.7							
Common sawshark	1	0.1	103.0							
Common seadragon	1	0.1								
Greenback flounder	1	0.1	23.3							
Grooved gurnard	1	0.1	27.5							
Magpie perch	1	0.1	28.8							
Senator wrasse	1	0.1	26.9							
Thresher shark	1	0.1	350.0							
Whitley's skate	1	0.1								
Banded stingaree						1	0.3			

Appendix 2 (a) cont.

	108 mm mesh					*114 mm mesh*				
			Length (cm)					*Length (cm)*		
Species	*No.*	*%*	*Mean*	*Min.*	*Max.*	*No.*	*%*	*Mean*	*Min.*	*Max.*
Southern conger eel						1	0.3			
Southern sawshark						1	0.3			
Sparsely spotted stingaree						1	0.3			
Sweep						1	0.3	40.0		
Yellowtail kingfish						1	0.3	59.5		
Southern rock lobster	29	3.8				10	3.1			
Crabs	23	3.0				6	1.8			
Total	762	100				327	100			

Appendix 2 cont. (b) Soft bottom habitat south-eastern Tasmania.

	108 mm mesh					*133 mm mesh*				
			Length (cm)					*Length (cm)*		
Species	*No.*	*%*	*Mean*	*Min.*	*Max.*	*No.*	*%*	*Mean*	*Min.*	*Max.*
Sand flathead	34	17.8	30.8	21.0	41.4	6	10.5	34.7	30.4	41.0
Australian salmon	25	13.1	43.8	40.4	48.7					
Gummy shark	17	8.9	87.5	65.2	135.0	8	14.0	99.3	80.5	114.0
Six-spined leatherjacket	12	6.3	32.5	27.7	36.4	13	22.8	36.4	31.8	44.4
Banded stingaree	4	2.1	28.0	28.0	28.0	8	14.0			
Brown striped leatherjacket	7	3.7	30.0	28.1	34.0					
Jack mackerel	6	3.1	29.5	23.2	32.4	1	1.8			
Greenback flounder	1	0.5	28.1			6	10.5	26.1	21.1	29.8
Atlantic salmon	6	3.1	61.1	53.1	74.2					
Red cod	5	2.6	33.0	33.0	33.0	1	1.8	35.5		
Long snouted boarfish	4	2.1	37.6	36.8	38.5	2	3.5	36.6	36.3	37.0
Eagle ray	4	2.1				1	1.8			
Thetis fish	4	2.1	33.0	31.7	35.2	1	1.8	37.0		
Red gurnard perch	3	1.6	32.4	32.4	32.4	1	1.8			
Thornback skate	3	1.6				1	1.8			
Draughtboard shark	1	0.5	51.5			3	5.3	82.8	82.5	83.0
Bastard trumpeter	3	1.6	33.7	31.8	34.7					
Blue throated wrasse	3	1.6	35.5	31.4	41.3					
Common sawshark	3	1.6	92.0	89.0	96.0					
White spotted dogfish	3	1.6	74.2	59.5	81.7					
Common stargazer	2	1.0	24.6	23.5	25.7					
Elephant fish	2	1.0	85.3	82.0	88.5					
Globe fish	2	1.0								
Jackass morwong	2	1.0	29.8	29.3	30.4					
Sparsely spotted stingaree	2	1.0								
Arrow squid	1	0.5								
Bearded rock cod	1	0.5								
Long snouted flounder	1	0.5	25.5							
Skates	1	0.5								
Southern sawshark	1	0.5	97.5							
Rock ling						1	1.8	74.0		
Total	191	100				57	100			

Appendix 2 cont. (c) Soft bottom habitat northern Tasmania.

	64 mm mesh					*108 mm mesh*					*133 mm mesh*				
			Length (cm)					*Length (cm)*					*Length (cm)*		
Species	*No.*	*%*	*Mean*	*Min.*	*Max.*	*No.*	*%*	*Mean*	*Min.*	*Max.*	*No.*	*%*	*Mean*	*Min.*	*Max.*
Yellow eye mullet	961	84.7	26.8	19.5	33.5	22	17.7	23.6	21.5	27.5	24	28.2	21.9	17.0	34.0
Elephant fish	7	0.6	46.3	38.5	52.5	47	37.9	50.7	40.5	65.0	18	21.2	52.3	40.5	65.0
Greenback flounder	1	0.1	11.5			27	21.8	21.0	19.0	26.5	32	37.6	24.7	20.0	30.5
Sand flathead	40	3.5	27.6	18.5	33.5	6	4.8	22.9	18.5	29.0	1	1.2	20.0		
Short-finned pike	25	2.2	50.5	38.0	70.0	1	0.8	43.5			2	2.4	43.3	43.0	43.5
Cod	23	2.0	25.2	19.5	36.0	1	0.8	24.5							
King George whiting	20	1.8	32.5	29.5	37.0										
Tailor	16	1.4	23.9	19.5	28.5	1	0.8	31.5							
Blue warehou	7	0.6	19.6	17.0	21.0	7	5.6	42.6	35.5	48.5					
Jack mackerel	11	1.0	29.0	27.0	32.5										
Gummy shark						4	3.2	63.9	52.5	76.5	7	8.2	52.6	43.5	68.5
Arrow squid	8	0.7													
Bastard trumpeter	3	0.3	27.0	26.0	28.5	3	2.4	31.2	30.5	32.5					
Silver trevally	4	0.4	19.3	18.5	20.0										
Australian salmon	4	0.4	23.0	18.5	25.0										
Whitley's skate	1	0.1	33.0			2	1.6	36.5	34.0	39.0					
Common toadfish	1	0.1	10.0			1	0.8	16.5							
Sea mullet						1	0.8	43.5			1	1.2	55.0		
Gurnard	1	0.1	32.0												
Southern calamary	1	0.1													
Blue throated wrasse						1	0.8	38.5							
Total	1134	100				124	100				85	100			

Appendix 3 Catch composition by mesh size for day and overnight sets (a) Reef habitat south-eastern Tasmania

	108 mm				*114 mm*			
	Day		*Night*		*Day*		*Night*	
Species	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
Bastard trumpeter	165	41.5	47	14.9	71	55.5	23	12.5
Blue warehou	42	10.6	69	21.9	9	7.0	21	11.4
Blue throated wrasse	52	13.1	12	3.8	19	14.8	5	2.7
Red gurnard perch	9	2.3	27	8.6			25	13.6
Marble fish	32	8.0	8	2.5	10	7.8	2	1.1
Banded morwong	23	5.8	1	0.3	8	6.3	3	1.6
Draughtboard shark	4	1.0	11	3.5	2	1.6	18	9.8
Long snouted boarfish	5	1.3	13	4.1	1	0.8	11	6.0
Red cod	2	0.5	20	6.3			5	2.7
Bearded rock cod	6	1.5	12	3.8	2	1.6	6	3.3
Jack mackerel	1	0.3	13	4.1			8	4.3
Striped trumpeter	14	3.5						
Six-spined leatherjacket	1	0.3	6	1.9			5	2.7
Toothbrush leatherjacket	8	2.0	2	0.6	1	0.8		
Elephant fish	1	0.3					9	4.9
Jackass morwong	4	1.0	3	1.0			1	0.5
White spotted dogfish	1	0.3	4	1.3	1	0.8	2	1.1
Gummy shark			2	0.6			5	2.7
Purple wrasse	3	0.8	1	0.3	1	0.8		
Eagle ray	1	0.3	1	0.3			2	1.1
Velvet leatherjacket	4	1.0						
Common bullseye			2	0.6			1	0.5
Common stargazer	1	0.3	2	0.6				
Mosaic leatherjacket	2	0.5	1	0.3				
Octopus	1	0.3	1	0.3			1	0.5
Rock ling			1	0.3			2	1.1
Sand flathead	2	0.5	1	0.3				
Shaw's cowfish	1	0.3					2	1.1
Globe fish	1	0.3					1	0.5
Long-finned pike			1	0.3			1	0.5
Silver dory	2	0.5						
Silver trevally	1	0.3					1	0.5
Thetis fish							2	1.1
Thornback skate							2	1.1
Yellow eye mullet	1	0.3					1	0.5
Arrow squid	1	0.3						
Banded stingaree							1	0.5
Brown striped leatherjacket	1	0.3						
Common sawshark	1	0.3						
Common seadragon	1	0.3						
Greenback flounder			1	0.3				
Grooved gurnard	1	0.3						
Magpie perch	1	0.3						
Senator wrasse	1	0.3						

Appendix 3 (a) cont.

	108 mm				*114 mm*			
	Day		*Night*		*Day*		*Night*	
Species	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
Southern conger eel							1	0.5
Southern sawshark							1	0.5
Sparsely spotted stingaree							1	0.5
Sweep							1	0.5
Thresher shark	1	0.3						
Whitley's skate			1	0.3				
Yellowtail kingfish							1	0.5
Southern rock lobster			29	9.2	3	2.3	7	3.8
Crabs			23	7.3			6	3.3
Total	398	100	315	100	128	100	184	100

Appendix 3 Cont. (b) Soft bottom habitat south-eastern Tasmania

	108 mm				*133 mm*			
	Day		*Night*		*Day*		*Night*	
Species	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
Sand flathead	12	22.6	22	20.0			6	15.4
Gummy shark	5	9.4	12	10.9	5	35.7	3	7.7
Six-spined leatherjacket	5	9.4	7	6.4	4	28.6	9	23.1
Australian salmon			25	22.7				
Banded stingaree	2	3.8	2	1.8	2	14.3	6	15.4
Brown striped leatherjacket	3	5.7	4	3.6		0.0		0.0
Greenback flounder	1	1.9			1	7.1	5	12.8
Jack mackerel			6	5.5			1	2.6
Atlantic salmon	4	7.5	2	1.8				
Long snouted boarfish			4	3.6	2	14.3		
Red cod			5	4.5			1	2.6
Eagle ray	2	3.8	2	1.8			1	2.6
Thetis fish	2	3.8	2	1.8			1	2.6
Draughtboard shark			1	0.9			3	7.7
Red gurnard perch	1	1.9	2	1.8			1	2.6
Thornback skate	1	1.9	2	1.8			1	2.6
Bastard trumpeter	2	3.8	1	0.9				
Blue throated wrasse	2	3.8	1	0.9				
Common sawshark	3	5.7						
White spotted dogfish	1	1.9	2	1.8				
Common stargazer	1	1.9	1	0.9				
Elephant fish	1	1.9	1	0.9				
Globe fish			2	1.8				
Jackass morwong	2	3.8						
Sparsely spotted stingaree	1	1.9	1	0.9				
Arrow squid			1	0.9				
Bearded rock cod			1	0.9				
Long snouted flounder	1	1.9						
Rock ling							1	2.6
Skates			1	0.9				
Southern sawshark	1	1.9						
Total	53	100	110	100	14	100	39	100

Appendix 3 Cont. (c) Soft bottom habitat northern Tasmania

	64 mm				*108 mm*				*133 mm*			
	Day		*Night*		*Day*		*Night*		*Day*		*Night*	
Species	*No.*	*%*	*No.*	*%*	*n*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
Yellow eye mullet	170	72.6	789	87.9	6	13.0	16	20.5	9	47.4	15	22.1
Elephant fish	1	0.4	6	0.7	23	50.0	24	30.8	3	15.8	15	22.1
Greenback flounder			1	0.1	6	13.0	21	26.9	2	10.5	30	44.1
Short-finned pike	19	8.1	6	0.7	1	2.2			2	10.5		
Cod	1	0.4	22	2.4			1	1.3				
Silver trevally			4	0.4								
King George whiting	7	3.0	13	1.4								
Blue warehou	2	0.9	5	0.6			7	9.0				
Tailor	7	3.0	9	1.0			1	1.3				
Bastard trumpeter	2	0.9	1	0.1	3	6.5						
Jack mackerel			11	1.2								
Gummy shark					1	2.2	3	3.8			7	10.3
Arrow squid	1	0.4	7	0.8								
Southern calamary	1	0.4			1	2.2						
Australian salmon	1	0.4	3	0.3								
Blue throated wrasse					1	2.2						
Gurnard			1	0.1								
Sea mullet			0				1	1.3			1	1.5
Toadfish	1	0.4	0				1	1.3				
Whitley’s skate			1	0.1			1	1.3				
Total	234	100	898	100	46	100	78	100	19	100	68	100

Appendix 4 Quality and proportion of catch dead and damaged by species and treatment (a) South-eastern Tasmania.

	Treat-	*Total*	*Organoleptic score*						*%*	*Damaged*	
Species	*ment*	*no.*	*1*	*2*	*3*	*4*	*5*	*6*	*dead*	*No.*	*%*
Bastard trumpeter	D3	49	43	2	3	1			8.2	2	4.1
	D2	55	49		5	1			10.9	1	1.8
	D	134	99	22	10	3			9.7	2	1.5
	N	71	45	7	8	10		1	26.8	12	16.9
Blue warehou	D3	4	1	2		1			25.0	1	25.0
	D2	22	1	3	12	2		4	81.8	6	27.3
	D	25	8	7	9	1			40.0	2	8.0
	N	90	5	7	46	15	17		86.7	9	10.0
Blue throated wrasse	D3	22	15	1	6				27.3	1	4.5
	D2	11	9	1	1				9.1	0	0
	D	40	20	8	11	1			30.0	0	0
	N	18	6	3	7	1		1	50.0	1	5.6
Atlantic salmon	D3	1		1					0	0	0
	D2	2		1	1				50.0	0	0
	D	1	1						0	0	0
	N	2				2			100	1	50.0
Banded morwong	D3	10	9		1				10.0	1	10.0
	D2	8	8						0	0	0
	D	13	12	1					0	0	0
	N	4	4						0	0	0
Bearded rock cod	D3	1	1						0	0	0
	D2	3	2		1				33.3	0	0
	D	4			2	2			100	0	0
	N	19	1	1	3	5	6	3	89.5	9	47.4
Common sawshark	D3	1	1						0	0	0
	D2	1	1						0	0	0
	D	2		1	1				50.0	0	0
	N	1						1	100	0	0
Common stargazer	D3	2	2						0	0	0
	N	3	3						0	0	0
Australian salmon	N	25			25				100	3	12.0
Elephant fish	D3	1	1						0	0	0
	D	1	1						0	0	0
	N	10	6	2	1	1			20.0	0	0
Greenback flounder	D3	1	1						0	0	0
	D	1	1						0	0	0
	N	6	6						0	0	0
Gummy shark	D3	2	1	1					0	0	0
	D	8		2	5		1		75.0	2	25.0
	N	22	3	2	7	1	9		77.3	9	40.9
Jack mackerel	D3	1			1				100	0	0
	N	31	1		13	14		3	96.8	11	35.5
Jackass morwong	D3	4	3	1					0	0	0
	D2	2	2						0	0	0
	N	4	2		2				50.0	1	25.0
Long snouted boarfish	D3	2	2						0	0	0
	D2	2	2						0	0	0
	D	4	3		1				25.0	0	0
	N	28	13	4	1	10			39.3	0	0

Appendix 4 (a) cont.

	Treat-	*Total*	*Organoleptic score*						*%*	*Damaged*	
Species	*ment*	*no.*	*1*	*2*	*3*	*4*	*5*	*6*	*dead*	*No.*	*%*
Marble fish	D3	14	14						0	0	0
	D2	15	15						0	0	0
	D	13	8	2	3				23.1	0	0
	N	10	5	3	2				20.0	2	20.0
Purple wrasse	D2	1	1						0	0	0
	D	3	1		1	1			66.7	0	0
	N	1	1						0	0	0
Red cod	D	2			1	1			100	0	0
	N	31		1	8	10		12	96.8	11	35.5
Red gurnard perch	D3	5	5						0	0	0
	D2	3	3						0	0	0
	D	2			2				100	0	0
	N	55	47	1	5	2			12.7	1	1.8
Sand flathead	D3	4	3	1					0	0	0
	D2	9	8	1					0	0	0
	D	1		1					0	0	0
	N	39	28	6		2	1	2	12.8	3	7.7
Striped trumpeter	D3	12	9	3					0	0	0
	D2	2	2						0	0	0
Thetis fish	D3	1	1						0	0	0
	D	1	1						0	0	0
	N	5	2	2		1			20.0	1	20.0
Brown striped	D3	1	1						0	0	0
leatherjacket	D2	1	1						0	0	0
	D	2	2						0	0	0
	N	4	4						0	0	0
Mosaic leatherjacket	D2	2	2						0	0	0
	N	1	1						0	0	0
Six-spined leatherjacket	D3	1	1						0	0	0
	D2	2	2						0	0	0
	D	7	7						0	0	0
	N	29	26	2			1		3.4	0	0
Toothbrush	D3	3	3						0	0	0
leatherjacket	D2	3	3						0	0	0
	D	3	2	1					0	0	0
	N	2	1	1					0	0	0
Velvet leatherjacket	D3	1	1						0	0	0
	D2	3	3						0	0	0
Banded stingaree	D3	2	2						0	0	0
	D	2	2						0	0	0
	N	9	9						0	0	0
Eagle ray	D3	1	1						0	0	0
	D2	1	1						0	0	0
	D	1	1						0	0	0
	N	6	6						0	0	0
Sparsely spotted	D3	1	1						0	0	0
stingaree	N	2	2						0	0	0

Appendix 4 (a) cont.

	Treat-	Total	Organoleptic score						%	Damaged	
Species	*ment*	*no.*	*1*	*2*	*3*	*4*	*5*	*6*	*dead*	*No.*	*%*
Thornback skate	D3	1	1						0	0	0
	N	5	5						0	0	0
Draughtboard shark	D3	1	1						0	0	0
	D2	3	3						0	0	0
	D	2	2						0	0	0
	N	33	32	1					0	0	0
White spotted dogfish	D2	1	1						0	0	0
	D	2	2						0	0	0
	N	8	2		3	1	1	1	75.0	2	25.0

Appendix 4 cont. (b) Northern Tasmania.

	Treat-	Total	Organoleptic score						%	Damaged	
Species	*ment*	*no.*	*1*	*2*	*3*	*4*	*5*	*6*	*dead*	*No.*	*%*
Yellow eye mullet	D2	17	7	5	5	0	0	0	29.4	0	0
	D	170	27	49	40	43	6	5	55.3	15	8.8
	N	820	65	177	88	237	149	104	70.5	312	38.0
Greenback flounder	D2	3	3	0	0	0	0	0	0	0	0
	D	3	1	2	0	0	0	0	0	0	0
	N	52	21	31	0	0	0	0	0	1	1.9
Elephant fish	D2	21	7	11	3	0	0	0	14.3	0	0
	D	6	2	4	0	0	0	0	0	0	0
	N	45	6	9	2	16	12	0	66.7	9	20.0
Bastard trumpeter	D2	3	2	1	0	0	0	0	0	0	0
	D	2	1	0	0	1	0	0	50.0	0	0
	N	1	0	1	0	0	0	0	0	0	0
Blue warehou	D	2	0	0	0	1	1	0	100	1	50.0
	N	12	0	0	0	9	3	0	100	4	33.3
Sand flathead	D	19	1	3	1	7	5	2	78.9	8	42.1
	N	21	4	6	1	1	7	2	52.4	9	42.9
Cod	D	1	1	0	0	0	0	0	0	0	0
	N	23	0	3	1	8	10	1	87.0	8	34.8
Australian salmon	D	1	0	0	1	0	0	0	100	0	0
	N	3	0	1	0	2	0	0	66.7	0	0
Gummy shark	D2	1	1	0	0	0	0	0	0	0	0
	N	10	4	0	3	3	0	0	60.0	0	0
Jack mackerel	N	11	0	0	2	5	2	2	100	5	45.5
King George whiting	D2	5	2	3	0	0	0	0	0	0	0
	D	2	0	1	0	1	0	0	50.0	0	0
	N	13	0	8	4	0	0	1	38.5	0	0
Silver trevally	D2	7	2	3	0	2	0	0	28.6	0	0
	N	4	2	2	0	0	0	0	0	0	0
Short-finned pike	D2	5	0	0	5	0	0	0	100	0	0
	D	17	0	0	7	6	4	0	100	4	23.5
	N	6	1	0	2	3	0	0	83.3	1	16.7
Tailor	D	7	1	0	4	2	0	0	85.7	1	14.3
	N	10	0	1	2	6	1	0	90.0	4	40.0
Arrow Squid	D	1	1	0	0	0	0	0	0	0	0
	N	7	5	1	1	0	0	0	14.3	1	14.3
Whitley's skate	N	3	1	2	0	0	0	0	0	0	0

Appendix 5 Catch condition by species and treatment (mesh sizes and habitats combined).

	Treat-	*Numbers*				*Proportion (%)*		
Species	*ment*	*High*	*Medium*	*Poor*	*Total*	*High*	*Medium*	*Poor*
Bastard trumpeter	D3	47	2		49	96	4	0
	D2	53	2		55	96	4	0
	D	131	1	2	134	98	1	1
	N	57	8	6	71	80	11	8
Striped trumpeter	D3	12			12	100	0	0
	D2	2			2	100	0	0
Blue warehou	D3	3	1		4	75	25	0
	D2	14	4	4	22	64	18	18
	D	23	1	1	25	92	4	4
	N	56	28	6	90	62	31	7
Yellow eye mullet	D	116	38	16	170	68	22	9
	N	320	243	258	821	39	30	31
Sand flathead	D3	4			4	100	0	0
	D2	9			9	100	0	0
	D	6	8	7	21	29	38	33
	N	44	1	13	58	44	1	13
Bearded rock cod	D3	1			1	100	0	0
	D2	3			3	100	0	0
	D	2	2		4	50	50	0
	N	4	8	7	19	21	42	37
Red cod	D	1	1		2	50	50	0
	N	8	10	13	31	26	32	42
Blue throated wrasse	D3	21	1		22	95	5	0
	D2	11			11	100	0	0
	D	39	1		40	98	3	0
	N	15	2	1	18	83	11	6
Greenback flounder	D3	1			1	100	0	0
	D	6			6	100	0	0
	N	58			58	100	0	0
Australian salmon	N	22	2	1	25	88	8	4
Jack mackerel	D3	1			1	100	0	0
	N	12	13	6	31	39	42	19
Banded morwong	D3	9	1		10	90	10	0
	D2	8			8	100	0	0
	D	13			13	100	0	0
	N	4			4	100	0	0
Jackass morwong	D3	4			4	100	0	0
	D2	2			2	100	0	0
	N	3	1		4	75	25	0
Long snouted boarfish	D3	2			2	100	0	0
	D2	2			2	100	0	0
	D	4			4	100	0	0
	N	18	10		28	64	36	0
Red gurnard perch	D3	5			5	100	0	0
	D2	3			3	100	0	0
	D	2			2	100	0	0
	N	53	2		55	96	4	0

Appendix 5 cont.

	Treat-	*Numbers*				*Proportion (%)*		
Species	*ment*	*High*	*Medium*	*Poor*	*Total*	*High*	*Medium*	*Poor*
Thetis fish	D3	1			1	100	0	0
	D	1			1	100	0	0
	N	4		1	5	80	0	20
Brown striped	D3	1			1	100	0	0
leatherjacket	D2	1			1	100	0	0
	D	2			2	100	0	0
	N	4			4	100	0	0
Mosaic leatherjacket	D2	2			2	100	0	0
	N	1			1	100	0	0
Six-spined leatherjacket	D3	1			1	100	0	0
	D2	2			2	100	0	0
	D	7			7	100	0	0
	N	28	1		29	97	3	0
Toothbrush	D3	3			3	100	0	0
leatherjacket	D2	3			3	100	0	0
	D	3			3	100	0	0
	N	2			2	100	0	0
Velvet leatherjacket	D3	1			1	100	0	0
	D2	3			3	100	0	0
Elephant fish	D3	1			1	100	0	0
	D2	21			21	100	0	0
	D	7			7	100	0	0
	N	26	21	8	55	47	38	15
Gummy shark	D3	2			2	100	0	0
	D	5	2	1	8	63	25	13
	N	17	6	9	32	53	19	28