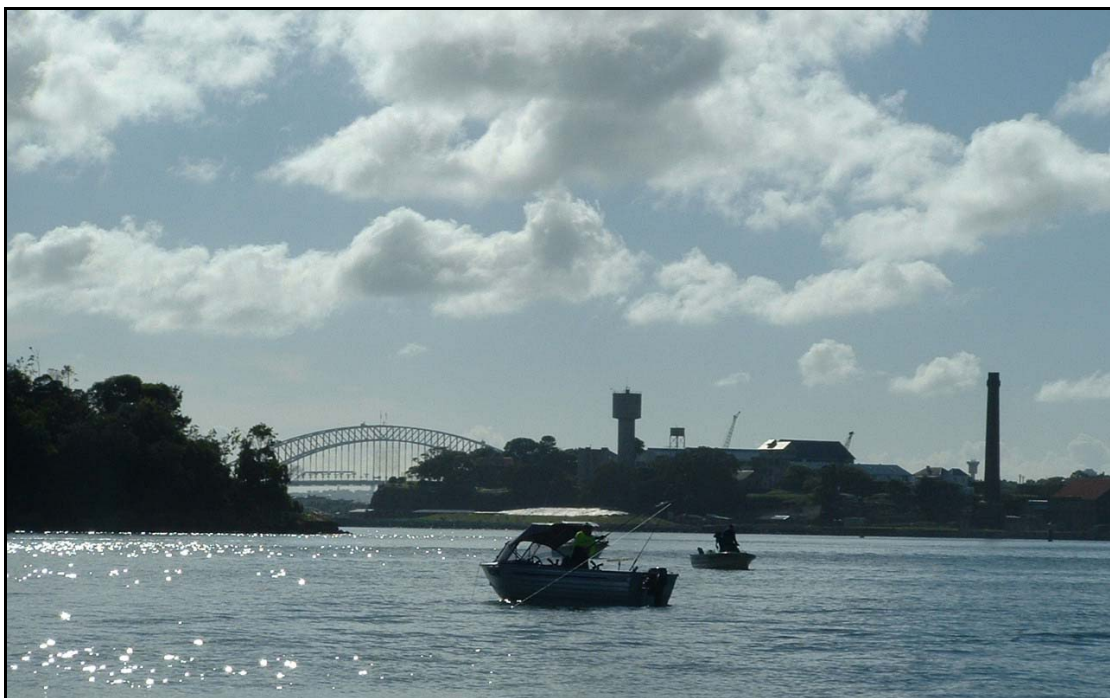


An assessment of the effort and catch of shore-based and boat-based recreational fishers in the Sydney Harbour estuary over the 2007/08 summer period

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NON-TECHNICAL SUMMARY

OBJECTIVES:

- To assess the status of the recreational fishery in the Sydney Harbour estuary.
- To estimate the level of daytime recreational fishing effort in the Sydney Harbour estuary over the summer period of 2007/08.
- To estimate the daytime catch (landed harvest, bait harvest and discarded catch) of recreational fishers in the Sydney Harbour estuary over the summer period of 2007/08.
- To compare daytime levels of recreational effort and catch in the eastern (seaward) and western (upstream) estuary zones of the Sydney Harbour estuary.

NON TECHNICAL SUMMARY:

The Sydney Harbour estuary on the east coast of Australia is an iconic natural harbour. It was the site of first European settlement in Australia and consequently has a long history of urbanisation, industrialisation and military use. It is currently surrounded by a large population of about 4.4 million Sydney residents making this waterway an important recreational and commercial centre. In the wake of the detection of high levels of dioxins in certain species in Sydney Harbour, significant changes in the management of its fisheries were recently put in place. These include a ban on commercial fishing, changes to guidelines on recreational fishing practices and recommendations regarding the consumption of fish, shellfish and cephalopods. It was expected that such changes may influence the patterns of recreational fishing effort and catch. These recent changes, and the general long-standing paucity of information about recreational fishing in this important estuary, led to the current study to quantify the levels of fishing effort and catch in the estuary and assess the status of the recreational fishery.

Two simultaneous but independent surveys were done to derive estimates of effort and catch over the 2007/08 summer period in the estuary. The first survey covered the area west of the Sydney Harbour Bridge, including the Parramatta and Lane Cove Rivers. The second survey covered the area east of the Sydney Harbour Bridge, including North and Middle Harbours.

The recreational fishery in the Sydney Harbour estuary was dominated by shore-based fishing with about 62% of the fishing effort estimated to be shore-based and 38% boat-based. Similarly, the largest portion of harvest was taken by shore-based fishers (74% by number and 58% by weight of fish, crabs and cephalopods). This is very different to the distribution of effort and harvest recorded from other estuarine fisheries in NSW, which are dominated by boat-based fishing. The distribution of effort and harvest in the Sydney Harbour estuary over the 2007/08 summer period was attributed to: (i) the close proximity of a large urban population; (ii) a number of physical attributes of the estuary that encourage recreational fishing (e.g., easy public access to boat ramps and shorelines adjacent to deep water, protection from the weather, aesthetic appeal of this estuary); and (iii) the availability of diverse and high quality recreational fishing opportunities throughout the estuary.

Large amounts of daytime recreational fishing effort were recorded (about 300 000 fisher hours over the 3-month survey period) in the Sydney Harbour estuary. This amount of fishing effort was relatively large compared to surveys of other estuarine recreational fisheries in NSW. The majority of this effort can be attributed to recreational fishers of local origin as 96% of fishers interviewed were found to be residents of the suburbs of Sydney.

Levels of daytime harvest and discarded catch were found to be large compared to other NSW estuarine surveys with the daytime recreational harvest of finfish, crabs and cephalopods estimated to be about 74 tonnes and consisting of about 225 000 finfish, crabs and cephalopods. Another 293 000 individuals were estimated to have been discarded (i.e., caught and released) by recreational fishers over the survey period.

There were considerable quantities of finfish, crabs and cephalopods retained from both the eastern and western estuary zones of the Sydney Harbour estuary with approximately 84 600 and 97 700 individuals estimated in the landed harvest of the eastern and western estuary zones, respectively. These numbers equated to about 44.4 tonnes of fish, crabs and cephalopods from the eastern estuary zone and about 25.3 tonnes from the western estuary zone. A large number of individuals were retained by recreational fishers in the western estuary zone despite the recommendation that fish, crabs and cephalopods taken from this zone should not be consumed.

Despite the availability of high quality recreational fishing opportunities throughout the estuary, it was found that the proportions of under-sized fish in the harvest from this fishery were much higher than those recorded during recent recreational fishing surveys in other NSW estuaries. The proportion of under-sized fish recorded in the harvest of the Sydney Harbour estuary are similar to levels recorded in NSW estuarine recreational fishing surveys done in the 1980s.

The levels of daytime recreational fishing effort, harvest and discarded catch recorded during this survey indicate that the Sydney Harbour estuary is a popular and productive fishing location during summer. Despite the relatively high rate of recreational usage and given the long history of recreational and commercial exploitation of this fishery, there are no indications that current levels of recreational fishing in the Sydney Harbour estuary are unsustainable. Rather, the results indicate that this estuary offers a variety of good recreational fishing opportunities. Fisher perceptions supported this conclusion with about 70% of interviewed fishers rating the quality of the fishery as good.

1. INTRODUCTION

The Sydney Harbour estuary (33°51'S, 151°12'E) on the east coast of Australia is an iconic natural harbour. It was the site of the first European settlement in Australia and has a long history of urbanisation, industrialisation and military use. It is currently surrounded by a large population of about 4.4 million Sydney residents (Australian Bureau of Statistics 2009) making this waterway an important recreational and commercial centre. The estuary is a tide-dominated drowned valley with a large open entrance (Roy *et al.* 2001) and, despite its urban surroundings, contains an array of important habitats that support a diverse marine assemblage. There have been 575 fish species recorded in the Sydney Harbour estuary (McGrouther 2009).

The Sydney Harbour estuary has a long history of fishery exploitation by indigenous, commercial and recreational fishers. There is evidence to suggest that the fisheries resources of Sydney Harbour were important for the Aboriginals of the region dating prior to European settlement (Attenbrow 2002; Pepperell 2008).

Little research has been done on recreational fisheries in the Sydney Harbour estuary. The only previous survey of recreational fishing in this estuary was done during the period September 1980 to August 1981 inclusive (Henry 1984). The levels of recreational fishing pressure in the estuary were shown to be highly seasonal with the summer and autumn periods having the largest amounts of fishing effort (Henry 1984). There were 46 species of finfish taken by recreational anglers during the survey period with yellowtail scad (*Trachurus novaezelandiae*), tailor (*Pomatomus saltatrix*), yellowfin bream (*Acanthopagrus australis*) and snapper (*Pagrus auratus*) the most commonly recorded harvested species (Henry 1984).

Commercial fisheries have also existed in the Sydney Harbour estuary since the time of first European settlement until January 2006 when commercial fishing was banned because of concerns about elevated levels of dioxin contamination in the flesh of fish, shellfish and cephalopods (NSW DPI 2006). A series of precautionary recommendations were implemented for the recreational fishery regarding the consumption of fish, shellfish and cephalopods. These recommendations were heavily publicised in the media and by direct contact with fishing parties. Key recommendations were: (a) that recreational fishers should consider the estuary as a 'catch and release' fishery; (b) that recreational fishers do not consume any fish, shellfish or cephalopods caught in the area west of the Sydney Harbour Bridge; and (c) that recreational fishers minimise the amount of fish, shellfish and cephalopods that they consume in accordance with a set of precautionary guidelines that documented safe levels of consumption for different species. The management of fisheries resources targeted in this recreational fishery continued with existing bag and size limit rules.

These changes in the management of the fisheries in the Sydney Harbour estuary were expected to influence the patterns of recreational fishing effort and catches. These changes, as well as the general and long-standing lack of information about recreational fishing in this important estuary, led to the current study to quantify the current levels of fishing effort and catch within the estuary and assess the status of the recreational fishery.

2. OBJECTIVES

The principal aims of this project were:

- To assess the status of the recreational fishery in the Sydney Harbour estuary.
- To estimate the level of daytime recreational fishing effort in the Sydney Harbour estuary over the summer period of 2007/08.
- To estimate the daytime catch (landed harvest, bait harvest and discarded catch) of recreational fishers in the Sydney Harbour estuary over the summer period of 2007/08.
- To compare daytime levels of recreational effort and catch in the eastern (seaward) and western (upstream) estuary zones of the Sydney Harbour estuary.

3. METHODS

3.1. Study area and access points to the fishery

The Sydney Harbour estuary (33°51'S, 151°12'E) on the east coast of Australia is comprised of Port Jackson (including the North and Middle Harbours) and the Parramatta, Lane Cove and Duck Rivers (Figure 1). This estuary has a catchment area of 117 km², water surface area of 50 km², is tide-dominated and characterised by a large open entrance and drowned valley (West *et al.* 1985; Roy *et al.* 2001). The Parramatta River is the largest of the three rivers that enter Port Jackson and is estuarine for some nineteen kilometres upstream of the start of the river at Balmain (NSW DNR 2008). The Lane Cove River, a tributary of the Parramatta River, is estuarine and extends eleven kilometres upstream to a concrete weir (NSW DNR 2008). The Duck River is a small estuarine tributary that enters the Parramatta River about 200 metres upstream from Silverwater Bridge.

A large amount of the Sydney Harbour estuary shoreline is accessible to recreational fishers. There are many parks, sea walls, wharves, baths and jetties that allow public access and many are close to deep water, which is likely to provide good recreational fishing opportunities. This estuary is also easily accessible by boat with more than twenty public boat ramps available for use (NSW Maritime 2008).

There are also many private access points that can potentially be used for recreational fishing purposes. These include over forty private marinas (Widmer & Underwood 2004), over 4700 private moorings, about 570 private berthing pens or jetties and 14 rowing clubs with boat shed access (T. Williams, NSW Maritime, personal communication 10 March 2009). There are also many private waterfront properties that do not have jetties but do have sea walls and accessible areas that could be used for recreational fishing.

There are large amounts of shoreline where access is restricted, preventing the legal use of these areas for recreational fishing purposes. These areas include industrial estates (particularly west of the Sydney Harbour Bridge), commercial wharves, military bases and installations.

Recreational fishing in some areas of the estuary is regulated. No fishing is allowed in Homebush Bay and the Duck River, and the Upper Lane Cove River is a no-take zone. There are restrictions in place within the boundaries of the North (Sydney) Harbour Aquatic Reserve, which exclude spearfishing, collecting of shellfish (dead, alive or empty shells) or digging for worms (NSW Fisheries 2002). However, angling for finfish is allowed in this Aquatic Reserve (NSW Fisheries 2002).

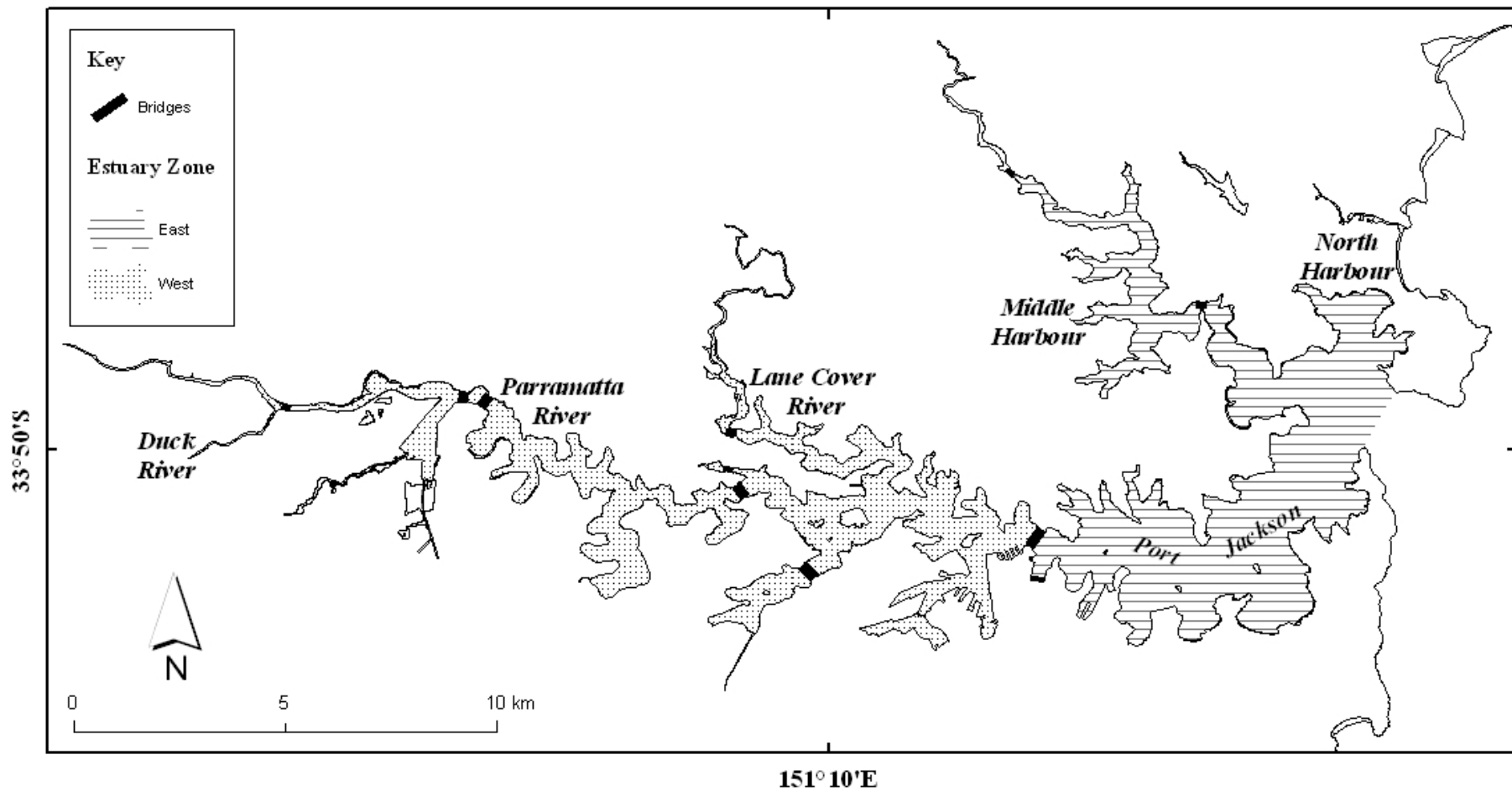


Figure 1. Map of the Sydney Harbour estuary showing the spatial extent of the recreational fishing survey and the boundary used to divide the estuary into eastern and western zones.

3.2. Terminology

It is necessary to define some of the common terms used throughout this report and to provide a brief description of the issues associated with their measurement and/or interpretation. A flow diagram that shows the relationship between these terms is provided in Figure 2.

Recreational catch: Number or weight of all fish, crabs and cephalopods caught, whether they are harvested (kept) or discarded (released).

Harvest: Number or weight of all fish, crabs and cephalopods that are kept regardless of their fate. Harvest includes landed harvest and bait harvest components.

Landed harvest: That part of the harvest that is in the possession of the fishing party and is not being used as bait at the time of interview. The landed harvest is observed directly by survey clerks when on-site survey methods are used. It is possible for survey clerks to make accurate identifications and collect length information whenever fishers are cooperative. All references to harvest and harvest rates throughout this report refer to the landed harvest component of the catch.

Bait harvest: That part of the harvest that has been or is being used as bait at the time of interview. The bait harvest is self reported by recreational fishers and these data are subject to various biases such as recall bias, rounding bias and the varying skill levels of fishers in identifying different species. It is not possible for survey clerks to obtain accurate length information because this bait harvest is used during the fishing trip and cannot always be observed directly.

Discarded catch: That part of the catch which is not kept. All discarded catch is self reported by recreational fishers and these data are subject to various biases such as recall bias, rounding bias and the varying skill levels of fishers in identifying different species. It is not possible for survey clerks to obtain accurate length information because discard cannot be observed directly.

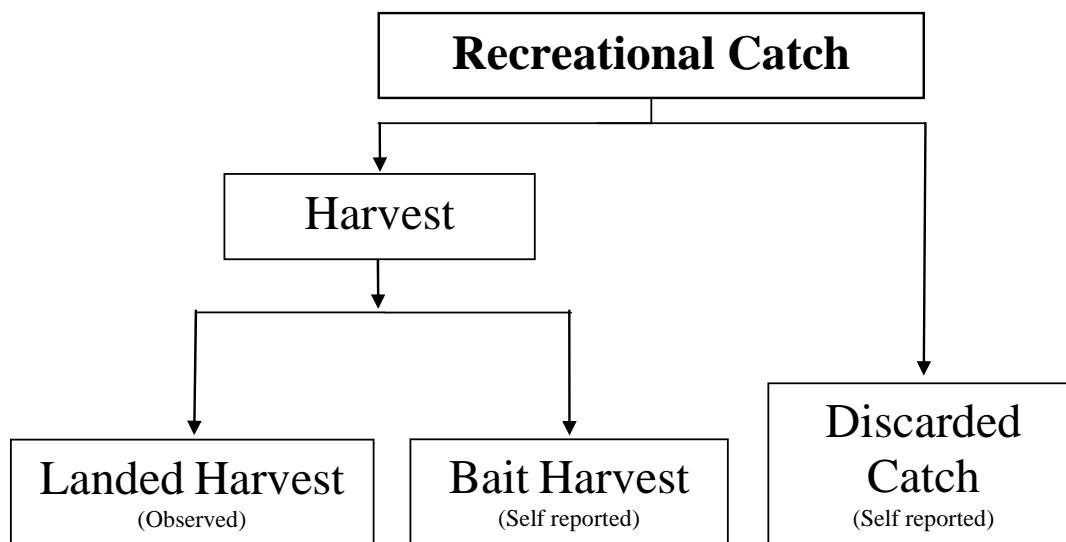


Figure 2. Flow diagram of the terminology used throughout this report to define the different types of catch and their relationship to each other. These include: landed harvest; bait harvest and discarded catch.

3.3. Survey design

A boat-based roving (effort) – roving (harvest) survey design was used to assess both the shore-based and boat-based recreational fisheries in the Sydney Harbour estuary. Two simultaneous but independent surveys were done during the summer period of 2007/08. The first survey covered the area west of the Sydney Harbour Bridge including the Parramatta and Lane Cove Rivers (Fig. 1). The second survey covered the area east of the Sydney Harbour Bridge, including North and Middle Harbours (Fig. 1). Detailed information about roving survey designs can be found in Pollock *et al.* (1994). A roving design was used due to the diffuse nature of angler access to the Sydney Harbour estuary. Stratified random sampling methods were used with day being the primary sampling unit for all strata. By definition, a survey day started at sunrise and ended at sunset.

3.3.1. Spatial and temporal frames and stratification

The spatial sampling frame (geographical boundary) and stratification of the Sydney Harbour estuary into two distinct zones (east and west) are presented in Figure 1. Stratification into these two zones was done to reflect spatial differences in fish habitats, current recreational fishing practices and recent government guidelines for recommended levels of fish consumption due to dioxin contamination. The temporal sampling frame of this survey spanned one summer period between December 2007 and February 2008. This period was stratified into weekday and weekend day-types. Public holidays were classified as weekend days.

3.4. Data collection methods

Two independent datasets were collected in each zone and used to estimate recreational fishing effort, landed harvest rates, bait harvest rates and discarded catch rates. These datasets consisted of: (i) progressive counts of recreational fishing effort; and (ii) interviews with recreational fishing parties. These two datasets were then used to obtain estimates of boat-based and shore-based recreational harvests and discarded catches.

3.4.1. Progressive counts of recreational fishing effort

Estimates of recreational fishing effort for the boat-based and shore-based fisheries were made with progressive counts on randomly selected survey days. Progressive counts were made separately of all boats and all shore-based persons that were observed to be involved in some type of recreational fishing activity. These recreational fishing activities included all forms of angling and the setting, checking and retrieval of crab nets, but excluded activities such as spearfishing, and bait collecting without using lines (e.g., digging worms, pumping nippers, netting prawns and using fish traps). We specifically excluded boats travelling across the estuary and persons moving along the shore from the counts (even when recreational fishing gear was visible) when it was not possible to determine their destination or their immediate intent to engage in any recreational fishing activity.

The time needed to complete separate circuits of the eastern and western estuary zones by boat was determined during a pilot study. These data were used to schedule the starting times for the progressive counts east and west of the Sydney Harbour Bridge by picking one of a set of discrete possible starting times as recommended by Hoenig *et al.* (1993). The starting location and direction of travel were randomly selected for each scheduled progressive count. This progressive count method will, under general conditions, provide unbiased estimates of fishing effort during the day (Hoenig *et al.* 1993). The collection of recreational effort data by means of these progressive counts was, in a statistical sense, independent of the collection of interview data. The number of replicate progressive counts done for each zone, and for each day-type stratum is summarised in

Table 1. The level of replication achieved during the three-month survey period represents a sampling fraction of 8.2% and 16.7% for the weekday and weekend day-type strata respectively (Table 1).

3.4.2. *Interviews with recreational fishing parties*

Separate circuits of each estuarine zone were done on randomly scheduled interview days. Starting times and directions of travel were randomly assigned for each survey day in each zone. Interviews with recreational shore-based and boat-based fishing parties were done in all areas that were safely accessible by boat. It was assumed that the fishing activities of accessible recreational fishers were representative of all recreational fishing parties fishing in the Sydney Harbour estuary.

Fishing parties were approached and asked to participate in the survey by providing information about their fishing trip and their catch. Attempts were made to interview all recreational fishing parties encountered (shore-based and boat-based), however, during periods of high recreational activity it was necessary to systematically sub-sample every second or third fishing party (depending on the number of fishing parties available for interview). The number of days spent interviewing recreational fishing parties and the number of interviews obtained are summarised for each day-type and estuary zone (Table 1). Refusals to provide information, or to show the fish retained, were also recorded (Table 1).

All co-operative fishing parties were asked about their targeting preferences during their current fishing trip, the time they started fishing and their intended time to stop fishing. The number of fishers of each gender in the fishing party (non-fishers were not included as part of a fishing party) and the home postcode of each fisher were also recorded.

An attitudinal question was also asked of the fisher being interviewed in the fishing party. The fisher was requested to provide a rating of the overall quality of the Sydney Harbour fishery in terms of the variety of fishes available, the number usually caught and their average sizes. An eleven-point Likert scale as recommended by Matlock *et al.* (1991) was used to measure these fishery ratings.

The retained catches were identified by survey personnel and, whenever possible, measurements of all fish (fork length), crabs (carapace length) and squid (mantle length) were taken to the nearest whole centimetre. When fishers were in a hurry to leave or it was not possible to measure all fish, crabs or squid, the survey personnel were instructed to record counts of the identified harvest and attempt to measure a sub-sample of the harvest. Discarded catch and any fish, crab or squid reported to have been caught and used as bait during that trip were also recorded. Machine-readable interview forms were used to record the information from interviews.

Table 1. Number of days sampled for effort and catch rates, number of interviews, number of refusals and refusal rates for the boat-based and shore-based recreational fisheries in the Sydney Harbour estuary during summer 2007/08. Data are presented for all temporal and spatial strata.

Estuary Zone	Day-Type	Days in Stratum	Effort Counts	Interview Days	BOAT FISHERY			SHORE FISHERY			WHOLE FISHERY		
					No. of Interviews	No. of Refusals	Refusal Rate (%)	No. of Interviews	No. of Refusals	Refusal Rate (%)	No. of Interviews	No. of Refusals	Refusal Rate (%)
East	Weekend	30	5	5	60	2	3.3	58	0	0	118	2	1.7
	Weekday	61	5	5	26	1	3.8	72	11	15.3	98	12	12.2
	Total	91	10	10	86	3	3.5	130	11	8.5	216	14	6.5
West	Weekend	30	5	5	16	0	0	83	0	0	99	0	0
	Weekday	61	5	5	12	0	0	77	6	7.8	89	6	6.7
	Total	91	10	10	28	0	0	160	6	3.8	188	6	3.2
Whole Estuary	Weekend	30	5	5	76	2	2.6	141	0	0	217	0	0
	Weekday	61	5	5	38	1	2.6	149	17	11.4	187	18	9.6
	Total	91	10	10	114	3	2.6	290	17	5.9	404	20	5.0

3.5. Estimation methods

The following sections provide brief explanations of the estimation methods used to calculate: (a) fishing effort; (b) landed harvest rates, bait harvest rates and discarded catch rates for the boat-based and shore-based fisheries; (c) estimates of landed harvest, bait harvest and discarded catch; and (d) the variances associated with these estimated totals. Equations used are provided by Steffe and Chapman (2003). Detailed explanations of the statistical procedures used can be found in Cochran (1977), Robson (1961, 1991), Malvestuto (1983), Hoenig *et al.* (1993; 1997) and Pollock *et al.* (1994; 1997).

3.5.1. Estimation of effort

Estimation of recreational effort was done separately for the boat-based fishery (units of boat hours) and the shore-based fishery (units of fisher hours). The base level of effort estimation was a day-type stratum for each of the two zones (Fig. 1). The progressive counts of recreational fishing boats and shore-based fishers were expanded separately to estimate the daily effort for each fishing day that was sampled. These daily effort replicates for each zone were expanded to estimate day-type stratum totals. Boat-based data were then converted into units of fisher hours for each base level strata. Seasonal estimates from the total fishery (boat-based and shore-based) were obtained by adding the estimates from the base level strata together. Whenever strata were combined, their variances were additive.

3.5.2. Estimation of landed harvest rate

The harvest rate data collected during this survey were based on incomplete trips, which documented only part of the total effort and harvest for these fishing trips (Robson 1961, 1991; Pollock *et al.* 1994). The use of roving survey methods introduced a sampling bias because the probability of interviewing a group is proportional to the duration of their fishing trip. That is, parties that fish for longer time periods are more likely to be encountered by field staff moving through the fishery: this is termed the 'length-of-stay' bias (Robson 1991; Pollock *et al.* 1994; Hoenig *et al.* 1997; Pollock *et al.* 1997). This means that harvest rates derived from roving survey methods tend to be based on samples that contain an over-representative number of longer trips and an under-representative number of short trips. Roving survey methods require the following assumptions be made: (a) the harvest rate for the portion of a fishing trip documented is the same as the harvest rate for the entire trip; and (b) the harvest rate of interviewed fishing parties is representative of the whole fishing population, which is the expected outcome for estimates derived from randomly selected samples (Malvestuto 1983; Phippen & Bergersen 1991; Pollock *et al.* 1994; Hoenig *et al.* 1997).

When the objective is to estimate total harvest, and the interviews are based on incomplete trips, the correct harvest rate estimator to use is the 'mean of ratios' (Pollock *et al.* 1994; Jones *et al.* 1995; Hoenig *et al.* 1997; Pollock *et al.* 1997). This estimator is essentially the mean of the individual rates for all fishing parties interviewed on a given day and was used to estimate the harvest for the boat-based and shore-based fisheries.

Hoenig *et al.* (1997) used simulation procedures to show that the 'mean of ratios' estimator has a large variance caused by the inclusion of high harvest rates resulting from very short, incomplete trips that have harvested some fish already. These authors found that the truncation (exclusion) of all short incomplete trips reduced the variance greatly without inducing an appreciable bias. Hoenig *et al.* (1997) recommended the truncation of short trips less than 20 – 30 minutes but noted that there was a trade-off between the level of truncation used and the number of interviews that were discarded.

The relationship between harvest rate and fishing trip duration was examined for the shore-based and boat-based fishing party interviews separately. Discarding all incomplete trips that had been in progress for less than or equal to 30 fisher minutes (shore-based fishery) and less than or equal to 35 fisher minutes (boat-based fishery) removed the interviews with the most extreme harvest rates. These truncation criteria resulted in the removal of 65 (22.4%) shore-based interviews and 12 (10.5%) boat-based interviews. All fishing parties were routinely asked about their intended finishing time for their current trip. We retained and used fishing party interviews that had completed their trips regardless of the time spent fishing. It is logical to keep and use the data from all completed trips, particularly short trips, because it is these short trips that are under-represented in roving surveys due to “length-of-stay” bias.

3.5.3. Estimation of landed harvest

Shore-based and boat-based harvests (numbers) were calculated separately as the product of effort and a truncated mean daily harvest rate. Harvest estimation for both the boat-based and shore-based fisheries was done separately for each day-type stratum over the survey period. Harvest estimates from the total fishery were calculated by adding the boat-based and shore-based harvests together. Whenever strata were combined their variances were additive.

We did not attempt to make expanded estimates of harvest for any taxa that were considered to have been “rare” throughout the survey period. “Rare” taxa were determined for the boat-based and shore-based fisheries separately. “Rare” taxa are defined as any that had been recorded from only one interview during the survey period, regardless of the number of individuals harvested in those trips. All taxa that did not meet the criterion for rarity were classified as common taxa and expanded estimates of harvest were made for these taxa.

Harvest estimation (kilograms) was also calculated as the product of effort and a truncated mean daily harvest rate for each day-type stratum over the survey period. The observed numbers of fish, crabs and cephalopods were converted into weights prior to the calculation of harvest. Length measurements taken during interviews were converted using length to weight keys (Steffe *et al.* 1996; Stewart *et al.* 1998; Steffe & Chapman 2003; Kulbicki *et al.* 2005). The remaining unmeasured component of the harvest (i.e., those fish seen during interviews but only counted) were assigned the median weight for that taxon as calculated from the pooled interview data over the survey period. The estimated weights were then used to calculate mean daily harvest rates for use in the estimation of landed harvest.

3.5.4. Estimation of bait harvest and discarded catch

All species that were reported as bait harvest or discarded catch during the trip were combined into broader taxonomic groups to account for the varying skill levels for fish identification among fishers. A list of these groups and the taxa included in each can be found in Appendix 1.

The methods used to estimate bait harvest and discarded catch by number follow those described for the estimation of landed harvest rates and landed harvest. Bait harvest estimates in units of kilograms were calculated for all taxonomic groups that met the criterion for landed harvest estimation. Mean weights and variances for each of these groups were calculated from the landed harvest data at the scale of the whole fishery. Bait harvest estimates for each group were then calculated as the product of these mean weights and the bait harvest numbers for the whole fishery. Variances were calculated using the equation for estimating the variance of a product. Bait harvest estimates in units of kilograms and their associated variances for each stratum were then derived using proportional allocation based on the ratios of the bait harvest numbers in each stratum.

Discarded catch estimates in units of kilograms were not calculated as there are no size data for discards to allow length to weight conversions to be made. It cannot be assumed that the size structure of discards is similar to that of the landed harvest. For example, the majority of discarded individuals of edible species are released because of their small size. This is true for all species including those that have regulated minimum sizes. In contrast, the size structures of species that are commonly targeted and harvested for bait are expected to be similar to that of the landed harvest component of the catch.

3.6. Indicators of recreational fishing quality and their estimation

An assessment of a recreational fishery can be improved if reliable indicators of recreational fishing quality are available. The indicators of recreational fishing quality that are provided in this report include: (1) seasonal landed harvest rates; discarded catch rates; and bait harvest rates for the six most abundant species in the landed harvest (number and weight) and their associated broad taxonomic groups; (2) length frequency distributions for the same six species; and (3) angler ratings of the quality of the fishery.

3.6.1. *Seasonal landed harvest rates, bait harvest rates and discarded catch rates*

The seasonal landed harvest, bait harvest and discarded catch rates for the boat-based and shore-based fisheries in each of the zones of the Sydney Harbour estuary are based on calculations made using total fishing effort i.e., non-directed effort, which is the combined fishing effort regardless of targeting practices (Steffe & Chapman 2003). The calculation of these rates was done by combining the mean daily rates obtained for each day-type stratum. All seasonal rates are presented in units of number of fish per fisher hour. Seasonal landed harvest rates are presented alongside seasonal bait harvest and discarded catch rates for their corresponding broad taxonomic groups (see Appendix 1). Seasonal harvest and discarded catch rates are weighted by the relative size of each day type stratum. The equations used to calculate these rates and their associated measures of precision are provided in Pollock *et al.*(1994) and Steffe and Chapman (2003).

3.6.2. *Length frequency distributions*

Length data were pooled across all spatial and temporal strata and presented as length frequency distributions for the six species of highest landed harvest (number and weight) during the survey period. Sample sizes and other descriptive statistics are provided for all species recorded in the landed harvest of the Sydney Harbour estuary (Appendix 2).

3.6.3. *Angler ratings of the quality of the fishery*

All attitudinal interview data have been summarised into three categories. These categories represent that portion of fishers who believed: a) the fishery to be poor (Likert scale 0 – 4); b) had no opinion of the status of the fishery (Likert scale 5); or c) believed the fishery to be good (Likert scale 6 – 10). Some fishers could not comprehend or respond to the attitudinal question because of language problems. Thus, the sample size of responses to the attitudinal question is lower than that obtained for harvest estimation.

4. RESULTS

4.1. Recreational fishing effort

It was estimated that about 300 100 fisher hours of daytime recreational fishing effort (boat and shore fisheries combined) were expended in the Sydney Harbour estuary during the 2007/08 summer period (Table 2). In the eastern and western estuary zones of the Sydney Harbour estuary, it was estimated that about 173 500 (57.8%) and 126 600 (42.2%) fisher hours were expended, respectively (Table 2).

In the eastern estuary zone there were similar amounts of boat-based and shore-based effort expended with about 85 000 (49.0%) and 88 500 (51.0%) fisher hours, respectively (Table 2). In contrast, in the western estuary zone there was far greater shore-based effort than boat-based effort with about 98 500 (77.8%) and 28 000 (22.2%) fisher hours expended, respectively (Table 2).

Table 2. Estimates of daytime recreational fishing effort (fisher hours) for the boat-based and shore-based recreational fisheries of the Sydney Harbour estuary during summer 2007/08. Data are presented for all temporal and spatial strata.

		EFFORT FOR WHOLE ESTUARY					
Estuary Zone	Day-Type	BOAT FISHERY		SHORE FISHERY		WHOLE FISHERY	
		Total Effort (fisher h)	SE	Total Effort (fisher h)	SE	Total Effort (fisher h)	SE
East	Weekday	32 771 ±	9095	37 136 ±	10125	69 907 ±	13 610
	Weekend	52 164 ±	6119	51 393 ±	6967	103 557 ±	9 273
	Total	84 935 ±	10962	88 529 ±	12291	173 464 ±	16 469
West	Weekday	15 344 ±	4406	55 402 ±	11600	70 746 ±	12 409
	Weekend	12 763 ±	3164	43 109 ±	6076	55 872 ±	6 851
	Total	28 107 ±	5424	98 511 ±	13095	126 618 ±	14 174
Total	Weekday	48 115 ±	10106	92 538 ±	15398	140 653 ±	18 418
	Weekend	64 927 ±	6889	94 502 ±	9245	159 429 ±	11 529
	Total	113 042 ±	12230	187 040 ±	17960	300 082 ±	21 729

4.2. Spatial demography of the fishing population

The postcodes of fishers interviewed during the survey are presented by each of the following home residence categories: Sydney-near; Sydney-far; NSW/ACT (excluding Sydney); Interstate; and International. A list of the postcodes included in each of the home residence categories is presented in Appendix 3.

The great majority of fishers (96.4%) were local, residing in either the Sydney-near or Sydney-far home residence categories (Table 3). This pattern was true for the two zones with 95.7% of fishers accessing the eastern estuary zone and 97.0% of fishers accessing the western estuary zone of a local Sydney origin (Table 3). This trend was also true for both the shore-based and boat-based fishers with 97.0% and 94.6% of fishers residing in the Sydney area, respectively (Table 3).

Table 3. Numbers and percentages of interviewed fishers by home residence category and estuary zone for the boat-based and shore-based recreational fisheries of the Sydney Harbour estuary during summer 2007/08.

Estuary Zone	Home Residence Category	HOME RESIDENCE					
		BOAT FISHERY		SHORE FISHERY		WHOLE FISHERY	
		Number of fishers	% Total	Number of fishers	% Total	Number of fishers	% Total
East	Sydney-Near	173	87.8	222	92.9	395	90.6
	Sydney-Far	14	7.1	8	3.4	22	5.0
	NSW/ACT (excl. Sydney)	8	4.1	5	2.1	13	3.0
	Interstate	1	0.5	2	0.8	3	0.7
	International	1	0.5	2	0.8	3	0.7
	Total	197	100	239	100	436	100
West	Sydney-Near	52	85.2	285	95.6	337	93.8
	Sydney-Far	5	8.2	6	2.0	11	3.1
	NSW/ACT (excl. Sydney)	2	3.3	5	1.7	7	1.9
	Interstate	0	0.0	2	0.7	2	0.6
	International	2	3.3	0	0.0	2	0.6
	Total	61	100	298	100	359	100
Total	Sydney-Near	225	87.1	507	94.4	732	92.2
	Sydney-Far	19	7.4	14	2.6	33	4.2
	NSW/ACT (excl. Sydney)	10	3.9	10	1.9	20	2.5
	Interstate	1	0.4	4	0.7	5	0.6
	International	3	1.2	2	0.4	4	0.5
	Total	258	100	537	100	795	100

4.3. Targeting preferences

The main targeting preferences nominated by boat-based and shore-based fishing parties over the survey period were grouped into 17 target categories (Table 4). Generalist fishing parties (i.e., those that did not have any specific target preference and nominated “anything” as their main target category) were ranked highest (39.9%) across the whole fishery (Table 4). Bream, kingfish and flathead were other popular main target categories nominated by fishing parties of the Sydney Harbour estuary. Fishing parties that had nominated any of these four main target categories made up over 85% of the fishing population of the Sydney Harbour estuary (Table 4).

The main target categories within the eastern estuary zone were the generalist fishing category (35.9%), kingfish (30.4%) and bream (11.8%). This targeting behaviour was consistent across the shore-based and boat-based fisheries within this zone (Table 4). In contrast, it was found that the generalist fishing category (44.3%), bream (29.5%) and flathead (6%) were the main target categories within the western estuary zone. This targeting behaviour was also consistent across the shore-based and boat-based fisheries within this zone (Table 4).

4.4. Landed harvest

This section describes the landed harvest component of the catch of recreational fishers of the Sydney Harbour estuary during the 2007/08 summer survey period. Descriptions are provided for the whole fishery and comparisons are made of the landed harvest between estuary zones and boat-based and shore-based fisheries.

4.4.1. Whole fishery

There were 33 taxa recorded in the landed harvest of daytime recreational fishers during the summer 2007/08 survey period (Table 5). This landed harvest was estimated to be about 182 300 fish, crabs and cephalopods (Table 5).

Finfish dominated the landed harvest accounting for 97.8% of the total estimated landed harvest (about 178 300 finfish; Table 5) of daytime recreational fishers during the summer 2007/08 survey period. The ten most commonly harvested taxa in number were yellowtail scad (36.0%), yellowfin bream (15.3%), snapper (7.9%), tailor (6.9%), dusky flathead (6.6%), kingfish (5.7%), trumpeter whiting (4.8%), slimy mackerel (2.4%), sand whiting (1.9%) and yellow-finned leatherjacket (1.6%; Table 5). These ten most common taxa accounted for 89.1% of the estimated landed harvest in number.

Landed harvest in weight was estimated to be about 69.7 tonnes of fish, crabs and cephalopods with the ten most commonly harvested taxa including: kingfish (38.8%); yellowfin bream (19.5%); dusky flathead (10.5%); yellowtail scad (7.6%); snapper (4.6%); tailor (3.5%); mulloway (3.4%); luderick (2.6%); fan-bellied leatherjacket (1.5%); and, sand whiting (1.3%; Table 6). These ten most common taxa accounted for 93.3% of the estimated landed harvest in weight of daytime recreational fishers during the summer 2007/08 survey period.

4.4.2. Estuary zones

There were about 84 600 and 97 700 fish, crabs and cephalopods estimated in the landed harvest of the eastern and western estuary zones, respectively (Table 5). These numbers equated to about 44.4 tonnes of fish, crabs and cephalopods in the eastern estuary zone and about 25.3 tonnes of fish, crabs and cephalopods in the western estuary zone (Table 6).

A greater number of taxa were recorded in the landed harvest in the eastern estuary zone compared to the western estuary zone (30 and 23 taxa respectively). The five most common taxa in number in the landed harvest of the eastern estuary zone were yellowtail scad (35.3%), snapper (12.6%), kingfish (11.5%), yellowfin bream (11.2%) and dusky flathead (5.2%; Table 5). In the western estuary zone the five most common taxa by number in the landed harvest were yellowtail scad (36.6%), yellowfin bream (18.9%), tailor (9.1%), trumpeter whiting (8.9%) and dusky flathead (7.8%). These five most common taxa accounted for 75.8% and 81.3% of the total estimated landed harvest in number in the eastern and western estuary zones, respectively (Table 5).

The five most common taxa by weight in the landed harvest of the eastern estuary zone were kingfish (57.6%), yellowfin bream (9.0%), dusky flathead (7.7%), snapper (5.5%) and yellowtail scad (4.6%) (Table 6). In the western estuary zone the five most common taxa by weight were yellowfin bream (38.1%), dusky flathead (15.4%), yellowtail scad (12.9%), mulloway (8.6%) and kingfish (5.8%). These five most common taxa accounted for 84.4% and 80.8% of the total estimated landed harvest by weight in the eastern and western estuary zones, respectively (Table 6).

4.4.3. Boat-based and shore-based fisheries

There were about 39 100 and 143 200 fish, crabs and cephalopods estimated in the landed harvest of boat-based and shore-based fishers, respectively (Tables 7 & 8). These numbers equated to about 29.1 tonnes of fish, crabs and cephalopods by boat-based fishers and about 40.6 tonnes of fish, crabs and cephalopods by shore-based fishers (Tables 9 & 10).

A smaller number of taxa were recorded in the landed harvest by boat-based fishers compared to shore-based fishers with 22 and 30 taxa, respectively. The five most common taxa by number in the landed harvest of boat-based fishers were yellowtail scad (19.3%), kingfish (18.3%), yellowfin bream (15.9%), dusky flathead (11.8%) and tailor (6.9%) (Table 7). The five most common taxa by number in the landed harvest of shore-based fishers were yellowtail scad (40.4%), yellowfin bream (15.2%), snapper (8.9%), tailor (6.9%) and dusky flathead (5.2%; Table 8). These five most common taxa accounted for 72.1% and 77.6% of the total estimated landed harvest in number of the boat-based and shore-based fisheries, respectively (Tables 7 & 8).

The five most common taxa by weight in the landed harvest of boat-based fishers were kingfish (55.7%), dusky flathead (12.2%), yellowfin bream (9.4%), mulloway (7.4%) and tailor (5.9%) (Table 9). The landed harvest of shore-based fishers was dominated by yellowfin bream (26.8%), kingfish (26.7%), yellowtail scad (11.5%), dusky flathead (9.2%) and snapper (6.7%; Table 10). These five taxa accounted for 90.6% and 80.9% of the total estimated landed harvest in weight of the boat-based and shore-based fisheries, respectively (Table 6).

4.5. Bait harvest

4.5.1. Whole fishery

Recreational bait harvest during the 2007/08 summer survey period included eight broad bait harvest groups and accounted for about 18.9% of the total recreational harvest by number and about 5.2% of the total recreational harvest by weight (landed harvest and bait harvest combined). There was an estimated bait harvest of about 42 500 fish and cephalopods, which represents 4.6 tonnes taken by daytime recreational fishers from the Sydney Harbour estuary during the survey period (Table 11).

4.5.2. Estuary zones

There was an estimated bait harvest of about 32 200 individuals in the eastern estuary zone and about 10 300 individuals in the western estuary zone (Table 11). Bait harvest by number in the eastern estuary zone was dominated by scads (60.2%), squids and cuttlefishes (23.3%) and slimy mackerel (14.6%) whilst bait harvest in the western estuary zone was dominated by tailor (38.6%), scads (32.8%) and slimy mackerel (24.4%) (Table 11).

These bait harvest numbers represent about 3.3 tonnes of fish and cephalopods taken by fishers of the eastern estuary zone and about 1.4 tonnes of fish and cephalopods taken by fishers of the western estuary zone (Table 12). A greater proportion of the total bait harvest was taken by fishers from the eastern estuary zone in both numbers (75.8% eastern versus 24.2% western) and weight (70.4% eastern versus 29.6% western; Table 12).

4.5.3. Boat-based and shore-based fisheries

Bait harvest estimates for the daytime recreational boat-based and shore-based fisheries were about 19 500 and 23 000 individual fish and cephalopods, respectively (Table 11). The principal bait harvest group by number for both boat-based and shore-based recreational fisheries were scads (50.2% and 56.3% respectively). The other two main bait harvest groups by number for the boat-based fishery were squids and cuttlefish (38.5%) and slimy mackerel (11.3%). In contrast, the other two main bait harvest groups in numbers for the shore-based fishery were slimy mackerel (21.7%) and tailor (20.0%) (Table 11).

These bait harvest numbers represent about 2.1 tonnes of fish and cephalopods taken by fishers of the boat-based fishery and about 2.6 tonnes of fish and cephalopods taken by fishers of the shore-based fishery (Table 12). The main bait harvest groups for the boat-based fishery by weight were squids and cuttlefish (47.3%), scads (38.2%) and slimy mackerel (14.5%). In contrast, the main bait harvest groups for the shore-based fishery by weight were scads (41.9%), tailor (28.4%) and slimy mackerel (26.3%; Table 12).

4.6. Discarded catch

4.6.1. Whole fishery

Estimated discarded catch during the 2007/08 summer survey period included 30 discarded catch groups and accounted for about 56.6% of the total recreational catch by number. Discarded catch estimated for the whole fishery was about 292 800 individuals (Table 13). The ten most common discarded catch groups included snapper (43.2%), breams (17.1%), scads (9.1%), sweep (6.9%), flatheads (3.8%), tailor (3.8%), leatherjackets (3.2%), kingfishes (2.4%), mados (2.4%) and whittings (2.2%). These ten most common discarded catch groups accounted for about 94.1% of the fish, crabs and cephalopods in the discarded catch.

4.6.2. Estuary zones

Discarded catch estimated for the Sydney Harbour estuary during the 2007/08 summer survey period included 26 and 20 discard catch groups for the eastern and western estuary zones, respectively. There was an estimated discarded catch of about 168 600 individuals for the eastern estuary zone and about 124 200 individuals for the western estuary zone (Table 13).

The ten most common discarded catch groups of the eastern estuary zone were snapper (44.2%), breams (13.0%), sweep (11.5%), flatheads (5.4%), leatherjackets (4.8%), mados (4.2%), kingfishes (4.2%), scads (4.2%), sharks and rays (1.8%) and wrasses (1.5%). These ten most common discarded catch groups accounted for about 94.8% of the total discarded catch within this zone (Table 13).

The ten most common discarded catch groups of the western estuary zone were snapper (41.8%), breams (22.6%), scads (15.7%), tailor (6.9%), whittings (4.2%), toadfishes (3.5%), flatheads (1.8%), silver batfish (1.1%), leatherjackets (1.1%) and sweep (0.5%). These ten most common discarded catch groups accounted for about 99.1% of the total discarded catch in this estuary zone (Table 13).

4.6.3. Boat-based and shore-based fisheries

Discarded catch estimates were about 99 900 individuals and 192 900 individuals for the boat-based and shore-based fisheries, respectively (Tables 14 & 15). There were 23 broad discard groups recorded in the discarded catch in both the boat-based and shore-based recreational fisheries, however the list of broad discard groups of each fishery were comprised differently (Tables 14 & 15). Snapper dominated the discarded catch estimates for both the boat-based and shore-based recreational fisheries of the Sydney Harbour estuary accounting for about 60.1% and about 34.4% of the discarded catch of each fishery, respectively. Bream had the second highest discarded catch estimates for both the boat-based and shore-based recreational fisheries accounting for about 13.1% and about 19.2% of the discarded catch of each fishery, respectively (Tables 14 & 15).

4.7. Seasonal catch rates for landed harvest, bait harvest and discarded catch

Seasonal catch rates for landed harvest, bait harvest and discarded catch are presented in Figures 3 and 4 for the six species having the greatest landed harvest by weight (Table 8). Seasonal catch rates for landed harvest, bait harvest and discarded catch for all taxa are presented in Appendices 4, 5 and 6, respectively. Catch rates were found to be highly variable and there were differences in these rates between species. For example, snapper were mostly discarded indicated by high discard rates and low landed harvest and bait harvest rates across all strata (Fig. 4b). In contrast, the landed harvest, bait harvest and discard rates of scads were high across all strata indicating this species was important in all catch categories (Fig. 4a).

Table 4. Main target categories nominated by shore-based and boat-based fishing parties in the eastern and western zones of the Sydney Harbour estuary during summer 2007/08. These main target data are pooled across all spatial and temporal strata.

Main Target Category	TARGETING PREFERENCES													
	BOAT FISHERY				SHORE FISHERY				WHOLE FISHERY					
	EAST		WEST		EAST		WEST		EAST		WEST		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Anything	26	31.3	9	32.1	47	39.3	72	46.6	73	35.9	81	44.3	154	39.8
Breams	10	12.0	11	39.2	14	11.7	43	27.7	24	11.8	54	29.5	78	20.2
Kingfishes	34	41.1	1	3.6	28	23.3	7	4.5	62	30.4	8	4.4	70	18.1
Flatheads	7	8.4	3	10.7	9	7.5	8	5.2	16	7.9	11	6.0	27	7.0
Mulloway	2	2.4	1	3.6	1	0.8	7	4.5	3	1.5	8	4.4	11	2.8
Luderick	1	1.2	1	3.6	4	3.3	3	1.9	5	2.5	4	2.2	9	2.3
Leatherjackets	-	-	-	-	4	3.3	4	2.6	4	2.0	4	2.2	8	2.1
Scads	-	-	-	-	1	0.8	7	4.5	1	0.5	7	3.8	8	2.1
Whittings	-	-	1	3.6	3	2.5	1	0.6	3	1.5	2	1.1	5	1.3
Tailor	1	1.2	-	-	-	-	3	1.9	1	0.5	3	1.6	4	1.0
Squids and cuttlefishes	1	1.2	-	-	2	1.7	-	-	3	1.5	-	-	3	0.8
Trevallies	-	-	-	-	3	2.5	-	-	3	1.5	-	-	3	0.8
Black Trevally (Spinefoot)	-	-	-	-	2	1.7	-	-	2	1.0	-	-	2	0.5
Crabs	-	-	1	3.6	-	-	-	-	-	-	1	0.5	1	0.3
Australian salmon	-	-	-	-	1	0.8	-	-	1	0.5	-	-	1	0.3
Slimy mackerel	-	-	-	-	1	0.8	-	-	1	0.5	-	-	1	0.3
Snapper	1	1.2	-	-	-	-	-	-	1	0.5	-	-	1	0.3
Total	83	100	28	100	120	100	155	100	203	100	183	100	386	100

Table 5. Daytime harvest estimates (number of individuals) with standard errors (SE) for taxa taken by recreational fishers in the eastern and western zones of the Sydney Harbour estuary during summer 2007/08. These harvest data are pooled across all spatial and temporal strata.

COMMON NAME	HARVEST (NUMBER) FOR WHOLE ESTUARY								
	EASTERN ZONE			WESTERN ZONE			WHOLE ESTUARY		
	Total Harvest (number)	SE	% Total	Total Harvest (number)	SE	% Total	Total Harvest (number)	SE	% Total
Yellowtail scad	29 820 ± 13 725		35.3	35 762 ± 16 785		36.6	65 582 ± 21 682		36.0
Yellowfin bream	9 488 ± 3 997		11.2	18 452 ± 6 343		18.9	27 940 ± 7 497		15.3
Snapper	10 621 ± 5 550		12.6	3 772 ± 1 822		3.9	14 393 ± 5 842		7.9
Tailor	3 635 ± 2 041		4.3	8 932 ± 4 053		9.1	12 567 ± 4 538		6.9
Dusky flathead	4 388 ± 1 967		5.2	7 624 ± 3 838		7.8	12 012 ± 4 312		6.6
Kingfish	9 750 ± 6 521		11.5	669 ± 435		0.7	10 419 ± 6 536		5.7
Trumpeter whiting	-	-	-	8 718 ± 8 254		8.9	8 718 ± 8 254		4.8
Slimy mackerel	2 307 ± 1 403		2.7	1 992 ± 1 219		2.0	4 299 ± 1 859		2.4
Sand whiting	2 638 ± 1 617		3.1	803 ± 590		0.8	3 441 ± 1 721		1.9
Yellow-finned leatherjacket	1 853 ± 733		2.2	1 026 ± 1 026		1.0	2 879 ± 1 261		1.6
Fan-bellied leatherjacket	655 ± 392		0.8	2 070 ± 1 418		2.1	2 725 ± 1 471		1.5
Luderick	2 079 ± 1 651		2.5	251 ± 246		0.3	2 330 ± 1 669		1.3
Common squid	2 003 ± 940		2.4	36 ± 36		<0.1	2 039 ± 941		1.1
Large-toothed flounder	828 ± 740		1.0	1 137 ± 1 031		1.2	1 965 ± 1 269		1.1
Southern calamari	1 972 ± 1 245		2.3	-	-	-	1 972 ± 1 245		1.1
Small-toothed flounder	150 ± 150		0.2	1 443 ± 1 061		1.5	1 593 ± 1 072		0.9
Southern herring	-	-	-	1 504 ± 1 101		1.5	1 504 ± 1 101		0.8
Black trevally (Spinefoot)	1 365 ± 1104		1.6	-	-	-	1 365 ± 1 104		0.7

Table 5 - Continued.

COMMON NAME	HARVEST (NUMBER) FOR WHOLE ESTUARY								
	EASTERN ZONE			WESTERN ZONE			WHOLE ESTUARY		
	Total Harvest (number)	SE	% Total	Total Harvest (number)	SE	% Total	Total Harvest (number)	SE	% Total
Mulloway	77 ±	77	0.1	1 287 ±	1 120	1.3	1 364 ±	1 122	0.7
Six-spined leatherjacket	294 ±	293	0.3	889 ±	690	0.9	1 183 ±	749	0.6
Silver batfish	#1	-	<0.1	1 043 ±	613	1.1	1 044 ±	613	0.6
Silver trevally	378 ±	235	0.4	157 ±	156	0.2	535 ±	282	0.3
Conger eel	274 ±	274	0.3	172 ±	172	0.2	446 ±	323	0.2
Chinaman leatherjacket	#2	-	<0.1	-	-	-	#2	-	<0.1
Silver biddy	#1	-	<0.1	-	-	-	#1	-	<0.1
Australian salmon	#1	-	<0.1	-	-	-	#1	-	<0.1
Samson fish	#1	-	<0.1	-	-	-	#1	-	<0.1
Blue swimmer crab	#1	-	<0.1	#7	-	<0.1	#8	-	<0.1
Six-lined trumpeter	-	-	-	#1	-	<0.1	#1	-	<0.1
Gunthers wrasse	#1	-	<0.1	-	-	-	#1	-	<0.1
Marbled flathead	#1	-	<0.1	-	-	-	#1	-	<0.1
Crimson-banded wrasse	#1	-	<0.1	-	-	-	#1	-	<0.1
Tarwhine	#1	-	<0.1	-	-	-	#1	-	<0.1
Total	84 586 ±	17 267	100	97 747 ±	19 162	100	182 333 ±	25 794	100

Key:

Expanded estimates of harvest have not been calculated. This observation was classified as a rare event and its occurrence is simply noted.

- Not recorded or not calculated for rare event occurrences.

Table 6. Daytime harvest estimates (kilograms) with standard errors (SE) for taxa taken by recreational fishers in the eastern and western zones of the Sydney Harbour estuary during summer 2007/08. These harvest data are pooled across all temporal strata.

COMMON NAME	HARVEST (kg) FOR WHOLE ESTUARY								
	EASTERN ZONE			WESTERN ZONE			WHOLE ESTUARY		
	Total harvest (kg)	SE	% Total	Total harvest (kg)	SE	% Total	Total harvest (kg)	SE	% Total
Kingfish	25 549 ± 16 541		57.6	1 464 ± 945		5.8	27 013 ± 16 568		38.8
Yellowfin bream	3 985 ± 1 709		9.0	9 627 ± 3 773		38.1	13 612 ± 949		19.5
Dusky flathead	3 394 ± 1 722		7.7	3 898 ± 2 012		15.4	7 292 ± 2 648		10.5
Yellowtail scad	2 024 ± 871		4.6	3 252 ± 1 812		12.9	5 276 ± 2 011		7.6
Snapper	2 450 ± 1 296		5.5	736 ± 440		2.9	3 186 ± 1 369		4.6
Tailor	1 822 ± 1 297		4.1	607 ± 209		2.4	2 429 ± 1 313		3.5
Mulloway	213 ± 213		0.5	2 184 ± 1 942		8.6	2 397 ± 1 954		3.4
Luderick	1 608 ± 1 314		3.6	195 ± 192		0.8	1 803 ± 1 328		2.6
Fan-bellied leatherjacket	358 ± 186		0.8	660 ± 385		2.6	1 018 ± 428		1.5
Sand whiting	765 ± 559		1.7	163 ± 124		0.6	928 ± 572		1.3
Yellow-finned leatherjacket	560 ± 216		1.3	328 ± 328		1.3	888 ± 393		1.3
Trumpeter whiting	-	-	-	703 ± 669		2.8	703 ± 669		1.0
Slimy mackerel	274 ± 167		0.6	277 ± 173		1.1	551 ± 240		0.8
Small-toothed flounder	40 ± 40		0.1	371 ± 279		1.5	411 ± 282		0.6
Silver trevally	168 ± 87		0.4	164 ± 163		0.6	332 ± 185		0.5
Six-spined leatherjacket	79 ± 79		0.2	232 ± 166		0.9	311 ± 184		0.4
Large-toothed flounder	107 ± 88		0.2	197 ± 180		0.8	304 ± 201		0.4
Black trevally (Spinefoot)	289 ± 250		0.7	-	-	-	289 ± 250		0.4

Table 6 - Continued.

COMMON NAME	HARVEST (kg) FOR WHOLE ESTUARY								
	EASTERN ZONE			WESTERN ZONE			WHOLE ESTUARY		
	Total harvest (kg)	SE	% Total	Total harvest (kg)	SE	% Total	Total harvest (kg)	SE	% Total
Common squid	279 ±	130	0.6	6 ±	6	<0.1	285 ±	130	0.4
Southern calamari	263 ±	167	0.6	-	-	-	263 ±	167	0.4
Conger eel	135 ±	135	0.3	84 ±	84	0.3	219 ±	159	0.3
Silver batfish	#<1	-	<0.1	48 ±	27	0.2	48 ±	27	0.1
Southern herring	-	-	-	94 ±	71	0.4	94 ±	71	0.1
Blue swimmer crab	#1	-	<0.1	#4	-	<0.1	#5	-	<0.1
Australian salmon	-	-	-	-	-	-	#2	-	<0.1
Samson fish	#1	-	<0.1	-	-	-	#1	-	<0.1
Chinaman leatherjacket	#<1	-	<0.1	-	-	-	#<1	-	<0.1
Crimson-banded wrasse	#<1	-	<0.1	-	-	-	#<1	-	<0.1
Gunthers wrasse	#<1	-	<0.1	-	-	-	#<1	-	<0.1
Marbled flathead	#<1	-	<0.1	-	-	-	#<1	-	<0.1
Silver biddy	#<1	-	<0.1	-	-	-	#<1	-	<0.1
Six-lined trumpeter	-	-	-	#<1	-	<0.1	#<1	-	<0.1
Tarwhine	#<1	-	<0.1	-	-	-	#<1	-	<0.1
Total	44 364 ±	16 911	100	25 294 ±	5 238	100	69 662 ±	17 703	100

Key:

Expanded estimates of harvest have not been calculated. This observation was classified as a rare event and its occurrence is simply noted.
 - Not recorded or not calculated for rare event occurrences.

Table 7. Daytime harvest estimates (number of individuals) with standard errors (SE) for taxa taken by boat-based recreational fishers in the eastern and western zones of the Sydney Harbour estuary during summer 2007/08. These harvest data are pooled across all temporal strata.

COMMON NAME	HARVEST (NUMBER) FOR THE BOAT FISHERY											
	EASTERN ZONE			WESTERN ZONE			BOAT FISHERY					
	Total Harvest (number)	SE	% Total	Total Harvest (number)	SE	% Total	Total Harvest (number)	SE	% Total			
Yellowtail scad	7 340	±4 193	22.1	197	±	197	3.3	7 537	±	4 198	19.5	
Kingfish	6 772	±5 851	20.4	406	±	346	6.8	7 178	±	5 862	18.3	
Yellowfin bream	3 762	±2 125	11.3	2 467	±	14	41.6	6 229	±	235	15.9	
Dusky flathead	3 512	±1 858	10.6	1 109	±	557	18.7	4 621	±	194	11.8	
Tailor	2 693	±	186	8.1	-	-	-	2 693	±	186	6.9	
Common squid	2 003	±	940	6.0	36	±	36	0.6	2 039	±	941	5.2
Southern calamari	1 969	±1 245	5.9	-	-	-	-	1 969	±	1 245	5.0	
Snapper	1 622	±	76	4.9	58	±	58	1	1 680	±	78	4.3
Sand whiting	1 170	±	677	3.5	290	±	29	4.9	1 460	±	737	3.7
Slimy mackerel	1 372	±1 212	4.1	-	-	-	-	1 372	±	1 212	3.5	
Mulloway	77	±	77	0.2	1 105	±	115	18.6	1 182	±	117	3.0
Silver trevally	378	±	235	1.1	156	±	156	2.6	534	±	282	1.4
Fan-bellied leatherjacket	270	±	165	0.8	-	-	-	-	270	±	165	0.7
Small-toothed flounder	150	±	15	0.5	100	±	1	1.7	250	±	18	0.6
Large-toothed flounder	94	±	94	0.3	-	-	-	-	94	±	94	0.2
Blue swimmer crab	-	-	-	-	#7	-	0.1	#7	-	-	<0.1	
Luderick	-	-	-	-	#5	-	0.1	#5	-	-	<0.1	
Six-spined leatherjacket	#1	-	<0.1	-	-	-	-	-	#1	-	<0.1	

Table 7 - Continued.

HARVEST (NUMBER) FOR THE BOAT FISHERY									
COMMON NAME	EASTERN ZONE			WESTERN ZONE			BOAT FISHERY		
	Total Harvest (number)	SE	% Total	Total Harvest (number)	SE	% Total	Total Harvest (number)	SE	% Total
Yellow-finned leatherjacket	#1	-	<0.1	-	-	-	#1	-	<0.1
Crimson-banded wrasse	#1	-	<0.1	-	-	-	#1	-	<0.1
Silver batfish	#1	-	<0.1	-	-	-	#1	-	<0.1
Tarwhine	#1	-	<0.1	-	-	-	#1	-	<0.1
Total	33 189 ± 826		100	5 936 ± 1 679		100	39 125 ± 15 564		100

Key:

Expanded estimates of harvest have not been calculated. This observation was classified as a rare event and its occurrence is simply noted.
 - Not recorded or not calculated for rare event occurrences.

Table 8. Daytime harvest estimates (number of individuals) with standard errors (SE) for taxa taken by shore-based recreational fishers in the eastern and western zones of the Sydney Harbour estuary during summer 2007/08. These harvest data are pooled across all temporal strata.

COMMON NAME	HARVEST (NUMBER) FOR THE SHORE FISHERY								
	EASTERN ZONE			WESTERN ZONE			SHORE FISHERY		
	Total Harvest (number)	SE	% Total	Total Harvest (number)	SE	% Total	Total Harvest (number)	SE	% Total
Yellowtail scad	22 480 ±	13 068	43.7	35 565 ±	16 784	38.7	58 045 ±	21 272	40.5
Yellowfin bream	5 726 ±	3 385	11.1	15 985 ±	6 263	17.4	21 711 ±	7 120	15.2
Snapper	8 999 ±	5 505	17.5	3 714 ±	1 822	4.0	12 713 ±	5 799	8.9
Tailor	942 ±	841	1.8	8 932 ±	4 053	9.7	9 874 ±	4 140	6.9
Trumpeter whiting	-	-	-	8 718 ±	8 254	9.5	8 718 ±	8 254	6.1
Dusky flathead	876 ±	645	1.7	6 515 ±	3 797	7.1	7 391 ±	3 851	5.2
Kingfish	2 978 ±	2 878	5.8	263 ±	263	0.3	3 241 ±	2 890	2.3
Slimy mackerel	935 ±	706	1.8	1 992 ±	1 219	2.2	2 927 ±	1 409	2.0
Yellow-finned leatherjacket	1 852 ±	733	3.6	1 026 ±	1 026	1.1	2 878 ±	1 261	2.0
Fan-bellied leatherjacket	385 ±	355	0.7	2 070 ±	1 418	2.3	2 455 ±	1 462	1.7
Luderick	2 079 ±	1 651	4.0	246 ±	246	0.3	2 325 ±	1 669	1.6
Sand whiting	1 468 ±	1 468	2.9	513 ±	513	0.6	1 981 ±	1 555	1.4
Large-toothed flounder	734 ±	734	1.4	1 137 ±	1 031	1.2	1 871 ±	1 266	1.3
Southern herring	-	-	-	1 504 ±	1 101	1.6	1 504 ±	1 101	1.1
Black trevally (Spinefoot)	1 365 ±	1 104	2.7	-	-	-	1 365 ±	1 104	1.0
Small-toothed flounder	-	-	-	1 343 ±	1 056	1.5	1 343 ±	1 056	0.9
Six-spined leatherjacket	293 ±	293	0.6	889 ±	690	1.0	1 182 ±	749	0.8

Table 8 - Continued.

COMMON NAME	HARVEST (NUMBER) FOR THE SHORE FISHERY								
	EASTERN ZONE			WESTERN ZONE			SHORE FISHERY		
	Total Harvest (number)	SE	% Total	Total Harvest (number)	SE	% Total	Total Harvest (number)	SE	% Total
Silver batfish	-	-	-	1 043 ±	613	1.1	1 043 ±	613	0.7
Conger eel	274 ±	274	0.5	172 ±	172	0.2	446 ±	323	0.3
Mulloway	-	-	-	182 ±	182	0.2	182 ±	182	0.1
Southern calamari	#3	-	<0.1	-	-	-	#3	-	<0.1
Chinaman leatherjacket	#2	-	<0.1	-	-	-	#2	-	<0.1
Silver biddy	#1	-	<0.1	-	-	-	#1	-	<0.1
Australian salmon	#1	-	<0.1	-	-	-	#1	-	<0.1
Samson fish	#1	-	<0.1	-	-	-	#1	-	<0.1
Gunthers wrasse	#1	-	<0.1	-	-	-	#1	-	<0.1
Six-lined trumpeter	-	-	-	-	-	-	#1	-	<0.1
Marbled flathead	#1	-	<0.1	-	-	-	#1	-	<0.1
Silver trevally	-	-	-	#1	-	<0.1	#1	-	<0.1
Blue swimmer crab	#1	-	<0.1	-	-	-	#1	-	<0.1
Six-lined trumpeter	-	-	-	#1	-	<0.1	#1	-	<0.1
Total	51 397 ±	15 163	100	91 811 ±	19 088	100	143 208 ±	24 377	100

Key:

Expanded estimates of harvest have not been calculated. This observation was classified as a rare event and its occurrence is simply noted.
 - Not recorded or not calculated for rare event occurrences.

Table 9. Daytime harvest estimates (kilograms) with standard errors (SE) for taxa taken by boat-based recreational fishers in the eastern and western zones of the Sydney Harbour estuary during summer 2007/08. These harvest data are pooled across all temporal strata.

COMMON NAME	HARVEST (kg) FOR THE BOAT FISHERY								
	EASTERN ZONE			WESTERN ZONE			BOAT FISHERY		
	Total harvest (kg)	SE	% Total	Total harvest (kg)	SE	% Total	Total harvest (kg)	SE	% Total
Kingfish	15 408 ±	13325	63.6	783 ±	655	16.2	16 191 ±	13 341	55.7
Dusky flathead	3 070 ±	1706	12.7	487 ±	235	10.1	3 557 ±	1 722	12.2
Yellowfin bream	1 457 ±	796	6.0	1 271 ±	513	26.2	2 728 ±	946	9.4
Mulloway	213 ±	213	0.9	1 925 ±	1 925	39.6	2 138 ±	1 937	7.4
Tailor	1 713 ±	1295	7.1	-	-	-	1 713 ±	1 295	5.9
Yellowtail scad	603 ±	368	2.5	26 ±	26	0.5	629 ±	369	2.2
Snapper	424 ±	155	1.7	45 ±	45	0.9	469 ±	162	1.6
Sand whiting	222 ±	134	0.9	114 ±	114	2.4	336 ±	176	1.2
Silver trevally	168 ±	87	0.7	163 ±	163	3.4	331 ±	185	1.1
Common squid	279 ±	130	1.2	6 ±	6	0.1	285 ±	130	1.0
Southern calamari	263 ±	167	-	-	-	-	263 ±	167	0.9
Fan-bellied leatherjacket	197 ±	122	0.8	-	-	-	197 ±	122	0.7
Slimy mackerel	163 ±	144	0.7	-	-	-	163 ±	144	0.6
Small-toothed flounder	40 ±	40	0.2	17 ±	17	0.4	57 ±	43	0.2
Large-toothed flounder	21 ±	21	0.1	-	-	-	21 ±	21	0.1
Blue swimmer crab	-	-	-	#4	-	0.083	#4	-	<0.1
Luderick	-	-	-	#3	-	0.1	#3	-	<0.1
Yellow-finned leatherjacket	#<1	-	<0.1	-	-	-	#<1	-	<0.1

Table 9 - Continued.

COMMON NAME	HARVEST (kg) FOR THE BOAT FISHERY								
	EASTERN ZONE			WESTERN ZONE			BOAT FISHERY		
	Total harvest (kg)	SE	% Total	Total harvest (kg)	SE	% Total	Total harvest (kg)	SE	% Total
Six-spined leatherjacket	#<1	-	<0.1	-	-	-	#<1	-	<0.1
Silver batfish	#<1	-	<0.1	-	-	-	#<1	-	<0.1
Crimson-banded wrasse	#<1	-	<0.1	-	-	-	#<1	-	<0.1
Tarwhine	#<1	-	<0.1	-	-	-	#<1	-	<0.1
Total	24 242 ± 13 531		100	4 844 ± 2 120		100	29 086 ± 13 696		100

Key:

Expanded estimates of harvest have not been calculated. This observation was classified as a rare event and its occurrence is simply noted.
 - Not recorded or not calculated for rare event occurrences.

Table 10. Daytime harvest estimates (kilograms) with standard errors (SE) for taxa taken by shore-based recreational fishers in the eastern and western zones of the Sydney Harbour estuary during summer 2007/08. These harvest data are pooled across all temporal strata.

COMMON NAME	HARVEST (kg) FOR THE SHORE FISHERY								
	EASTERN ZONE			WESTERN ZONE			SHORE FISHERY		
	Total harvest (kg)	SE	% Total	Total harvest (kg)	SE	% Total	Total harvest (kg)	SE	% Total
Yellowfin bream	2 528 ±	1513	12.6	8 356 ±	3 738	40.9	10 884 ±	4 033	26.8
Kingfish	10 141 ±	9801	50.4	681 ±	681	3.3	10 822 ±	9 824	26.7
Yellowtail scad	1 421 ±	790	7.1	3 226 ±	1 812	15.8	4 647 ±	1 977	11.5
Dusky flathead	324 ±	234	1.6	3 411 ±	1 998	16.7	3 735 ±	2 012	9.2
Snapper	2 026 ±	1287	10.1	691 ±	437	3.4	2 717 ±	1 359	6.7
Luderick	1 608 ±	1314	8.0	192 ±	192	0.9	1 800 ±	1 328	4.4
Yellow-finned leatherjacket	560 ±	216	2.8	328 ±	328	1.6	888 ±	393	2.2
Fan-bellied leatherjacket	161 ±	139	0.8	660 ±	385	3.2	821 ±	410	2.0
Tailor	109 ±	72	0.5	607 ±	209	3.0	716 ±	221	1.8
Trumpeter whiting	-	-	-	703 ±	669	3.4	703 ±	669	1.7
Sand whiting	543 ±	543	2.7	49 ±	49	0.2	592 ±	545	1.5
Slimy mackerel	111 ±	84	0.6	277 ±	173	1.4	388 ±	192	1.0
Small-toothed flounder	-	-	-	354 ±	279	1.7	354 ±	279	0.9
Six-spined leatherjacket	79 ±	79	0.4	232 ±	166	1.1	311 ±	184	0.8
Large-toothed flounder	86 ±	86	0.4	197 ±	180	1.0	283 ±	200	0.7
Black trevally (Spinefoot)	289 ±	250	1.4	289	250	1.4	289 ±	250	0.7
Mulloway	-	-	-	259 ±	259	1.3	259 ±	259	0.6
Conger eel	135 ±	135	0.7	84 ±	84	0.4	219 ±	159	0.5

Table 10 - Continued.

COMMON NAME	HARVEST (kg) FOR THE SHORE FISHERY								
	EASTERN ZONE			WESTERN ZONE			SHORE FISHERY		
	Total harvest (kg)	SE	% Total	Total harvest (kg)	SE	% Total	Total harvest (kg)	SE	% Total
Southern herring	-	-	-	94 ±	71	0.5	94 ±	71	0.2
Silver batfish	-	-	-	48 ±	27	0.2	48 ±	27	0.1
Australian salmon	-	-	-	-	-	-	#2	-	<0.1
Blue swimmer crab	#1	-	<0.1	-	-	-	#1	-	<0.1
Samson fish	#1	-	<0.1	-	-	-	#1	-	<0.1
Silver trevally	-	-	-	#1	-	<0.1	#1	-	<0.1
Southern calamari	#<1	-	<0.1	#<1	-	<0.1	#<1	-	<0.1
Chinaman leatherjacket	#<1	-	<0.1	-	-	-	#<1	-	<0.1
Gunthers wrasse	#<1	-	<0.1	-	-	-	#<1	-	<0.1
Marbled flathead	#<1	-	<0.1	-	-	-	#<1	-	<0.1
Silver biddy	#<1	-	<0.1	-	-	-	#<1	-	<0.1
Six-lined trumpeter	-	-	-	#<1	-	-	#<1	-	<0.1
Total	20 122 ±	10 143	100	20 450 ±	4 790	100	40 576 ±	11 217	100

Key:

Expanded estimates of harvest have not been calculated. This observation was classified as a rare event and its occurrence is simply noted.

- Not recorded or not calculated for rare event occurrences.

Table 11. Daytime bait harvest estimates (number of individuals) with standard errors (SE) for taxa taken by recreational fishers in the eastern and western zones of the Sydney Harbour estuary during summer 2007/08. These bait harvest data are pooled across all temporal strata.

		BAIT HARVEST NUMBERS FOR WHOLE ESTUARY								
Fishery	Common Name	EASTERN ZONE			WESTERN ZONE			WHOLE ESTUARY		
		Bait harvest (number)	SE	% Total	Bait harvest (number)	SE	% Total	Bait harvest (number)	SE	% Total
Boat	Scads	9 380	± 4 325	49.2	395	± 395	100	9 775	± 4 343	50.2
	Squids and cuttlefishes	7 507	± 2 586	39.3	-	-	-	7 507	± 2 586	38.5
	Slimy mackerel	2 205	± 1 306	11.5	-	-	-	2 205	± 1 306	11.3
	Tailor	#1	-	<0.1	-	-	-	#1	-	<0.1
	Snapper	#1	-	<0.1	-	-	-	#1	-	<0.1
	Total	19 094	± 5 206	100	395	± 395	100	19 489	± 5 221	100
Shore	Scads	10 000	± 4 160	76.2	2 979	± 1 727	30.1	12 979	± 4 504	56.3
	Slimy mackerel	2 498	± 1 861	19.0	2 512	± 2 178	25.4	5 010	± 2 865	21.8
	Tailor	624	± 414	4.8	3 971	± 2 746	40.1	4 595	± 2 777	20.0
	Whittings	-	-	-	348	± 274	3.5	348	± 274	1.5
	Squids and cuttlefishes	-	-	-	84	± 84	0.9	84	± 84	0.4
	Breams	#1	-	<0.1	-	-	-	#1	-	<0.1
	Snapper	-	-	-	#1	-	<0.1	#1	-	<0.1
	Unidentified taxa	-	-	-	#2	-	<0.1	#2	-	<0.1
Total	13 123	± 4 576	100	9 897	± 3 918	100	23 020	± 6 024	100	
Total	Scads	19 380	± 6 001	60.2	3 374	± 1 772	32.8	22 754	± 6 257	53.5
	Squids and cuttlefishes	7 507	± 2 586	23.3	84	± 84	0.8	7 591	± 2 587	17.9
	Slimy mackerel	4 703	± 2 274	14.6	2 512	± 2 178	24.4	7 215	± 3 148	17.0
	Tailor	625	± 414	1.9	3 971	± 2 746	38.6	4 596	± 2 777	10.8
	Whittings	-	-	-	348	± 274	3.4	348	± 274	0.8
	Snapper	#1	-	<0.1	#1	-	<0.1	#2	-	<0.1
	Unidentified taxa	-	-	-	#2	-	<0.1	#2	-	<0.1
	Breams	#1	-	<0.1	-	-	-	#1	-	<0.1
Total	32 217	± 6 931	100	10 292	± 3 938	100	42 509	± 7 972	100	

Key:

Expanded estimates of bait harvest have not been calculated. This observation was classified as a rare event and its occurrence is simply noted

- Not recorded or not calculated for rare event occurrences

Table 12. Daytime bait harvest estimates (kilograms) with standard errors (SE) for taxa taken by recreational fishers in the eastern and western zones of the Sydney Harbour estuary during summer 2007/08. These bait harvest data are pooled across all temporal strata.

		BAIT HARVEST (kg) FOR WHOLE ESTUARY								
Fishery	Common Name	EASTERN ZONE			WESTERN ZONE			WHOLE ESTUARY		
		Bait harvest (kg)	SE	% Total	Bait harvest (kg)	SE	% Total	Bait harvest (kg)	SE	% Total
Boat	Scads	750 ± 363	37.0	37 ± 37	100	787 ± 365	38.2			
	Squids and cuttlefishes	976 ± 353	48.2	-	-	976 ± 353	47.3			
	Slimy mackerel	298 ± 184	14.7	-	-	298 ± 184	14.5			
	Tailor	#<1	<0.1	-	-	#<1	<0.1			
	Snapper	#<1	<0.1	-	-	#<1	<0.1			
	Total	2 025 ± 539	100	37 ± 37	100	2 062 ± 540	100			
Shore	Tailor	99 ± 68	8.0	632 ± 453	47.3	731 ± 458	28.4			
	Slimy mackerel	337 ± 262	27.3	339 ± 307	25.4	676 ± 404	26.3			
	Scads	800 ± 349	64.7	280 ± 163	21.0	1 080 ± 385	42.0			
	Whitings	-	-	74 ± 58	5.5	74 ± 58	2.9			
	Squids and cuttlefishes	-	-	11 ± 12	0.8	11 ± 12	0.4			
	Unidentified taxa	-	-	#<1	<0.1	#<1	<0.1			
	Snapper	-	-	#<1	<0.1	#<1	<0.1			
	Breams	#<1	<0.1	-	-	#<1	<0.1			
Total	1 236 ± 442	100	1337 ± 574	100	2 573 ± 724	100				
Total	Scads	1 550 ± 503	47.5	317 ± 167	23.1	1 867 ± 530	40.3			
	Squids and cuttlefishes	976 ± 353	29.9	11 ± 12	0.8	987 ± 353	21.3			
	Slimy mackerel	635 ± 320	19.5	339 ± 307	24.7	974 ± 444	21.0			
	Tailor	99 ± 68	3.1	632 ± 453	46.0	731 ± 458	15.8			
	Whitings	-	-	74 ± 58	5.4	74 ± 58	1.6			
	Snapper	#<1	<0.1	#<1	<0.1	#<1	<0.1			
	Unidentified taxa	-	-	#<1	<0.1	#<1	<0.1			
	Breams	#<1	<0.1	-	-	#<1	<0.1			
Total	3 261 ± 697	100	1 374 ± 575	100	4 635 ± 903	100				

Key:

Expanded estimates of bait harvest have not been calculated. This observation was classified as a rare event and its occurrence is simply noted

- Not recorded or not calculated for rare event occurrences

Table 13. Daytime discarded catch estimates (number of released individuals) with standard errors (SE) for taxa taken by recreational fishers in the eastern and western zones of the Sydney Harbour estuary during summer 2007/08. These discarded catch data are pooled across all temporal and spatial strata.

COMMON NAME	DISCARD (NUMBERS) FOR WHOLE ESTUARY								
	EASTERN ZONE			WESTERN ZONE			WHOLE ESTUARY		
	Total Released (number)	SE	% Total	Total Released (number)	SE	% Total	Total Released (number)	SE	% Total
Snapper	74 475 ± 20 796		44.3	51 951 ± 15 463		41.8	126 426 ± 25 915		43.2
Breams	21 952 ± 4 446		13.0	28 047 ± 7 477		22.6	49 999 ± 8 699		17.1
Scads	7 094 ± 4 634		4.2	19 465 ± 10 479		15.7	26 559 ± 11 458		9.1
Sweep	19 417 ± 12 231		11.5	658 ± 658		0.5	20 075 ± 12 249		6.9
Flatheads	9 048 ± 4 494		5.4	2 223 ± 1 129		1.8	11 271 ± 4 634		3.8
Tailor	2 583 ± 1 279		1.5	8 539 ± 3 663		6.9	11 122 ± 3 880		3.8
Leatherjackets	8 145 ± 3 120		4.8	1 306 ± 804		1.1	9 451 ± 3 222		3.2
Kingfishes	7 096 ± 2 025		4.2	21 ± 21		<0.1	7 117 ± 2 025		2.4
Mados	7 097 ± 4 807		4.2	-		-	7 097 ± 4 807		2.4
Whiting	1 314 ± 713		0.8	5 253 ± 1 885		4.2	6 567 ± 2 016		2.2
Toadfishes	295 ± 162		0.2	4 342 ± 2 690		3.5	4 637 ± 2 695		1.6
Sharks and rays	2 952 ± 1 978		1.8	-		-	2 952 ± 1 978		1.0
Wrasses	2 613 ± 2 570		1.5	174 ± 174		0.1	2 787 ± 2 576		1.0
Silver batfish	614 ± 614		0.4	1 351 ± 797		1.1	1 965 ± 1 006		0.7
Flounders and soles	1 233 ± 509		0.7	414 ± 322		0.3	1 647 ± 602		0.6
Groupers	1 185 ± 791		0.7	-		-	1 185 ± 791		0.4
Unidentified taxa	803 ± 590		0.5	-		-	803 ± 590		0.3
Trevallies	383 ± 227		0.2	329 ± 329		0.3	712 ± 400		0.2
Seargent baker	46 ± 46		<0.1	132 ± 132		0.1	178 ± 140		0.1
Scorpionfishes	121 ± 86		<0.1	-		-	121 ± 86		<0.1
Eels	118 ± 81		0.1	-		-	118 ± 81		<0.1
Crabs	-		-	#8		<0.1	#8		<0.1
Slimy mackerel	#2		<0.1	#5		<0.1	#7		<0.1
Australian salmon	#3		<0.1	-		-	#3		<0.1
Blue devilfish	#1		<0.1	-		-	#1		<0.1
Catfishes	-		-	#1		<0.1	#1		<0.1
Luderick	#1		<0.1	-		-	#1		<0.1
Mulloway	-		-	#1		<0.1	#1		<0.1
Squids and cuttlefishes	-		-	#1		<0.1	#1		<0.1
Surgeonfish	#1		<0.1	-		-	#1		<0.1
Total	168 592 ± 26 359		100	124 221 ± 20 791		100	292 813 ± 33 572		100

Key:

Expanded estimates of harvest have not been calculated. This observation was classified as a rare event and its occurrence is simply noted.

- Not recorded or not calculated for rare event occurrences.

Table 14. Daytime discarded catch estimates (number of released individuals) with standard errors (SE) for taxa taken by boat-based recreational fishers in the eastern and western zones of the Sydney Harbour estuary during summer 2007/08. These discarded catch data are pooled across all temporal strata.

COMMON NAME	DISCARD (NUMBERS) FOR THE BOAT FISHERY								
	EASTERN ZONE			WESTERN ZONE			BOAT FISHERY		
	Total Released (number)	SE	% Total	Total Released (number)	SE	% Total	Total Released (number)	SE	% Total
Snapper	51 003 ± 19 421		62.9	9 019 ± 4 589		48.0	60 022 ± 19 956		60.1
Breams	8 966 ± 3 840		11.1	4 096 ± 1 733		21.8	13 062 ± 4 213		13.1
Flatheads	8 367 ± 4 482		10.3	351 ± 238		1.9	8 718 ± 4 489		8.7
Kingfishes	4 930 ± 1 473		6.1	-		-	4 930 ± 1 473		4.9
Whitings	918 ± 603		1.1	2 117 ± 997		11.3	3 035 ± 1 165		3.0
Tailor	794 ± 587		1.0	1 562 ± 947		8.3	2 356 ± 1 115		2.4
Sharks and rays	1 913 ± 1 765		2.4	-		-	1 913 ± 1 765		1.9
Sweep	715 ± 432		0.9	658 ± 658		3.5	1 373 ± 787		1.4
Flounders and soles	1 126 ± 501		1.4	113 ± 113		0.6	1 239 ± 513		1.2
Leatherjackets	873 ± 601		1.1	-		-	873 ± 601		0.9
Trevallies	383 ± 227		0.5	329 ± 329		1.8	712 ± 400		0.7
Scads	284 ± 284		0.4	390 ± 390		2.1	674 ± 482		0.7
Groupers	409 ± 291		0.5	-		-	409 ± 291		0.4
Seargent baker	46 ± 46		0.1	132 ± 132		0.7	178 ± 140		0.2
Toadfishes	152 ± 76		0.2	-		-	152 ± 76		0.2
Scorpionfishes	121 ± 86		0.1	-		-	121 ± 86		0.1
Eels	118 ± 81		0.1	-		-	118 ± 81		0.1
Crabs	-		-	#8		<0.1	#8		<0.1
Mados	#6		<0.1	-		-	#6		<0.1
Australian salmon	#3		<0.1	-		-	#3		<0.1
Slimy mackerel	#2		<0.1	-		-	#2		<0.1
Blue devilfish	#1		<0.1	-		-	#1		<0.1
Wrasses	#1		<0.1	-		-	#1		<0.1
Total	81 131 ± 20 470		100	18 775 ± 5 170		100	99 906 ± 21 113		100

Key:

Expanded estimates of harvest have not been calculated. This observation was classified as a rare event and its occurrence is simply noted.

- Not recorded or not calculated for rare event occurrences.

Table 15. Daytime discarded catch estimates (number of released individuals) with standard errors (SE) for taxa taken by shore-based recreational fishers in the eastern and western zones of the Sydney Harbour estuary during summer 2007/08. These discarded catch data are pooled across all temporal strata.

COMMON NAME	DISCARD (NUMBERS) FOR THE SHORE FISHERY								
	EASTERN ZONE			WESTERN ZONE			SHORE FISHERY		
	Total Released (number)	SE	% Total	Total Released (number)	SE	% Total	Total Released (number)	SE	% Total
Snapper	23 472 ±	7 436	26.8	42 932 ±	14 766	40.7	66 404 ±	16 533	34.5
Breams	12 986 ±	2 242	14.8	23 951 ±	7 274	22.7	36 937 ±	7 611	19.2
Scads	6 810 ±	4 626	7.8	19 075 ±	10 472	18.1	25 885 ±	11 448	13.4
Sweep	18 702 ±	12 224	21.4	-	-	-	18 702 ±	12 224	9.7
Tailor	1 789 ±	1 137	2.0	6 977 ±	3 538	6.6	8 766 ±	3 716	4.6
Leatherjackets	7 272 ±	3 062	8.3	1 306 ±	804	1.2	8 578 ±	3 165	4.5
Mados	7 091 ±	4 807	8.1	-	-	-	7 091 ±	4 807	3.7
Toadfishes	143 ±	143	0.2	4 342 ±	2 690	4.1	4 485 ±	2 694	2.3
Whitings	396 ±	381	0.5	3 136 ±	1 600	3.0	3 532 ±	1 645	1.8
Wrasses	2 612 ±	2 570	3.0	174 ±	174	0.2	2 786 ±	2 576	1.4
Flatheads	681 ±	323	0.8	1 872 ±	1 104	1.8	2 553 ±	1 150	1.3
Kingfishes	2 166 ±	1 390	2.5	21 ±	21	<0.1	2 187 ±	1 390	1.1
Silver batfish	614 ±	614	0.7	1 351 ±	797	1.3	1 965 ±	1 006	1.0
Sharks and rays	1 039 ±	894	1.2	-	-	-	1 039 ±	894	0.5
Unidentified taxa	803 ±	590	0.9	-	-	-	803 ±	590	0.4
Groupers	776 ±	735	0.9	-	-	-	776 ±	735	0.4
Flounders and soles	107 ±	91	0.1	301 ±	301	0.3	408 ±	315	0.2
Slimy mackerel	-	-	-	#5	-	<0.1	#5	-	<0.1
Catfishes	-	-	-	#1	-	<0.1	#1	-	<0.1
Luderick	#1	-	<0.1	-	-	-	#1	-	<0.1
Mulloway	-	-	-	#1	-	<0.1	#1	-	<0.1
Squids and cuttlefishes	-	-	-	#1	-	<0.1	#1	-	<0.1
Surgeonfish	#1	-	<0.1	-	-	-	#1	-	<0.1
Total	87 461 ±	16 607	100	105 446 ±	20 138	100	192 907 ±	26 102	100

Key:

Expanded estimates of harvest have not been calculated. This observation was classified as a rare event and its occurrence is simply noted.

- Not recorded or not calculated for rare event occurrences.

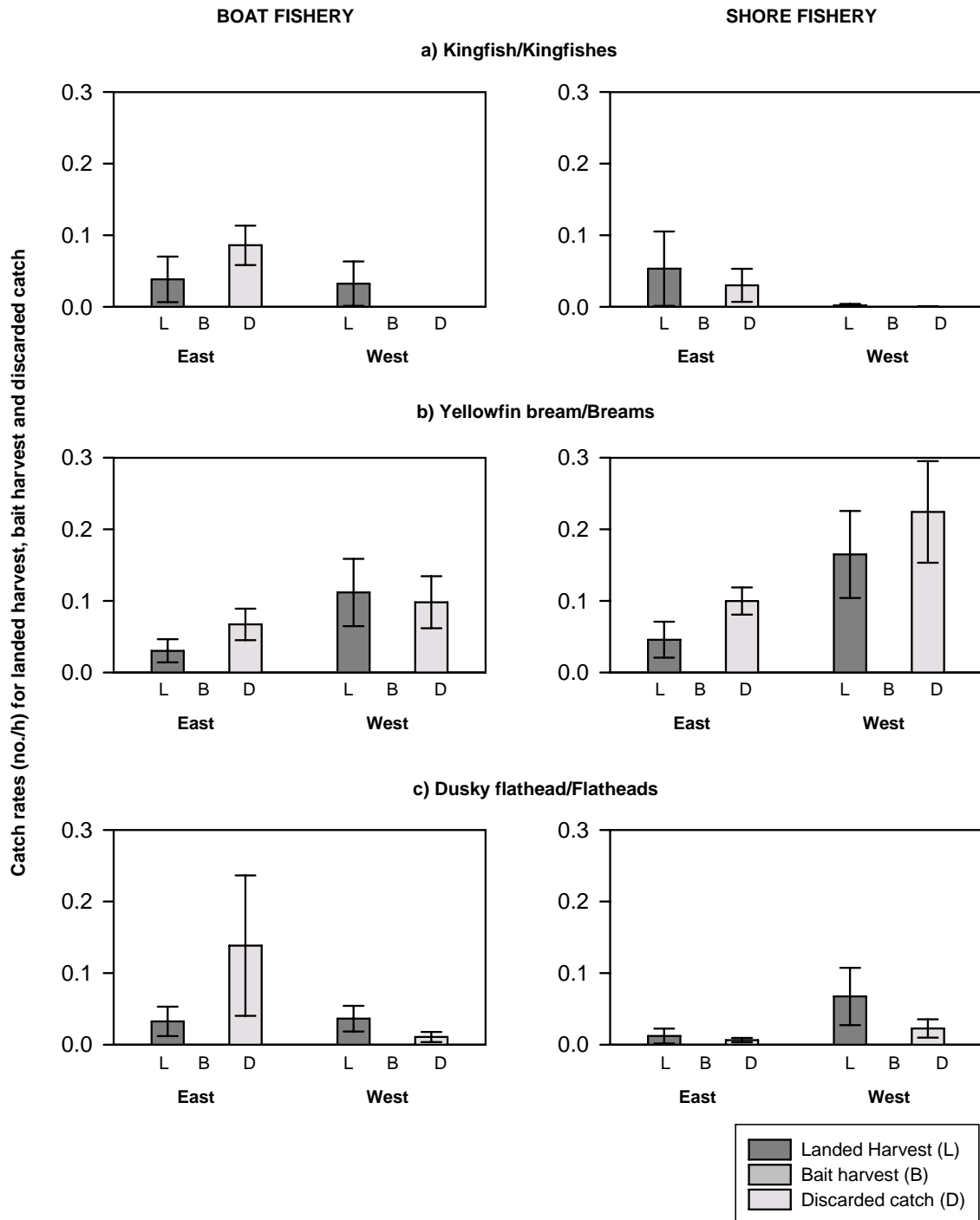


Figure 3. Seasonal catch rates (number of fish per fisher hour) for landed harvest, bait harvest and discarded catch with standard errors for the main harvested species of boat-based and shore-based recreational fisheries in the eastern and western zones of the Sydney Harbour estuary. Species and taxa groups presented include: a) kingfish or kingfishes; b) yellowfin bream or breams; and c) dusky flathead or flatheads.

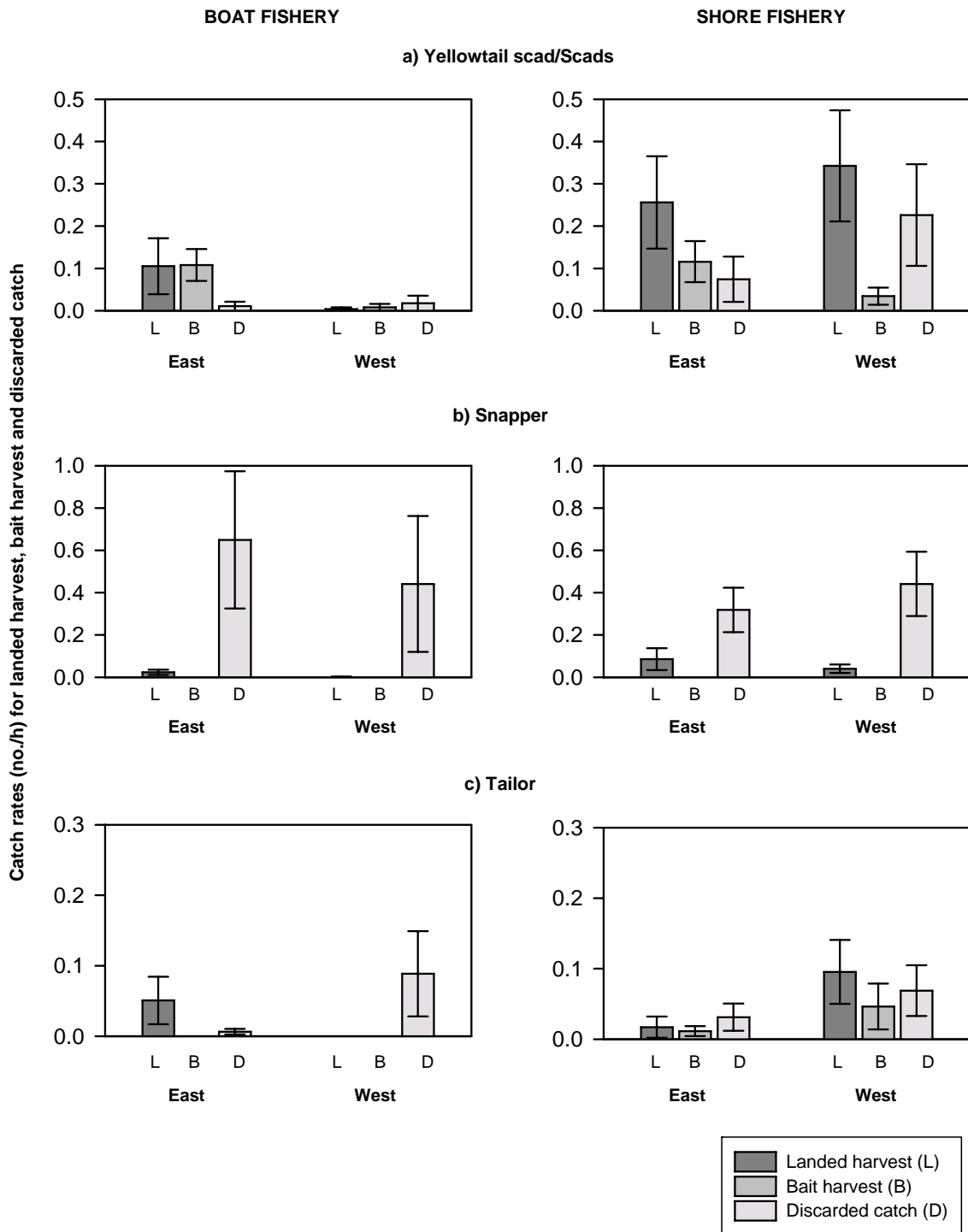


Figure 4. Seasonal catch rates (number of fish per fisher hour) for landed harvest, bait harvest and discarded catch with standard errors for the main species harvested by boat-based and shore-based recreational fishers in the eastern and western zones of the Sydney Harbour estuary. Species and taxa groups presented include: a) yellowtail scad or scads; b) snapper; and c) tailor.

4.8. Length frequency distributions

Descriptive statistics including the number of individuals observed (N), the number of individuals measured (n), minimum lengths (cm), maximum lengths (cm), mean lengths (cm) and median lengths (cm) for all taxa recorded in the landed harvest of recreational fishers of the Sydney Harbour estuary during the summer survey are presented in Appendix 2. Length frequency distributions, size statistics and the proportion of those fish measured that were less than the minimum legal length are presented in Figure 5 for kingfish; yellowfin bream; dusky flathead; yellowtail scad; snapper; and, tailor.

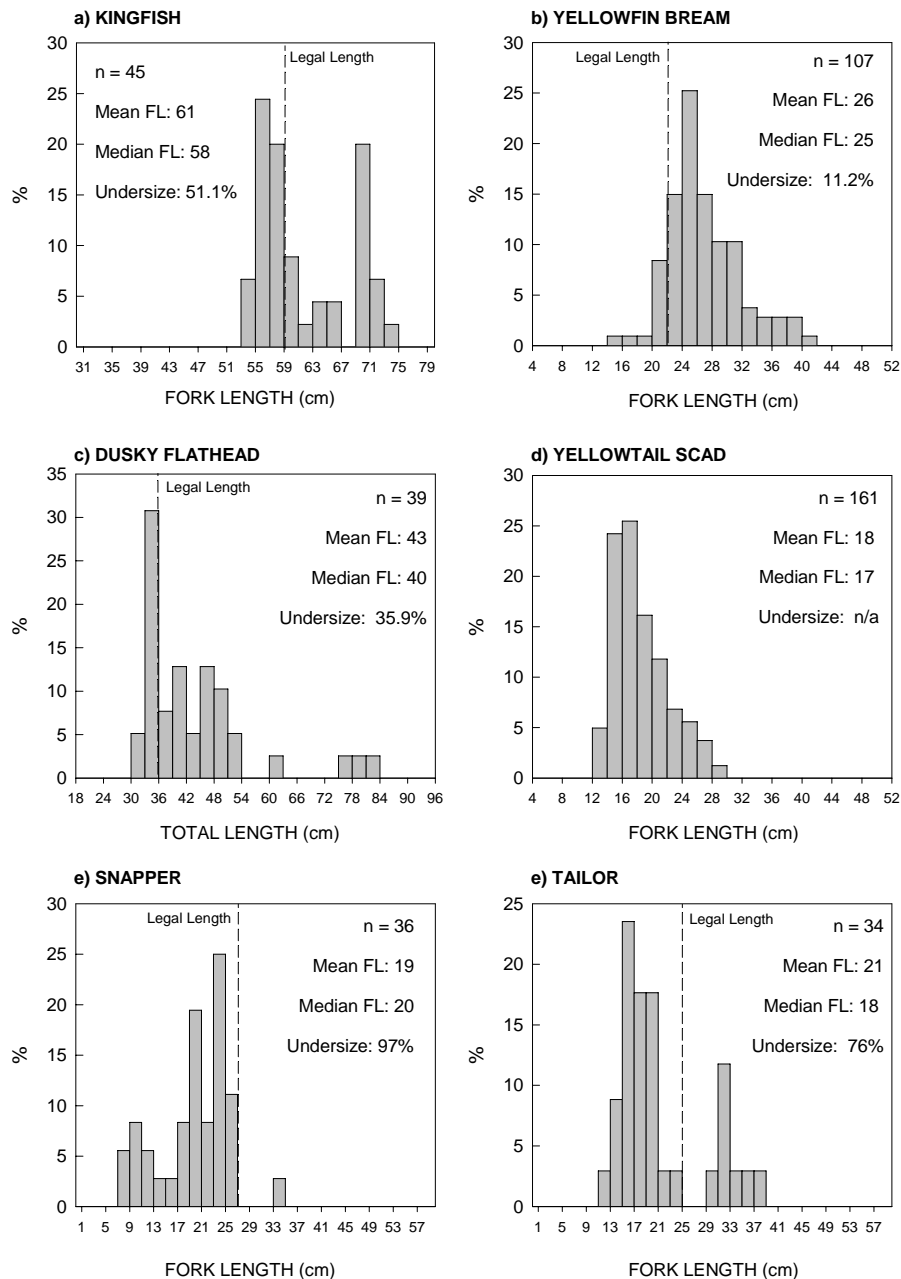


Figure 5. Length frequency distributions and size statistics for the main species of recreational importance in the Sydney Harbour estuary as determined by their relative harvest sizes during the survey period. Species presented include: a) kingfish; b) yellowfin bream; c) dusky flathead; d) yellowtail scad; e) snapper; and, f) tailor.

4.9. Angler ratings of the quality of the fisheries

The majority of fishers (70.3%) regarded the overall quality of the recreational fisheries of the Sydney Harbour estuary to be good in terms of the variety of fishes available, the number usually caught and their average sizes (Table 16). A further 19.1% of fishers were neutral or had no opinion regarding the overall fishery quality and 10.6% considered the fishery quality to be poor.

The overall quality of the fishery in the eastern zone was regarded to be good by 74.4% of fishers interviewed in this zone and a further 16.1% of fishers had no opinion. The overall quality of the fishery in the western zone was regarded to be good by 65.7% of fishers interviewed in this zone. A further 22.5% of fishers interviewed in the western zone had no opinion. A low percentage of fishers regarded the overall quality of the Sydney Harbour fishery to be poor in both the eastern (9.5%) and western (11.8%) estuary zones (Table 16).

Table 16. Fishery quality ratings by interviewed fishers by estuary zone for boat-based and shore-based recreational fishers of the Sydney Harbour estuary during summer 2007/08.

		ANGLER FISHERY QUALITY RATINGS					
Fishery	Overall Fishery Quality Rating	EASTERN ZONE		WESTERN ZONE		WHOLE ESTUARY	
		Number of fishers	% Total	Number of fishers	% Total	Number of fishers	% Total
Boat	good	65	78.3	18	66.7	83	75.5
	neutral	10	12.1	5	18.5	15	13.6
	poor	8	9.6	4	14.8	12	10.9
	Total	83	100	27	100	110	100
Shore	good	83	71.5	99	65.6	182	68.2
	neutral	22	19.0	35	23.2	57	21.3
	poor	11	9.5	17	11.2	28	10.5
	Total	116	100	151	100	267	100
Total	good	148	74.4	117	65.7	265	70.3
	neutral	32	16.1	40	22.5	72	19.1
	poor	19	9.5	21	11.8	40	10.6
	Total	199	100	178	100	377	100

5. DISCUSSION

The levels of daytime recreational fishing effort, harvest and discarded catch recorded during this summer survey indicate that the Sydney Harbour estuary is a popular and productive fishing location that offers a variety of good recreational fishing opportunities. Daytime recreational fishing effort for the summer survey period was estimated to be about 300 000 fisher hours and the daytime recreational harvest of finfish, crabs and cephalopods was estimated to be about 74 tonnes consisting of about 225 000 individuals. A further 293 000 finfish, crabs and cephalopods were estimated to have been discarded (i.e., caught and released) by recreational fishers over the summer 2007/08 survey period. The majority of this fishing effort and harvest can be attributed to fishers of local origin as more than 96% of recreational fishers interviewed during the survey were residents of the Sydney region.

Comparisons among different estuarine fisheries in NSW during summer show that the Sydney Harbour fishery does provide high quality recreational fishing opportunities (Table 17). The absolute levels of fishing effort expended and harvest taken during summer in the Sydney Harbour estuary are similar to those recorded in Lake Macquarie and much higher than those recorded from Tuross Lake (Table 17). These comparisons, when adjusted for differences in surface area of the estuaries, indicate that the Sydney Harbour estuary has the highest density of recreational fishing effort and the highest harvest per square kilometre (Table 17). This relatively high recreational usage of the Sydney Harbour estuary may be attributed to: (a) the close proximity of a large urban population; (b) a number of physical attributes of the estuary that encourage recreational fishing (e.g., easy public access to boat ramps and shorelines adjacent to deep water, protection from the weather, aesthetic appeal of the estuary), and (c) the availability of diverse and high quality recreational fishing opportunities throughout the estuary. The perception of fishers also supports the view that the quality of fishing in this estuary was high. More than 70% of the fishers interviewed rated the quality of recreational fishery as being good and only 11% rated it poor. Despite the relatively high rate of recreational usage and given the long history of recreational and commercial exploitation of these fisheries, there are no indications that these levels of fishing are unsustainable.

The recreational fishery in the Sydney Harbour estuary was dominated by shore-based fishing. It was found that about 62% of the fishing effort was shore-based and that 38% was boat-based. Similarly, the largest portion of harvest was taken by shore-based fishers (74% by number and 58% by weight). This is very different to the distribution of effort and harvest recorded from other estuarine fisheries in NSW, which have been found to be dominated by boat-based fishing (Steffe & Chapman 2003; Steffe *et al.* 2005a; Steffe *et al.* 2005b).

Despite the availability of good recreational fishing opportunities throughout the Sydney Harbour estuary it was found that the proportions of undersized fish in the harvest were much higher than those reported from other NSW estuarine fisheries (Steffe *et al.* 2005a; Steffe *et al.* 2005b). Interestingly, the proportions of undersized fish in the harvest from the Sydney Harbour recreational fishery are similar to the levels observed in NSW estuarine recreational fishing surveys done in the 1980s (Virgona 1983; Henry 1984; Henry *et al.* 1987). Clearly, some recreational fishers in this estuary are not complying with regulated size limits, which is of concern to the long-term sustainability of affected stocks.

It was also found that recreational fishers were retaining considerable quantities of fish from the area west of the Sydney Harbour Bridge (97 700 individuals equating to 25.3 tonnes of fish, crabs and cephalopods). These fish, crabs and cephalopods were retained despite the well advertised warnings that seafood taken from this area should not be consumed, suggesting that additional warnings and the distribution of advisory material may be appropriate.

Table 17. Comparisons of total effort (angler hours) and total harvest (kilograms kept) among the Lake Macquarie, Tuross Lake and Sydney Harbour estuarine recreational fishing surveys for the summer periods of those surveys.

COMPARISONS OF EFFORT AND HARVEST BETWEEN NSW ESTUARINE RECREATIONAL FISHING SURVEYS										
Survey	Effort (fisher hrs)	SE	Harvest (number)	SE	Harvest (kg)	SE	Surface area of waterway (km ²)**	Effort (fisher hrs/km ²)	Harvest per waterway area (number/km ²)	Harvest per waterway area (kg/km ²)
Sydney Harbour 2007/08	300 082 ±	21 729	182 333 ±	25 794	69 662 ±	17 703	49.7	6 042	3 671	1 403
Lake Macquarie 2003/04*	306 785 ±	14 925	180 090 ±	9 731	70 398 ±	4 391	115.1	2 665	1 564	612
Tuross Lake 2003/04*	38 454 ±	2 008	14 366 ±	852	6 045 ±	355	13.3	2 892	1 080	455

* Murphy and Steffe, unpublished data

** Roy *et al.* (2001)

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7. APPENDICES

Appendix 1. Broad groups used by recreational fishers to report their discarded catch and/or bait harvest and a description of taxa included in each group.

BAIT HARVEST AND DISCARDED CATCH GROUPS	
GROUP NAME	TAXA INCLUDED IN GROUP
Squids and cuttlefishes	Class Cephalopoda
Crabs	Order Decapoda
Sharks and rays	Subclass Elasmobranchii
Eels	Order Anguilliformes
Seargent baker	<i>Hime purpurissata</i>
Catfishes	Families Plotosidae and Ariidae
Scorpionfishes	Family Scorpaenidae
Flatheads	Family Platycephalidae
Groupers	Family Serranidae
Blue devilfish	<i>Paraplesiops bleekeri</i>
Whitings	Family Silliginidae
Tailor	<i>Pomatomus saltatrix</i>
Trevallies	Family Carangidae
Scads	<i>Trachurus spp.</i> and <i>Decapterus spp.</i>
Kingfishes	<i>Seriola spp.</i>
Australian salmon	<i>Arripis trutta</i>
Breams	<i>Acanthopagrus spp.</i> and <i>Rhabdosargus sarba</i>
Snapper	<i>Pagrus auratus</i>
Mulloway	<i>Argyrosomus japonicus</i>
Silver batfish	<i>Monodactylus argenteus</i>
Luderick	<i>Girella tricuspidata</i>
Mados	<i>Atypichthys spp.</i> and <i>Microcanthus strigatus</i>
Sweep	<i>Scorpiis lineolata</i>
Wrasses	Family Labridae
Slimy mackerel	<i>Scomber australasicus</i>
Surgeonfishes	Family Acanthuridae
Flounders and soles	Families Paralichthyidae, Soleidae and Pleuronectidae
Leatherjackets	Family Monacanthidae
Toadfishes	Family Tetraodontidae
Unidentified taxa	Anglers unable to provide identification

Appendix 2. The number of individuals observed (N), the number of individuals measured (n), minimum length (cm), maximum length (cm), mean length (cm) and median length (cm) for all taxa recorded in the landed harvest of recreational fishers of the Sydney Harbour estuary during the summer survey period.

SCIENTIFIC NAME	COMMON NAME	LENGTH STATISTICS					
		N	n	Minimum	Maximum	Mean	Median
<i>Portunus pelagicus</i>	Blue swimmer crab	9	9	8	10	9.0	9.0
<i>Sepia spp.</i>	Estuarine cuttlefish	3	0	-	-	-	-
<i>Loligo spp.</i>	Common squid	116	9	11	20	16.0	17.0
<i>Sepioteuthis australis</i>	Southern calamari	27	2	11	14	12.5	12.5
<i>Herklotsichthys castelnaui</i>	Southern herring	7	4	14	16	14.8	14.5
<i>Conger spp.</i>	Conger eel	2	1	71	71	71.0	71.0
<i>Platycephalus fuscus</i>	Dusky flathead	48	39	30	82	43.4	40.0
<i>Platycephalus marmoratus</i>	Marbled flathead	1	1	41	41	41.0	41.0
<i>Pelates quadrilineatus</i>	Six-lined trumpeter	1	1	14	14	14.0	14.0
<i>Sillago maculata</i>	Trumpeter whiting	22	7	17	22	19.6	20.0
<i>Sillago ciliata</i>	Sand whiting	22	18	21	34	27.7	26.0
<i>Pomatomus saltatrix</i>	Tailor	64	34	12	38	20.7	18.0
<i>Pseudocaranx georgianus</i>	Silver trevally	9	9	25	38	29.8	29.0
<i>Trachurus novaezelandiae</i>	Yellowtail scad	476	161	13	28	18.0	17.0
<i>Seriola lalandi</i>	Kingfish	50	45	53	74	61.4	58.0
<i>Seriola hippos</i>	Samson fish	1	1	47	47	47.0	47.0
<i>Arripis trutta</i>	Salmon	1	1	49	49	49.0	49.0
<i>Acanthopagrus australis</i>	Yellowfin bream	111	107	15	41	26.4	25.0
<i>Pagrus auratus</i>	Snapper	45	36	8	33	19.4	20.0
<i>Rhabdosargus sarba</i>	Tarwhine	1	1	25	25	25.0	25.0
<i>Gerres subfasciatus</i>	Silver biddy	1	1	15	15	15.0	15.0
<i>Argyrosomus japonicus</i>	Mulloway	8	8	50	69	55.9	55.0
<i>Monodactylus argenteus</i>	Silver batfish	7	6	9	18	13.8	14.0
<i>Girella tricuspidata</i>	Luderick	23	19	28	37	32.5	33.0
<i>Pseudolabrus guentheri</i>	Gunthers wrasse	1	0	-	-	-	-
<i>Scomber australasicus</i>	Slimy mackerel	39	7	19	26	21.6	21.0
<i>Siganus fuscescens</i>	Black trevally (Spinefoot)	20	20	20	26	23.4	24.0
<i>Pseudorhombus arsius</i>	Large-toothed flounder	9	9	23	29	25.3	25.0
<i>Pseudorhombus jenynsii</i>	Small-toothed flounder	6	6	25	29	27.0	27.5
<i>Monacanthus chinensis</i>	Fan-bellied leatherjacket	12	12	23	38	31.2	32.5
<i>Meuschenia freycineti</i>	Six-spined leatherjacket	12	11	12	32	23.0	25.0
<i>Meuschenia trachylepis</i>	Yellow-finned leatherjacket	14	8	21	29	26.5	27.0
<i>Nelusetta ayraudi</i>	Chinaman leatherjacket	2	0	-	-	-	-
<i>Notolabrus gymnogenis</i>	Crimson-banded wrasse	1	1	30	30	30.0	30.0

Appendix 3. A list of postcodes included in each residence category and the number of fishers recorded for each postcode or postcode range during the summer 2007/08 Sydney Harbour recreational fishing survey.

FISHERS RECORDED BY RESIDENCE CATEGORY				
Residence Category	Postcode or Postcode Range	State or Country of Residence	Number of Fishers Recorded	% of Total Number of Fishers
Sydney-Near Total	2000-2770	NSW	732	92.1
Sydney-Far Total	2560-2774	NSW	33	4.2
Other NSW	2250	NSW	1	
	2262	NSW	1	
	2281	NSW	1	
	2316	NSW	1	
	2340	NSW	1	
	2472	NSW	1	
	2517	NSW	1	
	2550	NSW	1	
	2575	NSW	4	
	2577	NSW	1	
	2614	NSW	1	
	2665	NSW	1	
	2714	NSW	1	
	2716	NSW	1	
	2797	NSW	1	
	2912	NSW	2	
Other NSW Total			20	2.5
Interstate - Australia	3023	VIC	1	
	3083	VIC	1	
	3754	VIC	1	
	3820	VIC	1	
	4035	QLD	1	
Interstate - Australia Total			5	0.6
International	N/A	Hong Kong	1	
	N/A	Turkey	1	
	N/A	UK	1	
	N/A	USA	2	
International Total			5	0.6
Total			795	100

Appendix 4. Landed harvest rate estimates (fish per fisher hour) and standard errors for all species taken by boat-based and shore-based fishers in the eastern and western zones of the Sydney Harbour estuary over the summer survey period.

SPECIES NAME	LANDED HARVEST RATES											
	SHORE FISHERY						BOAT FISHERY					
	EAST			WEST			EAST			WEST		
	Harvest Rate (fish/ fisher h)	±	SE	Harvest Rate (fish/ fisher h)	±	SE	Harvest Rate (fish/ fisher h)	±	SE	Harvest Rate (fish/ fisher h)	±	SE
<i>Loligo spp.</i>	-	-	-	-	-	-	0.039 ± 0.017	0.001 ± 0.001	-	-	-	
<i>Sepioteuthis australis</i>	-	-	-	-	-	-	0.018 ± 0.009	-	-	-	-	
<i>Herklotsichthys castelnaui</i>	-	-	-	0.018 ± 0.013	-	-	-	-	-	-	-	
<i>Conger spp.</i>	0.002 ± 0.002	-	-	0.002 ± 0.002	-	-	-	-	-	-	-	
<i>Platycephalus fuscus</i>	0.012 ± 0.010	-	-	0.067 ± 0.040	-	-	0.032 ± 0.021	0.036 ± 0.018	-	-	-	
<i>Sillago maculata</i>	-	-	-	0.105 ± 0.100	-	-	-	-	-	-	-	
<i>Sillago ciliata</i>	0.009 ± 0.009	-	-	0.004 ± 0.004	-	-	0.009 ± 0.006	0.009 ± 0.009	-	-	-	
<i>Pomatomus saltatrix</i>	0.017 ± 0.015	-	-	0.095 ± 0.045	-	-	0.051 ± 0.034	-	-	-	-	
<i>Pseudocaranx georgianus</i>	-	-	-	-	-	-	0.005 ± 0.004	0.007 ± 0.007	-	-	-	
<i>Trachurus novaezelandiae</i>	0.256 ± 0.109	-	-	0.342 ± 0.131	-	-	0.105 ± 0.066	0.004 ± 0.004	-	-	-	
<i>Seriola lalandi</i>	0.053 ± 0.052	-	-	0.002 ± 0.002	-	-	0.038 ± 0.032	0.032 ± 0.031	-	-	-	
<i>Acanthopagrus australis</i>	0.046 ± 0.025	-	-	0.165 ± 0.061	-	-	0.030 ± 0.016	0.112 ± 0.047	-	-	-	
<i>Pagrus auratus</i>	0.086 ± 0.052	-	-	0.040 ± 0.020	-	-	0.023 ± 0.012	0.002 ± 0.002	-	-	-	
<i>Argyrosomus japonicus</i>	-	-	-	0.002 ± 0.002	-	-	0.001 ± 0.001	0.050 ± 0.050	-	-	-	
<i>Monodactylus argenteus</i>	-	-	-	0.011 ± 0.007	-	-	-	-	-	-	-	
<i>Girella tricuspidata</i>	0.019 ± 0.014	-	-	0.003 ± 0.003	-	-	-	-	-	-	-	
<i>Scomber australasicus</i>	0.009 ± 0.007	-	-	0.022 ± 0.014	-	-	0.023 ± 0.023	-	-	-	-	
<i>Siganus fuscescens</i>	0.023 ± 0.020	-	-	-	-	-	-	-	-	-	-	
<i>Pseudorhombus arsius</i>	0.005 ± 0.005	-	-	0.009 ± 0.008	-	-	0.001 ± 0.001	- ± -	-	-	-	
<i>Pseudorhombus jenynsii</i>	-	-	-	0.011 ± 0.008	-	-	0.003 ± 0.003	0.003 ± 0.003	-	-	-	
<i>Monacanthus chinensis</i>	0.007 ± 0.006	-	-	0.022 ± 0.017	-	-	0.002 ± 0.001	- ± -	-	-	-	
<i>Meuschenia freycineti</i>	0.005 ± 0.005	-	-	0.007 ± 0.005	-	-	- ± -	- ± -	-	-	-	
<i>Meuschenia trachylepis</i>	0.018 ± 0.008	-	-	0.008 ± 0.008	-	-	-	-	-	-	-	

- Not recorded or not calculated for rare event occurrences

Appendix 5. Bait harvest rate estimates (fish per fisher hour) and standard errors for all taxa groups caught and used for bait by boat-based and shore-based fishers in the eastern and western zones of the Sydney Harbour estuary over the summer survey period.

GROUP NAME	BAIT HARVEST RATES							
	SHORE FISHERY				BOAT FISHERY			
	EAST		WEST		EAST		WEST	
	Harvest Rate (fish/ fisher h)	± SE	Harvest Rate (fish/ fisher h)	± SE	Harvest Rate (fish/ fisher h)	± SE	Harvest Rate (fish/ fisher h)	± SE
Squids and cuttlefishes	-	-	0.001	± 0.001	0.115	± 0.041	-	-
Whitings	-	-	0.004	± 0.003	-	-	-	-
Tailor	0.011	± 0.007	0.046	± 0.033	-	-	-	-
Scads	0.116	± 0.048	0.034	± 0.020	0.108	± 0.038	0.008	± 0.008
Slimy mackerel	0.038	± 0.032	0.030	± 0.026	0.035	± 0.022	-	-

- Not recorded or not calculated for rare event occurrences

Appendix 6. Discarded catch rate estimates (fish per fisher hour) and standard errors for all taxa groups caught and released by boat-based and shore-based fishers in the eastern and western zones of the Sydney Harbour estuary over the summer survey period.

GROUP NAME	DISCARDED CATCH RATES							
	SHORE FISHERY				BOAT FISHERY			
	EAST		WEST		EAST		WEST	
	Discard Rate (fish/ fisher hr)	± SE	Discard Rate (fish/ fisher hr)	± SE	Discard Rate (fish/ fisher hr)	± SE	Discard Rate (fish/ fisher hr)	± SE
Sharks and rays	0.007 ± 0.006	-	-	-	0.037 ± 0.033	-	-	-
Eels	-	-	-	-	0.001 ± 0.001	-	-	-
Seargent baker	-	-	-	-	< 0.001 ± < 0.001	0.003 ± 0.003	-	-
Scorpionfishes	-	-	-	-	0.001 ± 0.001	-	-	-
Flatheads	0.006 ± 0.003	-	0.023 ± 0.013	-	0.138 ± 0.098	0.011 ± 0.007	-	-
Groupers	0.005 ± 0.005	-	-	-	0.005 ± 0.004	-	-	-
Whitings	0.003 ± 0.002	-	0.033 ± 0.017	-	0.007 ± 0.004	0.115 ± 0.062	-	-
Tailor	0.031 ± 0.019	-	0.069 ± 0.036	-	0.006 ± 0.004	0.089 ± 0.061	-	-
Trevallies	-	-	-	-	0.007 ± 0.006	0.007 ± 0.007	-	-
Scads	0.074 ± 0.054	-	0.226 ± 0.120	-	0.011 ± 0.011	0.018 ± 0.018	-	-
Kingfishes	0.030 ± 0.023	-	< 0.001 ± < 0.001	-	0.086 ± 0.028	-	-	-
Breams	0.100 ± 0.019	-	0.224 ± 0.071	-	0.067 ± 0.022	0.098 ± 0.036	-	-
Snapper	0.318 ± 0.106	-	0.441 ± 0.152	-	0.650 ± 0.324	0.441 ± 0.321	-	-
Silver batfish	0.011 ± 0.011	-	0.015 ± 0.009	-	-	-	-	-
Mados	0.082 ± 0.056	-	-	-	-	-	-	-
Sweep	0.121 ± 0.077	-	± -	-	0.004 ± 0.003	0.013 ± 0.013	-	-
Wrasses	0.017 ± 0.017	-	0.001 ± 0.001	-	-	-	-	-
Flounders and soles	0.002 ± 0.002	-	0.002 ± 0.002	-	0.012 ± 0.007	0.005 ± 0.005	-	-
Leatherjackets	0.106 ± 0.046	-	0.013 ± 0.008	-	0.008 ± 0.006	-	-	-
Toadfishes	0.003 ± 0.003	-	0.051 ± 0.031	-	0.002 ± 0.001	-	-	-
Unidentified taxa	0.009 ± 0.006	-	-	-	-	-	-	-

- Not recorded or not calculated for rare event occurrences

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