

**A 12-month survey of recreational estuarine fishing in the  
South Coast bioregion of Western Australia during 2002/03**

C.B. Smallwood and N.R. Sumner

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Department of Fisheries  
Government of Western Australia



*Fish for the future*

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## **Executive Summary**

*A 12-month survey of recreational estuarine shore and boat-based fishing in the South Coast bioregion of Western Australia was conducted between December 2002 and November 2003. A total of 17 estuary and inlet locations were surveyed using creel, bus route and census methods to determine recreational catch and fishing effort. While not included in this survey the recreational fishing activity using nets and from charter boats is negligible (<2 % effort) in estuaries on the South Coast.*

*During the survey, 534 boat-based fishing groups were interviewed at public boat ramps when they returned from their fishing trips and 927 shore-based fishing groups were interviewed while fishing at locations around estuaries or inlets on the South Coast. In addition, a census was used to collect data from 132 groups fishing from houseboats rented in Walpole/Nornalup and Oyster Harbour.*

*The total annual recreational fishing effort for the estuaries and inlets of the South Coast bioregion was estimated at 254,171 fisher hours (SE  $\pm$  6,236) or 86,482 fisher days (SE  $\pm$  3,630). This comprised 202,658 fisher hours (67,778 fisher days) from boat-based fishers, 47,816 fisher hours (17,451 fisher days) by shore-based fishers and 3,698 fisher hours (1,253 fisher days) from houseboats. The highest fishing effort was found to occur in Walpole/Nornalup Inlet and Oyster Harbour.*

*The total recreational catch of all species recorded in the survey (except cockles, mussels and razor clams) was estimated at 212,575 kept fish (SE  $\pm$  13,099) and 201,710 released fish (SE  $\pm$  13,182). The highest catches occurred in Oyster Harbour (70,809 kept fish) and Walpole/Nornalup Inlet (57,366 kept fish). A summary of the total retained recreational catch (by numbers and weight) for the main species caught in each estuary and inlet surveyed is shown in Table 1. When combining all the survey locations within the South Coast bioregion, the most frequently kept species by recreational fishers were King George whiting (66,244 retained fish), black bream (46,216 retained fish), Australian herring (32,930 retained fish), skipjack/silver trevally (20,951 retained fish) and blue swimmer crabs (10,545 retained crabs).*

*The survey showed that most recreational fishers interviewed had a reasonable knowledge of the bag and size limits for the species they were targeting or the predominant species they had caught. Recreational shore-based and boat-based fishers correctly identified the bag limit during 60% and 78% of interviews, respectively. The size limits of species were correctly identified by 71% of shore-based and 90% of boat-based groups. Only four fishing groups exceeded their bag limit during the survey period although 74 fishing groups retained undersize fish.*

**Table 1.** Summary of total recreational catch expressed as number of fish, percentage of total catch and estimated weight for the main species in each estuary in the South Coast bioregion from December 2002 – November 2003. N/A = catch weight not able to be calculated.

Common name	Scientific name	Number of fish retained (%)*	Weight of retained catch (kg)
<b>Broke Inlet</b>			
Whiting, King George	<i>Sillaginodes punctata</i>	1,456 (63%)	413
Garfish, Southern Sea	<i>Hyporhamphus melanochir</i>	609 (28%)	N/A
	<b>Total</b>	<b>2,065 (91%)</b>	<b>413</b>
<b>Walpole/Nornalup Inlet</b>			
Bream, Black	<i>Acanthopagrus butcheri</i>	26,586 (44%)	14,780
Whiting, King George	<i>Sillaginodes punctata</i>	10,935 (18%)	1,712
Herring, Australian	<i>Arripis georgianus</i>	10,932 (18%)	1,488
Flathead, Southern Blue-Spotted	<i>Platycephalus speculator</i>	3,069 (5%)	1,102
Trevally, Skipjack/Silver	<i>Pseudocaranx dentex</i>	1,954 (3%)	721
Bream, Silver (Tarwhine)	<i>Rhabdosargus sarba</i>	1,521 (3%)	555
	<b>Total</b>	<b>54,997 (91%)</b>	<b>20,358</b>
<b>Irwin Inlet</b>			
Whiting, King George	<i>Sillaginodes punctata</i>	4,077 (49%)	713
Snapper, Pink	<i>Pagrus auratus</i>	1,987 (24%)	870
	<b>Total</b>	<b>6,064 (73%)</b>	<b>1,583</b>
<b>Wilson Inlet</b>			
Whiting, King George	<i>Sillaginodes punctata</i>	5,411 (39%)	1,343
Flathead, Southern Blue-Spotted	<i>Platycephalus speculator</i>	2,390 (17%)	1,522
Snapper, Pink	<i>Pagrus auratus</i>	1,728 (12%)	1,743
Bream, Black	<i>Acanthopagrus butcheri</i>	1,606 (12%)	793
Garfish, Southern Sea	<i>Hyporhamphus melanochir</i>	826 (6%)	242
	<b>Total</b>	<b>11,961 (86%)</b>	<b>5,643</b>
<b>Princess Royal Harbour</b>			
Whiting, King George	<i>Sillaginodes punctata</i>	13,303 (42%)	2,190
Herring, Australian	<i>Arripis georgianus</i>	6,860 (21%)	982
Trevally, Skipjack/Silver	<i>Pseudocaranx dentex</i>	3,299 (10%)	653
	<b>Total</b>	<b>23,462 (73%)</b>	<b>3,825</b>
<b>Oyster Harbour</b>			
Whiting, King George	<i>Sillaginodes punctata</i>	30,545 (43%)	4,544
Herring, Australian	<i>Arripis georgianus</i>	14,079 (20%)	1,608
Trevally, Skipjack/Silver	<i>Pseudocaranx dentex</i>	13,329 (19%)	4,528
Bream, Black	<i>Acanthopagrus butcheri</i>	2,845 (4%)	1,451
	<b>Total</b>	<b>60,798 (86%)</b>	<b>12,131</b>
<b>Beaufort Inlet</b>			
Bream, Black	<i>Acanthopagrus butcheri</i>	1,356 (96%)	614
	<b>Total</b>	<b>1,356 (96%)</b>	<b>614</b>
<b>Wellstead Estuary</b>			
Crab, Blue manna	<i>Portunus pelagicus</i>	8,557 (54%)	2,077
Bream, Black	<i>Acanthopagrus butcheri</i>	6,409 (40%)	2,796
	<b>Total</b>	<b>14,966 (94%)</b>	<b>4,873</b>
<b>Stokes Inlet</b>			
Bream, Black	<i>Acanthopagrus butcheri</i>	5,533 (99%)	2,103
	<b>Total</b>	<b>5,533 (99%)</b>	<b>2,103</b>
<b>Bandy Creek</b>			
Trevally, Skipjack/Silver	<i>Pseudocaranx dentex</i>	1,769 (61%)	241
Herring, Australian	<i>Arripis georgianus</i>	846 (29%)	N/A
	<b>Total</b>	<b>2,615 (90%)</b>	<b>241</b>
<b>Other locations</b>			
Bream, Black	<i>Acanthopagrus butcheri</i>	1,684 (76%)	735
	<b>Total</b>	<b>1,684 (76%)</b>	<b>735</b>

\*The proportion of the total catch, expressed as a percentage of the total number of fish caught in each estuary.

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## 1.0 Introduction

The Recreational Fisheries Program of the Department of Fisheries, Western Australia, has a strategic plan to conduct comprehensive creel surveys of recreational fishing in each of the state's marine bioregions (Penn et al., 2003). These bioregions are the West Coast, Gascoyne, Pilbara/Kimberley and South Coast (Figure 1). To record and monitor changes in recreational catch and fishing effort, an integrated approach where all bioregions are to be surveyed on a regular basis was proposed. Until this study, the South Coast was the only bioregion in which a survey of recreational fishing had not been undertaken. Although originally intended to be a survey of both marine and estuarine fishing, due to the high cost of surveys in this extensive region, a reduced-scale survey was devised to assess recreational fishing in estuaries and inlets only.

Recreational fishing is one of the most popular recreational activities in Western Australia. A recent phone survey estimated that 537,000 people participate in this activity at least once a year (Baharthah, 2006). According to this survey, the South Coast is the second most heavily used bioregion after the West Coast, with 13% of the state's recreational fishing effort. Information on recreational catch and fishing effort in Western Australia is required to develop management strategies to ensure the sustainability of fishing activities and for the conservation of fish stocks and habitats. This information will also be used as a basis for future management decisions to improve or maintain the quality and diversity of recreational fishing experiences and to assist with achieving equity between different users of this resource.

The South Coast bioregion lies between the western location of Black Point (115° 30' E) and the Western Australian border at Eucla (128° 53' E) to the east (Figure 1). The coastline between these two points is approximately 1,400km. The numerous estuaries, inlets and lakes that adjoin the coast within this region offer a unique environment, protected from adverse weather conditions, for recreational fishing from boats or the shore. There is a drop in rainfall towards the eastern end of the South Coast bioregion and as a consequence there are only a few relatively small estuaries located east of Esperance. For this reason, and due to the high cost of travelling to these locations, no sampling was undertaken east of this regional centre.

Estuarine fish populations vary significantly depending on the level of fresh or salt water, tolerance to fluctuating conditions, connection between the estuary and ocean as well as the population dynamics of adjacent marine fish populations (Brearley, 2005). Estuaries or inlets that are permanently open to the sea, such as Walpole/Nornalup Inlet, Waychinicup Inlet, Princess Royal Harbour and Oyster Harbour, generally have higher species diversity. Recreational fishers at these locations can target both estuarine species such as black bream as well as marine species such as squid, leatherjackets and blue mackerel. Normally closed systems (Beaufort Inlet, Wellstead Estuary, Gordon Inlet, Hamersley Inlet, Munglinup Inlet, Stokes Inlet, Bandy Creek) and permanently closed systems (Lake Quallilup) generally have lower species diversity as there is less opportunity for recruitment and few species can handle the more extreme conditions, such as high salinity. Recreational fishers target mainly black bream in these locations although if recently opened to the sea, fishers may also target species such as mullet, King George whiting and flathead. Similar to this, seasonally open systems, such as at Broke Inlet, Irwin Inlet, Torbay Inlet, Wilson Inlet and Taylor Inlet, depending on when the bar across the mouth was last open, also provide opportunities for fishers to target a range of both estuarine and marine species.

The aim of this report was to provide estimates of the recreational catch and fishing effort for estuaries and inlets in the South Coast bioregion. Additional information on recreational fishers, such as which species were being targeted, place of residence, compliance with regulations and knowledge of bag and size limits was also collected.



**Figure 1.** Boundaries of the marine bioregions used for management of Western Australian fisheries.

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## 2.0 Methods

### Survey design

There are many access sites for boats and potentially unlimited access for shore-based fishers along most of the Western Australian coastline. Several estuaries and inlets within the South Coast bioregion are located next to regional centres, such as Albany with Princess Royal and Oyster Harbours. However, others are isolated, only accessible by 4WD and have a limited number of access points for both boats and shore-based fishers, such as Stokes Inlet. Nonetheless, many recreational fishers visit estuaries and inlets within the South Coast bioregion for extended periods, with camping occurring at some locations.

Two creel survey methods and a census were used to estimate the recreational catch of all species for boat and shore-based fishers in the estuaries and inlets. The bus route method (Robson and Jones, 1989, Jones et al., 1990), where an interviewer visits all boat ramps in a district on the one day, was used for trailered boats launched from public boat ramps. Roving creel surveys were used to estimate the catch and fishing effort for shore-based fishers. These survey techniques have been used previously in Western Australia to collect recreational fishing data from other bioregions (Sumner et al., 2002). Some recreational fishing also occurs from houseboats operated in Oyster Harbour and Walpole/Nornalup Inlet and this was estimated by using a census of all fishing activity from these vessels.



## Spatial and temporal stratification

The 12-month survey of estuaries and inlets in the South Coast bioregion began in December 2002. The study included 17 estuaries, inlets and lakes from Broke Inlet to Bandy Creek (Figure 2). The seven survey routes were chosen to minimise travel time and hence the costs of using the bus route method. The estuaries and number of boat ramps surveyed at each (in parentheses) were as follows: Broke (1), Walpole/Nornalup (8), Irwin (2), Wilson (7), Princess Royal Harbour (5), Oyster Harbour (7), Beaufort (2), Wellstead (2) and Stokes (2). While travelling between boat ramps interviewers conducted counts of all shore-based fishers and interviewed as many as time permitted. To further reduce costs this was incorporated into the bus route schedule rather than conducting a separate survey.

The large inlets (Walpole/Nornalup Inlet, Wilson Inlet, Princess Royal Harbour and Oyster Harbour) were surveyed separately using the bus route method so that an interviewer could visit all the boat ramps and access points around a particular estuary in a day. Estuaries and inlets (Broke and Irwin Inlets, Beaufort and Wellstead Estuary, Stokes Inlet and Bandy Creek) within close proximity to each other were combined and surveyed using the same schedule without compromising the time spent at each ramp. The total catch and fishing effort for each of these estuaries and inlets was estimated separately.

Small lakes or inlets with anticipated lower levels of recreational fishing effort were visited less frequently by the interviewer to gain an understanding of fishing activity in these locations. Interviewers surveyed two days per month only and for this reason the quantity of data from these estuaries was insufficient to be reported separately during analysis. This occurred at Gordon Inlet, Hamersley Inlet, Lake Quallilup, Munmlinup Inlet, Taylor Inlet, Torbay Inlet and Waychinicup Inlet.

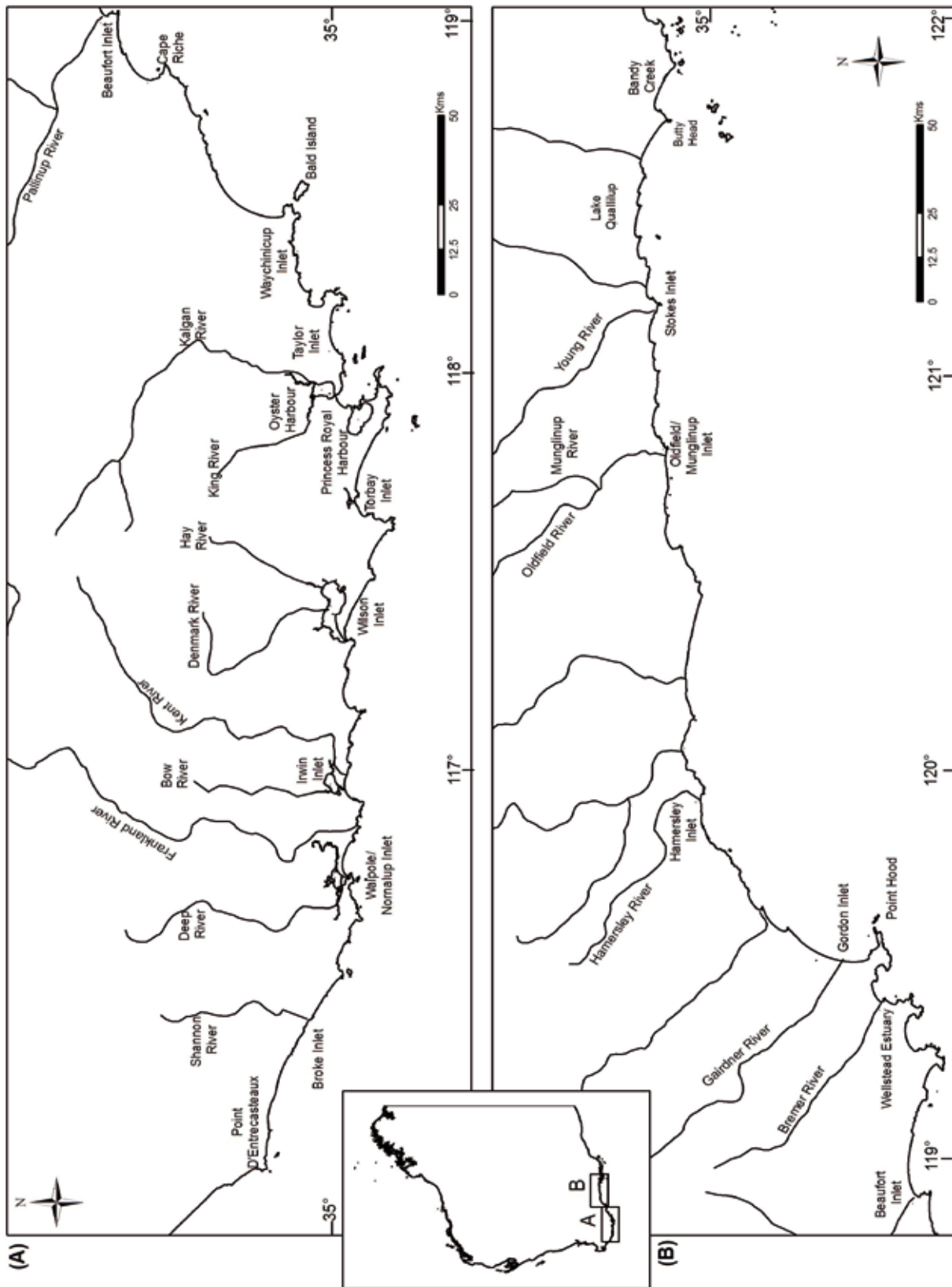
The survey of boat ramps and access points in each estuary was stratified by season (summer, autumn, winter and spring) and time of day (morning or afternoon). Data from these surveys were then aggregated to obtain the total recreational boat-based catch and effort within the South Coast bioregion. Separate total catch and fishing effort estimates were made for each estuary (except those small estuaries or lakes with lower sampling effort). Data collected from shore-based anglers intercepted in each area were analysed by season only as there was insufficient data for morning/afternoons to be analysed separately.

The number of days surveyed per month, length and start times of shifts varied depending on season (Table 2). Most days were allocated when the highest fishing effort occurred, based on prior information on recreational fishing patterns provided by Fisheries Officers and recreational fishers. Each interviewer worked one shift (morning or afternoon) on each of their scheduled days. The duration of patrols were limited to daylight hours due to concerns for the safety of staff and budgetary constraints.

**Table 2.** The number of days surveyed per month and shift length (in hours) for each season during the survey period from December 2002 – November 2003.

Season	Days surveyed per month	Shift length (hours)	Morning Shift	Afternoon Shift
Summer	10	6.5	0700 - 1330	1330 – 2000
Autumn	8	5.75	0700 - 1245	1245 – 1830
Winter	6	5.25	0700 – 1215	1215 – 1730
Spring	8	5.75	0700 - 1245	1245 – 1830

**Figure 2.** Location of estuaries and inlets surveyed in the South Coast bioregion from December 2002 – November 2003.



## **Sampling design**

### **Boats launched at public boat ramps – bus route method**

An independent bus route was set up for each of the seven survey areas. The schedules were constructed as described by Pollock et al. (1994). The start, travel and wait time for each ramp within a particular area were rounded to the nearest minute and randomised schedules were developed using a mathcad worksheet.

The starting location and direction of travel for each of the bus routes were chosen randomly. The bus route commenced either between ramps or at a ramp. However, due to the large distances between boat ramps, travel time and cost involved, starting at a ramp and returning to the same ramp to complete the route at the end of a shift was inefficient. Furthermore, removing this last leg of the bus route allowed more time to be spent at the boat ramps collecting data rather than travelling. For this reason the bus route method was constrained so that a shift could not commence part way through the wait time at a ramp although the probability of commencing at a ramp or travelling remained unchanged. Each site was visited during all hours of the day by the end of the season. McGlennon and Kinloch (1997) use a similar modification of the bus route survey method for a survey conducted in South Australia.

Within each season a random sample of survey days was chosen for each district. When it was not possible for recreational boats in an area to fish due to severe weather conditions, the survey was not conducted and it was assumed that there was zero catch and fishing effort for the day. The interviewer made this decision on the day after assessing the weather conditions. If the interviewer was unable to complete the survey, e.g. due to illness, then it was rescheduled to another day of that month.

The interviewer followed a pre-determined schedule specifying the boat ramps to visit and the sampling time at each boat ramp. A location form was used to record the environmental conditions as well as the time of boat launches and retrievals while the interviewer was at a boat ramp (Appendix 1). Only recreational boat trailers were counted at the boat ramps; these could be distinguished from trailers used by professional fishers. An interview form was used to record information such as the time-spent fishing, postcode for place of residence and catch (Appendix 2). As the interview was conducted at the completion of the day's fishing it represents the entire catch for the duration of the trip. The catch of each species was counted and a random total length sample of each measured.

### **Shore-based fishing – roving creel survey**

A roving creel survey was used for shore-based fishers, with information collected during the bus route surveys (used to gather data on boat-based fishing). The interviewers visited all locations around the estuary where shore-based fishing occurred, including those only accessible by four-wheel drive vehicle. Instantaneous counts of shore-based fishers were made on arrival at each fishing location visited and recorded on the location form (Appendix 1). Time spent fishing, catch and other relevant information was recorded from shore-based fishers when interviewed (Appendix 2). At camping sites groups of people were interviewed to collect participation and catch rate information to improve the accuracy of these calculations and estimates. As for boat-based fishers, the catch of each species was counted and a random sample measured.

## **Recreational fishing from houseboats – census**

Some recreational fishing also occurred from houseboats rented in Oyster Harbour and Walpole/Nornalup Inlet. A census was conducted to determine the catch and effort from these vessels. Data sheets were left on houseboats to be filled in by all groups renting the vessel during the period corresponding with the creel survey (Appendix 3). This data was analysed separately and it was assumed that all catch and effort from the houseboats was recorded by renters and there are therefore no errors associated with these figures.

## **Estimation of catch and effort**

### **Boat-based fishing – bus route method**

The fishing effort for the day was estimated, in boat hours, using counts of the number of trailers at the start and finish of the interviewers allocated time at a boat ramp in addition to information collected during interviews (Appendix 4). Catch rates were calculated from the time spent fishing and catch information obtained by interviewing fishers when they returned to the boat ramp at the completion of their fishing trip. The total catch was estimated for both kept and released species by multiplying the catch rate by the estimate of fishing effort in fisher hours. The standard error associated with the estimate of the number of fish kept  $SE(\hat{c})$  was calculated for each species. The reported estimates were rounded to reflect the level of precision.

The measure of fishing effort for each season was adjusted to correct for the number of boats not involved in fishing activities. The correction was made by multiplying the number of trailers counted at the boat ramp by the proportion of boats interviewed that were participating in recreational fishing. Corrections were also made for boats that fished outside of the estuary or inlet area and for those that used a mooring, instead of being launched or retrieved from the ramp.

Fishing effort by boats that were launched before the start of a morning shift (0700) and returned after the start of the morning shift was also taken into account. The ratio of effort occurring prior to the start of a morning shift to that occurring after the start of a morning shift was estimated and a correction factor ( $f$ ) applied to the effort estimate in the mornings for each season (Appendix 4).

### **Shore-based fishing – roving creel survey**

The fishing effort for shore-based fishers was calculated, in fisher hours, by multiplying the instantaneous counts of participants by the number of hours each fished in the fishing day (Appendix 5). Catch rates were estimated from information on the time spent fishing and catch obtained by interviewing anglers while they were still fishing. The total catch was estimated by multiplying the catch rate by the estimate of fishing effort in fisher hours.

### **Conversion of effort to fisher days**

Historically, effort has been presented as a fisher day, which represents an average fishing trip, and provides an estimate of the estimated total number of fishing trips undertaken in the study area during a 12-month survey period. For boat-based groups the total annual effort (in boat hours) was converted to fisher days by multiplying by the number of people on the boat and then dividing by the mean time spent fishing per trip (Appendix 4). For shore-based fishing the effort (in fisher hours) was converted to fisher days by dividing by the mean time spent fishing per trip (Appendix 5).

However, for comparisons between estuaries or different strata it is more appropriate to present effort in fisher hours due to variations in the length of fishing trips between estuaries. Effort is automatically calculated in fisher hours for shore-based and houseboat fishers while boat-based effort is calculated in boat hours and converted to fisher hours by multiplying by the mean number of people per boat. Fisher hours represent the estimated number of hours fished in the study area during the survey period.

### **Calculation of total weight**

The total length (in millimetres) of a random sample of the retained catch was collected in each estuary by interviewers. These total lengths were converted to weights (in grams) using length-weight regressions (Appendix 6). These weights were then used to calculate total estimated weight (in kilograms) for dominant species caught in a particular estuary. This was accomplished by multiplying the average weight for a species by the estimated number of fish caught. The number of lengths used to calculate average weight, average length (in millimetres) and the average weight for each fish (in grams), is shown in Appendix 7. In some instances the number of lengths was <20 and therefore these average weights were not used to calculate total weight due to the low sample size. In addition, for some recreational species no length data was collected, or no length-weight regression was available, and therefore calculation of a catch weight estimate was not possible.

The total weight of the main species caught recreationally was also compared with those caught commercially for the same time period in each estuary. Commercial fishing occurred in 11 estuaries included in the recreational survey and monthly returns are submitted to the Department of Fisheries by industry as a condition of renewal of their licences. The catch information from these returns was then extracted from the Catch and Effort Statistics System (CAESS). Due to <5 boats operating in most of these locations, the commercial catch could be reported for Stokes Inlet, Oyster Harbour, Wilson Inlet and Princess Royal Harbour only.

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## **3.0 Results**

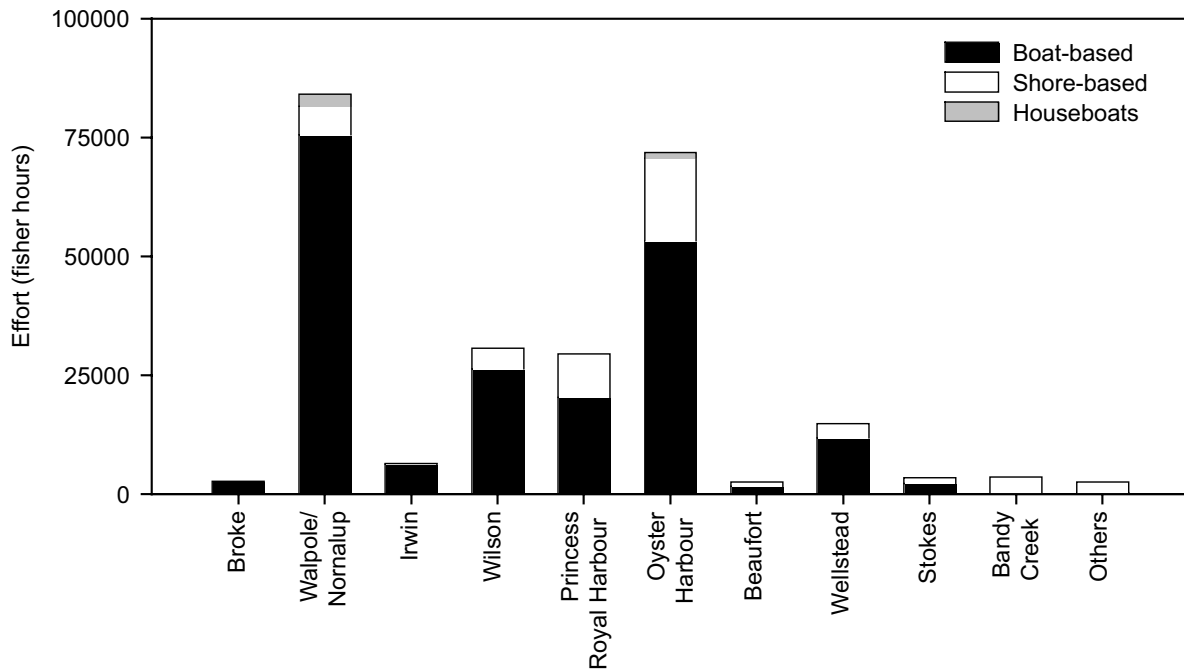
### **Summary of recreational fishing in the South Coast bioregion**

During the 12-month survey of South Coast estuaries and inlets, 1,914 interviews were conducted with shore and boat-based groups, of which 1,461 were participating in recreational fishing. Boat-based fishing comprised 37% of interviews and shore-based fishing 63% of interviews.

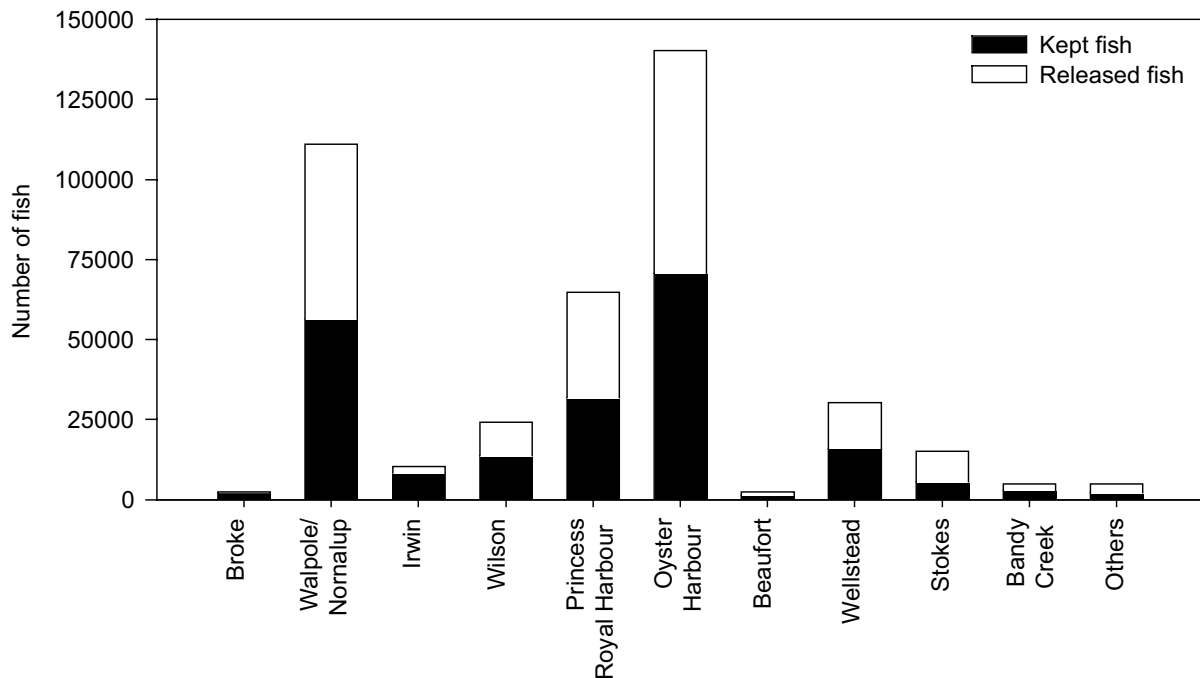
The total effort for recreational fishing in all estuaries and inlets surveyed within the South Coast bioregion from December 2002 – November 2003 was estimated at 254,171 fisher hours (SE  $\pm$  6,236) or 86,482 fisher days (SE  $\pm$  3,630). Of this, boat-based effort comprised 202,658 fisher hours (67,778 fisher days) and shore-based effort 47,816 fisher hours (17,451 fisher days). The remaining 3,698 fisher hours (1,253 fisher days) was people fishing from houseboats. This excludes effort for recreational netting, which will be presented in a separate report. A comparison of fishing effort found the highest to occur in Walpole/Nornalup Inlet, followed by Oyster Harbour (Figure 3).

The total estimated catch for recreational fishing (excluding cockles, mussels and razor clams) in the surveyed estuaries and inlets in the South Coast bioregion was 212,575 kept fish (SE  $\pm$  13,099) and 201,710 released fish (SE  $\pm$  13,182). This excludes the catch for recreational netting. A comparison of the catch between survey locations showed the highest catches to occur in Oyster Harbour and Walpole/Nornalup Inlet (Figure 4).

When combining all locations surveyed, the most frequently kept species by recreational fishers were King George whiting (66,244 fish), black bream (46,216 fish), Australian herring (32,930 fish), skipjack/silver trevally (20,951 fish) and blue swimmer crabs (10,545 crabs). A substantial number of black bream (71,659 fish), King George whiting (44,924 fish), six lined trumpeter (23,407 fish) and yellowtail scad (10,969 fish) were also released by recreational fishers in the South Coast bioregion.



**Figure 3.** Total fishing effort (in fisher hours) for each estuary and inlet surveyed in the South Coast bioregion from December 2002 – November 2003.



**Figure 4.** Total number of fish kept and released by recreational fishing from the shore, boats and houseboats from December 2002 – November 2003. Note: recreational catch excludes cockles, mussels and razor clams.

## Broke Inlet

There were 13 interviews at Broke Inlet during the 12-month survey. These were all boats, of which six were involved in recreational fishing and one waterskiing. No shore-based fishing was recorded at Broke Inlet, as suitable fishing sites were limited due to shallow water extending a considerable distance from the shore.

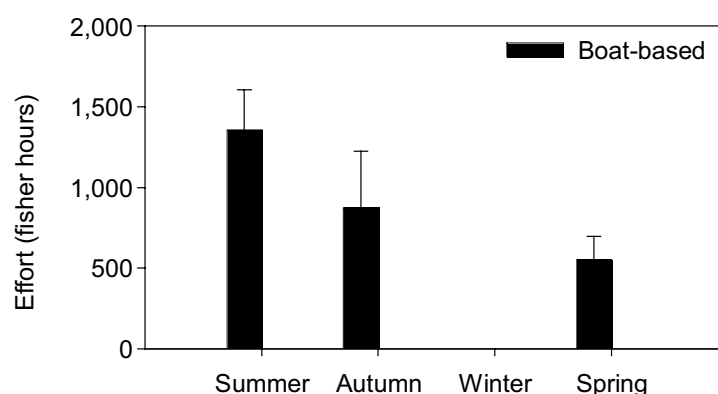
The largest proportion of recreational fishers interviewed at Broke Inlet during the survey resided in Regional WA (83%). The remainder were from the local postcode area surrounding the inlet (17%).

### Targeted species

The only species targeted by recreational anglers in Broke Inlet was King George whiting.

### Fishing effort

The total effort for Broke Inlet, all of which came from boat-based fishers, was estimated at 2,799 fisher hours (945 fisher days). The majority of this effort occurred in summer, with no effort observed during winter (Figure 5).



**Figure 5.** Effort ( $\pm$  standard error), in fisher hours, for boat-based fishing during each season surveyed at Broke Inlet from December 2002 – November 2003.

### Total catch

There were only three species of fish caught by recreational fishers in Broke Inlet. The highest retained catch was King George whiting with 1,456 kept fish (Table 3).

**Table 3.** Estimated number of fish kept and released by recreational fishers in Broke Inlet from December 2002 – November 2003.

Common name	Scientific name	Boat-based fishing		
		No. kept	SE kept	No. released
Whiting, King George	<i>Sillaginodes punctata</i>	1,456	202	152
Garfish, Southern Sea	<i>Hyporhamphus melanochir</i>	609	145	0
Bream, Silver (Tarwhine)	<i>Rhabdosargus sarba</i>	236	32	0
	<b>Total</b>	<b>2,301</b>	<b>251</b>	<b>152</b>

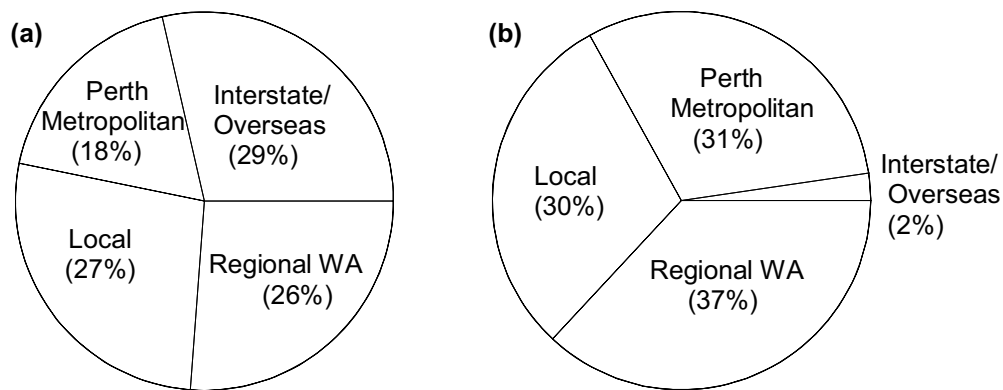
### Weight of main species

King George whiting was the only species for which there were >20 lengths recorded in Broke Inlet (Appendix 7). The weight of the retained recreational catch for this species during the survey period was estimated at 852 kg.

### Walpole/Nornalup Inlet

There were 279 interviews in Walpole/Nornalup Inlet during the survey, of which 153 were boat-based groups. These boat-based groups were involved in recreational fishing (83%), other activities (16%) and surfing (1%). All shore-based groups were involved in recreational fishing.

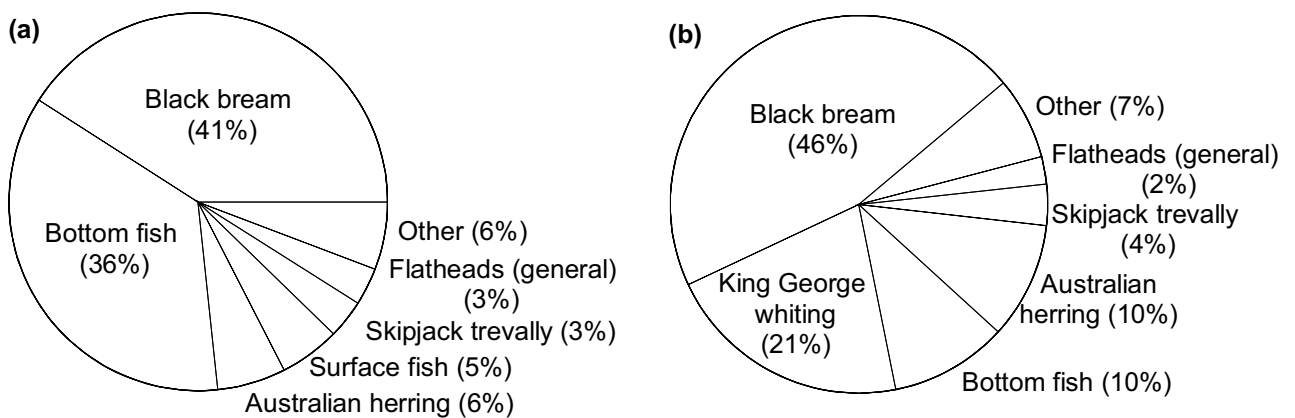
The place of residence for the majority of shore-based fishers interviewed at Walpole/Nornalup Inlet was Interstate/Overseas (29%) (Figure 6). This contrasts with boat-based fishers, for which the majority were from Regional WA (excluding the local postcode area) (37%).



**Figure 6.** Percentage of (a) shore-based and (b) boat-based fishing groups interviewed in Walpole/Nornalup Inlet from December 2002 – November 2003 according to their place of residence.

### Targeted species

The main species targeted in Walpole/Nornalup Inlet during the survey period were black bream with 41% of shore-based and 46% of boat-based fishers targeting this species (Figure 7).

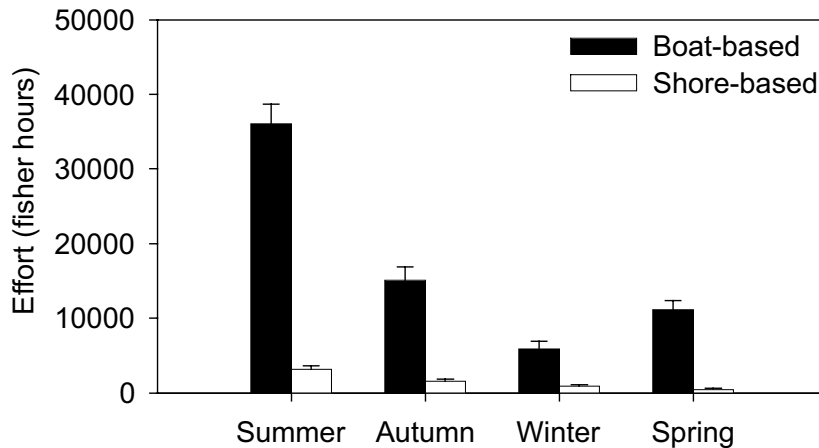


**Figure 7.** Percentage of (a) shore-based and (b) boat-based fishing groups targeting particular species in Walpole/Nornalup Inlet from December 2002 – November 2003.



### Fishing effort

The total effort for Walpole/Nornalup Inlet during the survey period was estimated at 81,661 fisher hours (26,163 fisher days). Fishers from houseboats contributed an additional 2,522 fisher hours (750 fisher days). The highest levels of effort for both boat and shore-based fishing were recorded in summer (Figure 8).



**Figure 8.** Effort ( $\pm$  standard error), in fisher hours, for shore and boat-based fishing during each season surveyed at Walpole/Nornalup Inlet from December 2002 – November 2003.

### Total catch

Recreational anglers caught 22 species, plus two general fish categories, in Walpole/Nornalup Inlet during the survey period. Black bream was the most frequently caught species by both shore and boat-based anglers with 1,297 and 24,976 kept fish, respectively (Table 4).

Anglers from houseboats caught 18 fish species during the survey period, plus an additional four fish and ray general categories for released fish (Table 5). The most frequently caught species was black bream, followed by Australian herring and King George whiting.

**Table 4.** Estimated number of fish kept and released by recreational fishers in Walpole/Nornalup Inlet from December 2002 – November 2003.

Common name	Scientific name	Boat-based fishing			Shore-based fishing		
		No. kept	SE kept	No. released	No. kept	SE kept	No. released
Bream, Black	<i>Acanthopagrus butcheri</i>	24,976	3,907	29,188	1,297	641	4,104
Whiting, King George	<i>Sillaginodes punctata</i>	10,764	2,534	11,232	Insig.		0
Herring, Australian	<i>Arripis georgianus</i>	9,863	3,101	2,851	774	567	Insig.
Flathead, Southern Blue-Spotted	<i>Platycephalus speculator</i>	2,862	1,081	Insig.	Insig.		Insig.
Trevally, Skipjack/Silver	<i>Pseudocaranx dentex</i>	1,542	553	670	368	232	0
Bream, Silver (Tarwhine)	<i>Rhabdosargus sarba</i>	1,287	485	1,398	184	109	125
Salmon, Australian	<i>Arripis truttaceus</i>	593	256	330	Insig.		0
Whiting, School Southern/ Silver	<i>Sillago bassensis</i>	405	325	0	0	0	Insig.
Mullet, Yellow Eye (Pilch)	<i>Aldrichetta forsteri</i>	345	220	Insig.	0	0	10
Flounder, Elongate	<i>Ammotretis elongatus</i>	168	116	89	Insig.		0
Flounder, Small-Toothed	<i>Pseudorhombus jenynsii</i>	99	98	0	0	0	0
Crab, Blue swimmer	<i>Portunus pelagicus</i>	Insig.		0	0	0	0
Flounders, general		Insig.		102	0	0	0
Tailor	<i>Pomatomus saltatrix</i>	Insig.		0	188	155	Insig.
Snapper, Pink	<i>Pagrus auratus</i>	Insig.		1,837	Insig.		0
Cobbler	<i>Cnidoglanis macrocephalus</i>	Insig.		0	0	0	0
Flathead, Rock	<i>Leviprora laevigatus</i>	Insig.		0	0	0	0
Whiting, Yellow-Finned	<i>Sillago schomburgkii</i>	0	0	Insig.	Insig.		0
Trumpeters/Grunters, General	Family Teraponidae	0	0	Insig.	0	0	87
Shark, Gummy	<i>Mustelus antarcticus</i>	0	0	Insig.	0	0	0
Ray, Southern Shovelnose	<i>Aptychotrema vincentiana</i>	0	0	Insig.	0	0	0
Sweep, Footballer	<i>Neatypus obliquus</i>	0	0	Insig.	0	0	0
Flathead, Long-headed	<i>Levipora inops</i>	0	0	0	Insig.		0
Trumpeter, Six Lined (Striped)	<i>Pelates sexlineatus</i>	0	0	0	0	0	50
	<b>Total</b>	<b>53,210</b>	<b>5,842</b>	<b>48,665</b>	<b>3,160</b>	<b>931</b>	<b>4,579</b>

**Table 5.** Actual number of fish kept and released by people fishing from houseboats in Walpole/ Nornalup Inlet from December 2002 – November 2003.

Common name	Scientific name	Actual houseboat catch	
		No. kept	No. released
Bream, Black	<i>Acanthopagrus butcheri</i>	313	674
Herring, Australian	<i>Arripis georgianus</i>	295	116
Whiting, King George	<i>Sillaginodes punctata</i>	138	162
Flathead, Southern Blue-Spotted	<i>Platycephalus speculator</i>	71	74
Bream, Silver (Tarwhine)	<i>Rhabdosargus sarba</i>	50	113
Trevally, Skipjack/Silver	<i>Pseudocaranx dentex</i>	44	46
Whiting, Yellow-Finned (Western Sand)	<i>Sillago schomburgkii</i>	22	6
Salmon, Australian	<i>Arripis truttaceus</i>	15	24
Flounder, Small-Toothed	<i>Pseudorhombus jenynsii</i>	10	5
Garfish, Southern Sea	<i>Hyporhamphus melanochir</i>	10	0
Trumpeter, Six Lined (Striped Trumpeter)	<i>Pelates sexlineatus</i>	8	74
Tailor	<i>Pomatomus saltatrix</i>	7	9
Snapper, Pink	<i>Pagrus auratus</i>	3	90
Mullet, Sea	<i>Mugil cephalus</i>	3	0
Mullet, Yellow Eye (Pilch)	<i>Aldrichetta forsteri</i>	3	1
Whiting, Trumpeter	<i>Sillago maculata</i>	2	0
Cobbler	<i>Cnidoglanis macrocephalus</i>	2	0
Ray, Southern Shovelnose	<i>Aptychotremata vincentiana</i>	0	12
Unknown Species		0	8
Rays, General		0	4
Toadfishes, General		0	2
Gobies, General		0	1
	<b>Total</b>	<b>996</b>	<b>1,421</b>

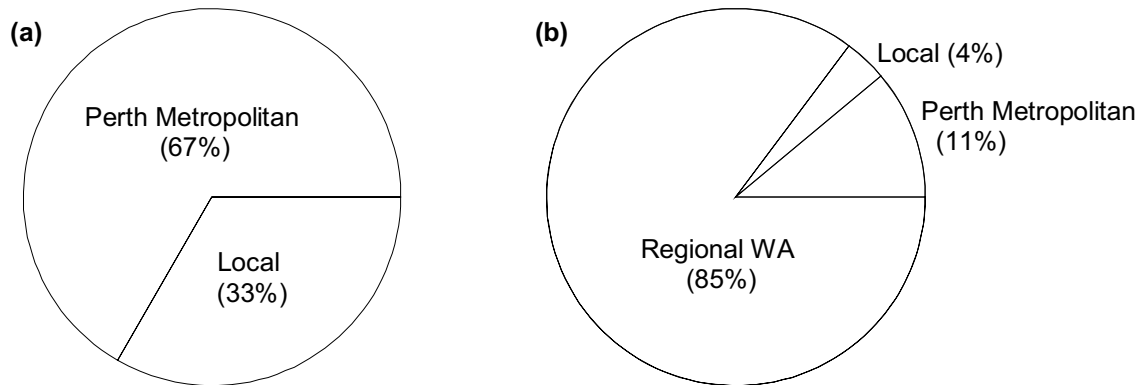
### Weight of main species

There were six recreational species in Walpole/Nornalup Inlet for which weight (in kilograms) could be calculated because they had >20 lengths (Appendix 7). These species were black bream (14,780 kg), King George whiting (1,712kg), Australian herring (1,488 kg), Southern blue-spotted flathead (1,102 kg), skipjack trevally (721 kg) and silver bream (555 kg).

## Irwin Inlet

There were 33 interviews conducted at Irwin Inlet during the survey period. There were three interviews with shore-based groups, of which all were fishing. Interviewed boat-based groups were participating in recreational fishing (87%), other activities (7%), surfing (3%) and waterskiing (3%).

Shore-based groups interviewed fishing in Irwin Inlet were from either the Perth Metropolitan (67%) or local postcode areas (33%) (Figure 9). Boat-based fishing groups were found to reside mostly in Regional WA (85%).



**Figure 9.** Percentage of (a) shore-based and (b) boat-based fishing groups interviewed in Irwin Inlet from December 2002 – November 2003 according to their place of residence.

## Targeted species

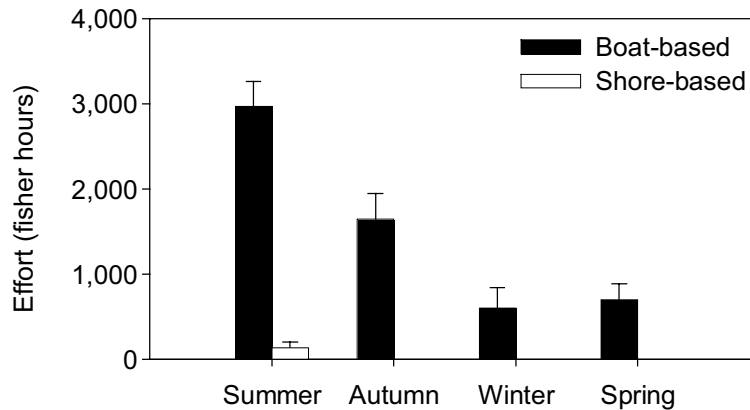
The only two species targeted by shore-based fishers interviewed during the survey period were unspecified bottom fish (67%) and King George whiting (33%) (Figure 10). King George whiting was the most frequently targeted species by boat-based anglers (67%), followed by blue swimmer crabs (14%).



**Figure 10.** Percentage of (a) shore-based and (b) boat-based fishing groups targeting particular species in Irwin Inlet from December 2002 – November 2003.

## Fishing effort

The total effort for Irwin Inlet was estimated at 6,540 fisher hours (2,788 fisher days). Shore-based effort only occurred in summer and coincided with the highest levels of boat-based activity (Figure 11).



**Figure 11.** Effort ( $\pm$  standard error), in fisher hours, for shore and boat-based fishing during each season surveyed at Irwin Inlet from December 2002 – November 2003.

### Total catch

There were 11 species caught by boat-based recreational fishers in Irwin Inlet. King George whiting, followed by pink snapper and yellow eye mullet, were the most frequently caught species (Table 6). Although there was a small amount of shore-based fishing during summer, these groups had no catch at the time of interview.

**Table 6.** Estimated number of fish kept and released by recreational fishers in Irwin Inlet from December 2002 – November 2003.

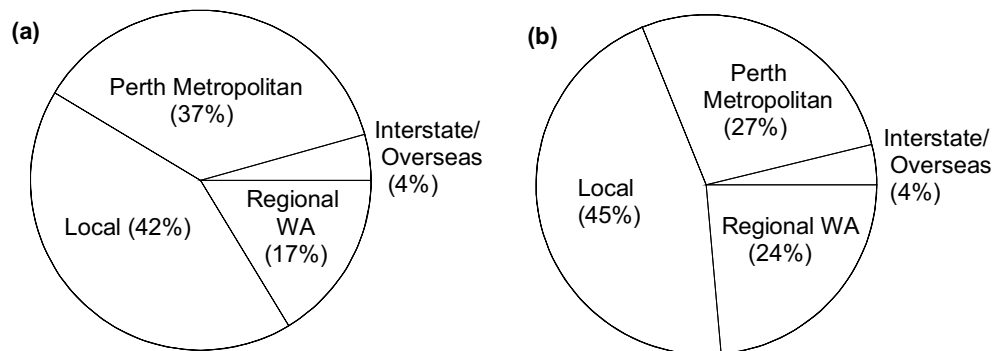
Common name	Scientific name	Boat-based fishing		
		No. kept	SE kept	No. released
Whiting, King George	<i>Sillaginodes punctata</i>	4,077	638	1,106
Snapper, Pink	<i>Pagrus auratus</i>	1,987	237	213
Mullet, Yellow Eye (Pilch)	<i>Aldrichetta forsteri</i>	831	109	0
Trumpeter, Six Lined (Striped Trumpeter)	<i>Pelates sexlineatus</i>	481	310	804
Herring, Australian	<i>Arripis georgianus</i>	387	106	0
Trevally, Skipjack/Silver	<i>Pseudocaranx dentex</i>	176	66	0
Crab, Blue swimmer	<i>Portunus pelagicus</i>	134	60	0
Bream, Silver (Tarwhine)	<i>Rhabdosargus sarba</i>	103	65	0
Garfish, Southern Sea	<i>Hyporhamphus melanochir</i>	41	12	0
Bream, Black	<i>Acanthopagrus butcheri</i>	37	10	0
Salmon, Australian	<i>Arripis truttaceus</i>	34	22	0
	<b>Total</b>	<b>8,289</b>	<b>772</b>	<b>2,123</b>

### Weight of main species

Pink snapper and King George whiting were the only two species for which the total weight (in kilograms) could be estimated as there were > 20 lengths recorded during the survey period (Appendix 7). The weight of these species was estimated at 870 kg and 713 kg respectively.

## Wilson Inlet

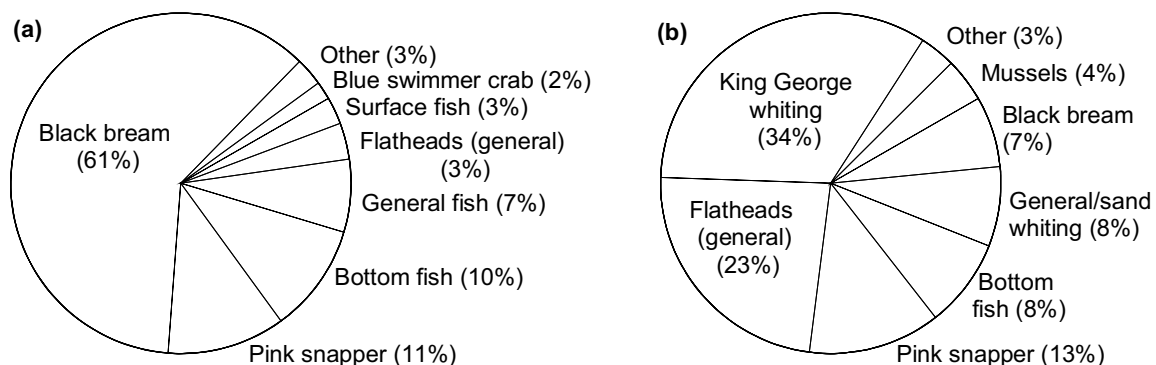
There were 230 interviews in Wilson Inlet during the 12-month survey of which 50% were boat-based groups. Fishing was the predominant activity, undertaken by 88% groups, with the remaining 12% groups participating in other activities. Camping sites were also available at Wilson Inlet and six interviews were conducted with fishing groups while they were using these facilities. The majority of both shore and boat-based fishing groups interviewed in Wilson Inlet resided in the local postcode area (Figure 12).



**Figure 12.** Percentage of (a) shore-based and (b) boat-based fishing groups interviewed in Wilson Inlet from December 2002 – November 2003 according to their place of residence.

## Targeted species

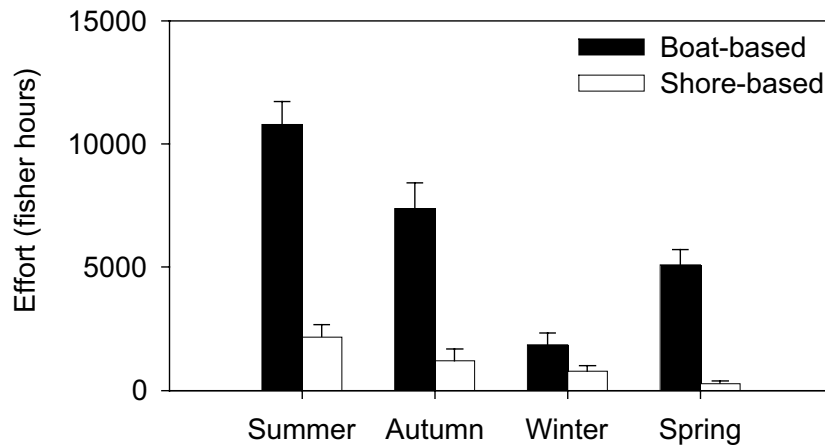
The majority of shore-based fishers targeted black bream (61%) and pink snapper (11%) (Figure 13). Boat-based fishers targeted mainly King George whiting (34%), flatheads (23%) and pink snapper (13%).



**Figure 13.** Percentage of (a) shore-based and (b) boat-based fishing groups targeting particular species in Wilson Inlet during the recreational survey from December 2002 – November 2003.

## Fishing effort

The total fishing effort for Wilson Inlet was estimated at 30,799 fisher hours (10,222 fisher days). The highest levels of both boat and shore-based effort occurred in summer (Figure 14). Boat-based effort was found to be higher than shore-based effort in all seasons.



**Figure 14.** Effort ( $\pm$  standard error), in fisher hours, for shore and boat-based fishing during each season surveyed at Wilson Inlet from December 2002 – November 2003.

### Total catch

Shore and boat-based recreational anglers caught a total of 18 species, plus four general fish categories, at Wilson Inlet during the survey period. The most frequently caught species by boat-based groups was King George whiting and Southern blue-spotted flathead, while shore-based groups caught mostly black bream (Table 7).

**Table 7.** Estimated number of fish kept and released by recreational fishers in Wilson Inlet from December 2002 – November 2003.

Common name	Scientific name	Boat-based fishing			Shore-based fishing		
		No. kept	SE kept	No. released	No. kept	SE kept	No. released
Whiting, King George	<i>Sillaginodes punctata</i>	5,411	1,236	2,464	0	0	0
Flathead, Southern Blue-Spotted	<i>Platycephalus speculator</i>	2,356	619	588	34	32	Insig.
Snapper, Pink	<i>Pagrus auratus</i>	1,482	616	1,557	Insig.		Insig.
Mussels	<i>Mytilus</i> , spp.	Insig.		0	Insig.		0
Garfish, Southern Sea	<i>Hyporhamphus melanochir</i>	807	277	215	Insig.		0
Bream, Black	<i>Acanthopagrus butcheri</i>	547	304	1,881	1,059	777	2,420
Mullet, Yellow Eye (Pilch)	<i>Aldrichetta forsteri</i>	440	171	0	0	0	0
Flathead, Long-headed	<i>Levipora inops</i>	359	256	Insig.	0	0	0
Bream, Silver (Tarwhine)	<i>Rhabdosargus sarba</i>	170	71	227	Insig.		183
Trevally, Skipjack/Silver	<i>Pseudocaranx dentex</i>	146	83	Insig.	0	0	0
Whiting, Yellow-Finned (Western Sand)	<i>Sillago schomburgkii</i>	120	118	0	0	0	0
Flatheads, general	Family Platycephalidae	Insig.		0	0	0	0
Trumpeter, Six Lined (Striped Trumpeter)	<i>Pelates sexlineatus</i>	102	100	184	0	0	0
Garfishes	Family Hemiramphidae	46	32	0	0	0	0
Herring, Australian	<i>Arripis georgianus</i>	34	33	0	0	0	11
Leatherjackets, general		34	33	0	0	0	0
Trumpeters/Grunters, General	Family Teraponidae	Insig.		138	0	0	77
Crab, Blue swimmer	<i>Portunus pelagicus</i>	0	0	0	Insig.		Insig.
Zebra Fish	<i>Girella zebra</i>	0	0	0	113	253	0
Cobbler	<i>Cnidoglanis macrocephalus</i>	0	0	0	Insig.		0
Wrasse, Brown-Spotted	<i>Pseudolabrus parilus</i>	0	0	0	Insig.		77
Trumpeter, Yellowtail	<i>Amniataba caudavittatus</i>	0	0	Insig.	0	0	0
<b>Total</b>		<b>12,193</b>	<b>1,901</b>	<b>7,344</b>	<b>1,633</b>	<b>1,004</b>	<b>3,091</b>

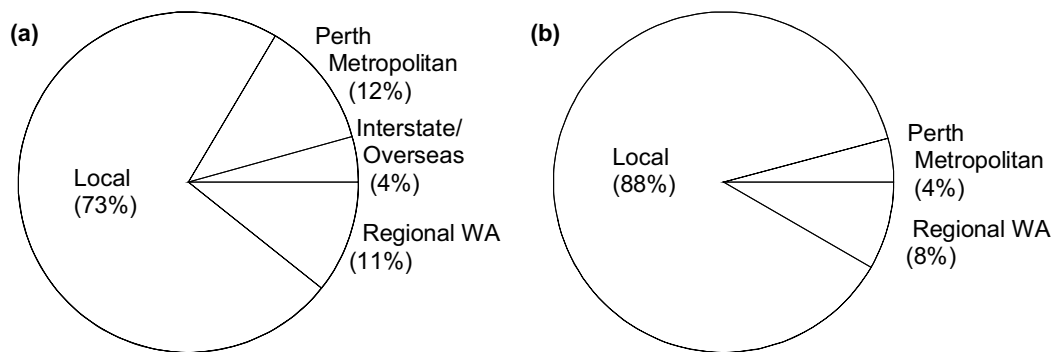
### Weight of main species

There were six species caught by recreational fishers which had >20 lengths recorded and for which an estimated total weight could be calculated (Appendix 7). These species were pink snapper (1,743 kg), southern blue-spotted flathead (1,522 kg), flatheads general (73 kg), King George whiting (1,343 kg), black bream (793 kg) and southern sea garfish (242 kg).

Commercial fishermen caught a total of 17 species, plus an additional six general categories in Wilson Inlet during the survey period (CAESS, unpublished data, 2005). The total catch for commercially caught species, which correspond to those caught recreationally, was pink snapper (5,427 kg), flatheads (all species) (9,311 kg), King George whiting (4,353 kg), black bream (6,613 kg) and southern sea garfish (2,265 kg).

### Princess Royal Harbour

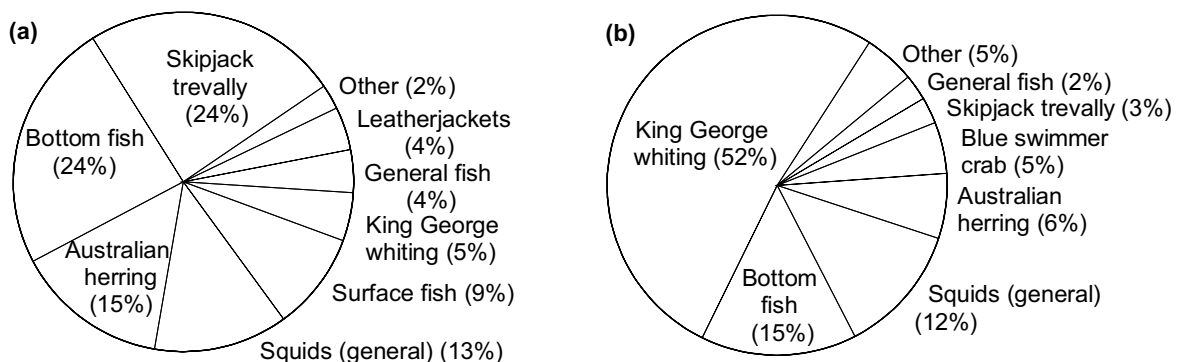
During the 12-month survey there were 227 interviews in Princess Royal Harbour, of which 62% were shore-based groups. All of these shore-based groups were involved in recreational fishing. Boat-based groups were participating in recreational fishing (83%), other activities (13%), surfing (2%), diving (1%) and waterskiing (1%). The majority of recreational fishers interviewed in Princess Royal Harbour during the survey period were from the local postcode area (Figure 15).



**Figure 15.** Percentage of (a) shore-based and (b) boat-based fishing groups interviewed in Princess Royal Harbour from December 2002 – November 2003 according to their place of residence.

### Targeted species

Skipjack trevally, unspecified bottom fish and Australian herring were the most frequently targeted species by shore-based fishers in Princess Royal Harbour (Figure 16). Boat-based fishers targeted predominately King George whiting (52%), unspecified bottom fish (15%) and squids (12%).

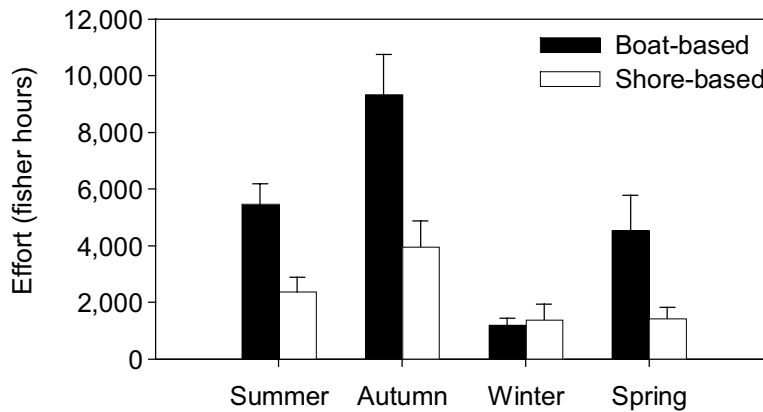


**Figure 16.** Percentage of (a) shore-based and (b) boat-based fishing groups targeting particular species in Princess Royal Harbour from December 2002 – November 2003.



## Fishing effort

The total effort in Princess Royal Harbour was estimated at 29,540 fisher hours (10,546 fisher days). The highest levels of effort for both boat-based and shore-based fishers occurred in autumn (Figure 17). The lowest levels of effort were recorded in winter.



**Figure 17.** Effort ( $\pm$  standard error), in fisher hours, for shore and boat-based fishing during each season surveyed at Princess Royal Harbour from December 2002 – November 2003.

## Total catch

Shore and boat-based recreational fishers in Princess Royal Harbour caught a total of 36 species, plus an additional seven general categories, during the survey. The highest catches were King George whiting for boat-based fishers and Australian herring for shore-based fishers (Table 8).

## Weight of main species

The total catch (in kilograms) could be estimated for King George whiting, Australian herring and skipjack/silver trevally as they had >20 lengths recorded during the survey period (Appendix 7). The catch for these species was 2,190 kg, 982 kg and 653 kg, respectively.

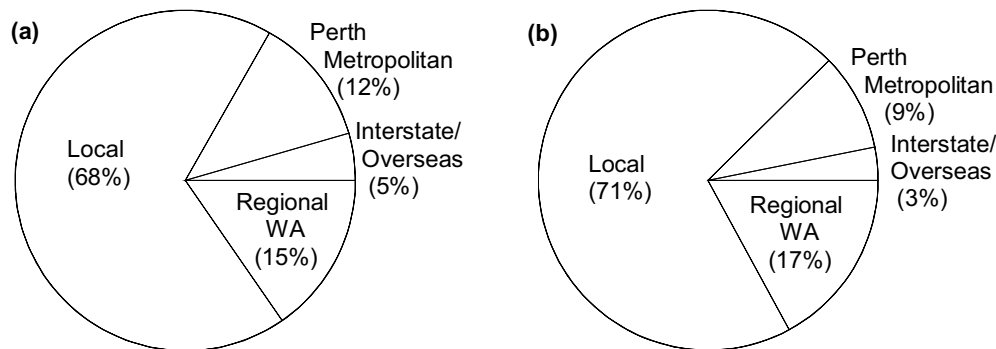
Commercial fishermen caught a total of 16 species, plus 11 general categories of aquatic species in Princess Royal Harbour in the period corresponding with the recreational survey (CAESS, unpublished data, 2005). For the only three species in which a comparison could be made with the recreational catch, the total commercial catch was King George whiting (334 kg), Australian herring (4,398 kg) and skipjack/silver trevally (75 kg).

**Table 8.** Estimated number of fish kept and released by recreational fishers in Princess Royal Harbour from December 2002 – November 2003.

Common name	Scientific name	Boat-based fishing			Shore-based fishing		
		No. kept	SE kept	No. released	No. kept	SE kept	No. released
Whiting, King George	<i>Sillaginodes punctata</i>	13,281	3,044	12,171	Insig.		83
Herring, Australian	<i>Arripis georgianus</i>	4,925	1,192	897	1,935	1,232	Insig.
Trevally, Skipjack/Silver	<i>Pseudocaranx dentex</i>	2,358	1,278	1,019	941	690	1347
Cockle	<i>Anadara and katelysia</i> spp	Insig.		0	0	0	0
Mackerel, Blue	<i>Scomber australasicus</i>	1,318	446	340	Insig.		0
Crab, Blue swimmer	<i>Portunus pelagicus</i>	810	487	0	0	0	0
Squid, Arrow Squid	<i>Nototodarus gouldi</i>	611	272	0	Insig.		Insig.
Bream, Black	<i>Acanthopagrus butcheri</i>	539	534	245	0	0	0
Whiting, School Southern/ Silver	<i>Sillago bassensis</i>	456	55	0	0	0	350
Garfish, Southern Sea	<i>Hyporhamphus melanochir</i>	414	163	0	Insig.		228
Wrasse, Brown-Spotted	<i>Pseudolabrus parilus</i>	248	89	472	0	0	13
Whiting, Blue Weed	<i>Haletta semifasciata</i>	219	121	2,133	Insig.		Insig.
Scad, Yellowtail	<i>Trachurus novaezelandiae</i>	217	64	2,431	Insig.		Insig.
Leatherjacket, Six-Spined	<i>Meuschenia freycineti</i>	182	22	0	Insig.		0
Snapper, Pink	<i>Pagrus auratus</i>	Insig.		333	0	0	0
Trumpeter, Six Lined (Striped Trumpeter)	<i>Pelates sexlineatus</i>	116	47	3330	Insig.		Insig.
Leatherjacket, Horseshoe	<i>Meuschenia hippocrepis</i>	98	97	0	Insig.		Insig.
Razor Clam	Family Pinnidae	90	38	0	0	0	0
Flathead, Southern Blue-Spotted	<i>Platycephalus speculator</i>	85	35	140	0	0	0
Flathead, Long-headed	<i>Levipora inops</i>	81	66	0	0	0	0
Flounder, Elongate	<i>Ammotretis elongatus</i>	81	66	0	0	0	0
Bream, Silver (Tarwhine)	<i>Rhabdosargus sarba</i>	79	34	0	0	0	0
Leatherjacket, Spiny-Tailed	<i>Bigener brownii</i>	Insig.		0	Insig.		
Salmon, Australian	<i>Arripis truttaceus</i>	42	44	0	0	0	0
Cod, Breaksea (Black-arse Cod)	<i>Epinephelides armatus</i>	30	13	0	0	0	0
Leatherjackets, general		Insig.		1,588	Insig.		711
Octopus, general		Insig.		0	Insig.		0
Seapike, Striped	<i>Sphyræna obtusata</i>	Insig.		0	0	0	0
Flatheads, general	Family Platycephalidae	20	9	0	0	0	0
Goatfish, Blue-spotted	<i>Upeneichthys vlamingii</i>	20	9	199	0	0	0
Sergeant Baker	<i>Aulopus purpurissatus</i>	20	9	0	0	0	0
Sweep, Banded	<i>Scorpius georgianus</i>	20	9	0	0	0	0
Wrasse, Maori	<i>Ophthalmolepis lineolatus</i>	20	9	39	0	0	0
Trumpeters/Grunters, General	Family Teraponidae	0	0	967	0	0	57
Wrasse/Groppers, general		0	0	725	0	0	0
Blowfish, Common	<i>Torquigener pleurogramma</i>	0	0	696	0	0	69
Shark, Port Jackson	<i>Heterodontus portusjacksoni</i>	0	0	403	0	0	0
Cuttlefish		0	0	0	Insig.		0
Mullet, Yellow Eye (Pilch)	<i>Aldrichetta forsteri</i>	0	0	0	Insig.		0
Wrasse, Blue-throated rainbow	<i>Suezichthys cyanolaemus</i>	0	0	0	57	52	0
Zebra Fish	<i>Girella zebra</i>	0	0	0	Insig.		0
Leatherjacket, Toothbrush	<i>Penicipelta vittiger</i>	0	0	0	Insig.		0
Stingrays, general		0	0	0	0	0	19
	<b>Total</b>	<b>26,535</b>	<b>3,636</b>	<b>28,127</b>	<b>5,458</b>	<b>4,725</b>	<b>4,623</b>

## Oyster Harbour

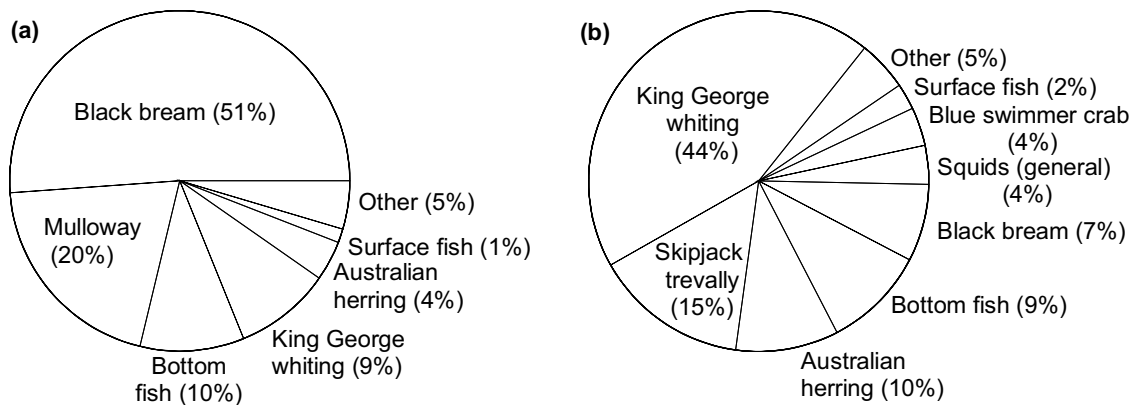
In Oyster Harbour during the 12-month survey there were 479 interviews, of which 61% were with shore-based groups (all participating in recreational fishing). Boat-based groups were participating in recreational fishing (73%), other activities (22%), waterskiing (4%) and diving (1%). The majority of groups interviewed fishing in Oyster Harbour during the survey period were from the local postcode area (Figure 18).



**Figure 18.** Percentage of (a) shore-based and (b) boat-based fishing groups interviewed in Oyster Harbour from December 2002 – November 2003 according to their place of residence.

## Targeted species

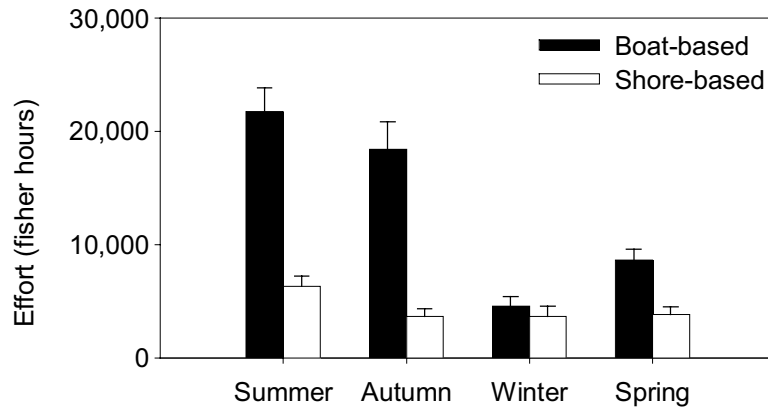
Black bream was the species most frequently targeted by shore-based recreational fishers, followed by mullet and unspecified bottom fish (Figure 19). This differs from boat-based fishers who targeted mainly King George whiting, skipjack trevally and Australian herring.



**Figure 19.** Percentage of (a) shore-based and (b) boat-based fishing groups targeting particular species in Oyster Harbour from December 2002 – November 2003.

## Fishing effort

The fishing effort for Oyster Harbour was estimated at 71,869 fisher hours (25,662 fisher days). Fishers from houseboats contributed an additional 1,176 fisher hours (503 fisher days). The seasonal effort for Oyster Harbour was highest in summer and lowest in winter for both boat-based and shore-based fishing (Figure 20).



**Figure 20.** Effort ( $\pm$  standard error), in fisher hours, for shore and boat-based fishing during each season surveyed at Oyster Harbour from December 2002 – November 2003.

### Total catch

Recreational fishers caught 37 species, plus six fish and ray general categories for released fish in Oyster Harbour during the survey. King George whiting was the most frequently caught species by boat-based fishers, followed by Australian herring and skipjack/silver trevally (Table 9). Black bream was the most frequently caught species by shore-based fishers.

Houseboats operate within Oyster Harbour and associated King and Kalgan Rivers. Fishers from these houseboats kept 11 species in Oyster Harbour during the survey period (Table 10). There were also three general categories for released fish and rays. The most frequently kept fish was King George whiting, followed by black bream and Australian herring.

### Weight of main species

There were four species caught by recreational fishers in Oyster Harbour for which the total catch (in kilograms) could be calculated (Appendix 7). These were skipjack/silver trevally (4,528 kg), King George whiting (4,544 kg), Australian herring (1,608 kg) and black bream (1,451 kg).

Commercial fishermen caught a total of 20 species, plus eight general categories during the period corresponding with the recreational survey (CAESS, unpublished data, 2005). There were four species for which the catch could be compared between the commercial and recreational sectors. These were skipjack/silver trevally (482 kg), King George whiting (2,526 kg), Australian herring (6,158 kg) and black bream (4,364 kg).

**Table 9.** Estimated number of fish kept and released by recreational fishers in Oyster Harbour from December 2002 – November 2003.

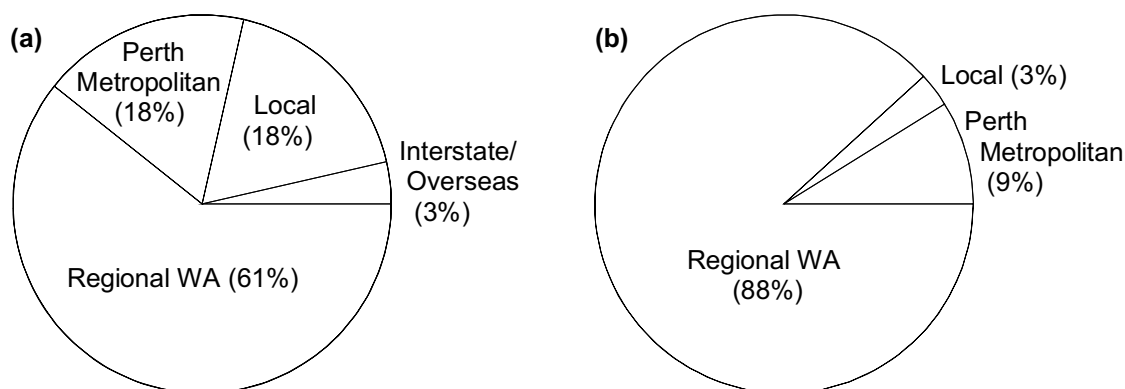
Common name	Scientific name	Boat-based fishing			Shore-based fishing		
		No. kept	SE kept	No. released	No. kept	SE kept	No. released
Whiting, King George	<i>Sillaginodes punctata</i>	30,125	5,324	17,365	328	232	182
Herring, Australian	<i>Arripis georgianus</i>	13,599	3,004	1,765	Insig.		Insig.
Trevally, Skipjack/Silver	<i>Pseudocaranx dentex</i>	13,201	3,576	2,634	Insig.		0
Salmon, Australian	<i>Arripis truttaceus</i>	1,887	1,523	1,047	97	95	292
Bream, Black	<i>Acanthopagrus butcheri</i>	1,559	709	1,316	1,196	985	6,480
Garfish, Southern Sea	<i>Hyporhamphus melanochir</i>	1,056	499	156	0	0	0
Squid, Arrow Squid	<i>Nototodarus gouldi</i>	1,020	635	0	178	411	0
Crab, Blue swimmer	<i>Portunus pelagicus</i>	860	439	0	0	0	0
Leatherjackets, general		782	410	2,379	0	0	19
Leatherjacket, Yellow Striped	<i>Meuschenia flavolineata</i>	475	278	0	0	0	0
Leatherjacket, Six-Spined	<i>Meuschenia freycineti</i>	398	255	0	Insig.		0
Sweep, Banded	<i>Scorpiis georgianus</i>	313	283	52	0	0	0
Leatherjacket, Spiny-Tailed	<i>Bigener brownii</i>	286	71	0	0	0	0
Flathead, Southern Blue-Spotted	<i>Platycephalus speculator</i>	252	143	Insig.	0	0	0
Scad, Yellowtail	<i>Trachurus novaezelandiae</i>	222	69	7,396	Insig.		Insig.
Trumpeter, Six Lined (Striped Trumpeter)	<i>Pelates sexlineatus</i>	212	141	15,514	Insig.		3,263
Goatfish, Blue-spotted	<i>Upenichthys vlamingii</i>	186	138	248	0	0	0
Leatherjacket, Horseshoe	<i>Meuschenia hippocrepis</i>	175	56	262	Insig.		0
Whiting, Blue Weed	<i>Haletta semifasciata</i>	147	53	669	0	0	0
Whiting, School Southern/Silver	<i>Sillago bassensis</i>	104	94	811	0	0	0
Leatherjacket, Bridled	<i>Acanthaluteres spilomelanurus</i>	104	41	0	0	0	0
Bream, Silver (Tarwhine)	<i>Rhabdosargus sarba</i>	87	36	0	Insig.		189
Snapper, Pink	<i>Pagrus auratus</i>	52	47	1,396	0	0	0
Wrasse, Brown-Spotted	<i>Pseudolabrus parilus</i>	44	18	1,993	0	0	49
Flounder, Elongate	<i>Ammotretis elongatus</i>	26	10	0	0	0	0
Flounder, Small-Toothed	<i>Pseudorhombus jenynsii</i>	16	8	0	0	0	0
Cockle	<i>Anadara and katelysia</i> spp	0	0	0	Insig.		0
Trumpeter, Sea (Stormy Perch)	<i>Pelsartia humeralis</i>	0	0	1,147	0	0	0
Wrasse, Red Banded	<i>Pseudolabris biserialis</i>	0	0	Insig.	0	0	0
Sergeant Baker	<i>Aulopus purpurissatus</i>	0	0	131	0	0	0
Morwong, Red-lipped (Red-band)	<i>Cheilodactylus rubrolabiatus</i>	0	0	Insig.	0	0	0
Ray, Southern Shovelnose	<i>Aptychotrema vincentiana</i>	0	0	104	0	0	0
Wrasse/Groper, general		0	0	78	0	0	0
Shark, Port Jackson	<i>Heterodontus portusjacksoni</i>	0	0	65	0	0	116
Ray, Southern Fiddler	<i>Trygonorhina fasciata</i>	0	0	52	0	0	0
Stingrays, general		0	0	52	0	0	Insig.
Cod, Breaksea (Black-arse Cod)	<i>Epinephelides armatus</i>	0	0	44	0	0	0
Flounders, general		0	0	21	0	0	23
Mulloway	<i>Argyrosomus hololepidotus</i>	0	0	0	Insig.		Insig.
Parrotfish, General		0	0	0	0	0	148
Mullet, Yellow Eye (Pilch)	<i>Aldrichetta forsteri</i>	0	0	0	0	0	62
Leatherjacket, Toothbrush	<i>Penicipelta vittiger</i>	0	0	0	0	0	Insig.
Trumpeters/Grunters, General	Family Teraponidae	0	0	0	0	0	Insig.
Family	<b>Total</b>	<b>67,189</b>	<b>7,369</b>	<b>57,289</b>	<b>3,357</b>	<b>1,693</b>	<b>11,538</b>

**Table 10.** Actual number of fish kept and released by people fishing from houseboats in Oyster Harbour from December 2002 – November 2003.

Common name	Scientific name	Actual houseboat catch	
		No. kept	No. released
Whiting, King George	<i>Sillaginodes punctata</i>	92	116
Bream, Black	<i>Acanthopagrus butcheri</i>	90	270
Herring, Australian	<i>Arripis georgianus</i>	50	7
Mulloway	<i>Argyrosomus hololepidotus</i>	11	34
Bream, Silver (Tarwhine)	<i>Rhabdosargus sarba</i>	8	85
Salmon, Australian	<i>Arripis truttaceus</i>	3	0
Trumpeter, Six Lined (Striped Trumpeter)	<i>Pelates sexlineatus</i>	3	223
Flounder, Small-Toothed	<i>Pseudorhombus jenynsii</i>	2	3
Mullet, Sea	<i>Mugil cephalus</i>	2	0
Tailor	<i>Pomatomus saltatrix</i>	1	0
Ray, Southern Fiddler	<i>Trygonorhina fasciata</i>	1	4
Rays, general		0	4
Flounders, general		0	3
Stingrays, general		0	1
	<b>Total</b>	<b>263</b>	<b>750</b>

### Beaufort Inlet

There were 34 interviews at Beaufort Inlet during the 12-month survey. All shore and boat-based groups interviewed were participating in recreational fishing. Camping is available at Beaufort Inlet and 16 interviews were conducted with fishing groups while staying for extended periods at this location. The majority of both shore and boat-based fishing groups interviewed at Beaufort Inlet were from Regional WA (excluding the local postcode area) (Figure 21).



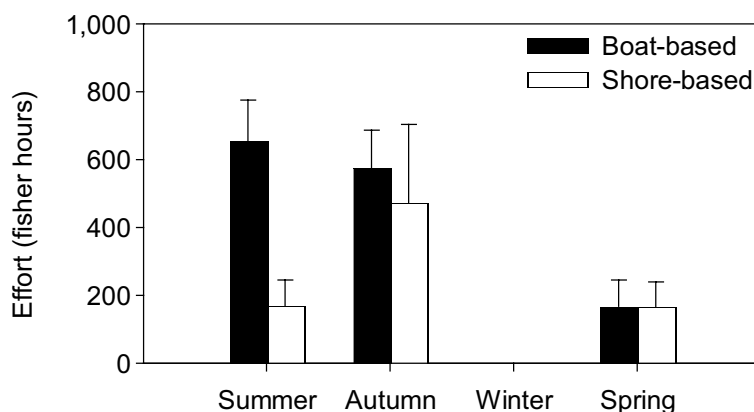
**Figure 21.** Percentage of (a) shore-based and (b) boat-based fishing groups interviewed in Beaufort Inlet from December 2002 – November 2003 according to their place of residence.

### Targeted species

Shore-based fishers interviewed in Beaufort Inlet targeted only two species, black bream (93%) and bottom fish (7%), during the survey period. Boat-based fishers were found to be targeting only black bream.

## Fishing effort

The total fishing effort for Beaufort Inlet was estimated at 2 547 fisher hours (942 fisher days). When analysed seasonally, the majority of shore and boat-based fishing effort occurred in summer and autumn (Figure 22). Fishing effort during winter for both boat and shore-based fishers was zero.



**Figure 22.** Effort ( $\pm$  standard error), in fisher hours, for shore and boat-based fishing during each season surveyed at Beaufort Inlet from December 2002 – November 2003.

## Total catch

Only two fish species, black bream and King George whiting, were caught by recreational anglers in Beaufort Inlet during the survey (Table 11).

**Table 11.** Estimated number of fish kept and released by recreational fishers in Beaufort Inlet from December 2002 – November 2003.

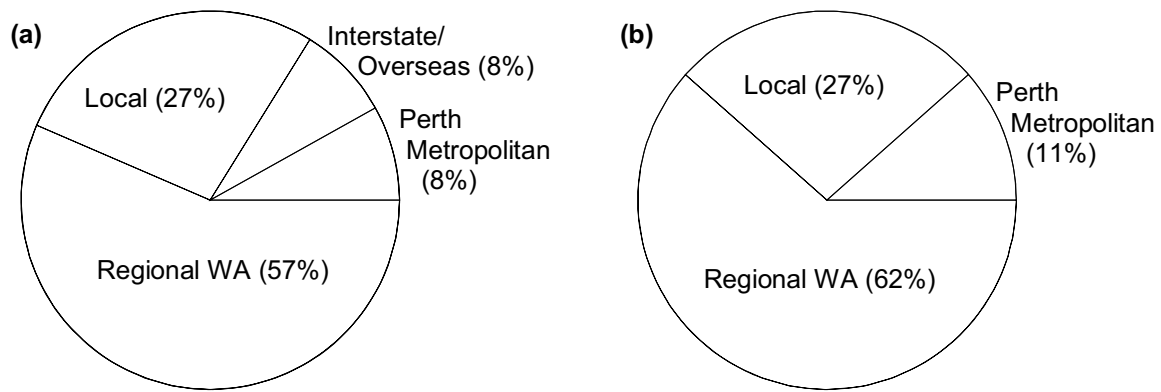
Common name	Scientific name	Boat-based fishing			Shore-based fishing		
		No. kept	SE kept	No. released	No. kept	SE kept	No. released
Bream, Black	<i>Acanthopagrus butcheri</i>	777	263	552	579	307	383
Whiting, King George	<i>Sillaginodes punctata</i>	0	0	0	Insig.		0
	<b>Total</b>	<b>777</b>	<b>263</b>	<b>552</b>	<b>Insig.</b>		<b>383</b>

## Weight of main species

Black bream was the only species caught in Beaufort Inlet for which >20 lengths were recorded (Appendix 7). The total catch of this species during the survey period was 614 kg.

## Wellstead Estuary

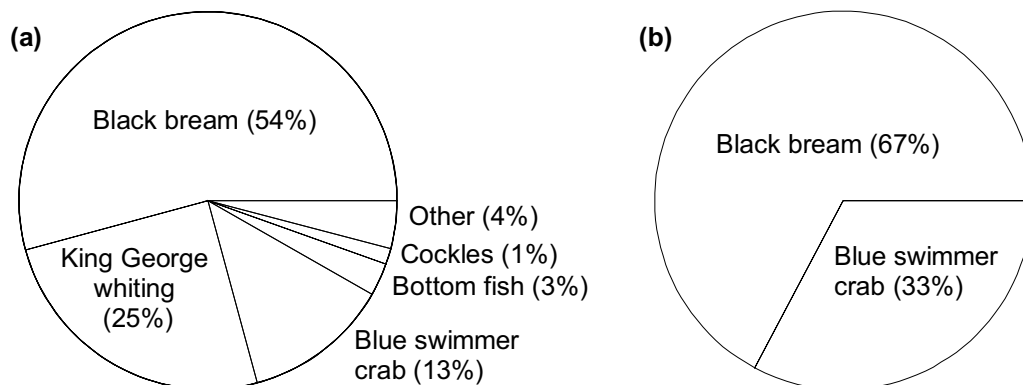
There were 113 interviews in Wellstead Estuary during the survey period. Of these, 55% were shore-based groups, all involved in recreational fishing. Interviews with boat-based groups found that 98% were involved in recreational fishing and 2% in other activities. Camping is available at Wellstead Estuary, however only one interview during the survey period was with a group staying at this location for an extended period. The majority of shore and boat-based fishing groups interviewed at Wellstead Estuary during the survey period were from regional WA, followed by the local postcode area (Figure 23).



**Figure 23.** Percentage of (a) shore-based and (b) boat-based fishing groups interviewed in Wellstead Estuary from December 2002 – November 2003 according to their place of residence.

### Targeted species

Black bream was the most frequently targeted species by shore and boat-based recreational fishers in Wellstead Estuary (Figure 24). Blue swimmer crabs were the only other species targeted by boat-based fishers.

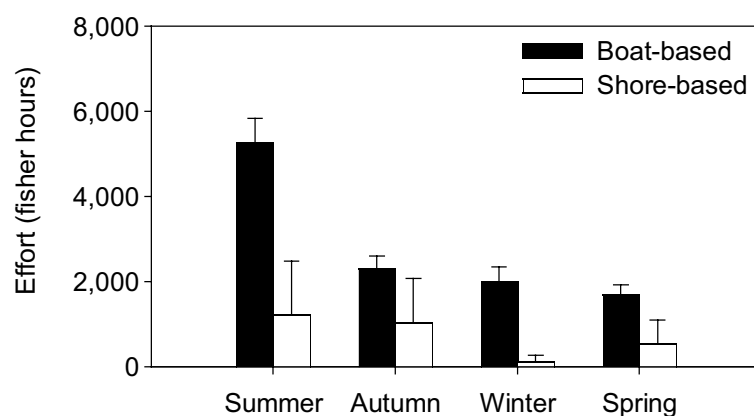


**Figure 24.** Percentage of (a) shore-based and (b) boat-based fishing groups targeting particular species in Wellstead Estuary from December 2002 – November 2003.

### Fishing effort

The total fishing effort was estimated at 14,879 fisher hours (4,728 fisher days). The highest boat-based effort and shore-based effort occurred in summer (Figure 25). The lowest fishing effort occurred in winter for shore-based groups and spring for boat-based groups.





**Figure 25.** Effort ( $\pm$  standard error), in fisher hours, for shore and boat-based fishing during each season surveyed at Wellstead Estuary from December 2002 – November 2003.

### Total catch

Recreational fishers caught a total of ten species in Wellstead Estuary during the survey period. The highest catch was blue swimmer crabs, followed by black bream, for both shore and boat-based fishers (Table 12).

**Table 12.** Estimated number of fish kept and released by recreational fishers in Wellstead Estuary from December 2002 – November 2003.

Common name	Scientific name	Boat-based fishing			Shore-based fishing		
		No. kept	SE kept	No. released	No. kept	SE kept	No. released
Crab, Blue swimmer	<i>Portunus pelagicus</i>	6,659	1,646	871	1,898	1,342	Insig.
Bream, Black	<i>Acanthopagrus butcheri</i>	5,476	983	10,128	933	1,382	2,684
Herring, Australian	<i>Arripis georgianus</i>	39	14	104	Insig.		0
Bream, Silver (Tarwhine)	<i>Rhabdosargus sarba</i>	35	28	0	Insig.		Insig.
Whiting, King George	<i>Sillaginodes punctata</i>	0	0	35	Insig.		Insig.
Cockle	<i>Anadara and katelaysia</i> spp	0	0	0	Insig.		0
Salmon, Australian	<i>Arripis truttaceus</i>	0	0	0	Insig.		Insig.
Prawn, River	<i>Metapenaeus dalli</i>	0	0	0	Insig.		0
Flathead, Southern Blue-Spotted	<i>Platycephalus speculator</i>	0	0	0	Insig.		30
Leatherjacket, Chinaman	<i>Nelusetta ayraudi</i>	0	0	0	Insig.		0
	<b>Total</b>	<b>12,209</b>	<b>1,918</b>	<b>11,137</b>	<b>3,695</b>	<b>2,190</b>	<b>3,422</b>

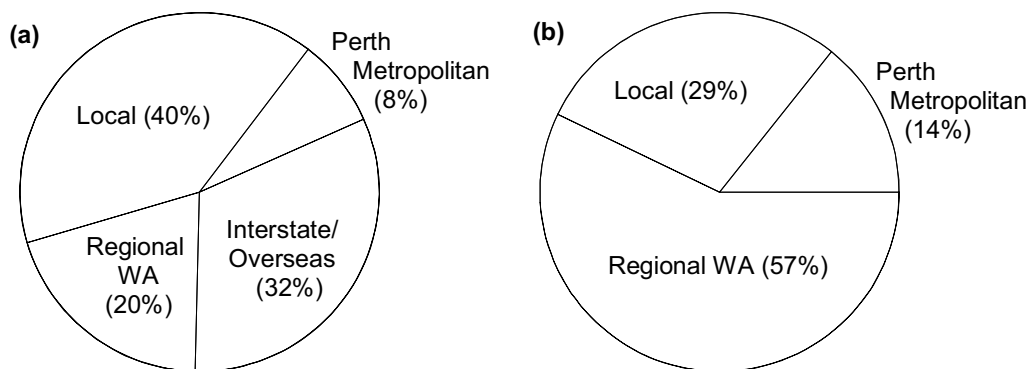
### Weight of main species

Blue swimmer crabs and black bream were the only species for which >20 lengths were recorded during the survey period (Appendix 7). The catch for these species in Wellstead estuary was calculated at 2,077 kg and 2,796 kg respectively.

## Stokes Inlet

Of the 104 interviews conducted at Stokes Inlet during the 12-month survey, 72% were shore-based groups (all involved in recreational fishing). The majority of boat-based groups (93%) were involved in recreational fishing and the remaining 7% were participating in other activities. Camping is available at Stokes Inlet and 40 interviews were undertaken with groups who had been fishing and were staying for an extended period at this location.

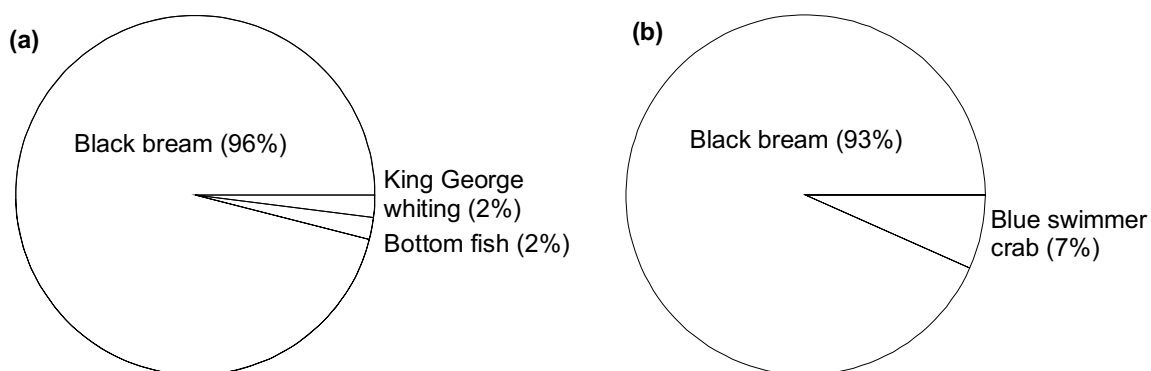
The majority of shore-based groups interviewed fishing at Stokes Inlet were from the local postcode area (40%), followed by interstate/overseas (32%) (Figure 26). Boat-based groups were mainly from regional WA (57%).



**Figure 26.** Percentage of (a) shore-based and (b) boat-based fishing groups interviewed in Stokes Inlet from December 2002 – November 2003 according to their place of residence.

## Targeted species

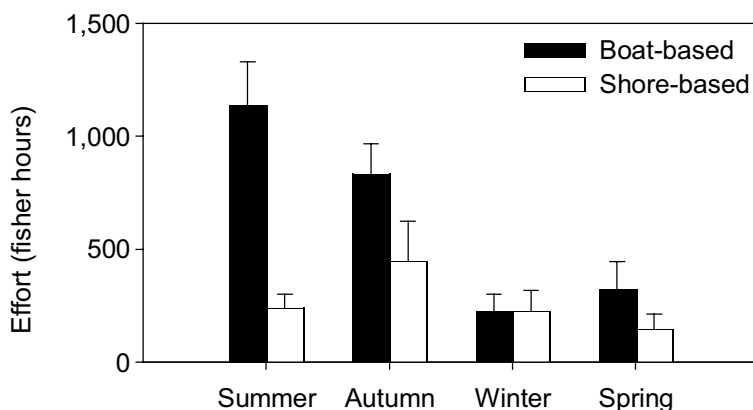
Black bream was the dominant species targeted by shore and boat-based recreational fishers in Stokes Inlet during the survey period (Figure 27). The only other species targeted were King George whiting and unspecified bottom fish by shore-based groups and, blue swimmer crabs by boat-based groups.



**Figure 27.** Percentage of (a) shore-based and (b) boat-based fishing groups targeting particular species in Stokes Inlet from December 2002 – November 2003.

## Fishing effort

The total effort for Stokes Inlet was estimated at 3,441 fisher hours (1,286 fisher days). The highest boat-based effort occurred in summer while the highest shore-based effort occurred in autumn (Figure 28).



**Figure 28.** Effort ( $\pm$  standard error), in fisher hours, for shore and boat-based fishing during each season surveyed at Stokes Inlet from December 2002 – November 2003.

## Total catch

Recreational fishers caught three fish species at Stokes Inlet during the survey period. The highest catch for both shore and boat-based groups was black bream (Table 13).

**Table 13.** Estimated number of fish kept and released by recreational fishers in Stokes Inlet from December 2002 – November 2003.

Common name	Scientific name	Boat-based fishing			Shore-based fishing		
		No. kept	SE kept	No. released	No. kept	SE kept	No. released
Bream, Black	<i>Acanthopagrus butcheri</i>	4,146	875	6,902	1,387	364	2,544
Bream, Silver (Tarwhine)	<i>Rhabdosargus sarba</i>	54	17	54	0	0	0
Flathead, Southern Blue-Spotted	<i>Platycephalus speculator</i>	0	0	0	Insig.		0
	<b>Total</b>	<b>4,200</b>	<b>875</b>	<b>6,956</b>	<b>Insig.</b>		<b>2,544</b>

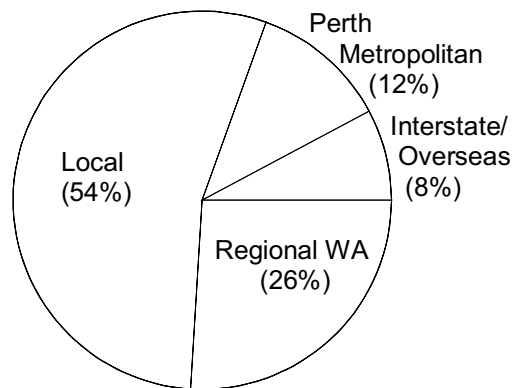
## Weight of main species

Black bream was the only species for which total catch (in kilograms) could be calculated (Appendix 7). The catch of this species by recreational fishers in Stokes Inlet during the survey period was 2,103 kg.

Commercial fishers caught four species, plus two general fish categories, during the same period as the recreational survey (CAESS, unpublished data, 2005). The only species for which a comparison could be made between the commercial and recreational catch was black bream. The commercial catch for this species was 17,714 kg.

## Bandy Creek

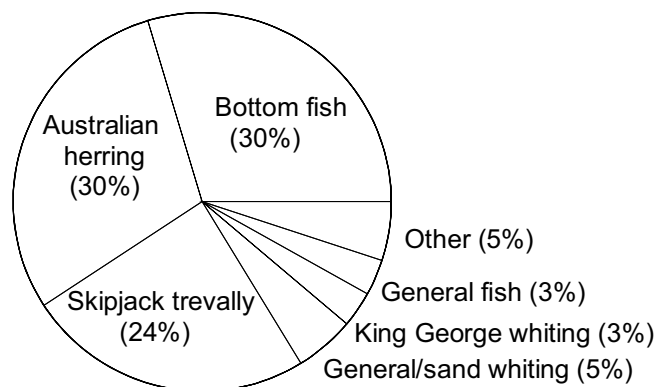
Interviews at Bandy Creek were undertaken with shore-based fishers only as boats launched from this location fish in the ocean (outside the creek area). There were 77 interviews with shore-based groups during the survey period, all of which were recreational fishing. The majority of these groups were from the local postcode area, followed by other regional WA locations and the Perth metropolitan area (Figure 29).



**Figure 29.** Percentage of shore-based fishing groups interviewed at Bandy creek December 2002 – November 2003 according to their place of residence.

## Targeted species

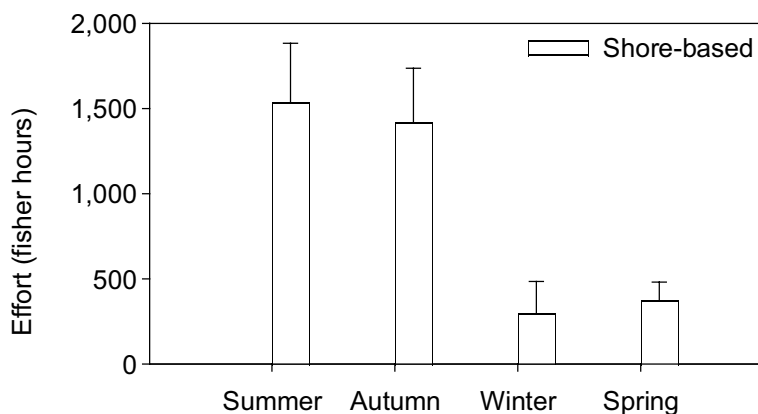
Shore-based recreational fishers in Bandy Creek were targeting mainly unspecified bottom fish (30%), Australian herring (30%) and skipjack trevally (24%) (Figure 30).



**Figure 30.** Percentage of shore-based fishing groups targeting particular species in Bandy Creek from December 2002 – November 2003.

## Fishing effort

Fishing effort at Bandy Creek was all shore-based, and estimated at 3,638 fisher hours (1,432 fisher days) for the survey period. The highest effort was found to occur in summer, and the lowest in spring (Figure 31).



**Figure 31.** Effort ( $\pm$  standard error), in fisher hours, for shore-based fishing during each season surveyed at Bandy Creek from December 2002 – November 2003.

## Total catch

Shore-based fishers at Bandy Creek caught ten fish species and two general fish categories during the survey period. The most frequently caught species was skipjack/silver trevally, followed by Australian herring (Table 14).

## Weight of main species

The only species for which the total catch could be calculated in kilograms because >20 lengths were recorded during the survey period was skipjack/silver trevally (Appendix 7). The total catch for this species was 241 kg.

**Table 14.** Estimated number of fish kept and released by recreational fishers in Bandy Creek from December 2002 – November 2003.

Common name	Scientific name	Shore-based fishing		
		No. kept	SE kept	No. released
Trevally, Skipjack/Silver	<i>Pseudocaranx dentex</i>	1,769	1,223	1,393
Herring, Australian	<i>Arripis georgianus</i>	846	584	Insig.
Whiting, King George	<i>Sillaginodes punctata</i>	Insig.		Insig.
Scad, Yellowtail	<i>Trachurus novaezelandiae</i>	Insig.		0
Bream, Black	<i>Acanthopagrus butcheri</i>	Insig.		183
Flounder, Small-Toothed	<i>Pseudorhombus jenynsii</i>	Insig.		Insig.
Flathead, Southern Blue-Spotted	<i>Platycephalus speculator</i>	13	15	56
Garfish, Southern Sea	<i>Hyporhamphus melanochir</i>	Insig.		0
Wrasse/Gropers, general		Insig.		0
Flounders, general		0	0	29
Old Wife	<i>Enoplosus armatus</i>	0	0	22
Mullet, Yellow Eye (Pilch)	<i>Aldrichetta forsteri</i>	0	0	Insig.
	<b>Total</b>	<b>2,880</b>	<b>1,402</b>	<b>2,070</b>

### **Other Locations (Gordon Inlet, Hamersley Inlet, Lake Quallilup, Munglinup Inlet, Taylor Inlet, Torbay Inlet and Waychinicup Inlet)**

All of the 68 interviews undertaken at this group of other locations were involved with recreational fishing. Shore-based groups comprised 87% of interviews. Camping is available at Munglinup Inlet, Torbay Inlet and Waychinicup Inlet and 10 interviews during the survey were conducted with groups who had fished and were staying for extended periods at these locations.

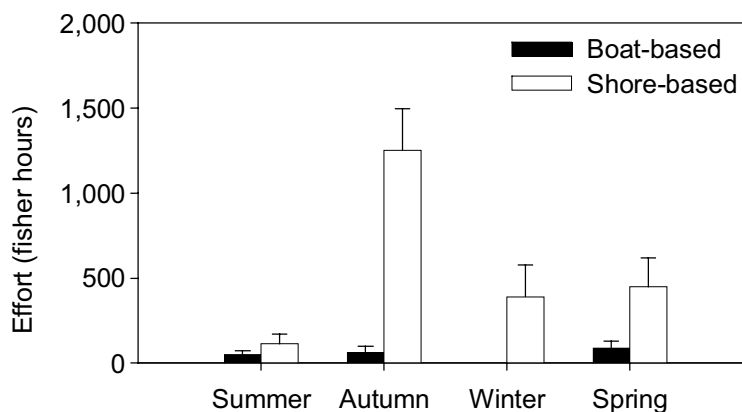
Fishers interviewed at these other locations could only be separated into three categories (regional WA, Perth metropolitan and interstate/overseas) as the local postcodes differed at each inlet or lake. Boat-based fishing groups were from regional WA (83%) or the Perth metropolitan area (17%) only. Shore-based groups resided in regional WA (90%), the Perth metropolitan area (7%) or interstate/overseas (3%).

#### **Targeted species**

Black bream was the only species targeted by shore and boat-based groups fishing in these estuaries and inlets.

#### **Fishing effort**

The combined fishing effort for other locations surveyed was estimated at 2,635 fisher hours (824 fisher days). The estimated effort could not be split for these locations due to the low level of sampling at these locations. The highest shore based fishing effort occurred in autumn (Figure 32). It can be ascertained by the number of interviews at each of these locations, that the highest effort occurred at Taylor Inlet (24 interviews) and Waychinicup Inlet (13 interviews). The lowest effort was at Gordon Inlet, with only one interview during the survey period.



**Figure 32.** Effort ( $\pm$  standard error), in fisher hours, for shore and boat-based fishing during each season surveyed at Gordon Inlet, Hamersley Inlet, Lake Quallilup, Munglinup Inlet, Taylor Inlet, Torbay Inlet and Waychinicup Inlet from December 2002 – November 2003.

#### **Total catch**

Recreational fishers caught a total of ten species at these other locations. The most frequently caught species was black bream for both shore and boat-based fishing groups (Table 15). The majority of black bream were caught in Munglinup Inlet and Lake Quallilup.

## Weight of main species

The only species for which weight could be calculated in these other locations was black bream because there were >20 lengths recorded (Appendix 7). The catch for this species during the survey period was 735 kg.

**Table 15.** Estimated number of fish kept and released by recreational fishers in Gordon Inlet, Hamersley Inlet, Lake Quallilup, Munglinup Inlet, Taylor Inlet, Torbay Inlet and Waychinicup Inlet from December 2002 – November 2003.

Common name	Scientific name	Boat-based fishing			Shore-based fishing		
		No. kept	SE kept	No. released	No. kept	SE kept	No. released
Bream, Black	<i>Acanthopagrus butcheri</i>	347	91	293	1,337	1,011	2,356
Mackerel, Blue	<i>Scomber australasicus</i>	39	21	0	0	0	0
Trevally, Skipjack/Silver	<i>Pseudocaranx dentex</i>	0	0	0	321	251	Insig.
Bream, Silver (Tarwhine)	<i>Rhabdosargus sarba</i>	0	0	4	Insig.		Insig.
Herring, Australian	<i>Arripis georgianus</i>	0	0	0	Insig.		0
Whiting, King George	<i>Sillaginodes punctata</i>	0	0	0	Insig.		Insig.
Snapper, Pink	<i>Pagrus auratus</i>	0	0	0	Insig.		Insig.
Zebra Fish	<i>Girella zebra</i>	0	0	0	Insig.		0
Wrasse, Brown-Spotted	<i>Pseudolabrus parilus</i>	0	0	0	Insig.		Insig.
Blowfish, Common	<i>Torquigener pleurogramma</i>	0	0	0	0	0	Insig.
<b>Total</b>		<b>386</b>	<b>93</b>	<b>297</b>	<b>1,818</b>	<b>1,047</b>	<b>2,475</b>

## Compliance and knowledge of fishing regulations

### Bag limits

The majority of shore (60%) and boat-based (78%) recreational fishers interviewed in the South Coast bioregion during the survey period correctly identified the bag limit of the species they were targeting or the predominant species they had caught. Of the remaining groups, 6% of boat-based and 9% of shore-based fishers incorrectly identified the bag limit, while 16% of boat-based and 31% of shore-based fishers didn't know the bag limit.

Of the 1,461 interviews conducted during the survey period, only 4 groups had exceeded their bag limit for four different species (cockles, King George whiting, blue swimmer crabs and pink snapper). A further 7 groups obtained their bag limit for these same four species, as well as for black bream.

### Size limits

Recreational fishers interviewed during the survey had a good knowledge of size limits with 71% of shore-based and 90% of boat-based groups correctly identifying this for the species they were targeting or the predominant species they had caught. Of the remaining groups interviewed, only 3% of boat-based and 8% of shore-based fishers incorrectly identified the size limit, while 7% of boat-based and 21% shore-based fishers didn't know the size limit.

Of the 1,461 interviews conducted during the survey period, 72 groups kept undersize fish from seven species. These species were King George whiting, pink snapper, black bream, skipjack/silver trevally, blue swimmer crabs, Australian salmon and silver bream. The minimum size for pink snapper in the South Coast bioregion is 410 mm, except in Wilson Inlet where it is 280 mm. Of the 51 undersize fish recorded for this species, 4 were in Wilson Inlet.

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## 4.0 Discussion

This 12-month study is the first comprehensive assessment of recreational fishing to be conducted in estuaries and inlets of the South Coast bioregion. Previous studies have provided a good knowledge of the characteristics that influence recruitment and the biology of key recreational species in major estuaries, such as Wilson and Walpole/Nornalup Inlets (Potter and Hyndes, 1994; Potter et al., 1993). However, hitherto knowledge of recreational fishing activity was limited. A creel survey of recreational fishers targeting Australian salmon and Australian herring from 1994 – 1996 in the West and South Coast bioregions was undertaken in marine coastal areas only (Ayvazian et al., 1997). A logbook survey from 1971 – 1975 (Caputi and Lenanton, 1977) measured the recreational usage by visitors to several South Coast estuaries. This indicated that recreational usage in these locations was increasing and, that estuarine rod and line fishing was one of the most popular activities undertaken by visitors.

A national survey of recreational fishing undertaken from May 2000 to April 2001 is the only previous study that has surveyed recreational estuarine fishers from the South Coast bioregion (Henry and Lyle, 2003). While this survey could not determine the catch and effort for individual estuaries or inlets with an acceptable level of precision, these data were available for the whole bioregion. The total effort for estuaries, inlets and rivers within the South Coast bioregion during the national survey was estimated to be 77,462 fisher days. The total catch was estimated at 850,252 retained fish and 365,316 released fish. When compared to the current 12-month survey, the national survey recorded a lower fishing effort, with a considerably higher number of retained fish.

The current survey encompassed all shore and boat-based recreational fishing, except recreational netting, which occurs in estuaries and inlets. Recreational netting is permitted (with some temporal and spatial restrictions) in Broke Inlet, Irwin Inlet, Wilson Inlet, Princess Royal Harbour, Beaufort Inlet, Wellstead Estuary, Stokes Inlet, Gordon Inlet and Hamersley Inlet. A phone/diary survey of recreational netting overlapped the on-site survey and due to the different sampling methodologies the results will be presented in a separate research report. However, preliminary results indicate that the effort from this activity for the whole South Coast bioregion was found to be small while the catch comprised 18 species plus an additional 13 general fish categories (T. Baharthah, unpublished data, Department of Fisheries, 2006).

Charter boats are also permitted to operate in estuaries and inlets if they hold a licence for the South Coast bioregion. At time of publication there are 29 licensed tour operators in this region. Since the introduction of compulsory returns for charter boat operators in 2001 one charter boat has reported operating in Walpole/Nornalup Inlet only. These trips did not correspond with the same time period as the recreational survey and, due to confidentiality issues, the catch cannot be reported.

Commercial fishing in the estuaries and inlets of the South Coast bioregion are managed under the South Coast Estuarine Fishery arrangements and operators provide compulsory logbook returns for catch and effort monitoring. During the survey period there were 13 locations at which commercial fishers were permitted to operate in this region. Of these, only Culham Inlet and Jerdacuttup Lakes were not included in the recreational survey. However, during the period corresponding to the recreational survey no commercial fishers operated at these two locations. Commercial fishing is not permitted in Walpole/Nornalup Inlet, which had the highest recreational catch and effort of any location surveyed during the study.



## **Catch composition**

The main species caught (using the estimated number of retained fish) by recreational fishers within the South Coast bioregion during this study were King George whiting, Australian herring, blue swimmer crabs and skipjack/silver trevally which are marine species that spend only part of their life cycle in estuaries. The highest catches of these species were recorded in Walpole/Nornalup Inlet, Princess Royal Harbour and Oyster Harbour. Black bream, an estuarine species, was also caught in high numbers (46,216 retained fish) by recreational fishers, particularly in Walpole/Nornalup Inlet (26,586 retained fish). Other species for which a high catch was retained in the South Coast bioregion was southern blue-spotted flathead and pink snapper, particularly in Irwin and Wilson Inlets which are open seasonally.

The diversity of species present in an estuary will depend on the frequency and length of time that the estuary is open to the sea. The greatest numbers of species are generally recorded in permanently open systems which have more stable temperatures and salinity due to the constant tidal influence (Lenanton, 1974). This trend was shown in this current survey, with the highest number of species caught by recreational fishers in the permanently open systems of Oyster Harbour, Princess Royal Harbour and Walpole/Nornalup Inlet. Waychinicup Inlet is also a permanently open system but there was a relatively small number of species caught at this location (although diversity was still high with species such as black bream and brown-spotted wrasse present). This may be due to a number of factors such its small size, low sampling effort and small number of fishers recorded at this location. Bandy Creek, although traditionally classed as a normally closed system, has been extensively modified to allow the development of a harbour for fishing vessels. This includes a weir, which provides a barrier for water exchange and fish migration, upstream from the harbour. All recreational fishers interviewed were located on the ocean side of this barrier, and therefore were able to catch a wider range of species generally associated with permanently open systems such as skipjack trevally and yellowtail scad. The only permanently closed system in the study, Lake Quallilup, had only one species (black bream) recorded caught by recreational anglers.

The three most important commercial estuarine fish stocks are cobbler, black bream and King George Whiting (Penn et al., 2005) and the highest commercial catches during the period corresponding to the recreational survey was from these species as well as sea mullet, leatherjackets, Australian herring and flatheads (CAESS, unpublished data, 2005). Cobbler and sea mullet were not targeted by recreational fishers in any location surveyed, and the recorded catch of both species was very small. The species for which high retained catches were recorded by both the recreational and commercial sectors during the survey period were King George whiting, black bream, Australian herring, flatheads, pink snapper and silver bream.

## **Size limits and bag limits**

The survey indicated that very few fishers achieved the daily bag limits specified under the recreational fishing regulations that applied at the time. For this reason, the bag limits for some species do not provide restrictions in total catch levels. However, recreational fishers were recorded keeping undersize fish, particularly pink snapper. This occurred mostly outside of Wilsons Inlet, where there is a smaller minimum size for this species (280 mm), compared to the legal minimum length of 410 mm that applies along the rest of the South Coast. This may be due to species identification issues, with fishers confusing the identification of juvenile pink snapper with other snapper species or silver bream (tarwhine) also found in estuarine systems.

Since the survey from December 2002 – November 2003, bag and size limits have been changed on two occasions (December 2003 and December 2005) with the introduction of regulations specifically for the South Coast bioregion (whereas they were previously combined with other bioregions such as the Pilbara/Kimberley). These changes affected mainly bag limits, which were reduced for many key recreational species in estuaries such as black bream, skipjack/silver trevally and pink snapper. The size limits were also increased for a few of the key recreational species such as silver bream and skipjack/silver trevally. It can be expected that these most recent changes in bag and size limits will start to restrict the number of fish caught by recreational fishers. By applying the current regulations to data from the current survey then an additional 28 fishing groups would have retained undersized fish and, an additional 53 groups would have exceeded their bag limit. The species mostly likely to be affected by these changes are black bream, silver bream, skipjack/silver trevally and King George whiting.

### **Sampling issues**

The bus route method was used to estimate the catch and effort from public boat ramps. The hours that the boat ramps were surveyed (0700 – 2000) covered the times that most recreational boats returned to the public boat ramps. On occasion there were boats already at the ramp when the interviewer arrived at 0700 or still remaining when the interviewer completed the bus route after 1830. Although it was possible to estimate the fishing effort before 7am, using correction factors based upon the number of trailers at each boat ramp when the interviewer arrived at that location, it was not possible to determine the fishing effort after the finish time. However, the number of boats remaining at boat ramps after 1830 was very small at all surveyed locations.

The estimated kept and released catch was reported for all species where possible. However, the catch of some species was unable to be precisely calculated due to large errors, mainly associated with small sample sizes. In this situation the species name was reported to provide a total species list for each estuary while the catch was listed as insignificant. In an effort to collect more catch information to alleviate this problem, interviews with fishers on the shore and at boat ramps was supplemented by interviewing groups at campsites that had been fishing earlier that day.

It was not practical to record fishing activities after 1830 (in winter) or 2000 (in summer) due to concerns for the safety of staff travelling at night as well as budgetary constraints. Recreational netting was undertaken in several of the survey locations and this is predominantly a nighttime activity. However, this fishing activity was recorded using a phone/diary survey that avoids the safety issues of on-site sampling. Although the fishing catch and effort may have been underestimated by not sampling at night, based on prior knowledge of fishing activity it was believed that the number of recreational fishers excluded from the current survey would be minor.

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## **5.0 Conclusions**

The total recreational catch in the 16 surveyed estuarine locations of the South Coast bioregion was 212,575 kept fish and 201,710 released fish. These results indicate the importance of recreational fishing in these estuarine locations, particularly in Walpole/Nornalup Inlet, which had the highest recreational catch and fishing effort of all surveyed areas.

The information from this survey has been and will be used in the development of regional recreational fisheries management arrangements and will provide a basis for future management decisions to improve or maintain the quality and diversity of recreational fishing experiences in the South Coast region. It will also be used in the assessment of the sustainability of fishing activities in the South Coast region and will provide one of the inputs for future catch allocation decision processes. Furthermore, these data provide indicators of fishing quality such as the variety of species caught. As a result of the changing environment of estuaries and inlets, particularly ones that open and close seasonally, these areas require long term monitoring to develop a proper understanding of the fish stocks in these locations. Further creel surveys are planned on a regular basis to assess changes in the recreational catch for this and other bioregions in the state.

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## **6.0 Acknowledgements**

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## Appendix 2. Recreational fishing interview questionnaire form.

Date: \_\_\_\_\_ Location: \_\_\_\_\_ Boat Reg. No.: \_\_\_\_\_

Start Time (include date if different)	Finish/Interview Time (include date if different)	Boat (Pwr/Yacht/Other), Shore	Fishing (Yes/No)	Dive/Snorkel/W-Ski/Other	Number in Party	Home Postcode of Interviewee	Length of Boat (ft/m)	Block Number or Estuary	Crabbing (Yes/No)	Time Spent Fishing (decimal hrs)	Number of Lines Used	Number and type of nets - Crab, Gill, Scoop, Pots

### FISHERS ONLY

Species	Number Kept	Number Released	Undersize Kept	Species Targeted 1: _____ 2: _____ Measurements (mm)
Black Bream				
King George Whiting				
Herring				
Skippy				
Other Whiting				

2. What is the size limit for \_\_\_\_\_ targeted/predominant species from catch?

Correct	Incorrect	Don't Know
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3. What is the bag limit for \_\_\_\_\_ targeted/predominant species from catch?

Correct	Incorrect	Don't Know
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### **Appendix 3. Census of recreational fishing from houseboats form.**

## **HOUSEBOAT HOLIDAYS**

PO Box 112, Walpole WA 6398 Tel/Fax: (08) 9840 1310

Fisheries, Western Australia are currently conducting a survey of the Walpole-Nornalup Inlets to estimate current fish stock levels and varieties. They have enlisted the assistance of Houseboat Holidays to canvas feedback from our customers holidaying on the inlet. We hope that you will help us with this survey and take a few moments to complete the information that Fisheries require.

Many thanks  
The Pernich Family

Date of Houseboat Return: -----

Hire Time (Days): -----

Time Spent Fishing (Hours): -----

No. of Lines Used: -----

<b>Species</b>	<b>No. Kept</b>	<b>No. Released</b>
King George Whiting		
Black Bream		
Silver Bream		
Flathead		
Flounder		
Herring		
Skippy		
Garfish		
Tailor		
Trumpeter		
Salmon Trout		
Juvenile Pink Snapper		



## Appendix 4. Catch and effort calculations for boats launched from public boat ramps.

### Estimation of Total Effort

The fishing effort for a day (boat hours) was estimated by the method of Jones and Robson (1991) as follows:

$$e = fT \sum_i \left[ \left( \frac{1}{w_i} \right) \sum X_{ij} \right] \quad (1)$$

where  $T$  is the time taken to complete the bus route,  $w_i$  is the interviewer wait time at site  $i$  and  $X_{ij}$  is the time trailer  $j$  spends at site  $i$ . A correction factor  $f \geq 1$  was used to adjust the effort for fishing that occurred before the morning shift commenced at time  $t$ .

$$f = \frac{\sum_j (r_j - \ell_j)}{\sum_j b_j} \quad (2)$$

where

$$b_i = \begin{cases} r_j - t, & \ell_j < t \\ r_j - \ell_j, & \ell_j \geq t \end{cases}$$

$r_j$  is the retrieval time for boat  $j$  and  $\ell_j$  is the launch time for boat  $j$ . The fishing effort was estimated for a random sample of days in each stratum (see Section 4.2). The estimated variance within stratum  $k$  is (Pollock et al., 1994)

$$s_k^2 = \frac{1}{n_k - 1} \sum_{m=1}^{n_k} (e_{km} - \bar{e}_k)^2 \quad (3)$$

where  $n_k$  is the sample size (days) for stratum  $k$ ,  $e_{km}$  the effort for stratum  $k$  on day  $m$  and  $\bar{e}_k$  the mean daily fishing effort for stratum  $k$ . The variance associated with the estimate of the mean, with finite population correction (Neter et al., 1988), is calculated as

$$Var(\bar{e}_k) = \frac{s_k^2}{n_k} \left( \frac{N_k - n_k}{N_k} \right) \quad (4)$$

where  $N_k$  is the total number of days in stratum  $k$ . The total effort for stratum  $k$  is estimated as

$$\hat{E}_k = \frac{N_k}{n_k} \sum_{m=1}^{n_k} e_{km} \quad (5)$$

The variance associated with  $\hat{E}_k$  is estimated by

$$Var(\hat{E}_k) = N_k^2 Var(\bar{e}_k) \quad (6)$$

and the standard error is calculated by the usual method

$$SE(\hat{E}_k) = \sqrt{Var(\hat{E}_k)} \quad (7)$$

The total effort is estimated by summing the effort for the strata as follows

$$\hat{E} = \sum_{k=1}^n \hat{E}_k \quad (8)$$

where  $n$  is the number of strata. Similarly the variance of  $\hat{E}$  is estimated from the independent variances for the strata

$$Var(\hat{E}) = \sum_{k=1}^n Var(\hat{E}_k) \quad (9)$$

and the standard error of  $\hat{E}$  is calculated by the usual method

$$SE(\hat{E}) = \sqrt{Var(\hat{E})} \quad (10)$$

For ease of interpretation, some of the results were expressed in fisher days ( $\hat{D}$ ) which was estimated by multiplying the effort in hours ( $\hat{E}$ ) by the mean number of fishers per boat ( $\bar{p}$ ) and dividing by the mean time spent fishing ( $\bar{t}$ )

$$\hat{D} = \frac{\hat{E}\bar{p}}{\bar{t}} \quad (11)$$

### Estimation of Total Catch

The catch rate for each stratum  $k$  is estimated by (Crone and Malvestuto, 1991)

$$\hat{R}_k = \frac{\bar{c}_k}{\bar{L}_k} = \frac{\sum_{j=1}^{n_k} c_{kj} / n_k}{\sum_{j=1}^{n_k} L_{kj} / n_k} \quad (12)$$

where  $n_k$  is the number of boats where the catch was recorded,  $c_{kj}$  the catch for boat  $j$  and  $L_{kj}$  the effort, in boat hours, for boat  $j$ . The variances for  $\bar{c}_k$  and  $\bar{L}_k$  can be calculated by the usual method (see (3) and (4) without the finite population correction factor). The variance for  $\hat{R}_k$  can be estimated using the formulae described in Kendall and Stuart<sub>t</sub> (1969)

$$Var(\hat{R}_k) \approx \hat{R}_k^2 \left( \frac{Var(\bar{c}_k)}{\bar{c}_k^2} + \frac{Var(\bar{L}_k)}{\bar{L}_k^2} - \frac{2Cov(\bar{c}_k, \bar{L}_k)}{\bar{c}_k \bar{L}_k} \right) \quad (13)$$

The total catch for stratum  $k$  is estimated as

$$\hat{C}_k = \hat{E}_k \hat{R}_k \quad (14)$$

and the variance was estimated using the formulae described in Kendall and Stuart (1969)

$$Var(\hat{C}_k) \approx \hat{C}_k^2 \left( \frac{Var(\hat{E}_k)}{\hat{E}_k^2} + \frac{Var(\hat{R}_k)}{\hat{R}_k^2} + \frac{2Cov(\hat{E}_k, \hat{R}_k)}{\hat{E}_k \hat{R}_k} \right) \quad (15)$$

where the covariance term was assumed to be zero. The total catch is estimated by summing the catch for each strata as follows

$$\hat{C} = \sum_{k=1}^n \hat{C}_k \quad (16)$$

and the variance of  $\hat{C}$  is estimated as

$$Var(\hat{C}) = \sum_{k=1}^n Var(\hat{C}_k) \quad (17)$$

and the standard error of  $\hat{C}$  is calculated by the usual method

$$SE(\hat{C}) = \sqrt{Var(\hat{C})} \quad (18)$$

## Appendix 5. Catch and effort calculations for shore-based fishers.

### Estimation of Total Effort

The fishing effort for a half day shift (fisher hours) was estimated by the roving creel survey method (Pollock et al., 1994) as follows:

$$e = IT \quad (1)$$

where  $I$  is the count of fishers and  $T$  is the length of the shift. The estimated variance within stratum  $k$  is (Pollock et al., 1994)

$$s_k^2 = \frac{1}{n_k - 1} \sum_{m=1}^{n_k} (e_{km} - \bar{e}_k)^2 \quad (2)$$

where  $n_k$  is the sample size (days) for stratum  $k$ ,  $e_{km}$  the effort for stratum  $k$  on day  $m$  and  $\bar{e}_k$  the mean daily fishing effort for stratum  $k$ . The variance associated with the estimate of the mean, with finite population correction (Neter et al., 1988), is calculated as

$$Var(\bar{e}_k) = \frac{s_k^2}{n_k} \left( \frac{N_k - n_k}{N_k} \right) \quad (3)$$

where  $N_k$  is the total number of days in stratum  $k$ . The total effort for stratum  $k$  is estimated as

$$\hat{E}_k = \frac{N_k}{n_k} \sum_{m=1}^{n_k} e_{km} \quad (4)$$

The variance associated with  $\hat{E}_k$  is estimated by

$$Var(\hat{E}_k) = N_k^2 Var(\bar{e}_k) \quad (5)$$

and the standard error is calculated by the usual method

$$SE(\hat{E}_k) = \sqrt{Var(\hat{E}_k)} \quad (6)$$

The total effort is estimated by summing the effort for each strata as follows

$$\hat{E} = \sum_{k=1}^n \hat{E}_k \quad (7)$$

where  $n$  is the number of strata. Similarly the variance of  $\hat{E}$  is estimated as

$$Var(\hat{E}) = \sum_{k=1}^n Var(\hat{E}_k) \quad (8)$$

and the standard error of  $\hat{E}$  is calculated by the usual method

$$SE(\hat{E}) = \sqrt{Var(\hat{E})} \quad (9)$$

For ease of interpretation, some of the results were expressed in fisher days ( $\hat{D}$ ) which was estimated by dividing the effort in hours ( $\hat{E}$ ) by the mean time spent fishing ( $\bar{t}$ )

$$\hat{D} = \frac{\hat{E}}{\bar{t}} \quad (10)$$

### Estimation of Total Catch

The catch rate for each stratum  $k$  is estimated by (Pollock et al., 1994)

$$\hat{R}_k = \frac{\sum_{j=1}^{n_k} \frac{w_{kj} c_{kj}}{L_{kj}}}{\sum_{j=1}^{n_k} w_{kj}} \quad (11)$$

where  $c_{kj}$  is the total catch and  $L_{kj}$  the total effort, in person hours, for party  $j$  with  $w_{kj}$  fishers,  $n_k$  is the number of shore-based parties where the catch was recorded. The variance for  $\hat{R}_k$  can be estimated using the formulae

$$Var(\hat{R}_k) \approx \frac{1}{\sum_{j=1}^{n_k} w_{kj} \left( \sum_{j=1}^{n_k} w_{kj} - 1 \right)} \sum_{j=1}^{n_k} w_{kj} \left( \frac{c_{kj}}{L_{kj}} - \hat{R}_k \right)^2 \quad (12)$$

The total catch for stratum  $k$  is estimated as

$$\hat{C}_k = \hat{E}_k \hat{R}_k \quad (13)$$

and the variance was estimated using the formulae described in Kendall and Stuart (1969)

$$Var(\hat{C}_k) \approx \hat{C}_k^2 \left( \frac{Var(\hat{E}_k)}{\hat{E}_k^2} + \frac{Var(\hat{R}_k)}{\hat{R}_k^2} + \frac{2Cov(\hat{E}_k, \hat{R}_k)}{\hat{E}_k \hat{R}_k} \right) \quad (14)$$

where the covariance term was assumed to be zero. The total catch is estimated by summing the catch for each strata as follows

$$\hat{C} = \sum_{k=1}^n \hat{C}_k \quad (15)$$

and the variance of  $\hat{C}$  is estimated as

$$Var(\hat{C}) = \sum_{k=1}^n Var(\hat{C}_k) \quad (16)$$

and the standard error of  $\hat{C}$  is calculated by the usual method

$$SE(\hat{C}) = \sqrt{Var(\hat{C})} \quad (17)$$

## Appendix 6. Length-weight regressions used to calculate average weight (in grams) of major species.

Common Name	Species Name	Equation	Source
Bream, Black	<i>Acanthopagrus butcheri</i>	$W=0.00000813L^{3.14}$	Sarre (unpublished data)
Bream, Silver (Tarwhine)	<i>Rhabdosargus sarba</i>	$W=0.0000241L^{2.932}$	Hesp (unknown)
Flathead, Southern Blue Spotted	<i>Platycephalus speculator</i>	$W=0.0081*(L/10)^{2.92}$	Malseed (Fisheries WA, unpublished data)
Flatheads, General	Family Platycephalidae	$W=0.0081*(L/10)^{2.92}$	Malseed (Fisheries WA, unpublished data)
Garfish, Southern Sea	<i>Hyphoramphus melanochir</i>	$W=0.003188(L/10)^{3.125}$	Malseed (Fisheries WA, unpublished data)
Herring, Australian	<i>Arripis georgianus</i>	$W = 0.00001022L^{3.015}$	Fairclough (1998)
Snapper, Pink	<i>Pagrus auratus</i>	$W=0.0467727((L-0.7)/11.79)^{2.781}$	Moran and Burton (1990)
Trevally, Skipjack	<i>Pseudocaranx dentex</i>	$W=0.000014978L^{2.9683}$	Malseed (Fisheries WA, unpublished data)
Whiting, King George	<i>Sillago punctata</i>	$W = 0.0000011L^{3.29}$	Ayvazian et al. (2004)

**Appendix 7. Number of lengths used to calculate average weight, and average weight (in grams), of each species caught by recreational fishers.**

Estuary/Inlet	Common Name	Bream, Black	Bream, Silver (Tarrhine)	Crab, Blue Swimmer	Flathead, Southern Blue-Spotted	Flatheads, general	Garfish, Southern Sea	Herring, Australian	Leatherjackets, general	Mullet, Yellow Eye (Pileh)
Broke Inlet	Scientific Name	<i>Acanthopagrus butcheri</i>	<i>Rhabdosargus sarba</i>			Family Platycephalidae	<i>Hyphorhamphus melanochir</i>	<i>Arripis georgianus</i>		<i>Aldrichetta forsteri</i>
	No. lengths		6				4			
	Ave. length (mm) Ave. weight (g)		364 795				334 185			
Irwin Inlet	No. lengths	1	2	4			3	9		19
	Ave. length (mm) Ave. weight (g)	284 411	242 234	143 270			329 180	252 179		250 143
	No. lengths	94	8	11	58	26	29	1		18
Wilson Inlet	Ave. length (mm) Ave. weight (g)	296 494	292 428	130 190	478 636	437 636	385 293	240 153		299 232
	No. lengths	5		2	1		8	31	11	
	Ave. length (mm) Ave. weight (g)	291 446		130 188	466 603		466 152	220 143	282 400	
Princess Royal Harbour	No. lengths	46		6	1			35	7	
	Ave. length (mm) Ave. weight (g)	295 510		148 301	450 544			215 114	303 497	
	No. lengths	273	31	5	32			89		3
Walpole/Normalup Inlet	Ave. length (mm) Ave. weight (g)	308 556	278 356	140 252	388 359			229 136		246 157
	No. lengths	51								
	Ave. length (mm) Ave. weight (g)	286 453								
Beaufort Inlet	No. lengths	249	2	149						
	Ave. length (mm) Ave. weight (g)	285 436	290 421	140 243						
	No. lengths	1			1			13		
Wellstead Estuary	Ave. length (mm) Ave. weight (g)				310 183			195 83		
	No. lengths	148			1					
	Ave. length (mm) Ave. weight (g)	275 380			495 719					
Bandy Creek	No. lengths	51	5					4		
	Ave. length (mm) Ave. weight (g)	287 437	286 393					232 142		
	No. lengths	5								
Stokes Inlet	Ave. length (mm) Ave. weight (g)									
	No. lengths	148								
	Ave. length (mm) Ave. weight (g)	275 380			495 719					
Other locations	No. lengths	51	5					4		
	Ave. length (mm) Ave. weight (g)	287 437	286 393					232 142		
	No. lengths	5								

Estuary/Inlet	Common Name	Mulloway	Salmon, Australian	Snapper, Pink	Squid, Arrow	Tailor	Trevally, Skipjack/Silver	Whiting, King George	Whiting, School Southern/Silver	Whiting, Yellow Finned
	Scientific Name	<i>Argyrosomus hololepidotus</i>	<i>Arripis truttaceus</i>	<i>Pagrus auratus</i>	<i>Nototodarus gouldi</i>	<i>Pomatomus saltatrix</i>	<i>Pseudocaranx dentex</i>	<i>Sillaginodes punctata</i>	<i>Sillago bassensis</i>	<i>Sillago schomburgkii</i>
Broke Inlet	No. lengths Ave. length (mm) Ave. weight (g)							22 355 284		
Irwin Inlet	No. lengths Ave. length (mm) Ave. weight (g)	1 355 640		37 313 438			5 265 235	55 309 175		
Wilson Inlet	No. lengths Ave. length (mm) Ave. weight (g)			51 401 1,009			5 299 345	169 338 248		2 315 231
Princess Royal Harbour	No. lengths Ave. length (mm) Ave. weight (g)	1 310 420		3 270 288	6 254 566		22 249 198	128 301 165		
Oyster Harbour	No. lengths Ave. length (mm) Ave. weight (g)	2 620 1,595		1 290 350			* 167 272 340	151 293 149		
Walpole/Normalup Inlet	No. lengths Ave. length (mm) Ave. weight (g)	12 360 686		6 288 352		4 347 399	47 301 369	93 299 157	9 182 46	6 280 172
Beaufort Inlet	No. lengths Ave. length (mm) Ave. weight (g)							1 330 212		
Wellstead Estuary	No. lengths Ave. length (mm) Ave. weight (g)	4 280 330						15 272 125		
Bandy Creek	No. lengths Ave. length (mm) Ave. weight (g)						50 217 136	5 279 125		
Stokes Inlet	No. lengths Ave. length (mm) Ave. weight (g)									
Other locations	No. lengths Ave. length (mm) Ave. weight (g)						8 250 208	1 310 173		

\*The average weight (grams) in Oyster Harbour was calculated using data from all estuaries surveyed due to limited sampling of lengths at this location.