

Results

Summary for all survey regions (2 to 7) and years (2000–2003 and 2005)

Set times

Each year most regions took between four and five days to sample. Set time varied between all regions and years and ranged from 25 to 195 min (a total of 1935 sets) with a mean of 52.9 ± 0.31 min. The mean set time for each region for all years ranged from 47 min (Region 2) to 56 min (Region 6).

Length frequency distributions

In total 23 842 male and 4193 female spanner crabs were measured. Carapace lengths ranged from 30 to 162 mm for male crabs (Figure 2) and from 19 to 123 mm for female crabs (Figure 3). The length frequency of male crabs was normally distributed with a peak frequency in the 100 to 109 mm size class, which is greater than the minimum legal size (MLS; Queensland 100 mm rostral carapace length; NSW 93 mm orbital carapace length). Overall 68.1% of male crabs captured were above the MLS (Table 2). This percentage varied greatly between regions, ranging from 44.3% in Region 5 to 90.4% in Region 7.

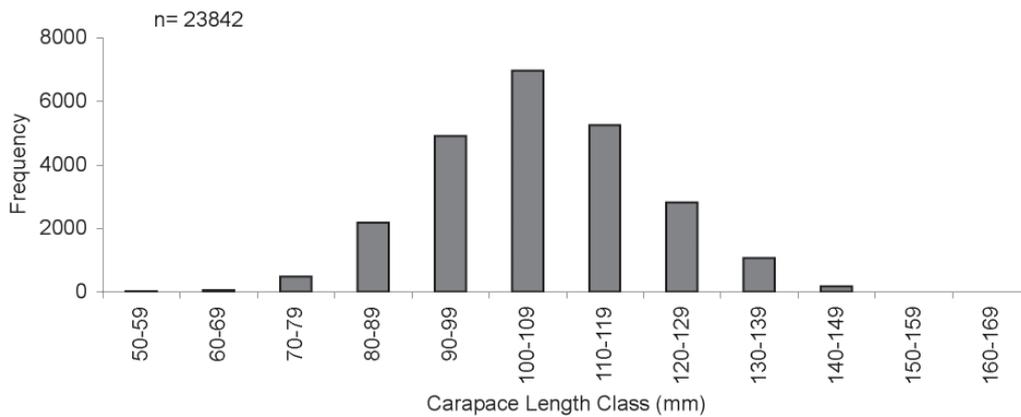


Figure 2. Male spanner crab length frequencies for all years and regions.

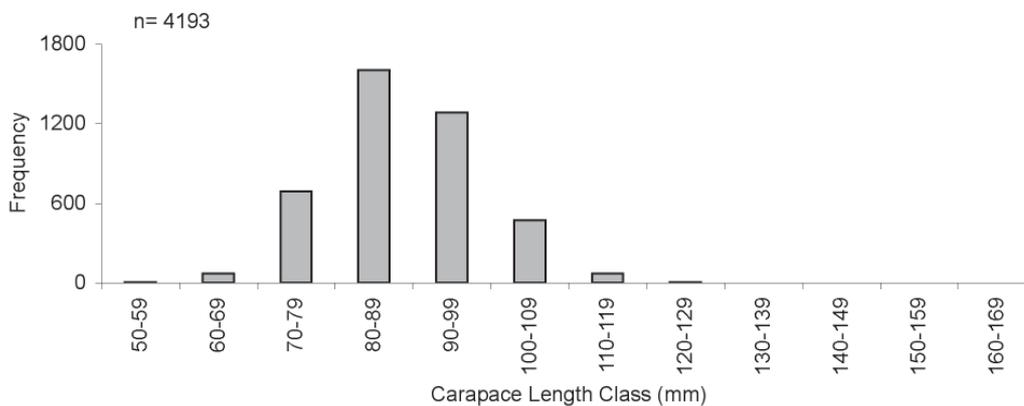


Figure 3. Female spanner crab length frequencies for all years and regions.

The length frequency of female crabs was slightly skewed, with a peak frequency in the 80 to 89 mm size class. Overall, 13.0% of females captured were above the MLS (Table 2). This percentage also varied greatly between regions ranging from 37.8% in Region 7 to 2.0% for Region 5.

Table 2. Percentages of male crabs captured that were above the minimum legal size (100 mm carapace length) in Regions 2 to 6, all years combined, and Region 7 in 2005.

Region	Males		Females	
	No of Crabs	≥100 mm (%)	No of Crabs	≥100 mm (%)
2	3 321	68.4	386	2.6
3	3 437	63.2	543	2.4
4	9 450	74.9	1 014	6.9
5	3 982	44.3	852	2.0
6	3 443	79.9	1 181	29.9
7	209	90.4	217	37.8
Total	23 842	68.1	4 193	13.0

There was substantial variation in the mean size of male crabs within regions (between years) and between regions (all years combined). Variation also existed in the mean size of female crabs between regions (all years combined) however variation within regions (between years) was less pronounced (Figure 4).

Mean size of male crabs was highest in Region 7 (116.03 ± 1.02 mm) and lowest in Region 5 (98.70 ± 0.21 mm). The pattern for females was similar, although less pronounced, ranging from 97.40 ± 0.49 mm in Region 7 to 82.00 ± 0.30 mm in Region 5.

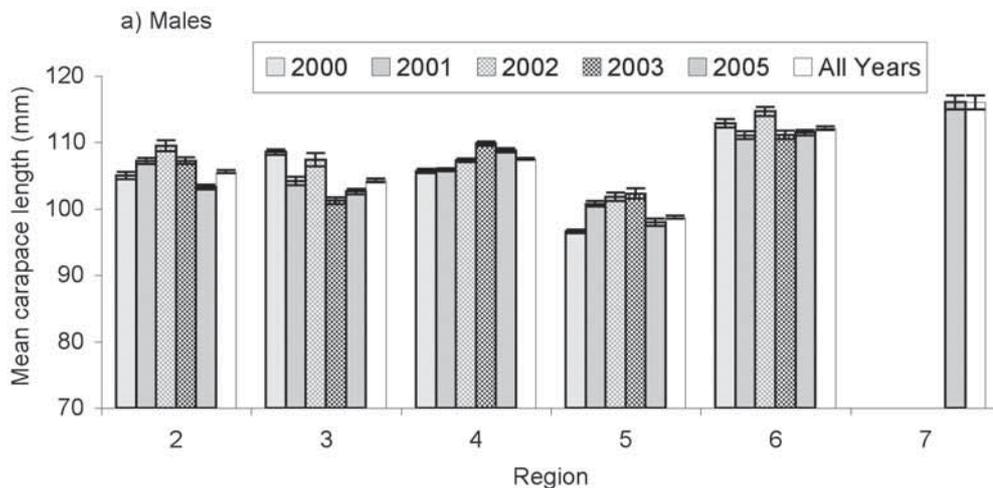


Figure 4. Mean male (a) and female (b) carapace lengths (mm) by region (2 to 7) and year (2000–2003 and 2005) for the Long Term Monitoring Program spanner crab survey. Error bars are \pm standard error.

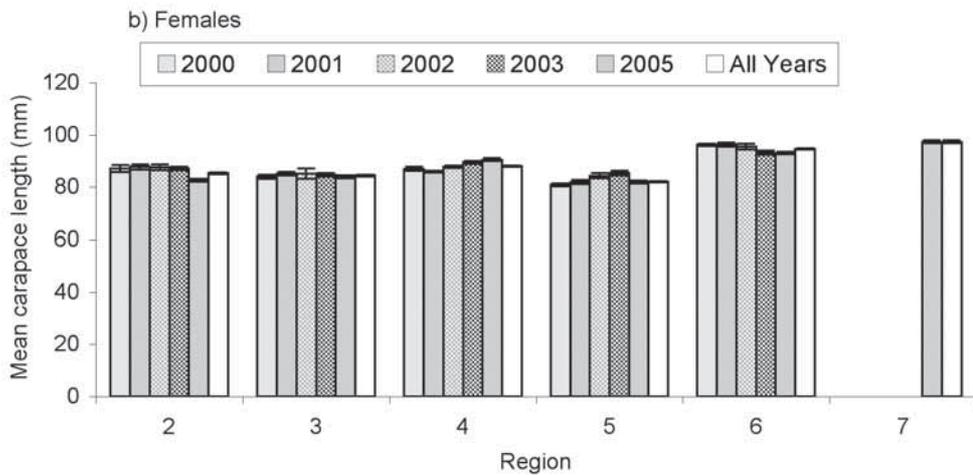


Figure 4 (continued). Mean male (a) and female (b) carapace lengths (mm) by region (2 to 7) and year (2000–2003 and 2005) for the Long Term Monitoring Program spanner crab survey. Error bars are \pm standard error.

Sex-ratios

The overall proportion of males to females varied little between survey years (all regions combined), with males representing 85.0% of the overall catch (Figure 5). Catches were heavily biased towards males in all regions except Region 7 which had a considerably lower proportion of males in the catch (0.49) compared to Regions 2, 3, 4, 5 and 6 (0.74 to 0.90) (Figure 6).

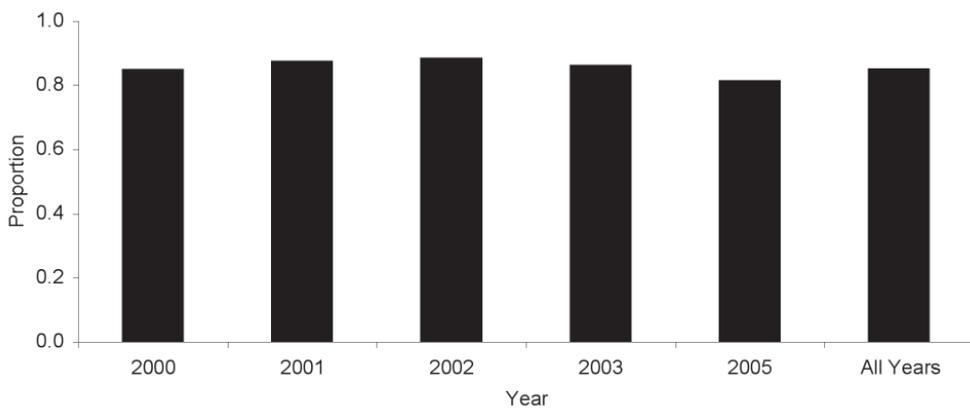


Figure 5. Annual sex-ratio of males to females (all regions combined) for the Long Term Monitoring Program spanner crab survey.

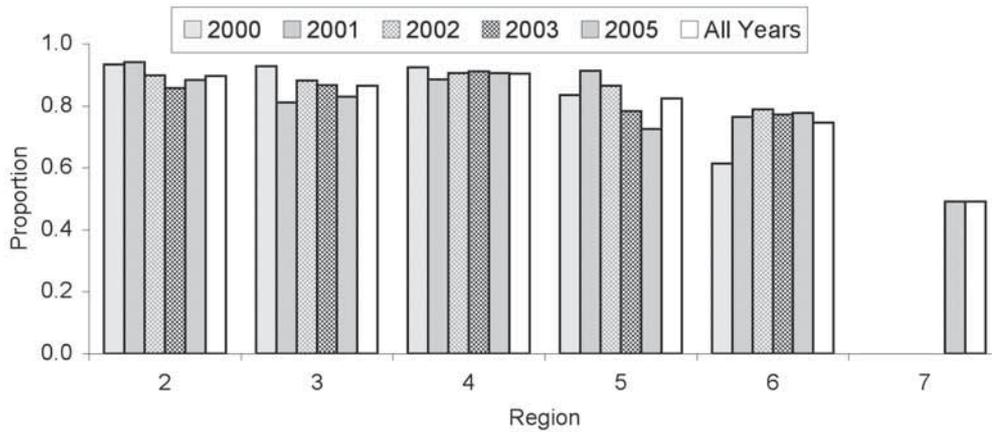


Figure 6. Annual sex-ratio of males to females by region (2 to 7) for the Long Term Monitoring Program spanner crab survey.

Catch rates

Mean catch rates of male and female crabs were lowest in 2002 in most regions (Figure 7). In all regions, mean catch rate was higher in 2005 than in 2002. Further, for both males and females in all regions, except males in Region 5, the mean catch rate in 2003 was between the low in 2002 and the high in 2005.

Mean catch rate of male spanner crabs from Region 4 was greater than two crabs per dilly per hour in all years and was greater than the catch rates of all other regions in all years except 2000. In 2000 the highest mean catch rate of male crabs was observed in Region 5. The mean catch rates recorded for females were lower than those observed for males, ranging from 0.05 crabs/dilly.hour (Region 3, 2002) to 0.52 crabs/dilly.hour (Region 6, 2005).

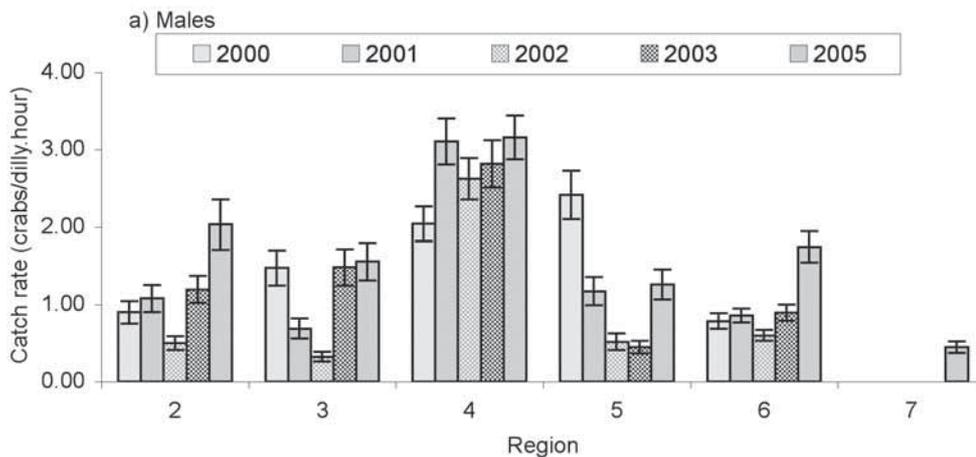


Figure 7. Mean male (a) and female (b) catch rates (crabs/dilly.hour) by region (2 to 7) and year (2000–2003 and 2005) for the Long Term Monitoring Program spanner crab survey. Error bars are \pm standard error.

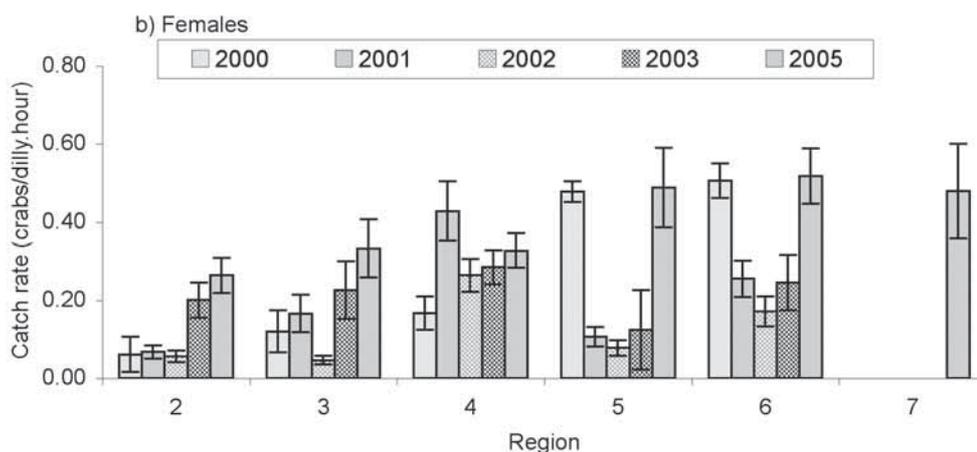


Figure 7 (continued). Mean male (a) and female (b) catch rates (crabs/dilly.hour) by region (2 to 7) and year (2000–2003 and 2005) for the Long Term Monitoring Program spanner crab survey. Error bars are \pm standard error.

Relationships with physical characteristics

Sampling during the survey was carried out in water depths ranging from 4 to 98 m (Table 3). The range of depths differed considerably between regions. For example, all sets in Region 3 were in depths ranging from 15 to 46 m, but sets in Region 4 ranged from 45 to 76 m (Table 3).

Table 3. Minimum and maximum set depths and depth range in which most sets were made for Regions 2 to 6 in all years (2000–2003 and 2005) and Region 7 in 2005 of the Long Term Monitoring Program spanner crab survey.

Region	Minimum set depth	Maximum set depth	Depth range with most sets
2	29	55	30 - 39
3	15	46	20 - 29
4	45	76	50 - 59
5	4	98	40 - 49
6	17	89	80 - 89
7	10	60	50 - 59
All	4	98	30 - 39

Highest mean catch rates were observed in depths of 60 to 69 m for both males (2.28 ± 0.14 crabs/dilly.hour) and females (0.42 ± 0.03 crabs/dilly.hour) (Figure 8). Ninety percent of males and females were caught in depths between 30 and 79 m. This was in part due to the unbalanced nature of the sampling design with 77% of all sets carried out in this depth range.

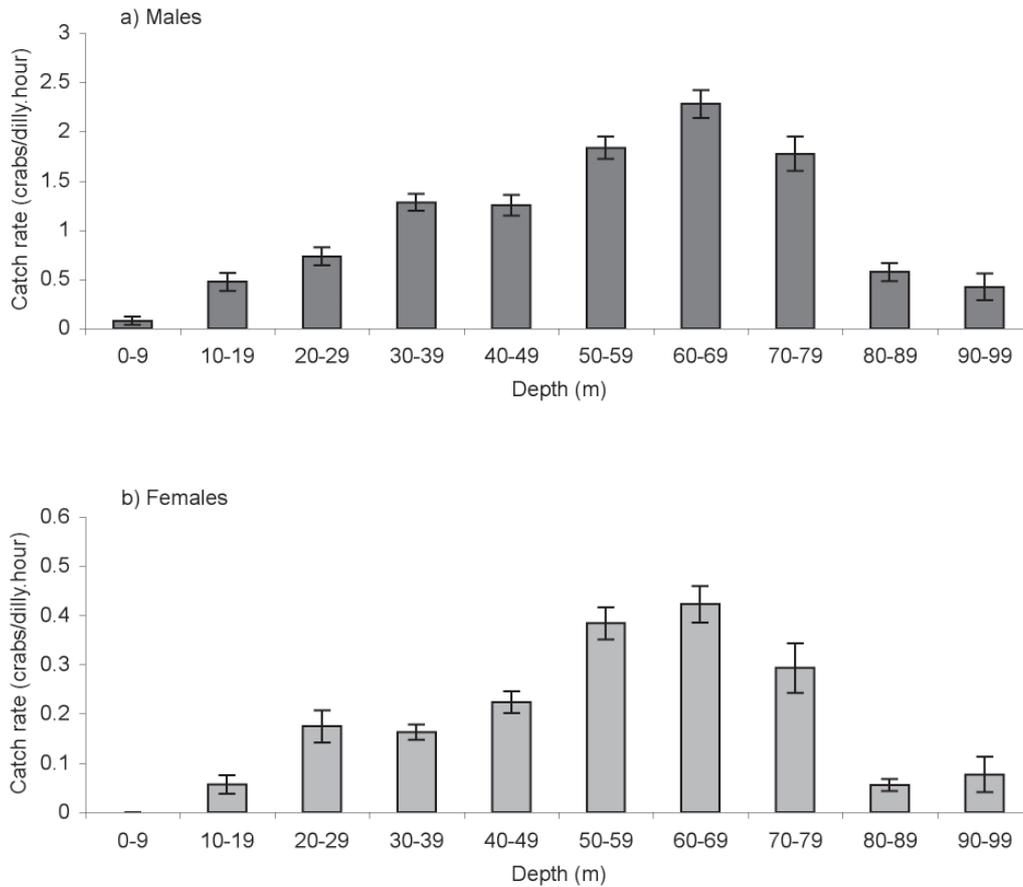


Figure 8. Mean male (a) and female (b) catch rates (crabs/dilly.hour) by depth of the set. All regions and years combined. Error bars are \pm standard error.

Temperature data-loggers were placed on 327 sets over the five year survey period (Table 4). Mean water temperature during sets ranged from 18.7 to 24.8°C.

The highest mean catch rate for males (2.29 ± 0.38 crabs/dilly.hour) was observed at temperatures of 24 to 24.9°C. The highest catch rate from an individual string occurred in the 23 to 23.9°C temperature range. Mean female catch rate was highest (0.29 ± 0.06 crabs/dilly.hour) in the 21 to 21.9°C range (Figure 9). The highest catch rate from an individual string occurred in the 22 to 22.9°C range. There were few observations and low catch rates in the temperature ranges of 18 to 18.9°C and 19 to 19.9°C, $n=2$ and $n=1$ respectively.

Table 4. Minimum and maximum mean water temperatures and the number of sets made with temperature data-loggers for Regions 2 to 6 in years 2001, 2003 and 2005 of the Long Term Monitoring Program spanner crab survey.

Region	Minimum temp (°C)	Maximum temp (°C)	No. of sets with Temp loggers
2	20.3	24.4	78
3	18.7	24.2	69
4	20.7	24.8	78
5	20.4	23.5	48
6	18.8	24.5	54
All	18.7	24.8	327

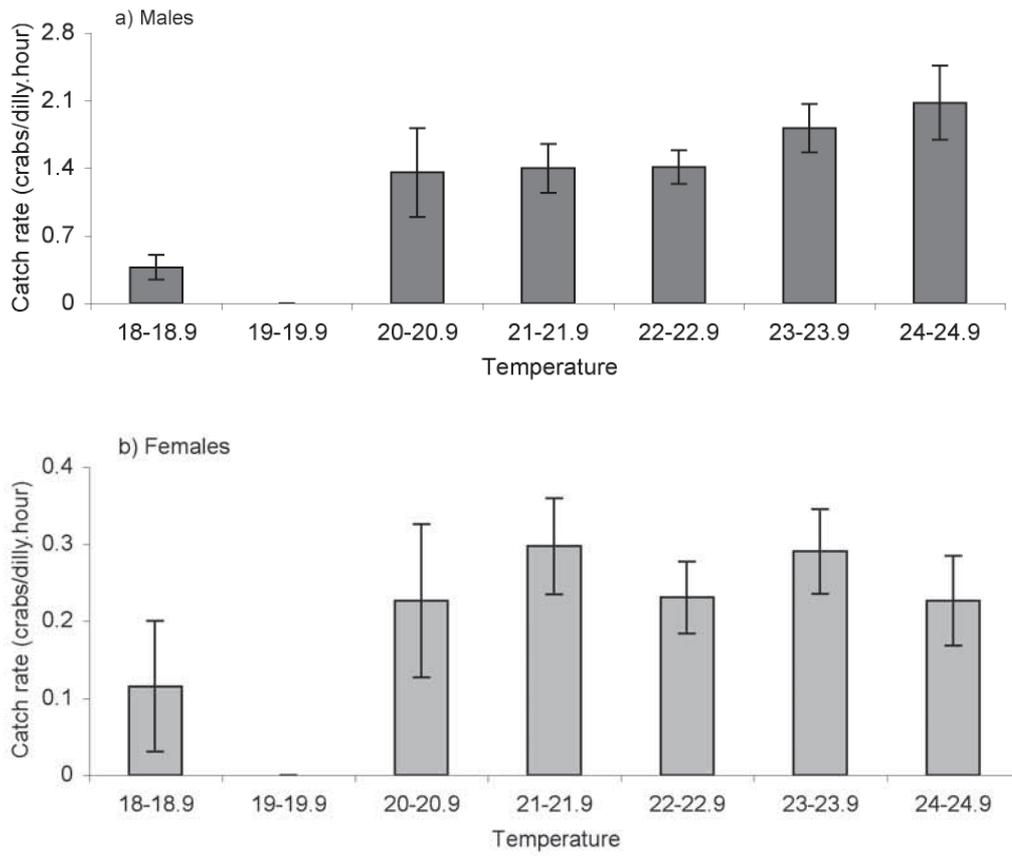


Figure 9. Mean male (a) and female (b) catch rates (crabs/dilly.hour) by mean water temperature. All regions and years combined. Error bars are \pm standard error.

Bycatch and interactions with other marine species

Bycatch species were assigned to broad taxonomic groupings, the catch rates of these groups were very low, ranging from 0.00 to 0.44 individuals per dilly lift (Table 5). There were no recorded interactions with protected species. The only species of conservation interest encountered were sea horses (Syngnathidae). Catch rates of bycatch species per region are presented in Appendix A.

Table 5. Mean catch rates (individuals per dilly lift) of bycatch groups caught during the Long Term Monitoring Program spanner crab survey in 2001, 2003 and 2005 in Regions 2–6. The only species of conservation interest (SOCI) encountered were sea horses (Syngnathidae).

Year	Region	Crustacean	Echinoderm	Fish	Mollusc	Porifera	SOCI
2002	2	<0.01	0.03	<0.01	0.04	<0.01	
	3	<0.01	0.08	0.03	0.04		
	4	<0.01	0.16	0.01	<0.01		
	5	<0.01		<0.01	0.01		
	6	0.05	0.36	0.02		<0.01	<0.01
2003	2	<0.01	0.07	0.01	0.03		<0.01
	3	<0.01	0.02	0.04	<0.01		
	4	<0.01	0.10	<0.01	<0.01		
	5	<0.01	0.01	0.03			<0.01
	6	<0.01	0.28	0.02		<0.01	<0.01
2005	2		0.01	<0.01	0.06	<0.01	
	3	<0.01	0.03	0.02	<0.01	<0.01	
	4	<0.01	0.07	<0.01	<0.01		
	5	0.01	0.12	0.01			
	6	<0.01	0.44	0.02	<0.01		<0.01

Region 2

Size frequency

The carapace length of males captured in Region 2 varied from 72 to 144 mm, with a peak in the length frequency distribution in the 100 to 109 mm class (Figure 10). Female carapace lengths ranged from 69 to 115 mm, with a peak in the length frequency distribution in the 80 to 89 mm class. In Region 2, 68.4% of male crabs captured had carapace lengths greater than MLS compared to female crabs of which only 2.6% were above MLS (Table 2).

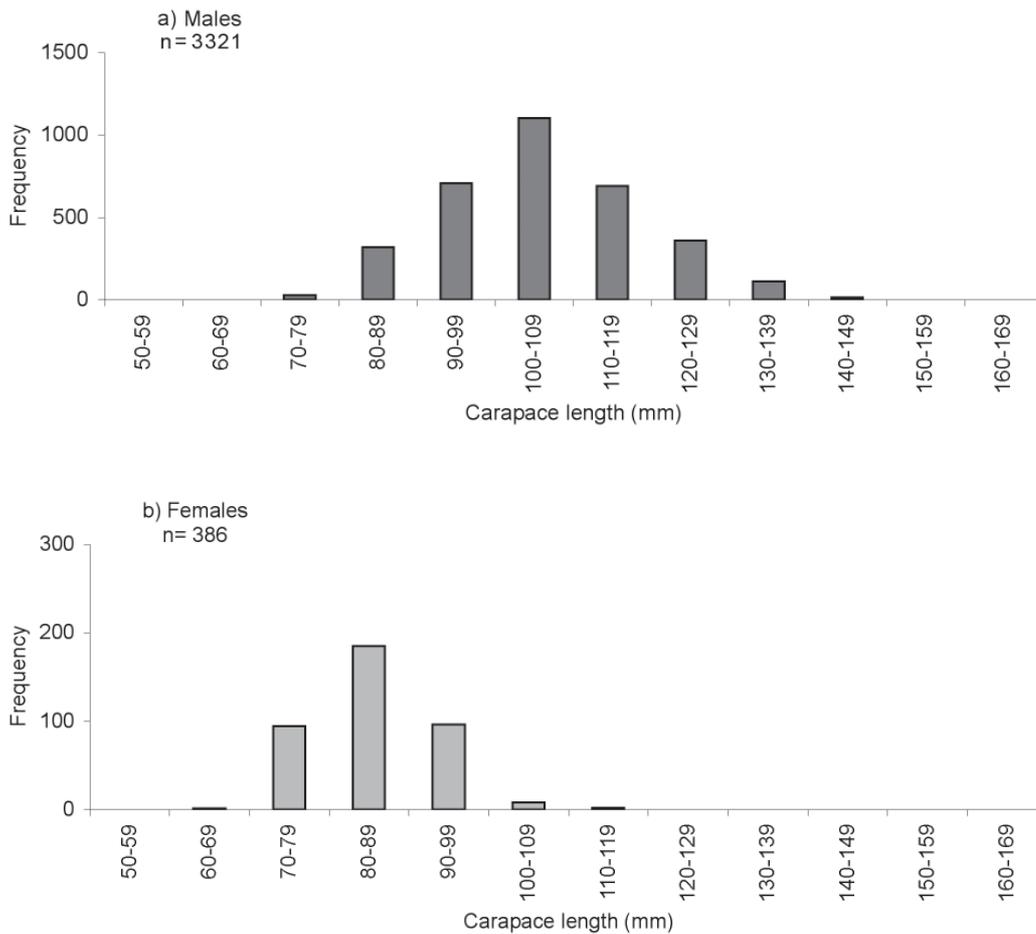


Figure 10. Male (a) and female (b) spanner crab length frequencies for all years in Region 2.

Mean male carapace length was highest in subgrid 19T30 (116.42 ± 0.65 mm) and lowest in subgrid 22U30 (102.44 ± 0.26 mm). Mean female carapace lengths showed little variation between subgrids. The mean carapace length of male and female crabs sampled from the new subgrid 23U30 (introduced in 2005), was slightly smaller than those sampled from the subgrid which it replaced (25U30) (Figure 11).

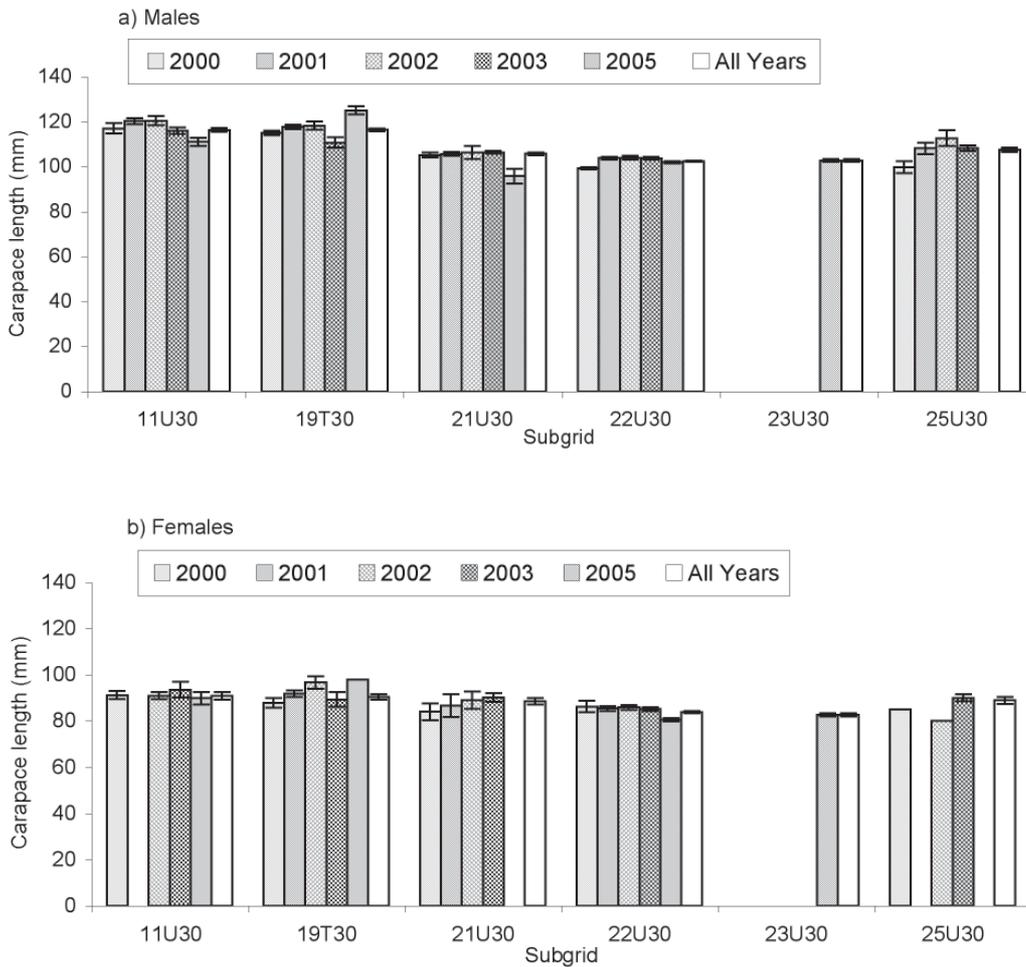


Figure 11. Mean male (a) and female (b) carapace lengths (mm) by year (2000–2003 and 2005) for Region 2. Error bars are \pm standard error.

Catch rates

Mean catch rate of males varied considerably between subgrids in Region 2, ranging from 0.05 to 4.99 crabs/dilly.hour (Figure 12). The mean catch rate of males in all subgrids was less than 1 crab/dilly.hour with the exception of subgrids 22U30 and 23U30 which had mean catch rates ranging from 1 to 5 crabs/dilly.hour. Mean female catch rate also varied considerably between subgrids, ranging from 0 to 0.78 crabs/dilly.hour. The mean catch rate of females followed a similar pattern to males, being highest in subgrids 22U30 and 23U30.

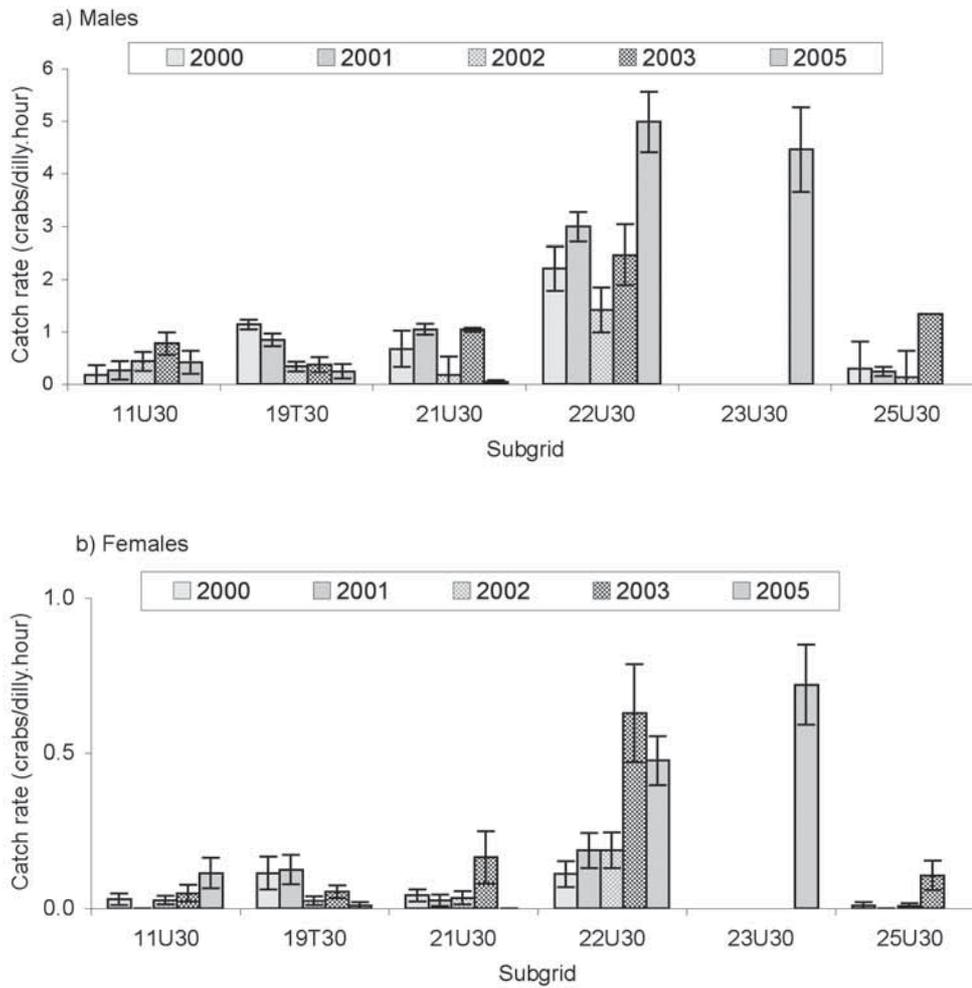


Figure 12. Mean male (a) and female (b) catch rates (crabs/dilly.hour) by year (2000–2003 and 2005) for Region 2. Error bars are ± standard error.

Sex-ratios

Sex-ratios of spanner crabs captured in Region 2 varied little between the five survey years. Males represented 79 to 100% of the total catch depending on the subgrid and year (Figure 13).

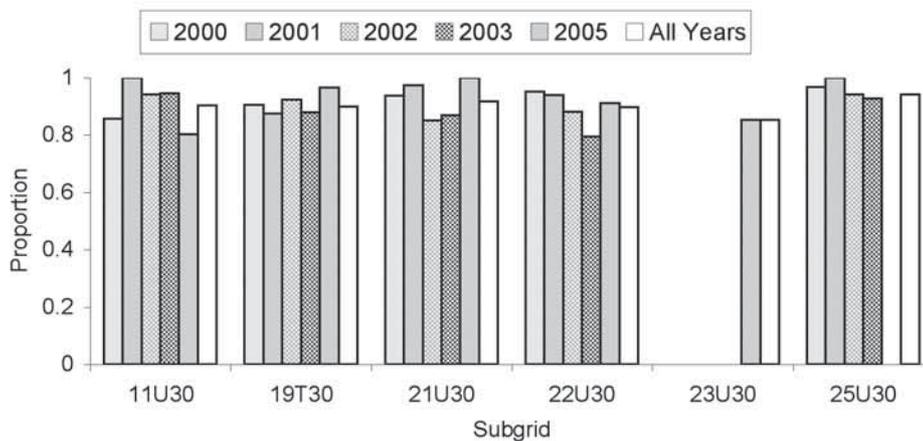


Figure 13. Sex-ratio of males to females by year (2000–2003 and 2005) for subgrids in Region 2.

Relationships with physical characteristics

Depths sampled in Region 2 ranged from 29 to 55 m, with most sets made in the 30 to 39 m depth range (Table 3). Highest mean male catch rates occurred at depths of 30 to 39 m whilst highest mean female catch rates occurred at depths of 20 to 29 m (Figure 14).

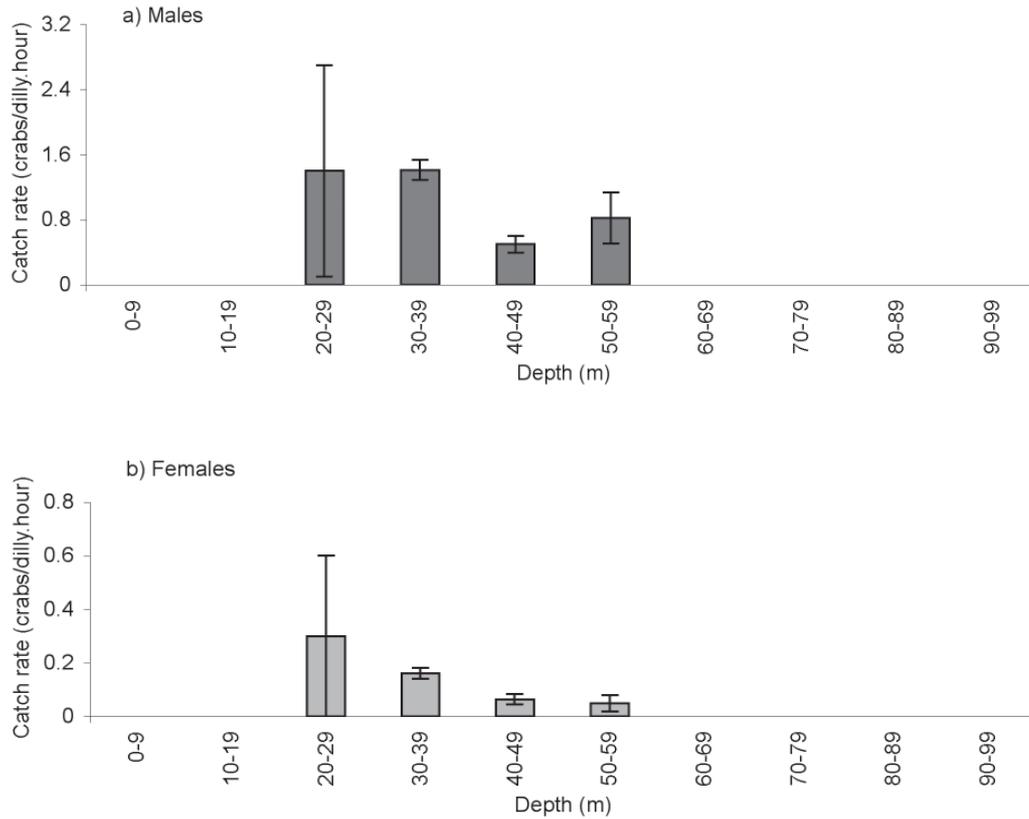


Figure 14. Mean male (a) and female (b) catch rates (crabs/dilly.hour) by depth of set for subgrids in Region 2. Error bars are \pm standard error.

Mean water temperatures observed in Region 2, ranged from 20.4 to 24.4°C (Table 4). During 64% of sets temperatures were recorded in a narrow range from 22 to 23.9°C.