

**2008 horseshoe crab trawl survey: Report to the Atlantic States Marine Fisheries  
Commission Horseshoe Crab Technical Committee**

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The 2008 Delaware Bay area horseshoe crab abundance monitoring survey was conducted in the mid-Atlantic region from Atlantic City, New Jersey (39° 20' N) to the Eastern Shore area of Virginia (37° 40' N) (Figure 1). Sampling was conducted in the Atlantic Ocean from shore out to 22.2 km (12 nautical miles). The survey area was stratified by distance from shore (0-3 nm, 3-12 nm) and bottom topography (trough, nontrough), following the results of the 2001 pilot study, as in previous years. Sampling was conducted aboard a 16.8-m chartered commercial fishing vessel out of Ocean City, MD. We used a two-seam flounder trawl of 18.3-m headrope and 24.4-m footrope, rigged with a Texas Sweep of 13-mm link chain and a tickler chain. The net body consisted of 15.2-cm (6-in) stretched mesh, and the bag consisted of 14-cm (5.5-in) stretched mesh. Tows were 15-minutes bottom time. A total of 45 stations were trawled between 29 September and 14 October 2008.

Horseshoe crabs (*Limulus polyphemus*) were culled from the catch, and either all individuals or a subsample were examined for prosomal width (millimeters) and identified for sex and maturity. Maturity classifications were: immature, primiparous - those that are newly mature but have not yet spawned, and multiparous - those that are mature and have spawned. Primiparous and multiparous males are morphologically distinct, and are believed to be classifiable without error. However, some error is associated with distinguishing primiparous from immature females. All examined females that were not obviously mature (i.e., bearing rub marks) or immature (too small or soft-shelled) were probed with an awl to determine presence or absence of eggs.

Females with eggs but without rub marks were considered primiparous (newly mature). Females with both eggs and rub marks were considered multiparous.

In each stratum, the mean catch per 15-minute tow and associated variance were calculated using two methods, i.e., either assuming a normal-distribution model or a delta-distribution model (Pennington, 1983; Pennington, 1996). Stratum mean and variance estimates were combined using formulas for a stratified random sampling design (Cochran, 1977). The approximate 95% confidence intervals were calculated using the effective degrees of freedom (Cochran, 1977). Annual means were considered significantly different if 95% confidence intervals did not overlap.

Interannual comparisons for the main DBA survey used the area from 39° 20' N to 37° 40' N that was consistent over the 2002-2008 period (Figure 1). This area has been subdivided in previous reports into a core area that was sampled in the 2001 pilot study, and a peripheral area. The core area was sampled from 2001-2008 (including the 2001 pilot study) and extends from 39° 10' N to 38° 10' N. The peripheral survey area is the main survey area outside the core area: from 39° 20' N to 39° 10' N, and from 38° 10' N to 37° 40' N, and was surveyed from 2002 to 2008. Catch means using the core area allow extension of the time-series for that region by one year. However, sample sizes and random station selection since 2002 are based on the entire survey area. Therefore, sample sizes within core and peripheral areas are small and variable year to year, resulting in large variances. In addition, because station selection is based on the entire survey area, strata within the core and peripheral areas may have insufficient sample sizes, necessitating merging strata in some years. When strata were merged, weighted mean catch and variance were calculated for the combined stratum, with observations weighted by the probability of selection in the combined stratum.

## **Results**

Stratified mean catches per tow for all horseshoe crabs, and for nearly all demographic groups, were lower in 2008 than in 2007 (Tables 1 and 2; Figure 2). Only primiparous females increased from the previous year, although changes for multiparous males and females were small; no changes were significant, based on the observation of

overlapping confidence intervals. Yearly trends from the delta- and normal distribution models followed similar patterns for all demographic groups.

Stratified mean catches per tow in the Delaware Bay survey core area generally followed the same trends as those for the entire survey area. Core area mean catches in 2008 decreased from 2007 for all categories except primiparous females (Tables 3-6; Figure 3). Catches in the peripheral area showed little change over the time-series.

Size-frequency distributions in the Delaware Bay area survey indicate continued recruitment of small horseshoe crabs to the survey area. Modal groups of immature crabs less than about 140-mm PW were generally unimportant prior to 2006, but constituted a relatively important portion of the immature crabs in 2007 and 2008 (Figure 4).

### **Literature Cited**

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Table 1. Stratified mean catch per tow of horseshoe crabs in the **Delaware Bay** survey area, 2002-2008, with standard deviation (sd) and coefficient of variation (cv), calculated using the **delta distribution** model, by demographic group. Also included are the estimated upper and lower 95% confidence limits (UCL, LCL).

	mean	UCL	LCL	cv	sd		mean	UCL	LCL	cv	sd
<b>Immature females</b>						<b>Immature males</b>					
2002	24.7	42.6	6.9	0.34	8.5	2002	14.3	25.7	2.9	0.38	5.5
2003	7.3	12.8	1.8	0.35	2.6	2003	3.8	6.2	1.3	0.32	1.2
2004	21.5	33.4	9.7	0.26	5.6	2004	17.3	27.3	7.4	0.27	4.7
2005	28.2	49.1	7.2	0.36	10.2	2005	24.5	45.4	3.6	0.41	10.1
2006	32.0	48.5	15.6	0.24	7.5	2006	24.1	41.2	7.0	0.29	7.0
2007	42.9	87.0	-1.3	0.40	17.2	2007	32.3	87.0	-1.8	0.43	13.9
2008	29.0	50.6	7.4	0.33	9.7	2008	20.4	50.6	5.7	0.32	6.6
<b>Multiparous females</b>						<b>Multiparous males</b>					
2002	10.8	16.0	5.6	0.23	2.5	2002	25.5	36.7	14.4	0.21	5.5
2003	7.8	11.8	3.8	0.24	1.9	2003	17.9	29.0	6.9	0.29	5.1
2004	6.5	9.9	3.2	0.25	1.6	2004	14.7	23.9	5.6	0.30	4.4
2005	9.6	15.7	3.5	0.28	2.6	2005	21.2	33.7	8.7	0.28	5.9
2006	14.7	26.5	3.0	0.35	5.1	2006	37.4	58.7	16.1	0.27	10.0
2007	18.9	30.1	7.7	0.29	5.5	2007	43.9	69.0	18.9	0.28	12.4
2008	17.3	27.0	7.6	0.27	4.7	2008	37.8	56.8	18.8	0.25	9.4
<b>Primiparous females</b>						<b>Primiparous males</b>					
2002	3.2	4.7	1.7	0.23	0.7	2002	1.6	2.5	0.6	0.28	0.4
2003	1.4	2.9	-0.1	0.51	0.7	2003	0.2	0.5	-0.1	0.74	0.1
2004	1.2	1.9	0.4	0.32	0.4	2004	2.0	2.9	1.0	0.23	0.4
2005	1.7	2.8	0.6	0.29	0.5	2005	2.5	4.5	0.6	0.37	0.9
2006	5.5	9.9	1.2	0.32	1.8	2006	7.5	12.7	2.2	0.38	3.0
2007	5.6	9.8	1.3	0.36	2.0	2007	8.6	13.8	3.3	0.29	2.5
2008	7.0	12.2	1.8	0.36	2.5	2008	2.6	4.3	1.0	0.30	0.8
						<b>Total</b>					
						2002	76.5	108.2	44.7	0.20	15.4
						2003	41.8	66.1	17.5	0.27	11.4
						2004	68.2	105.8	30.6	0.27	18.2
						2005	95.6	157.5	33.6	0.32	30.3
						2006	118.0	173.4	62.6	0.21	24.9
						2007	172.5	288.9	56.1	0.32	55.4
						2008	115.1	170.0	60.2	0.23	26.5

Table 2. Stratified mean catch per tow of horseshoe crabs in the **Delaware Bay** survey area, 2002-2008, with standard deviation (sd) and coefficient of variation (cv), calculated using the **normal distribution** model, by demographic group. Also included are the estimated upper and lower 95% confidence limits (UCL, LCL).

	mean	UCL	LCL	cv	sd		mean	UCL	LCL	cv	sd
Immature females						Immature males					
2002	21.3	31.5	11.0	0.23	4.9	2002	12.6	19.3	5.8	0.26	3.3
2003	7.3	12.8	1.7	0.36	2.6	2003	3.7	6.0	1.4	0.29	1.1
2004	18.8	26.1	11.5	0.19	3.6	2004	15.3	21.4	9.1	0.20	3.0
2005	25.6	43.7	7.4	0.34	8.7	2005	26.8	56.0	-2.4	0.52	13.8
2006	32.8	49.6	15.9	0.24	8.0	2006	22.0	32.7	11.4	0.23	5.1
2007	39.4	76.6	2.1	0.39	15.2	2007	34.5	68.5	0.5	0.46	15.8
2008	27.5	42.2	12.7	0.25	7.0	2008	18.9	29.0	8.8	0.26	4.8
Multiparous females						Multiparous males					
2002	10.3	14.9	5.8	0.21	2.2	2002	22.9	31.2	14.7	0.17	4.0
2003	7.7	11.3	4.1	0.22	1.7	2003	16.7	24.7	8.6	0.23	3.8
2004	6.5	9.6	3.4	0.23	1.5	2004	15.2	24.7	5.8	0.30	4.5
2005	10.3	17.1	3.4	0.32	3.3	2005	18.9	28.0	9.8	0.23	4.3
2006	16.0	27.7	4.2	0.33	5.3	2006	36.5	54.9	18.2	0.24	8.6
2007	17.0	25.7	8.3	0.25	4.3	2007	35.7	49.9	21.6	0.19	7.0
2008	19.2	32.5	5.9	0.34	6.5	2008	39.7	63.5	16.0	0.29	11.6
Primiparous females						Primiparous males					
2002	3.1	4.6	1.7	0.22	0.7	2002	1.6	2.6	0.6	0.30	0.5
2003	1.4	3.0	-0.1	0.50	0.7	2003	0.2	0.5	-0.1	0.74	0.1
2004	1.2	1.9	0.4	0.32	0.4	2004	2.0	2.9	1.1	0.22	0.4
2005	1.8	3.2	0.5	0.33	0.6	2005	2.6	4.7	0.6	0.37	1.0
2006	5.6	9.2	2.0	0.29	1.6	2006	7.8	14.1	1.6	0.38	3.0
2007	4.9	7.5	2.2	0.26	1.3	2007	7.7	11.6	3.7	0.25	1.9
2008	7.6	12.6	2.6	0.32	2.4	2008	2.8	4.4	1.1	0.29	0.8
						Total					
						2002	71.9	94.4	49.4	0.15	10.9
						2003	37.0	52.1	21.9	0.19	7.2
						2004	59.0	82.2	35.7	0.19	11.3
						2005	86.0	140.0	32.0	0.30	26.0
						2006	120.7	172.3	69.1	0.21	24.9
						2007	139.1	219.6	58.6	0.27	37.3
						2008	115.7	169.8	61.7	0.23	26.4

Table 3. Stratified mean catch per tow of horseshoe crabs in the **Delaware Bay** survey **core area**, 2001-2008, with standard deviation (sd) and coefficient of variation (cv), calculated using the **delta distribution** model, by demographic group. Also included are the estimated upper and lower 95% confidence limits (UCL, LCL).

	mean	UCL	LCL	cv	sd		mean	UCL	LCL	cv	sd
<b>Immature females</b>						<b>Immature males</b>					
2001	10.3	16.0	4.6	0.26	2.7	2001	5.3	8.4	2.1	0.28	1.5
2002	17.8	34.1	1.5	0.39	6.9	2002	9.8	20.2	-0.5	0.43	4.2
2003	6.8	21.5	-8.0	0.51	3.4	2003	2.3	6.2	-1.7	0.40	0.9
2004	18.1	29.7	6.6	0.29	5.3	2004	14.5	26.4	2.5	0.32	4.6
2005	28.6	50.4	6.7	0.37	10.5	2005	38.7	82.5	-5.1	0.53	20.7
2006	32.2	57.8	6.7	0.34	10.8	2006	23.7	54.3	-6.9	0.41	9.6
2007	44.7	100.8	-11.4	0.45	20.2	2007	36.0	80.2	-8.3	0.50	18.1
2008	24.4	47.2	1.7	0.38	9.3	2008	16.7	32.0	1.4	0.39	6.5
<b>Multiparous females</b>						<b>Multiparous males</b>					
2001	10.4	14.5	6.3	0.19	2.0	2001	19.7	29.7	9.6	0.24	4.8
2002	11.2	16.6	5.9	0.22	2.5	2002	24.2	34.2	14.1	0.20	4.8
2003	12.3	21.0	3.7	0.27	3.4	2003	27.1	48.9	5.3	0.34	9.2
2004	8.2	12.9	3.5	0.27	2.2	2004	22.3	38.4	6.2	0.34	7.6
2005	10.7	17.5	3.8	0.30	3.2	2005	23.3	36.1	10.4	0.25	5.9
2006	24.6	45.6	3.5	0.27	6.6	2006	47.9	77.5	18.4	0.24	11.5
2007	29.1	47.9	10.3	0.31	8.9	2007	63.3	104.7	21.9	0.31	19.4
2008	21.9	34.5	9.4	0.27	6.0	2008	48.1	73.7	22.5	0.25	12.1
<b>Primiparous females</b>						<b>Primiparous males</b>					
2001	1.6	2.3	0.9	0.21	0.3	2001	1.3	2.4	0.3	0.37	0.5
2002	2.2	3.6	0.8	0.29	0.6	2002	0.9	1.6	0.2	0.39	0.3
2003	0.2	0.5	-0.1	0.31	0.1	2003	0.1	0.3	-0.1	0.85	0.1
2004	1.7	2.9	0.5	0.32	0.5	2004	1.5	2.7	0.3	0.37	0.6
2005	1.5	4.0	-0.9	0.50	0.8	2005	2.6	5.5	-0.4	0.51	1.3
2006	4.1	9.2	-0.9	0.38	1.6	2006	10.5	24.2	-3.2	0.57	5.9
2007	4.6	9.2	0.0	0.45	2.1	2007	10.6	18.8	2.4	0.35	3.7
2008	6.3	11.7	1.0	0.40	2.5	2008	2.3	4.1	0.6	0.35	0.8

Table 3 continued.

	mean	UCL	LCL	cv	sd
Total					
2001	51.7	75.4	28.1	0.22	11.4
2002	67.2	103.8	30.5	0.25	16.5
2003	40.6	79.1	2.0	0.39	15.8
2004	66.5	103.8	29.2	0.26	17.5
2005	97.7	166.0	29.5	0.34	32.8
2006	139.3	240.6	38.1	0.26	36.5
2007	208.4	365.6	51.2	0.35	73.7
2008	119.1	182.8	55.3	0.25	29.9

Table 4. Stratified mean catch per tow of horseshoe crabs in the **Delaware Bay** survey **core area**, 2001-2008, with standard deviation (sd) and coefficient of variation (cv), calculated using the **normal distribution** model, by demographic group. Also included are the estimated upper and lower 95% confidence limits (UCL, LCL).

	mean	UCL	LCL	cv	sd		mean	UCL	LCL	cv	sd
<b>Immature females</b>						<b>Immature males</b>					
2001	9.2	12.2	6.1	0.16	1.5	2001	4.7	6.7	2.8	0.20	1.0
2002	16.3	28.3	4.3	0.33	5.3	2002	9.8	18.6	1.1	0.41	4.1
2003	6.8	21.2	-7.7	0.50	3.4	2003	2.3	5.2	-0.6	0.40	0.9
2004	18.3	28.3	8.4	0.25	4.6	2004	13.6	21.2	6.1	0.25	3.4
2005	31.4	59.5	3.4	0.42	13.2	2005	36.7	83.0	-9.6	0.58	21.4
2006	35.5	68.4	2.7	0.40	14.3	2006	23.0	41.6	4.4	0.36	8.2
2007	43.6	93.6	-6.5	0.45	19.5	2007	44.7	101.6	-12.2	0.58	26.1
2008	24.1	42.8	5.5	0.33	7.9	2008	15.7	27.3	4.1	0.31	4.9
<b>Multiparous females</b>						<b>Multiparous males</b>					
2001	11.0	15.7	6.3	0.21	2.3	2001	19.6	28.0	11.2	0.21	4.1
2002	11.5	17.8	5.2	0.25	2.9	2002	24.5	35.4	13.6	0.21	5.1
2003	11.8	18.3	5.2	0.23	2.8	2003	24.1	39.0	9.3	0.26	6.3
2004	8.9	13.7	4.1	0.25	2.2	2004	22.4	37.0	7.8	0.30	6.8
2005	11.3	20.6	2.0	0.38	4.3	2005	22.8	34.8	10.9	0.24	5.5
2006	25.1	49.2	1.0	0.30	7.6	2006	48.3	78.3	18.2	0.25	12.3
2007	25.7	40.1	11.4	0.26	6.7	2007	52.3	74.7	29.9	0.20	10.4
2008	26.3	46.6	6.0	0.37	9.7	2008	54.7	91.5	17.8	0.32	17.4
<b>Primiparous females</b>						<b>Primiparous males</b>					
2001	1.7	2.5	0.9	0.23	0.4	2001	1.3	2.2	0.4	0.34	0.4
2002	2.2	3.7	0.8	0.29	0.7	2002	0.9	1.7	0.1	0.41	0.4
2003	0.2	0.5	0.0	0.32	0.1	2003	0.1	0.3	-0.1	0.82	0.1
2004	1.7	2.9	0.6	0.30	0.5	2004	1.7	2.9	0.5	0.33	0.6
2005	1.5	3.6	-0.6	0.51	0.8	2005	2.5	5.1	-0.1	0.46	1.2
2006	4.2	8.7	-0.3	0.39	1.6	2006	9.6	22.7	-3.6	0.58	5.5
2007	4.4	8.2	0.6	0.38	1.7	2007	9.7	16.1	3.4	0.31	3.0
2008	7.9	15.0	0.8	0.42	3.3	2008	2.4	4.4	0.5	0.38	0.9

Table 4 continued.

	mean	UCL	LCL	cv	sd
Total					
2001	47.5	62.8	32.2	0.16	7.6
2002	65.2	94.4	36.1	0.21	13.6
2003	37.6	65.1	10.1	0.28	10.7
2004	66.7	101.1	32.3	0.24	16.0
2005	106.2	189.1	23.3	0.37	38.9
2006	145.6	240.2	51.0	0.29	41.8
2007	180.3	302.2	58.5	0.31	55.9
2008	131.1	209.0	53.2	0.28	37.4

Table 5. Stratified mean catch per tow of horseshoe crabs in the **Delaware Bay** survey **peripheral area**, 2002-2008, with standard deviation (sd) and coefficient of variation (cv), calculated using the **delta distribution** model, by demographic group. Also included are the estimated upper and lower 95% confidence limits (UCL, LCL).

	mean	UCL	LCL	cv	sd		mean	UCL	LCL	cv	sd
Immature females						Immature males					
2002	45.7	111.6	-20.2	0.56	25.6	2002	22.2	44.7	-0.3	0.39	8.8
2003	7.6	16.1	-0.9	0.46	3.5	2003	5.1	9.0	1.3	0.32	1.6
2004	23.5	41.1	5.8	0.31	7.2	2004	22.3	43.3	1.2	0.37	8.2
2005	12.6	25.0	0.2	0.35	4.5	2005	8.4	16.9	-0.1	0.36	3.0
2006	30.8	67.6	-6.0	0.28	8.5	2006	23.0	58.2	-12.3	0.36	8.2
2007	29.0	60.9	-2.9	0.51	14.8	2007	19.3	40.7	-2.2	0.52	10.0
2008	36.2	87.0	-14.7	0.51	18.3	2008	24.3	68.2	-19.5	0.42	10.2
Multiparous females						Multiparous males					
2002	6.7	12.5	1.0	0.39	2.6	2002	18.5	36.2	0.8	0.39	7.2
2003	2.7	5.2	0.3	0.36	1.0	2003	7.9	16.3	-0.6	0.44	3.4
2004	3.2	7.0	-0.6	0.43	1.4	2004	3.2	7.2	-0.8	0.39	1.2
2005	2.8	5.0	0.6	0.35	1.0	2005	6.7	13.3	0.1	0.42	2.8
2006	5.5	12.0	-1.1	0.28	1.5	2006	27.8	53.3	2.3	0.36	9.9
2007	2.8	7.9	-2.3	0.42	1.2	2007	10.0	20.6	-0.6	0.38	3.8
2008	6.4	14.3	-1.6	0.45	2.9	2008	14.8	33.5	-4.0	0.49	7.3
Primiparous females						Primiparous males					
2002	3.3	7.7	-1.0	0.47	1.6	2002	2.9	5.9	0.0	0.40	1.2
2003	2.5	5.5	-0.6	0.52	1.3	2003	0.2	0.8	-0.4	0.99	0.2
2004	0.2	0.6	-0.2	0.66	0.1	2004	3.1	5.8	0.3	0.28	0.9
2005	2.4	5.2	-0.5	0.43	1.0	2005	2.7	6.4	-1.1	0.50	1.3
2006	8.2	24.2	-7.9	0.46	3.7	2006	6.7	12.3	1.0	0.27	1.8
2007	6.1	11.8	0.4	0.42	2.5	2007	4.5	7.9	1.1	0.35	1.6
2008	7.2	18.7	-4.3	0.58	4.1	2008	3.6	9.3	-2.1	0.57	2.0
						Total					
						2002	92.5	169.2	15.7	0.34	31.4
						2003	26.9	47.5	6.3	0.32	8.7
						2004	61.5	116.8	6.1	0.38	23.4
						2005	38.4	68.5	8.3	0.33	12.7
						2006	97.9	140.9	54.8	0.19	18.7
						2007	85.2	187.8	-17.5	0.55	47.1
						2008	94.5	195.2	-6.2	0.41	39.2

Table 6. Stratified mean catch per tow of horseshoe crabs in the **Delaware Bay** survey **peripheral** area, 2002-2008, with standard deviation (sd) and coefficient of variation (cv), calculated using the **normal distribution** model, by demographic group. Also included are the estimated upper and lower 95% confidence limits (UCL, LCL).

	mean	UCL	LCL	cv	sd		mean	UCL	LCL	cv	sd
<b>Immature females</b>						<b>Immature males</b>					
2002	33.2	58.1	8.2	0.29	9.7	2002	20.5	32.0	9.1	0.22	4.5
2003	8.7	21.0	-3.5	0.55	4.8	2003	5.7	11.4	0.0	0.41	2.3
2004	20.1	32.6	7.6	0.25	5.1	2004	18.9	35.5	2.3	0.34	6.5
2005	12.6	25.1	0.2	0.36	4.5	2005	8.4	16.8	0.0	0.36	3.0
2006	30.2	53.4	7.1	0.28	8.3	2006	20.9	53.5	-11.7	0.36	7.6
2007	26.4	48.4	4.4	0.39	10.2	2007	16.9	30.7	3.1	0.38	6.4
2008	34.1	73.2	-5.0	0.41	14.1	2008	25.6	57.0	-5.9	0.44	11.3
<b>Multiparous females</b>						<b>Multiparous males</b>					
2002	5.7	10.1	1.3	0.34	1.9	2002	15.8	29.4	2.2	0.34	5.3
2003	3.3	5.8	0.8	0.32	1.1	2003	8.6	15.3	1.9	0.32	2.7
2004	2.7	5.5	-0.1	0.38	1.0	2004	3.7	7.1	0.4	0.28	1.1
2005	3.1	6.0	0.1	0.41	1.3	2005	6.2	11.6	0.8	0.37	2.3
2006	5.4	9.7	1.2	0.28	1.5	2006	24.2	41.0	7.4	0.27	6.5
2007	3.0	5.7	0.2	0.40	1.2	2007	10.6	18.8	2.4	0.35	3.7
2008	5.7	10.1	1.4	0.33	1.9	2008	12.8	23.7	1.8	0.35	4.5
<b>Primiparous females</b>						<b>Primiparous males</b>					
2002	4.1	8.2	0.0	0.39	1.6	2002	3.0	6.0	0.0	0.39	1.2
2003	3.1	7.0	-0.9	0.53	1.6	2003	0.3	1.1	-0.5	0.99	0.3
2004	0.2	0.5	-0.1	0.69	0.1	2004	2.7	4.9	0.5	0.32	0.9
2005	2.3	4.9	-0.3	0.40	0.9	2005	2.7	6.9	-1.4	0.55	1.5
2006	7.8	22.3	-6.6	0.43	3.4	2006	6.6	10.8	2.4	0.25	1.6
2007	6.4	11.8	1.0	0.38	2.4	2007	4.7	8.2	1.2	0.34	1.6
2008	7.0	17.7	-3.6	0.54	3.8	2008	3.3	7.5	-0.8	0.45	1.5
						<b>Total</b>					
						2002	82.3	131.7	32.9	0.25	20.2
						2003	29.7	57.3	2.1	0.36	10.7
						2004	48.3	78.6	18.0	0.27	12.8
						2005	35.4	67.1	3.7	0.32	11.4
						2006	95.1	135.3	55.0	0.18	17.4
						2007	67.9	120.1	15.7	0.36	24.2
						2008	88.6	170.9	6.3	0.36	32.0

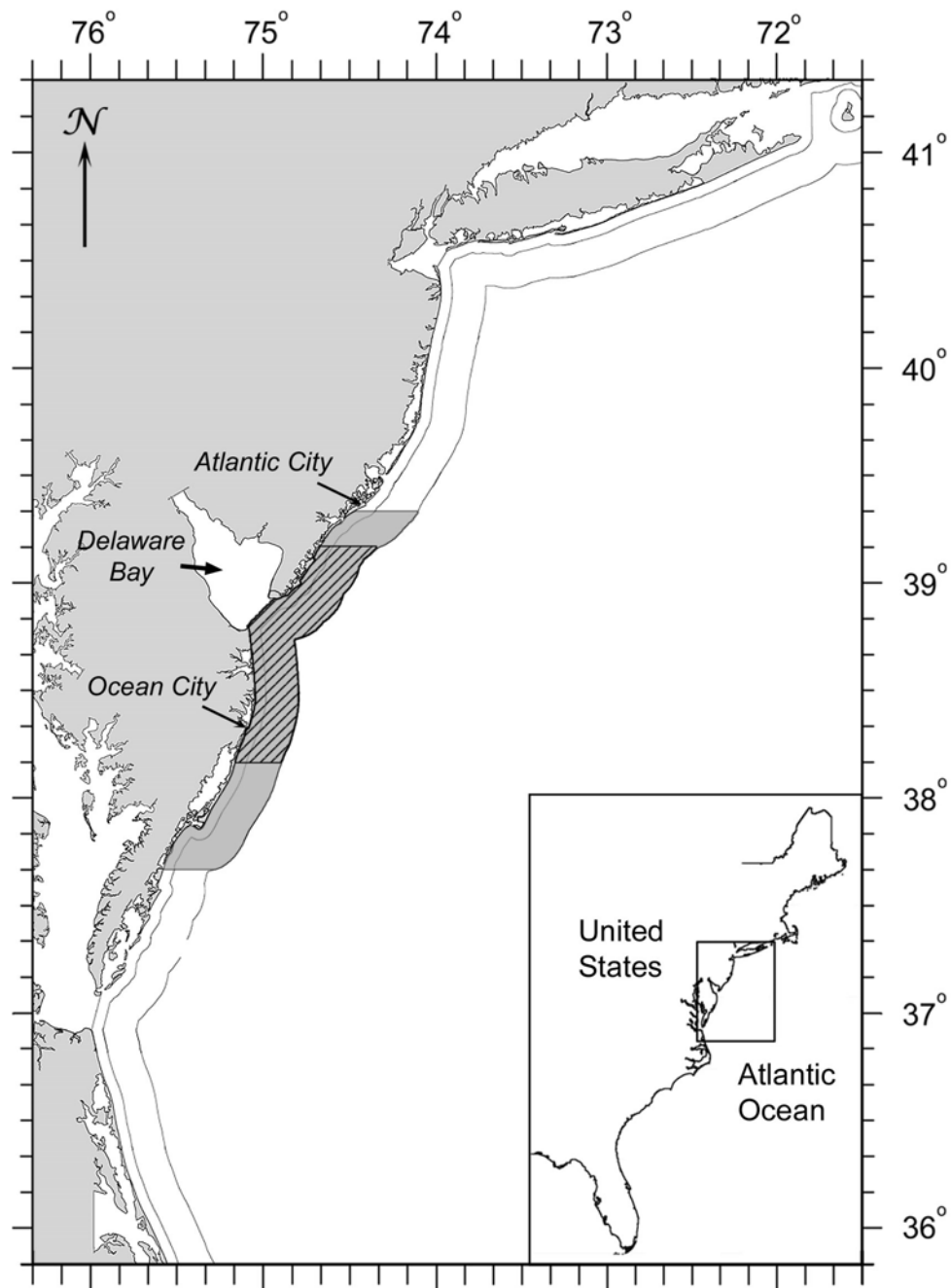


Figure 1. Delaware Bay horseshoe crab trawl survey sampling area. The core survey area, indicated by diagonal lines, has been surveyed every year since 2001. The peripheral area has been surveyed every year since 2002. Contour lines indicate 3 and 12 nautical miles from shore.

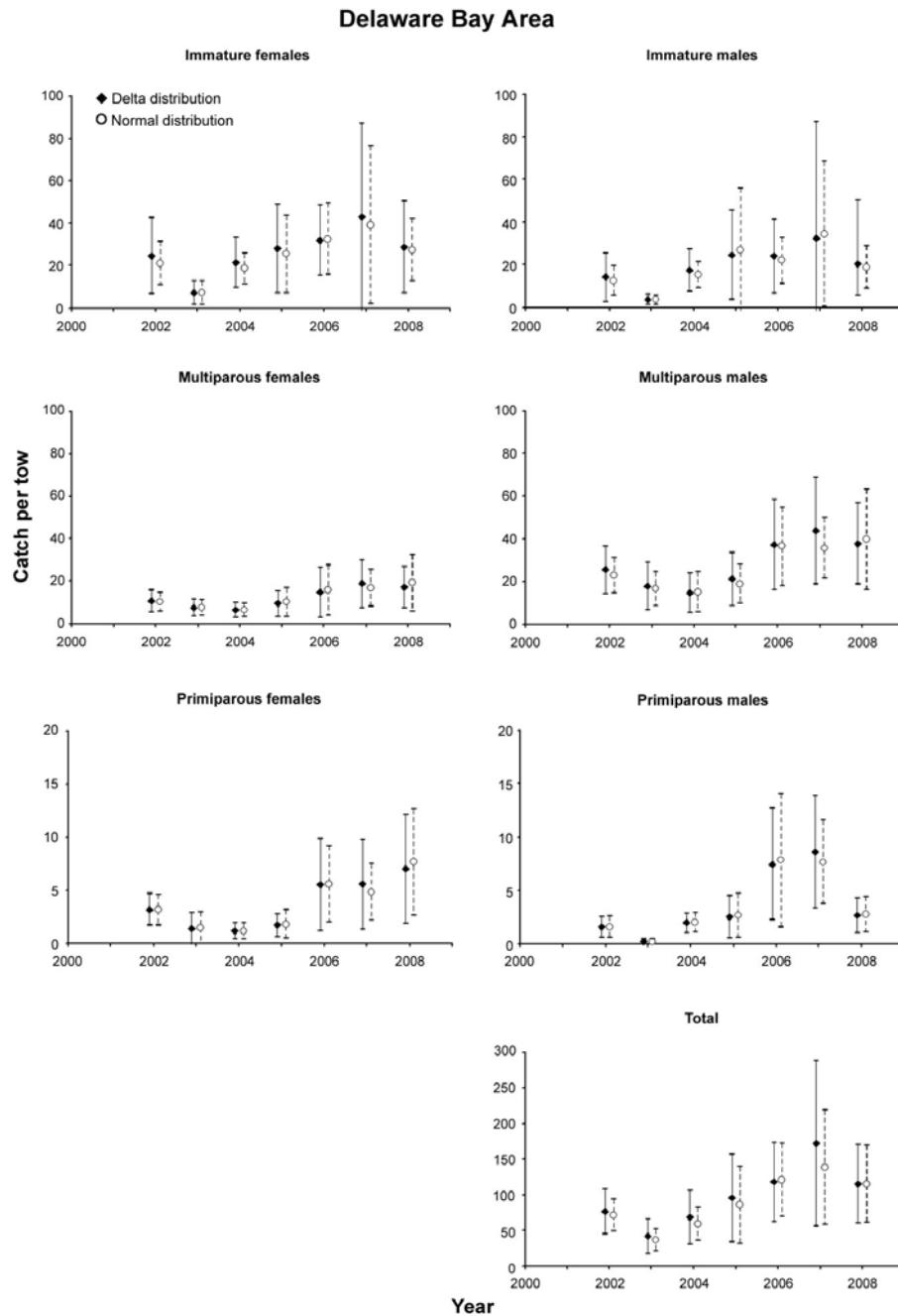


Figure 2. Plots of stratified mean catches per tow of horseshoe crabs in the Delaware Bay survey area by demographic group. Vertical lines indicate 95% confidence limits. Solid symbols and lines indicate the delta distribution model. Open symbols and dashed lines indicate the normal distribution model. Data are from Tables 1 and 2. Note differences in y-axis scales.

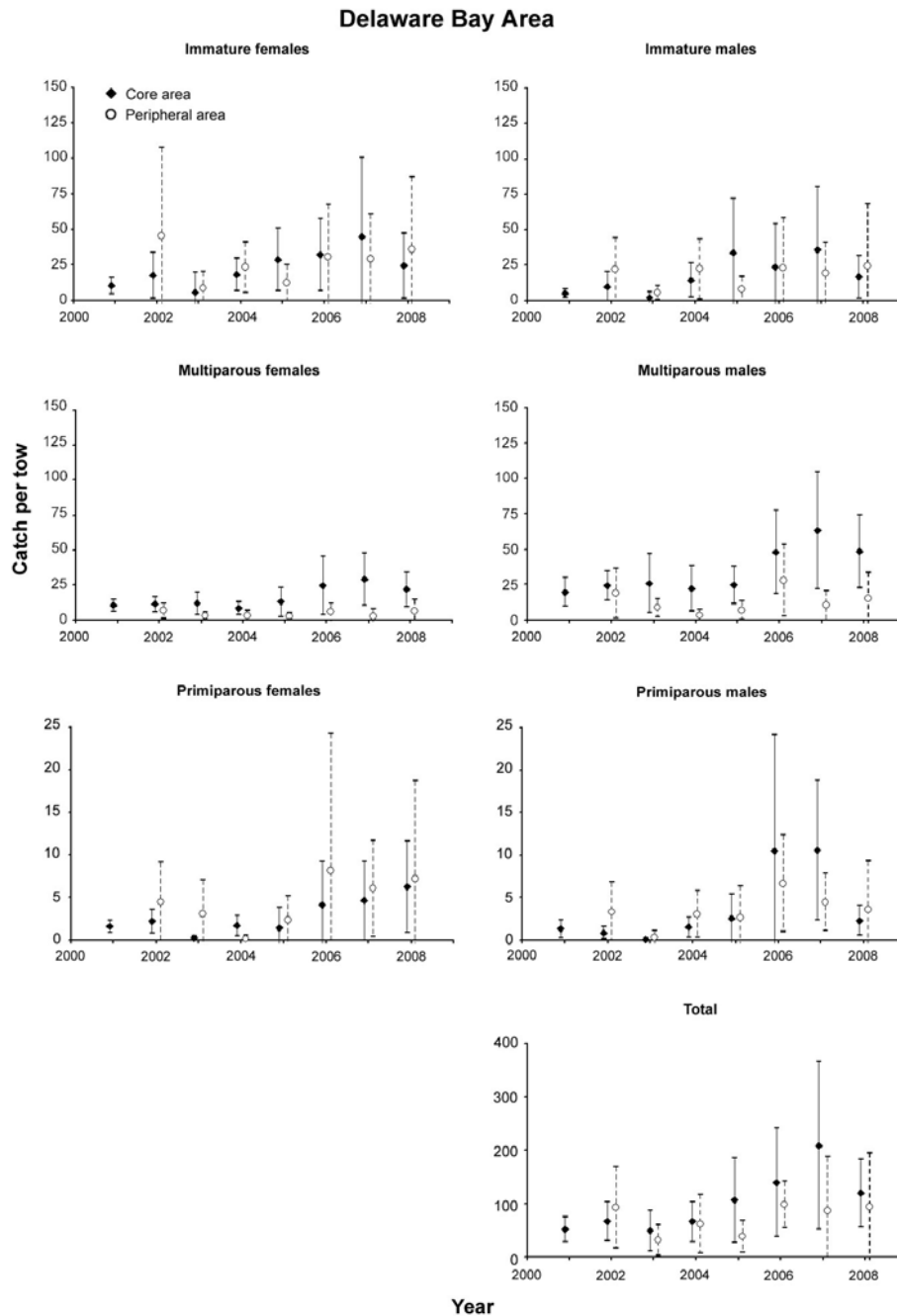


Figure 3. Plots of stratified mean catches per tow of horseshoe crabs in the Delaware Bay survey area by demographic group. Vertical lines indicate 95% confidence limits. Only delta distribution means are illustrated for the sake of clarity. Solid symbols and lines indicate the core survey area. Open symbols and dashed lines indicate the peripheral survey area. Data are from Tables 3 and 5. Note differences in y-axis scales.

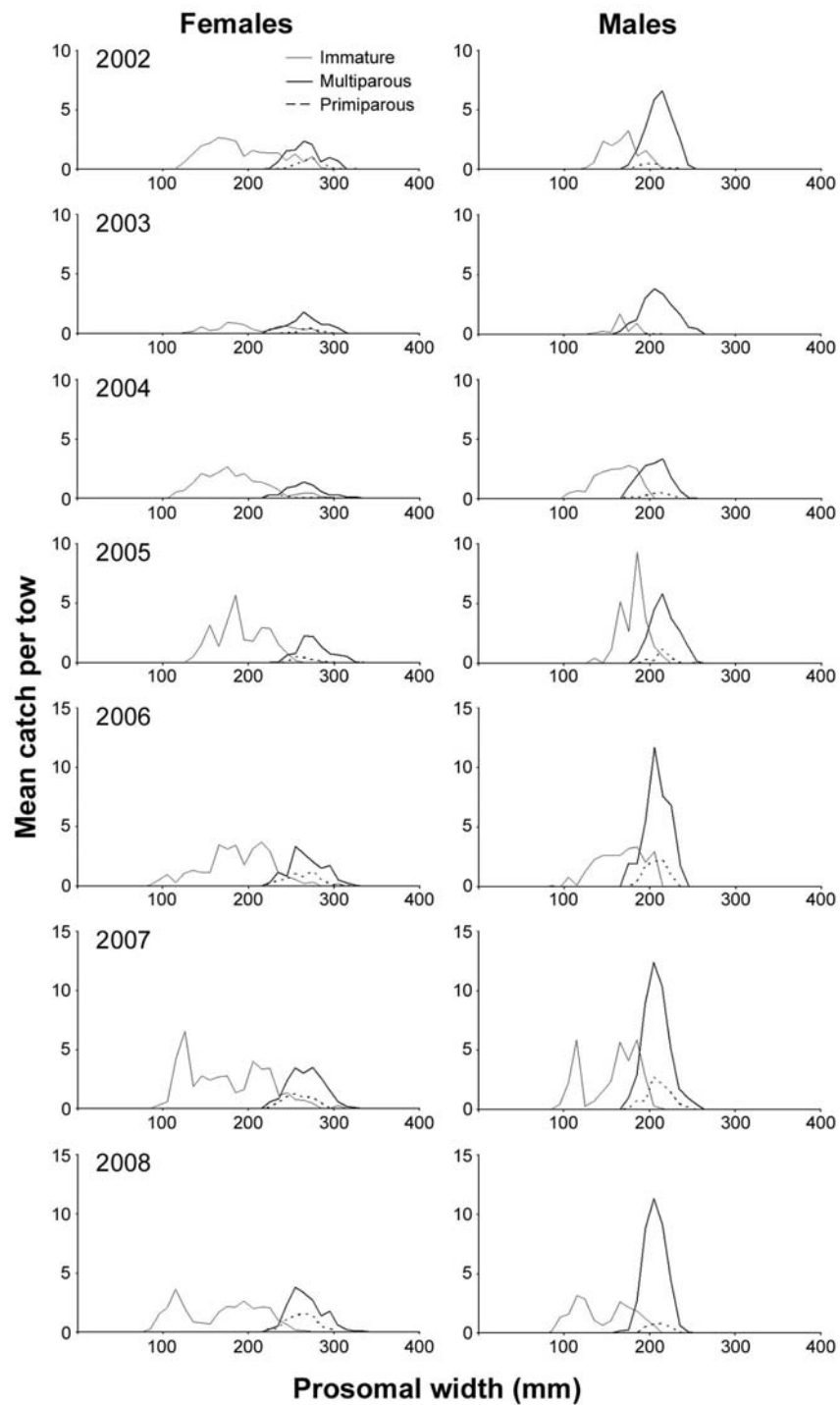


Figure 4. Relative size-frequency distributions of horseshoe crabs, by demographic group and year, in the Delaware Bay area trawl survey. Relative frequencies are scaled to represent stratified mean catches in Table 1.