

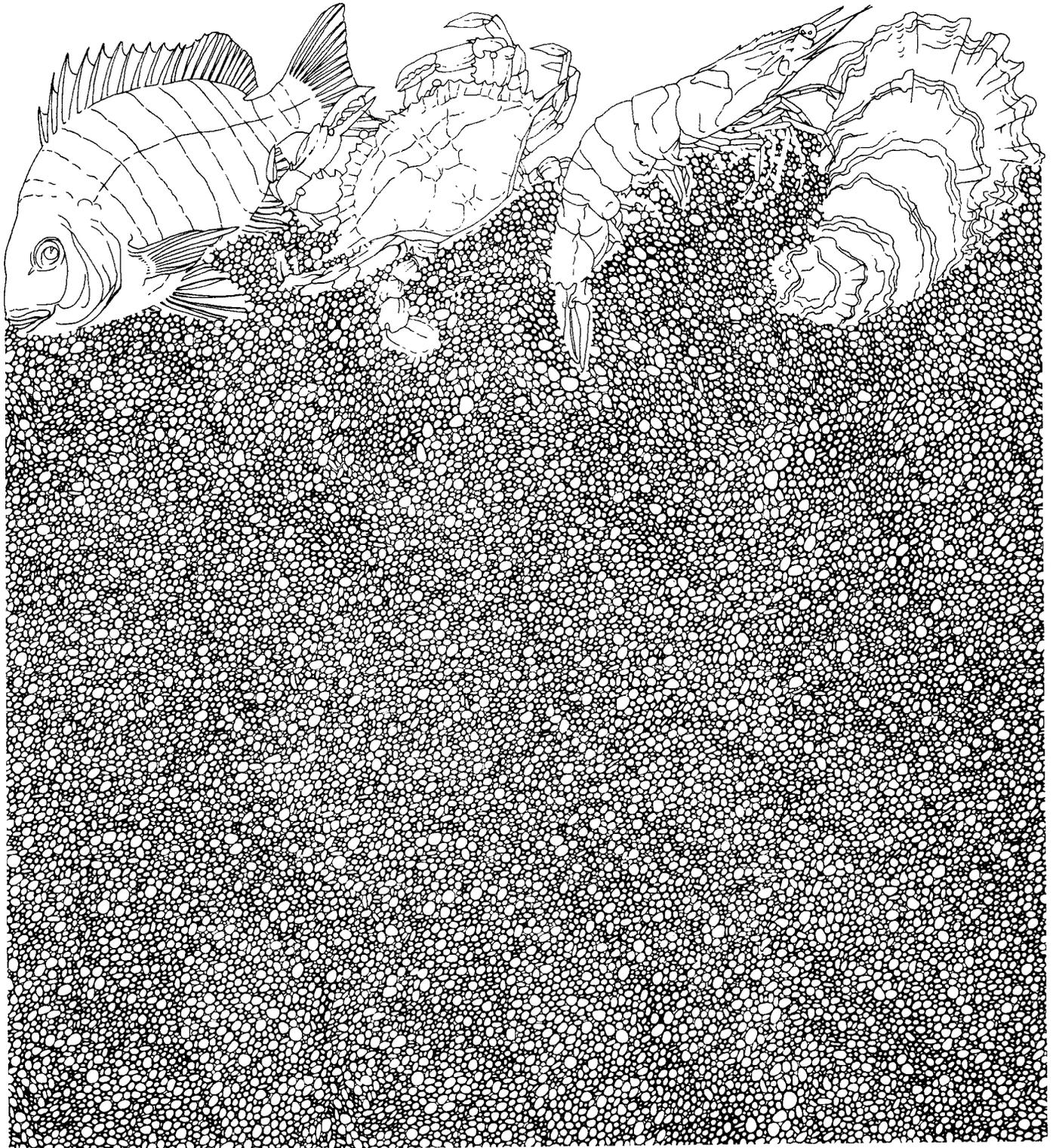
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Sample Sizes in Texas Headboat Surveys

by L.W. McEachron and A.W. Green

Management Data Series Number 67
1984

Texas Parks and Wildlife Department
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ABSTRACT

Bay and Gulf headboats were surveyed in three areas of the Texas coast from 1 September 1978 through 31 August 1982. Sample size (No. of headboat trip surveys) analyses of bay headboats indicate conducting 21 headboat trip surveys each season (15 May-20 November; 21 November-14 May) in both the Aransas Bay/Corpus Christi Bay and lower Laguna Madre areas and 34 surveys (15 May-20 November) and 48 surveys (21 November-14 May) in the Galveston Bay area would enable detection of a 75% difference between two mean catches 80% of the time at the 10% significance level. Conducting 42 Gulf headboat surveys each year in each of the three Texas coast areas would enable detection of a 50% difference between two mean catches 95% of the time at the 10% significance level.

INTRODUCTION

The Texas marine recreational fishery is a diverse composite of bay and Gulf wade/bank, pier, private boat and chartered fishing entities (McEachron 1980, McEachron et al. 1981, Campbell-Hostettler 1982, Spiller 1982, Weixelman 1982, McEachron and Green 1983, McEachron 1984). It has become increasingly expensive for resource management agencies to monitor all the major components. For example, approximately \$335,000 and 3,360 man days were spent by the Texas Parks and Wildlife Department (TPWD) in 1982 to survey weekend and weekday private boat and chartered fishermen (TPWD 1982).

The TPWD has surveyed bay and Gulf headboats since September 1978 (McEachron 1983; McEachron and Matlock 1983; McEachron 1984). This fishery is a major component of the overall marine recreational fishery with over 700,000 fish being landed by headboats in Texas each year. Estimates of harvest historically have been presented annually (September-August) for Gulf headboats and seasonally (January-April; May-December) for bay headboats (McEachron 1984). Initial analyses by McEachron (1984) found no significant differences in catch among months for Gulf headboat data collected during September 1978-August 1982. However, significant differences were found among months for bay headboat catches; catch data within May-December were similar and catch data within January-April were similar. These seasonal periods are similar to the seasonal periods (15 May-20 November; 21 November-14 May) used in the routine creel monitoring program (McEachron and Green 1984).

TPWD has determined the seasonal sample sizes needed to provide efficient estimates of harvest and catch per effort for the private boat fishery (TPWD unpublished data). It is important that sample sizes (No. of headboat trip surveys) for the headboat fishery be determined so that estimates of harvest can be determined efficiently. The objectives of this survey were to:

(1) determine the number of bay headboat trip surveys required which would detect a 50% and 75% difference in the mean daily harvest during 15 May-20 November and during 21 November-14 May at the 5% and 10% significance level 80% and 95% of this time.

(2) determine the number of Gulf headboat trip surveys required which would detect a 50% and 75% difference in the mean daily harvest on an annual basis (1 September-31 August) at the 5% and 10% significance level 80% and 95% of the time.

MATERIALS AND METHODS

Headboats in the Galveston Bay/Freeport (Area 1), Aransas Bay/Corpus Christi Bay (Area 2) and lower Laguna Madre (Area 3) areas of the Texas coast (Figure 1) were surveyed during September 1978-August 1982 using

methods described by McEachron (1984). A headboat was defined as a boat, operated by a guide and crew, that carried >10 people for a fee. The areas that headboats fished were divided into:

1. Gulf: that area seaward of the barrier islands and pass entrances; and,
2. Bay: that area shoreward of the barrier islands and pass entrances.

Mean catch (\bar{X} No. fish/boat/day) and the corresponding coefficient of variation (CV) were grouped by area and season (15 May-20 November; 21 November-14 May) for bay headboats and by area and year (1 September-31 August) for Gulf headboats. Sample sizes (No. of headboat trip surveys) for each boat type in each area were calculated using the technique described in Sokal and Rohlf (1981):

$$n \geq 2 \left(\frac{cv}{d} \right)^2 (t_{\alpha(v)} + 6_{2(1-P)(v)})^2$$

Where:

- n = number of samples required (headboat trip surveys)
- cv = coefficient of variation
- d = smallest difference which will be detected (expressed as percent)
- v = degrees of freedom of the sample standard deviation with a groups and n replications
- α = probability at which a null hypothesis is rejected
- P = probability a true difference as small as d will be found significant (power of test).

Sample sizes were estimated for bay headboats in each area which would detect a 50% and a 75% difference in the mean daily harvest during 15 May-20 November and 21 November-14 May at the 5% and 10% level 80% and 95% of the time. Sample sizes for Gulf headboats were estimated at the same probability levels and confidence levels in each area on an annual basis. Sample size estimates were rounded up to the nearest whole number.

RESULTS

The bay headboat mean catch during 15 May-20 November was higher (29.6-140.5 fish/boat/day) than the mean catch during 21 November-14 May (15.3-31.3 fish/boat/day); the CV among areas ranged from 84-123% during the 15 May-20 November season and from 71-146% during the 21 November-14 May season (Table 1). The Gulf headboat mean annual catch ranged from 214.0-377.2 fish/boat/day; the CV among areas ranged from 40-68%.

Sample size varied among areas and between boat types, seasons, precisions, probabilities and confidence levels (Table 2). Approximately twice as many samples were needed to detect a difference between two means at the same probability level and confidence level as the precision increased from 75% to 50%.

The estimated sample sizes for bay headboats during 21 November-14 May were lower than those estimated during 15 May-20 November in Areas 2 and 3. However, in Area 1 this finding was reversed. Sample sizes required in Area 1 were higher than those estimated in Area 2 and 3 at all probability levels and confidence levels.

The estimated sample size for Gulf headboats was ≤ 50 in each area (Table 2). Area 1 required more samples than Areas 2 and 3 at all probability levels and confidence levels.

DISCUSSION

The maximum number of bay headboat surveys that can be conducted within personnel and budgetary constraints is 21 in each season in each area. Conducting the maximum number of surveys in each season would enable detection of a 75% difference between two mean catches 80% of the time at the 10% significance level in Areas 2 and 3. Conducting 21 bay headboat surveys in both seasons in Area 1 will only permit the detection of a 100% difference between mean catches 80% of the time at the 10% significance level. To increase the level of precision in Area 1 to that in Areas 2 and 3 would require a sample size of 34 trip surveys during 15 May-20 November and 48 trip surveys during 21 November-14 May. Since the bay headboat harvest constitutes ~1% of the total estimated marine sport harvest (McEachron 1984, McEachron and Green 1984) it may not be efficient to increase the sample size in this segment of the fishery at the expense of other segments. However, since Galveston Bay is adjacent to large population centers the potential for significant increases in the bay headboat fishery exists and monitoring at existing levels is justifiable.

The maximum number of Gulf headboat surveys that can be conducted in each area is 42/year because of personnel and budgetary constraints required by current TPWD sampling programs. Conducting the maximum number of Gulf headboat surveys would enable a 50% difference between two mean catches to be detected 95% of the time at the 10% significance level in Areas 1 and 2 and at the 05% significance level in Area 3.

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Table 1. Mean daily catch (fish/boat/day) and coefficient of variation (CV) of bay headboats during two seasons and on Gulf headboats annually in three areas of the Texas coast (September 1978-August 1982).

Season	Area ^a	Sample size	Fish/boat/day	CV
Bay headboats				
15 May-20 November				
	Area 1	25	140.5	123
	Area 2	30	63.3	84
	Area 3	27	29.6	98
21 November-14 May				
	Area 1	18	31.3	146
	Area 2	16	15.3	71
	Area 3	14	16.8	88
Gulf headboats				
Annual				
	Area 1	65	377.2	68
	Area 2	40	291.0	40
	Area 3	29	214.0	49

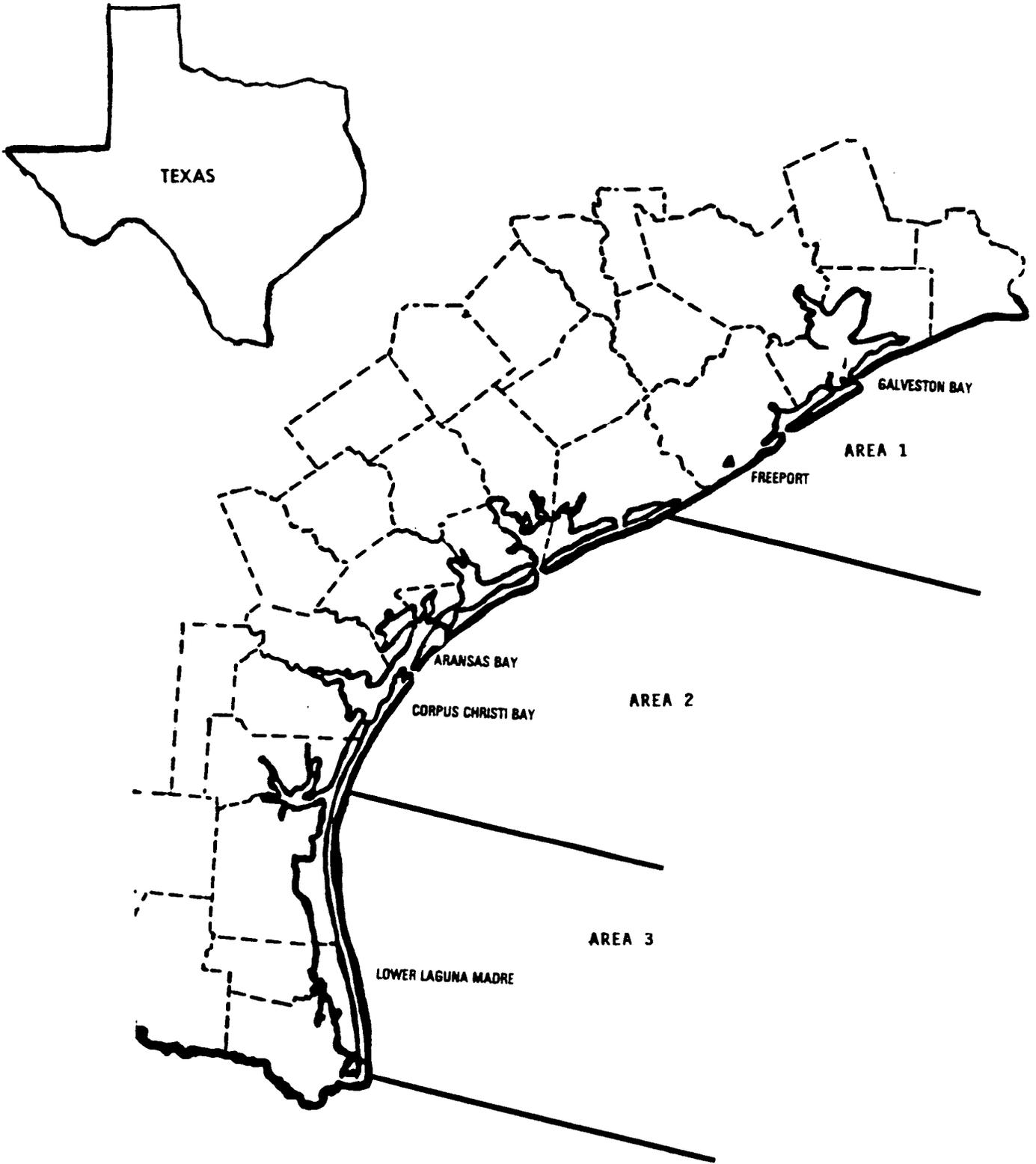
^aArea 1 = Galveston Bay/Freeport; Area 2 = Aransas Bay/Corpus Christi Bay; Area 3 = lower Laguna Madre.

Table 2. Estimated number of samples required to detect a difference between two mean daily harvests which vary by 50% and 75%, two levels of probability (80%, 95%) and two significance levels (5%, 10%) for bay and Gulf headboats in three areas of the Texas coast.

Season	Area ^a	Difference in means							
		Probability of detection		50%		75%			
		80%	95%	10%	5%	10%	5%		
Bay headboat									
15 May-20 November									
	Area 1	77	97	132	158	34	44	60	70
	Area 2	36	46	63	74	17	21	29	34
	Area 3	49	62	84	100	22	28	39	46
21 November-14 May									
	Area 1	106	134	186	222	48	61	83	99
	Area 2	26	33	45	54	12	16	21	25
	Area 3	40	50	68	81	18	23	31	38
Gulf headboat									
Annual									
	Area 1	24	30	41	50	12	15	19	23
	Area 2	23	29	39	47	11	14	18	22
	Area 3	13	17	22	27	7	9	11	13

^aArea 1 = Galveston Bay/Freeport; Area 2 = Aransas Bay/Corpus Christi Bay; Area 3 = lower Laguna Madre.

Figure 1. Areas of headboat activity during September 1978-
August 1982.



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