The Blue Crab Investigation, 1949-50

By

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Introduction

Basically, the blue crab investigation for 1949-50 was conducted in a manner similar to that employed in 1947-48 and 1948-49 (Daugherty, 1948, 1949). Objectives were essentially the same, however, methods of collection were different. Crab pots and the fish traps* in Cedar Bayou were used extensively in sampling. Several new stations were established and the original stations were checked only when it was deemed advisable. Deviation from the exclusive use of permanent stations and accentuation on new and varied areas gave gratifying results.

A broad program was originally planned for 1949-50, but as the year progressed work was automatically channeled along the lines of spawning, hatching, and migration. Emphasis was placed on the collection of crabs infested with the Rhizocephalid, Loxothylacus texanus. The Marine Laboratory was fortunate in having Dr. Edward G. Reinhard of Catholic University, Washington, D. C., work on this phase of the crab problem during the summer of 1950.

Fishing experiments using crab pots and trotlines had been planned, however, this work did not develop in light of increasing demands of the spawning, hatching, and migration portions of the investigation. It was possible, even so, to formulate hypothetical catch expectancies based on routine crab pot sampling.

General Data

A total of 8,492 blue crabs, Callinectes sapidus Rathbun, were examined during the fiscal year September 1, 1949 to August 31, 1950; of which 3,567 were measured and 4,925 were observed otherwise (Table 1).

Comparison of the blue crab population of the investigational area for 1949-50 varied from the trends of the 1947-48 and 1948-49 occurrence in that May, June, and July were peak months, whereas the peak fell in April for the

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*The Texas Game, Fish and Oyster Commission is operating a large fish trap in Cedar Bayou, between Matagorda and St. Joseph's Islands. This trap is under the direction of Ernest G. Simmons, Fishery Biologist.

two previous years (Graph 1). This can be explained in light of deviation from regular station testing and will be dealt with later.

Graph 1
Callinectes sapidus

Population of the investigational area by months.
Expressed as per cent of years sample.

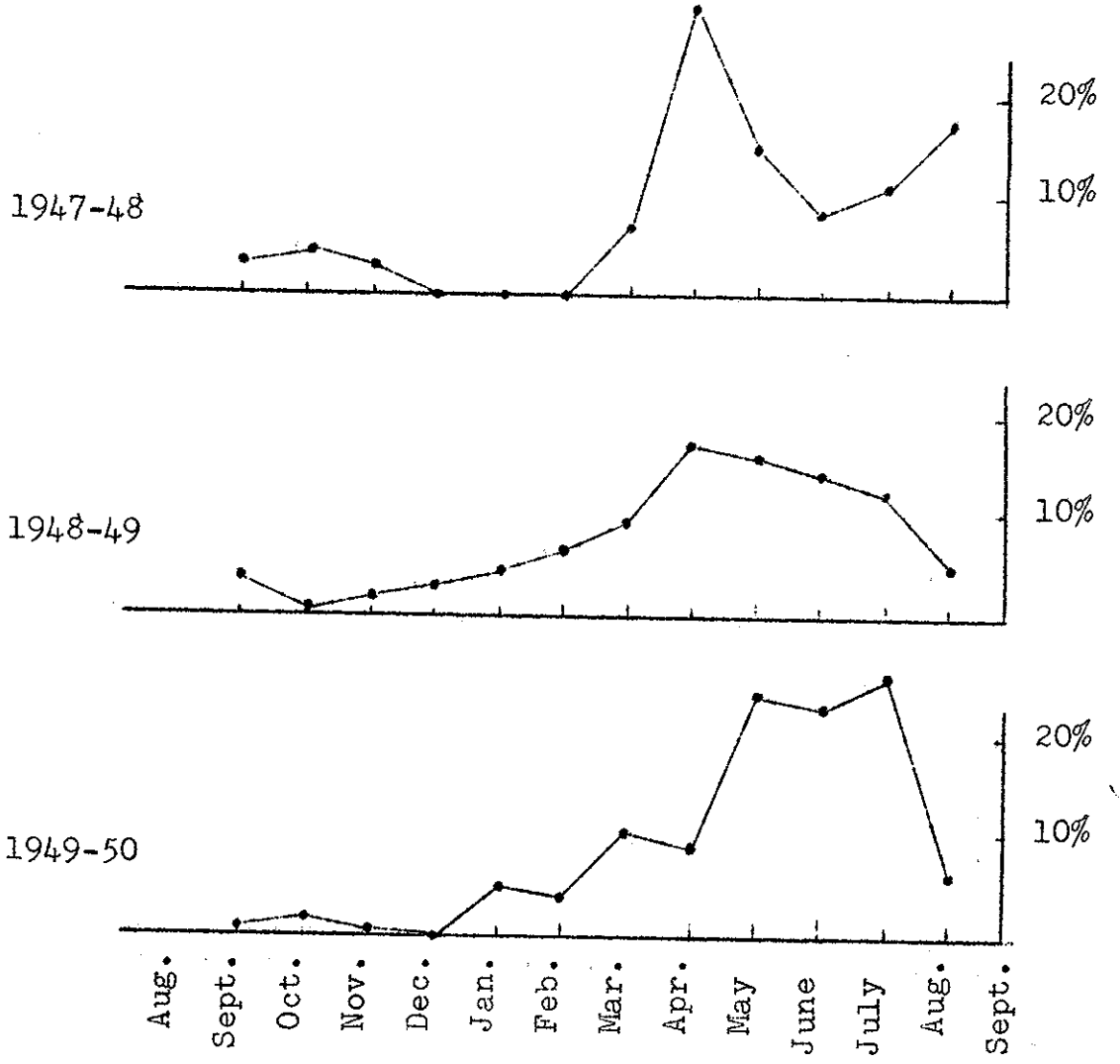

Table 1
General Sampling Data,
September 1, 1949 to August 31, 1950

	Measured crabs	Other crabs examined	Total crabs examined	% Total catch
♂♂	1,715	1,472	3,187	37.5
♀♀	1,852	3,453	5,305	62.5
Immature ♀♀	684	464	1,148	13.5
Mature ♀♀	1,000	2,952	3,952	46.5
Mature ♀♀ No egg mass	857	2,577	3,434	40.4
Orange egg mass	83	180	263	3.1
Black egg mass	60	195	255	3.0
Total with egg mass	143	375	518	6.1
♀♀ Infested	375	37	205	2.4
♂♂ Infested	77	8	85	1.0
Total Infested	245	45	290	3.4
Total ♂♂ and ♀♀	3,567	4,925	8,492	100.0

Spawning and Hatching

Spawning and hatching habits of the blue crab on the Texas coast have been a major problem of this investigation. In the early stages of the program it was realized that local spawning and hatching differed from the east coast pattern from a geographical and seasonal standpoint. Examination of swimmerets (Churchill, 1921; Hard, 1942) for egg remnants was utilized in determining whether or not a crab had spawned. This method was used rather than the more involved ovary examination described by Hard (1942).

Churchill (1921) stated that it was only necessary to clip a small portion of the tips of the pleopodal hairs. Examination of 2,224 mature female crabs, by the writer, revealed that it was best to remove an entire pleopod or at least an entire inner ramus. This was a more accurate procedure, for in many cases egg remains were found only on the basal portion of the hairs. In all cases the left anterior swimmeret was removed. Sufficient crabs with well healed pleopodal stumps were recovered to indicate that there was very little mortality due to removal of the entire pleopod.

This portion of the investigation was started in January, 1950 and will be continued, at least, through January, 1951. The fish trap in Cedar Bayou was placed in operation on March 16, 1950. It soon became evident that this trap would furnish valuable information on spawning, hatching, and movement of crabs. In five and one-half months 4,925 crabs or 1.6 crabs per trap hour were caught. Data from the trap, compared with that from crab pots set in Cedar Bayou, sampling by various methods in the bays, and by seine from the gulf surf, form a portion of the spawning and hatching picture.

Formation of the egg mass occurs to a minor extent in the bays and for the greatest part in the gulf proper. In 1949-50 only six or 4.8% mature female crabs out of 126 examined from the bays carried egg masses, and only three showed evidence of having spawned. During the same period 1,491 mature females were examined from the sampling of the out-going fish trap and crab pots set north of the fish trap, of which 240 or 16.1% carried egg masses and 233 or 15.6% had spawned. Thus, it may be seen that the majority of the mature female crabs moving through Cedar Bayou have not spawned, but will do so in the gulf.

Hatching takes place in the gulf, with occasional cases occurring in the bays. Only three out of 120 mature

females taken in the bays had spawned (Table 2). The north trap in Cedar Bayou, taking out-going movements, produced only ~~15.7~~ 18.8% spawned crabs; whereas, the south trap, taking incoming movements, produced 87.6% spawned crabs. Crab pots on each side of the fish trap and covering the entire bayou

Table 2
Spawning records for 1949-50, by Area

Location	Number Clean ♀♀ Examined	Number with egg mass	Number Spawned	% Spawned
Bays	120	6	3	2.4
Crab pots S. fish tp.	185	20	49	23.9
Crab pots N. fish tp.	79	6	13	15.3
South fish trap	640	12	571	87.6
North fish trap	1,172	234	220	18.8 ~~15.7~~
Gulf	28	3	0	0.0

caught only small percentages of spawned crabs, while taking large numbers of a static male population.

Crabs collected in the gulf near the mouth of Cedar Bayou from January to May, 1950 had not spawned. Later, seine hauls in the same area produced very few crabs, while catches in the bayou increased.

In general, mature females move out of the bays through passes to the gulf with considerable urgency, as evidenced by large numbers of unspawned and ovigerous crabs caught by the out-going fish trap; whereas, crab pots on each side of the trap produced a predominance of males. Concurrently, the incoming trap catch was, for the greater part, spawned crabs (87.6%). Lack of large numbers of mature females in the gulf adjacent to Cedar Bayou would indicate off-shore movement.

Analysis of the stomachs of 35 large sharks, caught from six to ten miles off-shore in August, 1949, revealed 30 crabs with egg masses. There was but little evidence of digestion, indicating that these crabs were eaten near the shark line set. More recently, March 17, 1950 a crab with a black egg mass was taken in a shrimp trawl four and one-half miles off-shore and on March 23, 1950 approximately 200 gravid females, half of which carried black egg masses, were taken two miles off-shore in 40 feet of water (Daugherty, 1950).

Spawning Season

Truitt (1939) states that in Chesapeake Bay egg production takes place from April to October, with a few records from other months. It was found in the course of the present investigation that in the fiscal years 1947-48 and 1948-49 spawning occurred from March to September, with peak egg production in March and April. In 1948-49 there was a second peak in June, in accord with later data, 1949-50, in which the spawning peak occurred in June and early July (Graph 2). There was a slight peak in March, 1950, which was negligible in comparison to the June, July, and August egg production.

In view of the sizeable movement of crabs through Cedar Bayou in June and early July (Graph 3), which corresponds to the high egg production season (Graph 2), it is apparent that the height of spawning comes in June and July and not in March or April as indicated in the two previous years (Daugherty, 1948, 1949).

Use of the fish trap as a means of sampling, and an intensification of work in Cedar Bayou for 1949-50 account for the fact that the June-July movement and spawning peaks were not noted in prior years. Heretofore, only routine collections were made from regular stations in Cedar Bayou.

In 1949-50 evidence of spawning was recorded during 10 months of the year, December to September*. The December spawning was not determined by the presence of crabs bearing egg masses, but was based on megalops found in Cedar Bayou on January 12, 1950 (Daugherty, 1950). These larvae molted on January 13, and some of the post larval crabs were raised through eight molts. This would indicate that there was a spawning approximately one month prior to January 13, 1950, probably in the second week of December, 1949. This would be significant in substantiating offshore

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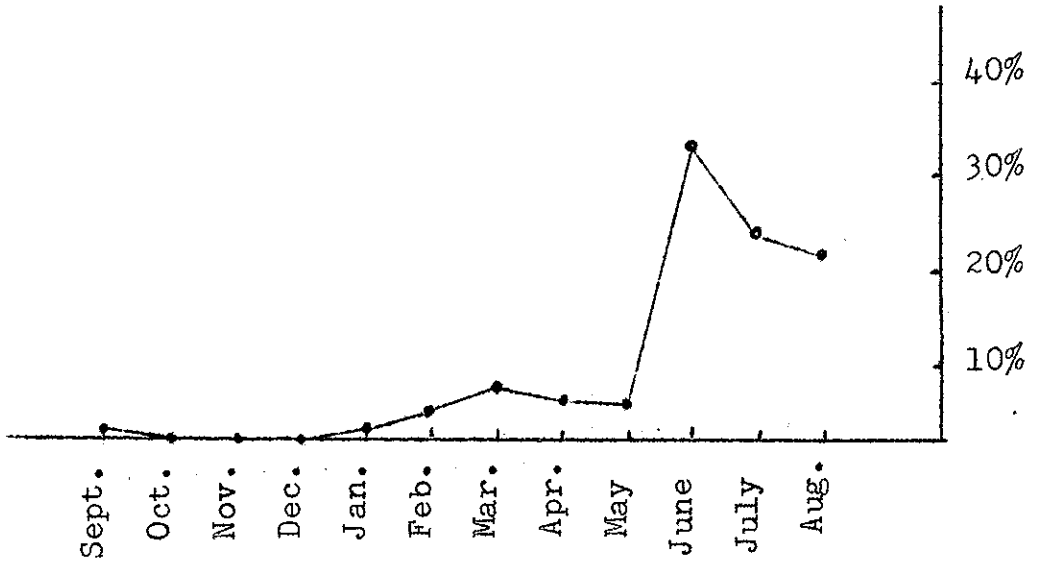
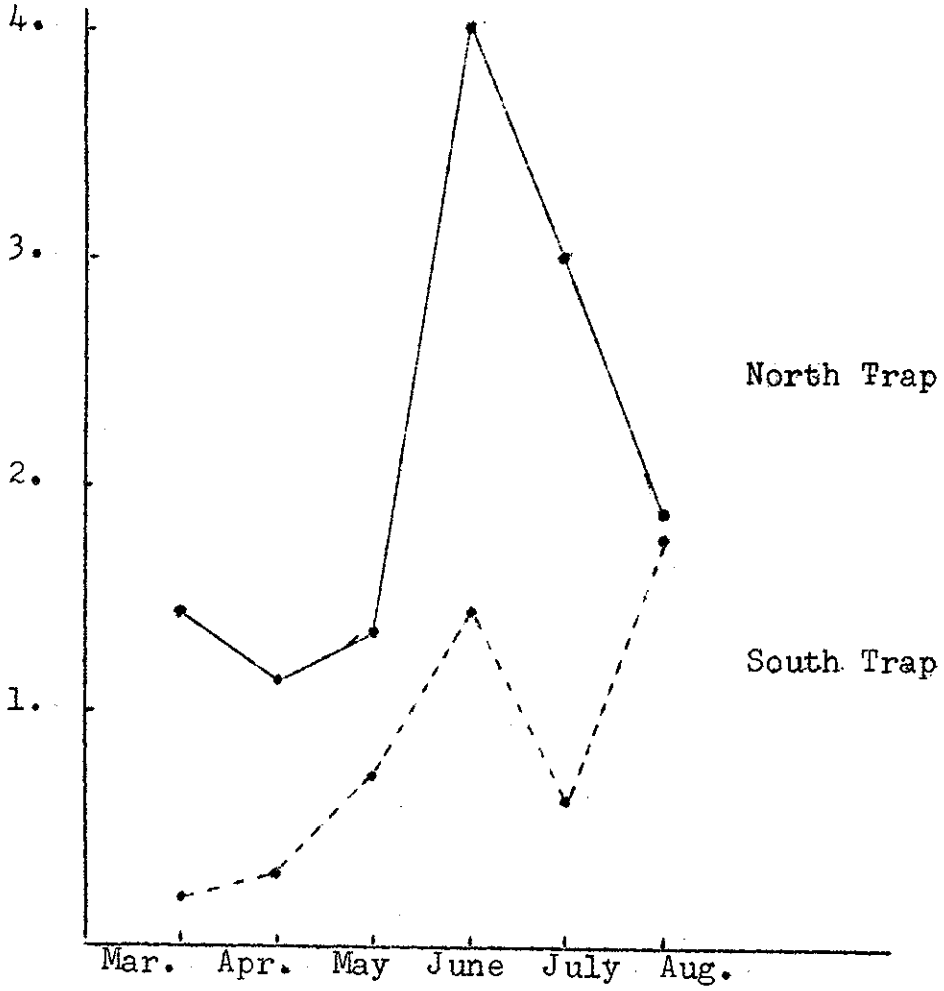
* Recently, October, 1950, egg bearing females were caught in the out-going fish trap, Cedar Bayou.

Graph 2

Population of gravid crabs by months.
Expressed as per cent of total years
sample from all stations.

September 1, 1949 - August 31, 1950





Graph 3

Crab catch in the Cedar Bayou fish trap based on catch per hour.

spawning, for no crabs were taken from the regular bay stations during December, 1949. Spawning for other months, January to September, was based on the occurrence of egg bearing crabs.

The unusually long spawning season, 1949-50, can be attributed to a very mild winter without a freeze. There is a definite possibility of year-around spawning, probably some distance offshore during those months for which there are no records. Dr. Sewell H. Hopkins* suggested that there was a possibility that egg masses formed in the early fall could be carried over to the following spring before hatching. This might be the case in years in which freezes occur and the water remains cold for long periods; however, in the event of a year such as 1949-50 spawning could continue throughout the year with no temperature barrier as a hindrance.

Shrimp fishermen report catches of egg-bearing crabs in offshore waters during the months of October and November; however, this must be confirmed.

Movement

In 1945 and 1946 an attempt to establish a large scale crab fishery in the Aransas Bay area failed, in part, because the supply of crabs in the bays during the mid-summer months was not sufficient to maintain necessary production. This made migration and movements habits prime objectives of the investigation.

Data collected in 1947-48 and 1948-49 indicated that there were very few crabs in the bays from September to February, inclusive (Graph 1). This accentuates the need for movement knowledge. All information gathered from the regular stations in 1947-48 and 1948-49 was plotted in an attempt to establish movement patterns, but no correlations were possible.

Operation of the Cedar Bayou fish trap gave the first concrete movement data of the investigation (Graph 3). Though the trap has only been functioning since March, 1950, it has given a basis for outlining the general movement plan and will probably furnish comprehensive data for the balance of the year.

A study was made of the fish trap by months, based on the production of both incoming and outgoing sides relative to the catch per trap per hour (Graph 3). It was

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* Dr. Sewell H. Hopkins, Agricultural and Mechanical College of Texas, College Station, Texas.

found that from March through May there was a steady gulfward movement of 1.1 to 1.4 crabs per trap hour, while the bayward movement for the same period was 0.2 to 0.7 crabs per trap hour. The peak of the migration came in June, corresponding to the spawning peak. In July the outward movement had slowed down somewhat, but was still high with 3.0 crabs per trap hour; while the inward movement had decreased to 0.6 crabs per trap hour. The large gulfward migration in June and July accounts for the failure of fishermen to find crabs in the bays in sufficient numbers to maintain a large fishery during those months in 1945 and 1946. In August there was a leveling off of movement with 1.3 crabs per trap hour outward bound and 1.2 crabs per trap hour coming in. Further material on the trap catch is anxiously awaited, for it should aid in formulating the complete movement picture.

The urgency of the movement through the bayou was corroborated by trapping with crab pots on each side of the fish trap. Females comprised 70% of the fish trap catch and only 37% of the crab pot catch. The major portion of the crab pot catch, large males, was from a static population. Thus it is indicative that even though there were many more females than males in or passing through Cedar Bayou, their spawning urge was great enough that food in the crab pots was ignored by the majority in the course of their gulfward migration.

The population trend for 1949-50 varied from that of the two previous years in that occurrence peaks fell in May, June, and July rather than in April (Graph 1). This can be accounted for by the intensification of work in Cedar Bayou in which the spawning migration was sampled. Therefore, it can be considered that the data for 1947-48 and 1948-49 are concerned for the most part with occurrence in bay waters and that the peak populations for April of these years apply only to the bays.

Shedding Grounds

No work has been specifically directed toward the shedding habits of the blue crab except for information collected in routine station operation. In general it has been noted that crabs preparing to molt and soft crabs prefer areas in which profuse vegetation is found.

Infestation by the Rhizocephalid, *Loxothylacus texanus*

Infestation of the blue crab by *Loxothylacus texanus*

has become of increasing importance to the investigation. In view of the deviation, in 1949-50, from the permanent station routine it has become evident that an incidence based on per cent of the years collection would not be comparable to those of the two previous years. Concentration of work in Cedar Bayou, a low infestation area, was responsible for a decrease in incidence when computed on the same basis and compared to that of 1948-49. Sampling in 1947-48 was probably not extensive enough for accurate comparison with the following years. If calculated on a per cent of the total sample of measured crabs the incidence for 1949-50 would be 6.9% in comparison to 5.4% for 1947-48 and 16.4% for 1948-49.

In each of the three years of investigation the major focus of infested crabs has been found in a small area near the southwest end of Mud Island, Aransas Bay. With an incidence discrepancy brought about through changes in collecting methods and areas, a comparison based on the samples taken from the major focal area would present a more accurate occurrence trend. (Table 3) Thus, it may be seen that there is a relatively small variation in incidence for 1948-49 and 1949-50 and that those two years compare favorably with the 25.8% incidence based on three years sampling of the southwest Mud Island area. The high incidence of 1948-49 (Daugherty, 1949) can be explained in light of a slight accentuation of work in the major focal area during that time.

Table 3
Loxothylacus texanus infestation
for fiscal years
1947-50

Fiscal year	% infested all stations	% infested S W Mud Is.
1947-48	5.4	40.0*
1948-49	16.4	27.5
1949-50	6.9	23.9
1947-50	8.2	25.8

* Based on a small sample (22 infested crabs).

It is evident, when calculations are based on the Mud Island focus of infestation, that the degree of infestation has been fairly constant for the past three years.

Fishing and Handling Methods

Pressure of spawning and migration work did not allow time for actual fishing and handling experimentation. However, some fishing data was compiled through the use of crab pots in sampling. A total of 3,014 hours of trap time was scattered over the entire year, with the exception of December. A hypothetical catch expectancy has been worked out on the basis of this fishing time even though the catch was relatively small. The crab pot catch amounted to 1,461 crabs or 0.48 crabs per trap hour. Of this number there were 1,160 crabs of marketable size or 0.38 crabs per trap hour. With this information based on an 11 months catch record it is possible to formulate a catch expectancy based on a five day work week (Table 4).

Further studies are needed to substantiate the figures presented in Table 4. It must be remembered that these figures were based on a very small catch and the question of sustained yield would constitute the major problem. In connection with this it might be well to state that crab pots must be replaced about three times during a year of fishing and that 100 unframed traps cost from $250 to $300.

Summary

1. A total of 8,492 blue crabs were examined during the fiscal year, 1949-50.

2. Occurrence trends for 1949-50 deviated from those of 1947-48 and 1948-49 in that May, June, and July were peak months and not April.

3. Formation of the egg mass occurs to a minor extent in the bays and for the greater part in the gulf proper.

4. Hatching takes place in the gulf, with occasional cases occurring in the bays.

5. Mature females move out of the bays through passes to the gulf with considerable urgency as evidenced by large numbers of unspawned and ovigerous crabs caught by

Table 4
Hypothetical crab pot catch expectancy.
Based on 11 months catch.
Catch is 0.38 crabs per trap per hour.

	100 Traps Number crabs	100 Traps Lbs. Meat	50 Traps Number Crabs	50 Traps Lbs. Meat	25 Traps Number Crabs	25 Traps Lbs. Meat
250 Day catch (50 weeks)	228,000	16,285 to 25,333	114,000	8,142 to 12,666	57,000	4,071 to 6,333
200 Day catch (40 weeks)	182,400	13,028 to 20,266	91,200	6,514 to 10,133	45,600	3,257 to 5,066
175 Day catch (35 weeks)	159,600	11,400 to 17,733	79,800	5,700 to 8,866	39,900	2,850 to 4,433
150 Day catch (30 weeks)	136,800	9,771 to 15,200	68,400	4,885 to 7,600	34,200	2,442 to 3,800
125 Day catch (25 weeks)	114,000	8,142 to 12,666	57,000	4,701 to 6,333	28,500	2,035 to 3,166
100 Day catch (20 weeks)	91,200	6,514 to 10,200	45,600	3,257 to 6,100	22,800	1,628 to 2,550

the outgoing fish trap.

6. The known spawning season, during mild years, extends from December to October, with a definite possibility of a November occurrence.

7. It was found that the peak of the spawning season occurred in June and early July, corresponding to the height of the gulfward movement.

8. During years in which a freeze occurs and the water remains cold for extended periods the known spawning season is from April to September.

9. There is a steady gulfward movement, predominantly females, from March through May with a rise to peak movement in June and July. Movement leveled off in August with outgoing and incoming catches almost identical as to numbers.

10. The April population peaks of 1947-48 and 1948-49 apply only to the bays.

11. In contrast to previous calculations, Loxothylacus texanus infestation incidence when based on sampling the major focal area, has been fairly constant for the past three years.

12. A hypothetical crab pot catch expectancy has been formulated, but must be substantiated by further studies.

Acknowledgements

The writer is indebted to Ernest G. Simmons and Joseph P. Breuer, Fishery Biologists, for supplying complete data on crab catches in the Cedar Bayou fish trap and to the other Marine Laboratory biologists for valuable bits of information. The work of Dr. Edward G. Reinhard was of great importance to the Loxothylacus texanus problem.

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