Job Report

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Project Name: Analysis of Populations of Sports and Commercial Fin-Fish
                and of Factors Which Affect These Populations in the
                Coastal Bays of Texas

Period Covered: January 1, 1963 to December 31, 1963   Job No.   8

Population Studies of the Sports and Commercial Fin-Fish and Forage
Species of the Upper Laguna Madre

Abstract: Pinfish and anchovies were the major forage species captured
throughout 1963 in trawl and seine samples. There was no evidence of a shortage
of forage fish at any time. Juvenile redfish and drum decreased in numbers in
1963 while the number of juvenile trout increased. Three methods of estimating
fish populations were tried, compared with commercial landings, and discussed.
It was concluded that commercial landings, when considered with monthly fish
prices, were the most indicative of population fluctuations. A mass tagging
and recovery program, using only those fish captured, tagged, and recovered from
drag seine samples, was the best of the methods investigated for fish population
estimations.

Objectives: To determine population fluctuations of food and game fish and
forage species of the upper Laguna Madre.

Procedures: Four seine stations established in 1961 were sampled each month
with a 60-foot bag seine of three-fourths of an inch stretched mesh webbing.
One station, a tidal pond, was discontinued when it became land-locked and
practically void of fish. All fin-fish, shrimp, and crabs caught in these
samples were counted, measured, and weighed by species. An attempt was made to
standardize all seine hauls by covering 12,000 square feet of bottom at each
station.
     Five stations were sampled each month with a 10-foot otter trawl lined
with a 1½-inch stretched mesh liner. Each sample was of 15 minutes duration.
The catches were sorted, measured, and weighed similar to the seine catches.
     At the first of the year 4 adult fish stations were sampled monthly with
1,200 feet of drag seine. In July, 1, station was sampled with 2,400 feet of
drag seine attached to 1,200 feet of trammel net. The trammel net did not work
well when pulled and was eliminated from the sampling gear. From July to
December, 2 stations were sampled each month with 2,400 feet of drag seine. All
game fish caught were counted, measured, and most were tagged. Gill nets,
trammel nets, and hook and line were also used to catch fish for tagging.

Findings and   Forage Species
Discussion: Table 1 shows the average weight in pounds of the forage
samples collected for this project. Table 2 lists the most common forage

species caught in the upper Laguna Madre, giving the relative monthly abundance and average size of each species caught.

Both trawl and seine sampling indicated that more food was available in the warmer months. Pinfish, Lagodon rhomboides, and anchovies, Anchoa sp., were by far the most abundant species throughout the year. Silversides, Menidia beryllina, spot, Leiostomus xanthurus, and shrimp, Penaeus sp., in this order, were the next most important forage species. Killifish, Cyprinodon variegatus, and Fundulus sp., were too small to be caught by either trawl or seine but were present in the lagoon all year in great numbers. Mullet, Mugil cephalus, were also present throughout the year in large quantities, but generally were too fast to be caught with the sampling gear.

Juvenile Game Species

Cynoscion nebulosus - Speckled trout were the most common juvenile game fish caught in the area in 1963, and they were more abundant than in the previous year. They were most common in July when 27, with an average standard length of 25 mm, were caught in the Intracoastal Waterway at Marker 23. Most samples taken in July contained one or more trout, which indicates that there was a successful trout spawn in May or June. August and November were the only other months in which juvenile trout were caught, and then only one fish was captured each month. Only 14 trout were caught in similar samples in 1962, and these were taken in June, July, and December. July was also the best month in 1962 for catching juvenile trout.

Sciaenops ocellata - Juvenile redfish declined sharply in numbers from 1962. Fifty-nine small redfish were caught in seine and trawl samples taken between February and March 1962. Three young redfish were taken in similar samples made in 1963. Other seine hauls made in March 1963, especially to locate young redfish, produced less than one redfish per three seine drags.

Pogonias cromis - No juvenile black drum were caught in 1963. The 1962 crop was also exceptionally small; only six drum were found. As was stated in the hydrographic report of this project, less than 15 inches of rain fell in either 1962 or 1963 and salinities of the upper Laguna Madre were high, above 44 parts per thousand. It appears that high salinity may inhibit the spawning of drum or the hatching or development of their eggs, but more intensive work needs to be done on this before a definite conclusion can be reached.

Adult Populations

A fish tagging and sampling program was conducted in the upper Laguna Madre as a means of estimating game fish populations. Population size estimations were attempted for redfish, Sciaenops ocellata, drum, Pogonias cromis, and sheepshead, Archosargus probatocephalus, because they were the most commonly caught fish with the highest ratio of tag returns. While trout, Cynoscion nebulosus, were nearly as abundant as drum, no estimate was attempted other than catch per acre because so few of the tagged trout were returned.

Drag seine catches per acre are listed in Table 6 by species. Table 7 gives the commercial landings for each month of 1963. Table 8 lists by species the number of fish tagged each month and Tables 9 and 10 include the data obtained from tags recovered. From this information, plus the 1962 fin-fish job report from the upper Laguna Madre, the following population estimates were made.

Redfish - Table 3 gives the figures and steps for estimating redfish populations by means of fish tagging and tag recovery. This calculation is known as the Schnabel method and is described by Rounsefell and Everhart (1953). The

population estimation derived by this method indicated a level of 575,000 to 708,000 fish during the period from May through September 1963.

Another method used was to calculate the number of redfish caught per acre in the drag seines and multiply by 128,000, the number of acres in the bay. This estimate, for the period May through October, is 230,000 fish. The monthly variation was extreme.

The Schnabel method was designed for use in a small body of water and is most reliable when a large percentage of the available fish are tagged. Neither of these conditions was possible in the lagoon. Since there was no practical way to determine how many fish were caught in the lagoon, commercial landings were used. Tag returns depended entirely on whim of the individuals who caught tagged fish, so it is safe to assume that not all tags were returned.

The second method is also subject to error since fish are never uniformly distributed, so 2 or 4 samples a month were not enough for an accurate estimate of the number of fish present in the area. At best this estimates the number of fish present in the sampling area.

The above two estimates of redfish populations, plus commercial landings, are plotted in Figure 1. Commercial landings and catch per acre follow very roughly the same seasonal increase in the warm months and a decrease in November and December. Almost no correlation can be seen between the tagging estimate and the other two graphs by month although the two averages are roughly comparable. Catch per acre is probably a more accurate way to estimate bay redfish populations than the Schnabel method.

Drum - The Schnabel method of estimating populations was worked out in the same manner for drum. The indicated population ranged from 856,000 fish to 8,330,000 fish for a 9-month average of 5,000,000 fish. The range of the population as determined by the catch per unit effort method was 358,000 to 4,761,000 fish with an average of 2,112,000 fish. It should be noted, however, that a more efficient net was placed in use in July, and samples from this net indicated an average population of 4,350,000 fish, very near the Schnabel estimation.

The minimum, average, and maximum are therefore:

Schnabel	856,000 - 5,000,000 - 8,330,000
Catch/Effort &	
Drag Seine	358,000 - 2,112,000 - 4,761,000
Drag Seine only	358,000 - 4,350,000 - 4,761,000

It was also possible to work out a sub-population. During the drag seine sampling several drum, tagged at Marker 65, were recovered at this same station. Schnabel's formula was used to estimate the drum in the vicinity of Marker 65 because an accurate record of tagged fish, total catch, and tag returns was available from the drag seine sampling of this station. (It was impossible to establish limits for this vicinity but another drag seine station was within four miles of Marker 65 and no fish tagged there were ever caught when seining at Marker 65. Only one drum tagged at Marker 65 was recovered from the other seine area.) The sub-population was estimated at approximately 90,000 fish during the fall months. Both estimates are charted by steps in Table 4. Three drum tagging population estimates were graphically compared in Figure 2 with commercial landings. Commercial catches are probably the best indicators of population fluctuations available. It should be noted, however, that the decrease in landing during fall months is due to

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a drop in prices and not to a scarcity of fish. Drag seine samples remained high during this same period. Catch per acre, sub-population estimate, and commercial landings at least agree in indicating a general increase in drum between May and November. In December, these two estimates declined while commercial catches increased. Low estimates in December were due to poor drag seine catches caused by fish moving from shallow water to deeper and warmer water that could not be sampled with the seine. A big commercial drum catch is an excellent indication that there was a large population of drum present in December.

Sheepshead, Archosargus probatocephalus. Monthly sheepshead populations were estimated by catch per acre in the same manner as redfish and drum estimates were made. Only one sheepshead tag was returned so a bay population estimation based on tag returns could not be made. However, a sub-population estimate, similar to the one made for drum, was attempted and its steps are described in Table 5.

Comparison of the two population estimates and commercial landings of sheepshead are plotted in Figure 3. Sheepshead are often not separated from drum at commercial fish houses, especially when they are in small lots. Therefore, many more sheepshead are marketed than are shown by landing statistics. Catch per acre figures increased in May and remained above 1.0 except for October and November (Table 6). Marker 65 produced the most sheepshead and this station was not sampled two of the three months in which the catch per acre fell below 1.0. The third month was December, when catches for all species were low as previously explained. In the case of sheepshead, it appears that the sub-population estimate based on tags released and recaptured at Marker 65 is the most dependable of the three means discussed in determining fluctuations in the annual sheepshead crop.

Comments: Juvenile trout were much more abundant in spring and summer of 1963 than in 1962. High salinities in the lagoon in 1962 and 1963 may have had an adverse affect on young redfish and drum but it did not appear to affect young trout.

Of the four means of estimating populations and trends discussed for the three species, commercial landings, when used in conjunction with prices paid for fish, appear to be the best. These tell of fluctuations in the population and in effort. Large scale tagging and recovery of tags, at widely separated stations, may prove to be a good key to population size as well as fluctuations. Catch per acre estimates based on drag seine catches depend on the area sampled, when it is sampled, water temperature, how the net is put out and pulled in, and a host of other factors. A large number of samples over each type of bay bottom, and at various depths and times each month, would increase the accuracy of this type of estimate. It is not possible to estimate populations based on random tagging and tag returns throughout the lagoon unless a method is devised to count all the fish caught and to insure a much larger percentage of returns of the tags actually found on fish by both sports and commercial fishermen.

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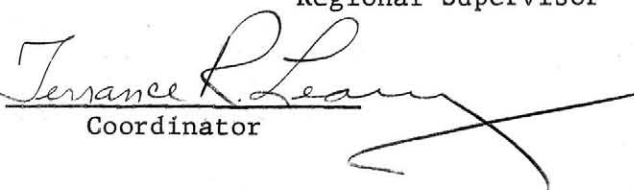
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Table 1
Forage Samples Collected in the Upper Laguna Madre in 1963

Average Weight in Pounds

Stations	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
T 1	.03	.01	No	.25	.12	.46	1.88	.09	.01	-	No
T 2	-	-	Boat	.12	.22	2.06	.09	.09	-	-	Boat
T 3	.09	.03		.06	.06	3.25	.50	.01	.03	0	
T 4	.06	.01		.12	.06	-	-	.19	.12	.31	
T 5	0	.09		.34	.25	-	-	.19	3.75	1.41	
Averages	.06	.06		.18	.14	1.92	.82	.11	.98	.57	
S 1	.19	.46	.93	1.88	.78	Lack	2.25	1.88	.15	.03	No
S 2	.01	.38	1.12	2.12	2.43	of	.75	1.47	.28	.06	Skiff
S 3	.19	1.12	.46	1.32	.25	Time	1.03	.37	.34	.01	
Averages	.13	.65	.84	1.77	1.15		1.34	1.21	.26	.03	

Numbers represent pounds of forage caught per sample
T 1 = Trawl east of Pita Island   S 1 = Seine at Tyler's Point
T 2 = Trawl west of Tropic Isle Channel   S 2 = Seine at Pita Island
T 3 = Trawl at Marker 23   S 3 = Seine west of Marker 27
T 4 = Trawl west of Marker 75
T 5 = Trawl in Yarborough Pass

Table 2

Composition of Monthly Forage Samples Taken in the Upper Laguna Madre in 1963

Date	Pinfish	Croakers	Anchovies	Spot	Silver Sides	Pigfish	Trout	Killifish	Mullet	Shrimp	Crabs
January	No samples collected										
February	70*	40x	25x		70-			-		-	30-
March	70*		35*	25x	75x			-		80-	35-
April	75*			50*		20-				85-	35-
May	55*	-	35*	55x	45x	-		-		70x	
June	60*		35*	75*	45x	45x		-	120-	65x	
July	65*	55x	40*	75-		50x	25x	x		60x	
August	65*		45*	60-	45x		100-	-		70x	
September	45*		40*	70-	45x	-		-		65-	
October	75*		40*		60x			-			
November	80x		40*		60-		90-	-			
December	No samples collected										

Numbers represent approximate average size in millimeters
* = Abundant
x = Common
- = Present

Table 3
Estimation of 1963 Redfish Population in the Upper Laguna Madre
by Intensive Marking

A	B	C	D	E	F	G	H	I
1962								
Sept.	49							
Oct.	52	5536	1	271,000	271,000	271,000	1	271,000
Nov.	53	6887		358,000	538,000	629,000	1	629,000
Dec.	56	2255		120,000	120,000	749,000	1	749,000
1963								
Jan.	56	1577		883,000	883,000	1,632,000	1	1,632,000
Feb.	56	1167		65,400	65,400	1,697,400	1	1,697,400
Mar.	75	2600		146,000	146,000	1,843,400	1	1,843,400
Apr.	79	2200		155,000	155,000	1,998,400	1	1,998,400
May	87	4207	3	332,000	110,888	2,330,400	4	575,100
June	94	2962		258,000	258,000	2,588,400	4	647,100
July	115	4533		426,000	426,000	3,014,400	4	753,600
Aug.	172	3770	1	434,000	434,000	3,448,400	5	689,680
Sept.	188	4672	1	804,000	804,000	4,252,400	6	708,733
Oct.	191	5179	4	674,000	168,500	4,926,400	10	492,640

A = Time interval of 1 month
B = Tagged redfish in bay at end of each month
C = Number of redfish caught each month (commercial landings in pounds
    divided by 2.54)
D = Tags recovered each month
E = Number of redfish caught (C) multiplied by the number of tagged
    redfish in the bay at the end of the previous month (B)
F = E/D
G = Cumulative E
H = Cumulative D
I = G/H = Estimated redfish in bay each month

Note: 2.54 is the average weight in pounds of 250 commercial redfish.

Table 4
Estimates of 1963 Drum Population in the Upper Laguna Madre
by Intensive Marking

A	B	C	D	E	F	G	H	I
Lagoon Population								
1962								
Sept.	15							
Oct.	53	5,533		72,850	72,850	72,850		72,800
Nov.	92	6,753		357,750	357,600	430,600		430,000
Dec.	103	8,191		753,480	753,480	1,184,080		1,180,000
1963								
Jan.	131	15,525		1,596,500	1,596,500	2,780,580		2,780,000
Feb.	131	8,112		1,062,410	1,062,410	3,842,990		3,842,000
Mar.	285	11,033		1,441,000	1,441,000	5,283,990		5,280,000
April	379	4,804		1,368,000	1,368,000	6,651,990		6,650,000
May	517	4,439		1,682,760	1,682,760	8,334,750		8,330,000
June	705	2,348	4	1,214,950	303,938	8,638,688	4	1,160,000
July	1,092	2,653	4	1,868,250	467,082	9,105,770	8	1,140,000
Aug.	1,162	4,277	4	4,673,760	1,168,440	10,274,210	12	856,000
Sept.	1,955	4,105	1	4,764,200	4,764,200	15,038,410	13	1,160,000
Sub-population at Marker 65								
April	56							
May	135	84		4,704	4,704	4,704		4,704
June	295	167	3	22,545	7,515	27,249	3	9,080
July	487	586	4	172,870	43,218	200,119	7	28,600
Aug.	723	915	4	445,605	111,401	645,724	11	58,700
Sept.	1,236	513		370,899	370,899	1,016,623	11	92,400
Oct.	1,236	No sample		1,236	1,236	1,017,859	11	92,500
Nov.	1,236	26		32,136	32,136	1,049,995	11	95,500
Dec.	1,242	7	1	8,652	8,652	1,058,647	12	88,200

A = Time interval of 1 month
B = Tagged drum in bay at end of each month
C = Number of drum caught each month (commercial landings in pounds divided by 3.6)
    (3.6 is the average weight of drum caught in the lower Laguna Madre by contract
    netters in 1962)
D = Tags recovered each month
E = Number of drum caught (C) multiplied by the number of tagged drum free at the
    end of the previous month (B)
F = E/D
G = Cumulative E
H = Cumulative D
I = G/H = Estimated monthly populations

Lagoon population figures are based on all tags used in the area and uses commercial
    landings for C.
Sub-population figures are based on only those tags used and recovered in drag seine
    samples at Marker 65. The value of C is the number of drum caught in each sample.

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Table 5
Estimate of 1963 Sheepshead Population at Marker 65
in the Upper Laguna Madre by Intensive Marking

A	B	C	D	E	F	G	H	I
April	54							
May	77	26	3	1,404	468	1,404	3	468
June	91	19	4	1,467	367	2,871	7	410
July	125	42	3	3,780	1,260	6,651	10	665
Aug.	145	32	2	4,000	2,000	10,651	12	888
Sept.	181	37	0	5,365	5,365	16,016	12	1,340
Oct.	181	0	0	181	181	16,197	12	1,350
Nov.	201	21	1	3,801	3,801	19,998	13	1,540
Dec.	201	0	0	201	201	20,199	13	1,550

A = Time interval of 1 month
B = Cumulative total of sheepshead tagged at Marker 65 each month
C = Number of sheepshead caught in drag seine at Marker 65 each month
D = Tags recovered each month
E = Number of sheepshead caught (C) multiplied by the number of tagged sheepshead free at the end of the previous month (B)
F = E/D
G = Cumulative E
H = Cumulative D
I = G/H = Estimated monthly sheepshead population in the vicinity of Marker 65

Table 6
Results of Adult Drag Seine Sampling in the Upper Laguna Madre in 1963 (Fish/Acre)

Station		Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	T			0.5	1.5	1.0	1.8	2.8	1.2		0.9	1.1
	R	No		1.0	1.2	1.8	0.2	0.5	0.1		0	0
	D			23.0	21.0	41.8	36.6	57.2	32.1	Bad	3.2	4.4
	S	Samples		13.5	6.5	4.8	2.6	2.0	2.3		2.6	0
	F			0.2	1.2	0.5	1.6	0.4	0.1	Weather	0	0
	C			0	6.2	0	0	21.9	12.5		0	0
2	T		1.0	0.5			1.9	2.3	5.8	2.2	6.2	1.4
	R	Made	0	0	Lack of Time		0.5	3.1	1.1	4.4	4.4	0.1
	D		0	0.5			32.8	15.3	42.4	28.1	1.4	1.1
	S	in	0	0			0.1	0.9	0.1	0.1	1.3	0.1
	F		0	0			0.5	0.1	0	0	0.1	0
	C		0	0			27.8	0	4.7	12.5	0	0
3	T		0.5	0.5	0	0						
	R	Jan.	0.5	0	1.0	0.5						
	D		1.0	2.0	0.5	0.2						
	S	or	0	0	1.0	0.2	Station Discontinued					
	F		0	0	0	0						
	C		0	0	0	0						
4	T		2.6	2.2	2.2	3.2						
	R	Feb.	0.4	0	0.2	0.2						
	D		9.1	8.5	17.5	3.5						
	S		0.6	0.2	13.2	0	Station Discontinued					
	F		0	0	0	0.5						
	C		0.1	0	5.5	3.0						
Averages	T		1.2	0.9	1.2	1.2	1.8	2.6	3.5	2.2	3.5	2.1
	R		0.5	0.2	0.8	1.8	0.4	1.8	0.6	4.4	2.2	0.1
	D		3.4	8.5	13.0	15.2	34.7	36.2	37.2	28.1	2.3	2.8
	S		0.3	3.4	6.9	1.7	1.3	1.5	1.2	0.1	2.0	0.1
	F		0.1	0.1	0.4	0.3	1.0	0.2	0	0	0	0
	C		0	0	3.9	1.0	14.0	11.0	8.6	12.5	0	0

Numbers represent number of fish caught per acre sampled
Station 1 = Marker 65
Station 2 = East shore, Big Cove
Station 3 = West flats, Pita Island
Station 4 = Point of Rocks

T = Trout
R = Redfish
D = Drum
S = Sheepshead
F = Flounder
C = Croaker

Table 7
1963 Commercial Landings of the Upper Laguna Madre as Reported

Month	Redfish	Trout	Flounder	Drum	Sheepshead
January	4,006	5,918	72	56,899	0
February	2,964	2,576	0	29,203	0
March	6,603	12,270	12	39,738	0
April	6,555	11,207	185	17,295	0
May	10,688	15,708	412	15,797	0
June	7,523	11,282	579	8,452	0
July	11,515	11,451	574	9,552	281
August	9,576	15,326	36	15,398	0
September	11,869	14,155	85	14,788	0
October	13,157	15,801	93	11,517	0
November	9,092	7,471	622	10,500	1,547
December	7,262	7,667	683	33,861	2,027
Total	100,810	130,832	3,353	263,172	3,855

All figures represent pounds of fish

Table 8
Fish Tagged in the Upper Laguna Madre in 1963

Month	Trout	Drum	Sheepshead	Redfish	Flounder	Croaker	Total
January	0	28	1	0	1	0	30
February	0	0	0	0	0	0	0
March	36	154	11	19	8	1	229
April	11	94	54	4	2	0	165
May	68	138	80	8	5	15	314
June	16	188	19	10	4	22	259
July	71	387	39	21	35	0	553
August	80	370	37	58	5	0	550
September	93	793	38	17	0	0	941
October	29	112	0	7	0	0	148
November	15	34	42	6	2	0	99
December	22	17	1	2	0	0	42
Total	441	2,315	322	152	62	38	3,330

Table 9
Growth and Movement Data Collected from Fish Tagging in 1963

Release Date	Point of Release	Total Length	Growth	Time Free	Movement	Caught By
Redfish						
8/ 1/62	Marker 201	12¼	3 3/4	5 3/4 mo.	*80 miles S	S
7/25/62	Pita Island	-	-	10 mo.	4 miles N	S
7/26/62	Marker 201	11½	4½	10 mo.	-	C
8/13/62	Pita Island	13½	6	9 mo.	None	C
10/31/62	Pita Island	26	0	7½ mo.	5 miles S	C
4/29/63	Marker 65	20½	1½	2 mo.	11 miles N	C
7/25/62	Pita Island	13	-	11 mo.	43 miles S	S
11/ 9/62	Pita Island	17	3	7½ mo.	5 miles N	S
8/ 9/63	Marker 25	-	0	¼ mo.	None	S
12/19/62	Point of Rocks	15¼	2 3/4	8 mo.	*54 miles S	S
6/19/63	Marker 65	21½	-1	2 3/4 mo.	13 miles N	S
7/25/62	Pita Island	13½	10½	14½ mo.	2 miles S	C
11/19/62	Pita Island	21½	3½	11 mo.	-	C
6/15/62	Marker 201	10 3/4	12½	16 mo.	36 miles N	C
6/13/62	Marker 45	-	-	16 mo.	-	S
3/12/63	Pita Island	17 3/4	5 3/4	5½ mo.	5 miles N	S
12/19/62	Point of Rocks	16½	1½	9½ mo.	14 miles N	C
5/22/63	Marker 45	18¼	1	6 mo.	2 miles N	S
5/16/63	Marker 65	18	3½	6½ mo.	10 miles S	S
Drum						
7/19/62	Marker 89	17 3/4	-	5 mo.	2½ miles S	C
2/21/62	Marker 95	10½	2½	15 mo.	13 miles N	S
3/28/63	Point of Rocks	20¼	-1¼	2½ mo.	-	S
4/29/63	Marker 65	17	0	1 3/4 mo.	None	N
4/29/63	Marker 65	16 3/4	0	2 mo.	None	N
4/29/63	Marker 65	18 3/4	0	2 mo.	None	N
4/29/63	Marker 65	20 3/4	¼	3 mo.	None	N
5/21/63	Marker 65	23	0	2 mo.	None	N
6/19/63	Marker 65	11 3/4	0	1 mo.	None	N
4/29/63	Marker 65	20	¼	3 mo.	None	N
7/24/63	Marker 65	12¾	0	1 mo.	None	N
7/24/63	Marker 65	19 3/4	0	1 mo.	None	N
6/18/63	Marker 65	22½	0	2 mo.	None	N
6/18/63	Marker 65	20¼	0	2 mo.	None	N
12/ 5/61	Point of Rocks	19 3/4	-	-	-	C
2/ 8/62	Pita Island	23¼	-	-	-	C
7/24/63	Marker 65	21½	½	2 mo.	13 miles N	S
9/10/63	Marker 65	17¼	0	3 mo.	10 miles N	S
7/24/63	Marker 65	26½	-	2 mo.	13 miles N	S
8/21/63	Marker 73	29½	½	1¼ mo.	16 miles N	S
9/23/63	Marker 73	13 3/4	0	1¼ mo.	24 miles S	S
7/24/63	Marker 65	20¼	¼	4 mo.	14 miles N	C
11/15/62	Marker 45	-	-	13 mo.	*103 miles S	S
7/24/63	Marker 65	19½	0	4½ mo.	None	S
7/23/63	Marker 73	11½	-	5 mo.	-	S

No movement indicates fish was caught within one mile of point of release
S = Sport fisherman   Length and growth are shown in inches
C = Commercial fisherman   * Indicates fish was caught in an area
N = Recaptured in adult fish sampling   other than the upper Laguna Madre

Table 10
Growth and Movement Data Collected from Fish Tagging in 1963

Release Date	Point of Release	Total Length	Growth	Time Free	Movement	Caught By
Sheepshead						
4/29/63	Marker 65	19½	0	3/4 mo.	None	N
4/29/63	Marker 65	18¼	0	3/4 mo.	None	N
4/29/63	Marker 65	17 3/4	0	3/4 mo	None	N
4/29/63	Marker 65	13½	0	1 3/4 mo.	None	N
4/29/63	Marker 65	15¼	0	1 3/4 mo.	None	N
5/21/63	Marker 65	14¾	0	1 mo.	None	N
6/19/63	Marker 65	14¼	0	4 mo.	None	N
7/24/63	Marker 65	17½	0	1 mo.	None	N
6/19/63	Marker 65	13½	0	1 mo.	None	N
4/29/63	Marker 65	19¼	0	3 mo.	None	N
5/16/63	Marker 65	19	0	1¼ mo.	None	N
9/24/63	Marker 65	17½	0	1 mo.	None	S
6/19/63	Marker 65	12½	2"	5 mo.	4 miles SE	N
9/24/63	Marker 65	17¼	0	2 mo.	None	N
Trout						
3/13/63	Pita Island	20	0	2 mo.	None	C
4/24/63	Marker 185	10½	0	1 mo.	40 miles N	S
5/30/63	Marker 187	11 3/4	1	4 3/4 mo.	*55 miles S	S
Flounder						
4/ 4/63	Marker 201	12	2	4 mo.	None	S

No movement indicates fish was caught within one mile of point of release.
* Indicates fish was caught in an area other than the upper Laguna Madre.
Length and growth are shown in inches.

S = Sport fisherman
C = Commercial fisherman
N = Recaptured in adult fish sampling

Figure 1
1963 Upper Laguna Madre Redfish Population Estimates
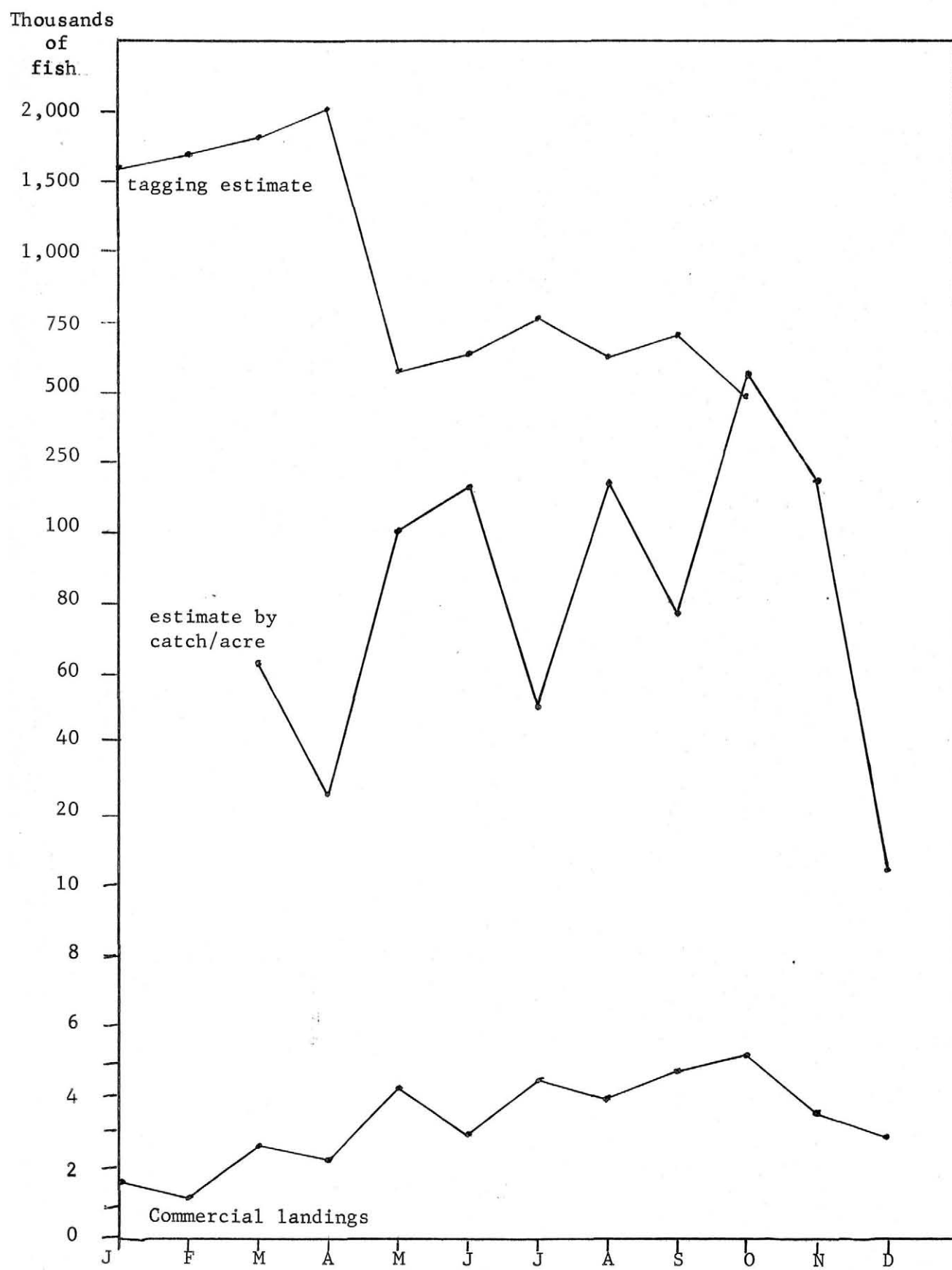Compared to Commercial Catches

Thousands of fish

tagging estimate

estimate by catch/acre

Commercial landings

J F M A M J J A S O N D

Figure 2
1963 Population Estimates of Drum in the Upper Laguna Madre
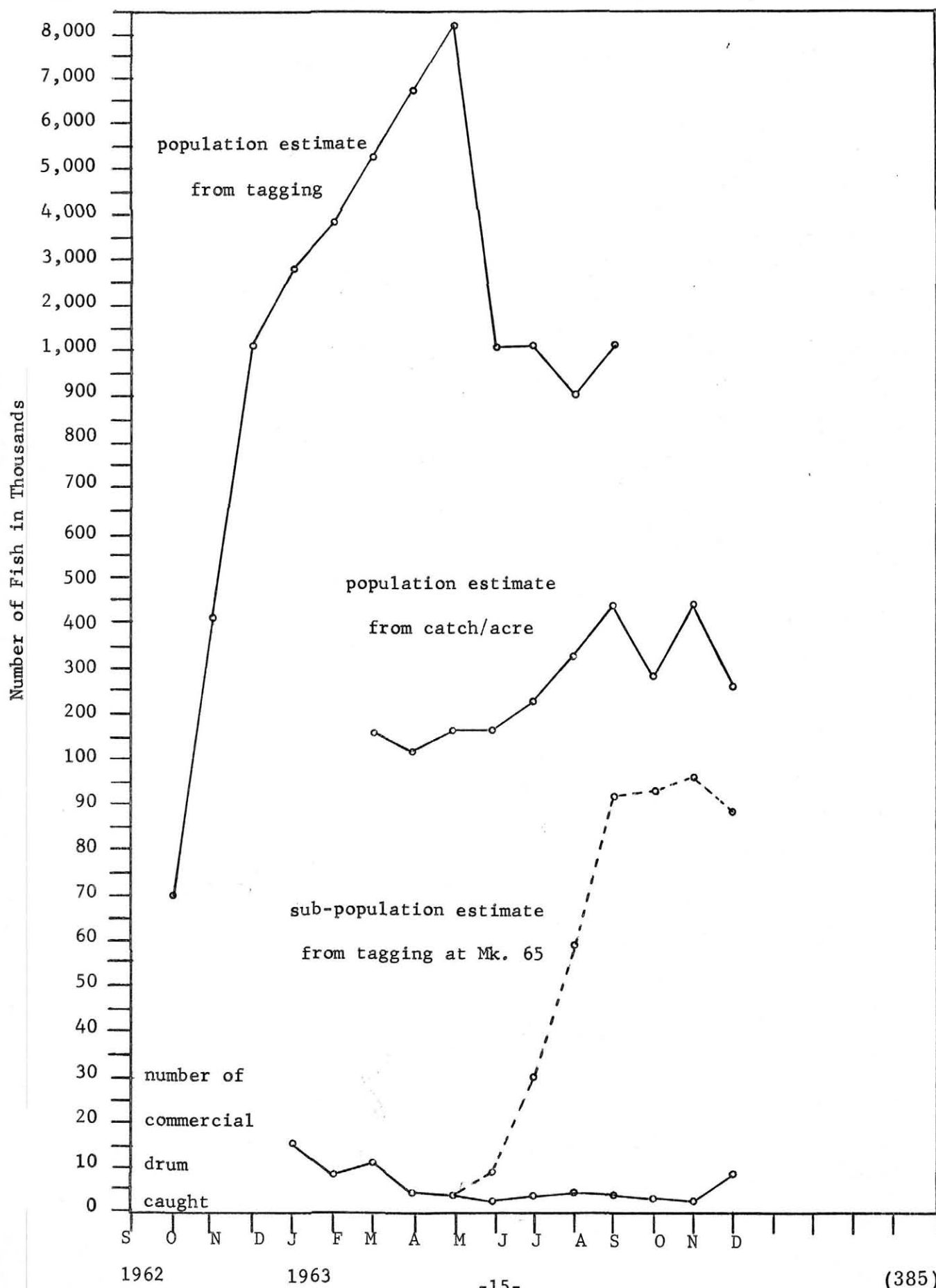Compared to Commercial Landings

Figure 3
1963 Estimates of Sheepshead Population in the Upper Laguna Madre
from Drag Seine Catches and Tag Returns Compared to
Commercial Landings

estimate by
catch/acre

sub-population estimate
by tagging

☐ = commercial catch in pounds.