

RESULTS OF THE TAGGING OF SALT WATER FISHES IN FLORIDA*

by

Robert F. Hutton, Robert M. Ingle and Robert W. Topp

Florida State Board of Conservation Marine Laboratory
Maritime Base, Bayboro Harbor, St. Petersburg, Florida

SECTION I: NOTES ON TAGGING SALT WATER FISHES ALONG THE SOUTHWEST COAST
OF FLORIDA (ZONE I)**

SECTION II: NOTES ON TAGGING SALT WATER FISHES IN SOUTH FLORIDA (ZONE II)

* This is a preliminary report with the final report to be presented later as a technical journal financed by the Jos. Schlitz Brewing Company.

** This section (Zone I) of the report was presented at the Sixth Game Fish Conference of the International Oceanographic Foundation held at Miami Beach, 15 November 1961.

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I. NOTES ON TAGGING SALT WATER FISHES ALONG THE SOUTHWEST

COAST OF FLORIDA (ZONE I)**

INTRODUCTION

Starting in December 1960 the Jos. Schlitz Brewing Company in cooperation with the Florida State Board of Conservation and the Florida Games and Fresh Water Fish Commission sponsored a fish-tagging program in the form of a "fishing contest". The Schlitz Company was mainly interested in the "contest" from the promotional aspect for the sale of their product, but they were also interested in the research value to the State fisheries.

Supervision of the tagging of salt water species was handled by the Conservation Department. The Game and Fresh Water Fish Commission was in charge of tagging fresh water species. The Conservation Department entered into the program with the idea that the "contest" would benefit not only the tourist trade of the State but the fisheries research programs as well. When the Conservation Department decided to enter the program there was relatively little time available before actual tagging was to start. With this in mind it was readily recognized that time did not permit detailed plans to be formulated and that the first year's work would be that of a pilot program with relatively few conclusions reached.

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Consequently the salt water tagging program was designed primarily to study movements of fishes and if possible to obtain some information on fishing mortality, growth and efficiency of tags used. Certain deficiencies in the program were anticipated and are dealt with later in the paper. Long-range objectives are to assess the salt water fisheries with respect to migration, abundance, mortality (natural and fishing) and growth for certain of the more valuable species.

Although the first year's work was in the nature of a pilot program available evidence allows us to make certain tentative conclusions. Also, the results of this tagging program substantiates the validity of certain conclusions drawn from other tagging programs in the State. The purpose of this paper is to report the results to date (October 1, 1961) of the 1960-61 fish-tagging program conducted in Zone I along the southwest coast of Florida. Reports on the other three Zones will be presented elsewhere. Since much of our data is too voluminous to include here our original records are on file for ready reference at the State Marine Laboratory, St. Petersburg, and at the Conservation Department main office, Tallahassee.

METHODS AND MATERIALS

The State was arbitrarily divided into four "zones". The "zones" for salt water species were as follows:

- Zone I. Northern Hernando County Line to Everglades City.
- Zone II. Everglades City to the northern Indian River County Line.
- Zone III. West Coast: Northern Hernando County Line to the Wacasassa River.
East Coast: Northern Indian River County Line to the northern Flagler County Line.
- Zone IV. West Coast: Wacasassa River to the western Escambia County Line.
East Coast: Flagler County Line to the northern Nassau County Line.

Tagging of salt water species began in Zone I on December 2, 1960, and stopped in Zone IV on May 5, 1961. More than 3000 individuals including more than 20 species were tagged by Messrs. Joseph Humphreys, Howard Foulk, Victor Springer, Andrew McErlean and Cassius Peddie. A total of 1001 tagged-fish were released in Zone I by January 4, 1961. At least 13 species were represented in varying numbers, depending upon their availability and adaptability to the tagging program.

During the period of the contest (January 1 to March 31, 1961, in Zone I) the Schlitz Company was to redeem all salt water tagged-fishes returned for values ranging from a minimum of \$25 to a possible maximum of \$10,000. The value of each tag was known only to the Schlitz officials until the fish was recaptured and turned in to the officials. A reward of \$25 was paid for each tagged fish returned prior to January 1, 1961. Tagged fishes returned after the end of the contest (March 31, 1961, in Zone I), and through December 31, 1962, would be redeemed by the same Company at \$3 each. The Schlitz Company decided that the first tagged fish caught after midnight December 31, 1960, and verified through a Schlitz wholesale dealer would have a bonus value of \$1000.

To be eligible for a monetary reward all tagged fishes caught during the contest had to be returned with the tag intact. The following information for all returned tagged-fishes was included on a Fishing Contest Release Form:

Date of catch:
Fish caught by:
Florida address:
Exact location where fish was caught:
Length to 1/2":
Tag No.:
Value:

Each contestant receiving a reward was required to sign the Release Form acknowledging the accuracy of the information and that he had complied with all the rules of the contest.

Probably more publicity was given to this tagging program than any other fish-tagging program ever conducted. In Zone I a dinner and press conference was held in Tampa before the official opening of the contest. The various news media, including outdoor and fishing editors of newspaper, radio and television, were invited. At this conference details of the contest were reported. Publicity for the contest was handled by the public relation firm, Barkin, Herman and Associates, Milwaukee, Wisconsin. The contest including all four Zones previously mentioned, was presented as the "\$500,000 Florida Fishing Contest". It was open to tourists and residents alike. Full page advertisements of the contest were carried in newspapers throughout the country. Much additional publicity was given by the various news media.

Fishes used for tagging were caught in gill nets, cast nets or on hook and line by commercial fishermen or on hook and line by sports fishermen. Only fishes that appeared in a healthy condition were tagged and released. In most cases fishes were released in areas of heavy sports fishing activity. Fishes that were released in areas other than where originally caught were transported in a 250 gallon recirculating water trailer. In some cases fishes were held overnight in bait tanks or in a portable floating fish cage (2' x 4' x 4') made of hardware cloth. If the fishes held in captivity overnight appeared healthy they were tagged and released.

Two types of tags were used. In Zone I all weakfish (Cynoscion nebulosus) were marked with yellow internal plastic streamer "anchor" tags (see Moffett, 1961). Other species were tagged with red Petersen disk tags (18 mm. dia.) consisting of two plastic disks, secured in place, one on each side of the back just under the anterior part of the dorsal fin, by a nickel pin that passed through the fish. Figures 1 and 2 show the types of tags used and the legend and type of identification serial number used.

For recording purposes the "A" on each tag was used to differentiate tags used by the Conservation Department from those used by the Game and Fresh Water Fish Commission.

Measurements of fishes were in millimeters after placing the anterior end of the fish (not necessarily the tip of the snout) against the edge of a standard fish measuring board. Standard length measurements were made to the base of the caudal fin (i. e. posterior edge of hypural plate). For species having truncate tails such as Red Fish and Weakfish total lengths were measured to the center of the posterior edge of the tail. Total length measurements for species such as Mullet, having caudal fin lobes of approximately equal length, were made along the horizontal line to the intersection of a line drawn from the tip of the dorsal lobe to the tip of the ventral lobe. For specimens having unequal caudal fin lobes measurements were taken on a horizontal line starting at the anterior end to the intersection of a perpendicular line drawn to the posterior end of the longer caudal fin lobe. In most cases fishes were frozen prior to being returned to the State Laboratory for final measurements.

RESULTS BY SPECIES

SPOTTED SEATROUT, Cynoscion nebulosus (Cuvier):

A total of 513 spotted seatrout were tagged in Zone I from December 5, 1960, through January 4, 1961. Tagged fish were returned from December 24, 1960, through August 17, 1961. The greatest distance traveled was 120 miles by a fish released at John's Pass in Pinellas County on December 7, 1960, and recovered at Steinhat-
chee in Taylor County on June 29, 1961. The distance was traveled in 205 days with an average speed of 0.59 miles per day. Little tendency was shown for the movement of long distances. 80.7% of the recovered seatrout were captured less than five miles from the point of release. 98.2% were captured less than 20 miles from the point of release. The numbers of fish tagged and recaptured by county are listed

in Table I.

Of the 513 seatrout tagged in Zone I 119 were returned by August 17, 1961, with a recovery rate of 23.2%. Three specimens were returned on January 1, 1961. Only one fish was returned within ten days of release. Table II and Figure 1 show the returns by 30 day periods. The longest period of time a fish was free was 243 days. It was caught less than five miles from where it was released.

Many specimens showed a length shrinkage and others showed a length increment. Length shrinkage and other factors influencing length measurements will be discussed later. Table III lists the ten specimens showing the greatest amount of length increment (mm.).

TABLE I.
NUMBERS OF SEATROUT RETURNED BY COUNTY.

COUNTY	NUMBER TAGGED	NUMBER RECAPTURED	PERCENTAGE
Hernando	41	4	9.8%
Pasco	15	1	6.7%
Pinellas	178	26	14.6%
Hillsborough	2	0	0.0%
Manatee	48	16	33.3%
Sarasota	138	36	26.1%
Charlotte	0	0	0.0%
Lee	86	36	41.9%
Collier	5	0	0.0%
TOTAL	513	119	23.2%

TABLE II
 NUMBERS OF SEATROUT RETURNED BY 30 DAY PERIODS.

DAYS	NUMBER RECAPTURED	PERCENTAGE RECAPTURED	Log ₁₀ RECAPTURES (see Figure 1)
1- 30	42	35.3%	1.623
31- 60	38	31.9%	1.580
61- 90	22	18.5%	1.342
91- 120	7	5.9%	.845
121-150	4	3.4%	.602
151-180	1	.8%	0.000
181-210	3	2.5%	.477
211-240	0	0.0%	-----
241-270	2	1.7%	.301
TOTAL	119	100.0%	

TABLE III.
TEN RECAPTURED SEATRUT SHOWING THE GREATEST
LENGTH INCREMENT (MM.).

DATE	RELEASE		NO. DAYS FREE	LENGTH INCREMENT	
	SL	TL		SL	TL
20/XII/60	321	377	22	2	8
17/XII/60	315	367	88	4	11
5/XII/60	307	364	135	5	10
20/XII/60	366	426	135	11	10
16/XII/60	312	367	137	11	22
21/XII/60	303	357	47	16	20
17/XII/60	322	379	16	18	21
17/XII/60	390	341	38	50	58
7/XII/60	262	307	44	78	93
20/XII/60	280	329	70	112	--

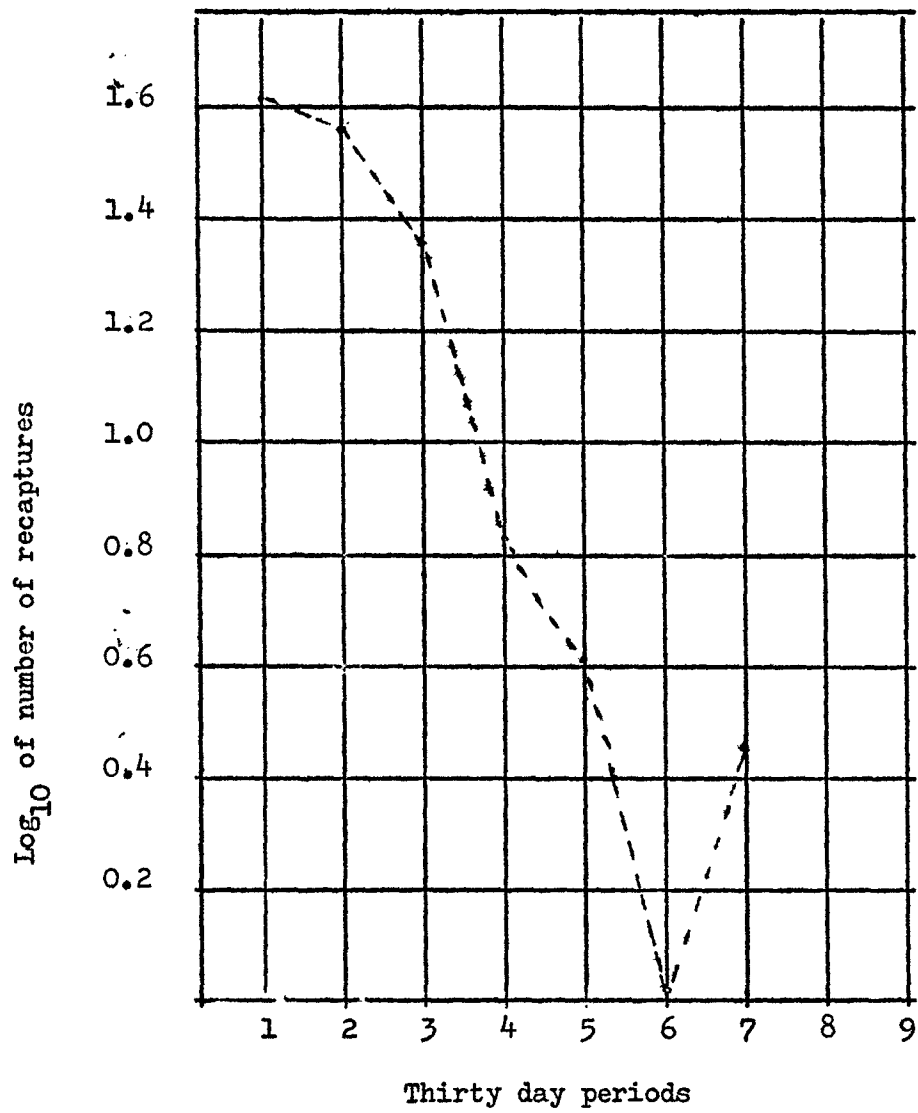


FIGURE 1. NUMBERS OF RECAPTURED WEAKFISH BY THIRTY DAY PERIODS.
(see Table II for actual values)

REDFISH, CHANNEL BASS, Sciaenops ocellata (Linnaeus):

Tagged redfish were released in Zone 1 from December 2, 1960, through January 3, 1961. Recaptured specimens were returned from December 7, 1960, through June 22, 1961. The longest distance traveled by a redfish was 112 miles in 186 days, an average of 0.60 miles per day. This fish was released on December 19, 1960, at City Island, Sarasota Bay, and was recaptured at Cedar Keys. Another tagged-specimen also free for 186 days was caught less than five miles from the release site as were 91.3% of the tagged specimens returned. 87.3% of the tagged specimens were captured less than 20 miles from the release site. The numbers of fish tagged and recaptured by county are listed in Table IV.

150 of 270 (55.6%) tagged redfish were returned. Eighteen of the recaptured fish were returned on January 1, 1961. One tag from a redfish was found entangled in a gill net, and there was a discrepancy between the release and recapture identity of another tagged specimen. These tags were deducted from the total number of fish tagged. These two tags were not considered in the compilation of data. Table V and Figure 2 show the returns by 30-day periods.

Thirty-three redfish free from 41 to 186 days before recapture showed an average increase in length of 29.2 mm. The ten fish exhibiting the greatest length increase are listed in Table VI. Only two redfish free for more than 40 days showed a length shrinkage. One fish free for 59 days and another free for 115 days showed a length shrinkage of 22 mm. and 7 mm. (average 14.5 mm.) respectively.

TABLE IV.
NUMBERS OF REDFISH RETURNED BY COUNTY.

COUNTY	NUMBER TAGGED	NUMBER RECAPTURED	PERCENTAGE
Hernando	3	0	00.0%
Pasco	6	4	66.7%
Pinellas	40	28	70.0%
Hillsborough	*45	*29	64.4%
Manatee	0	0	00.0%
Sarasota	82	57	69.5%
Charlotte	5	4	80.0%
Lee	22	13	59.1%
Collier	65	15	23.1%
TOTAL	270	150	55.6%

* Does not include one tag found entangled in gill net.

TABLE V.
NUMBERS OF REDFISH RETURNED BY 30 DAY PERIODS.

DAYS	NUMBER RECAPTURED	PERCENTAGE RECAPTURED	Log ₁₀ RECAPTURES (see Figure 2)
1- 30	83	55.7%	1.919
31- 60	28	18.8%	1.447
61- 90	20	13.4%	1.301
91-120	9	6.0%	0.954
121-150	6	4.0%	0.778
151-180	1	0.7%	0.000
181-210	2	1.3%	0.301
TOTAL	149	100.0%	

NOTE: The above total does not include one fish for which the recapture date was not recorded.

TABLE VI.

TEN RECAPTURED REDFISH SHOWING THE GREATEST
AMOUNT OF LENGTH INCREMENT (MM.).

RELEASE		NO. DAYS		LENGTH
DATE	TL	FREE		INCREMENT
				TL
4/XII/60	380	106		34
7/XII/60	358	176		97
*7/XII/60	373	186		115
18/XII/60	233	137		123
18/XII/60	351	139		56
19/XII/60	356	139		39
19/XII/60	302	89		42
31/XII/60	350	89		47
1/ I/61	385	58		40
1/ 1/61	343	140		49

* Late recovery (Recovered June 10, 1961).

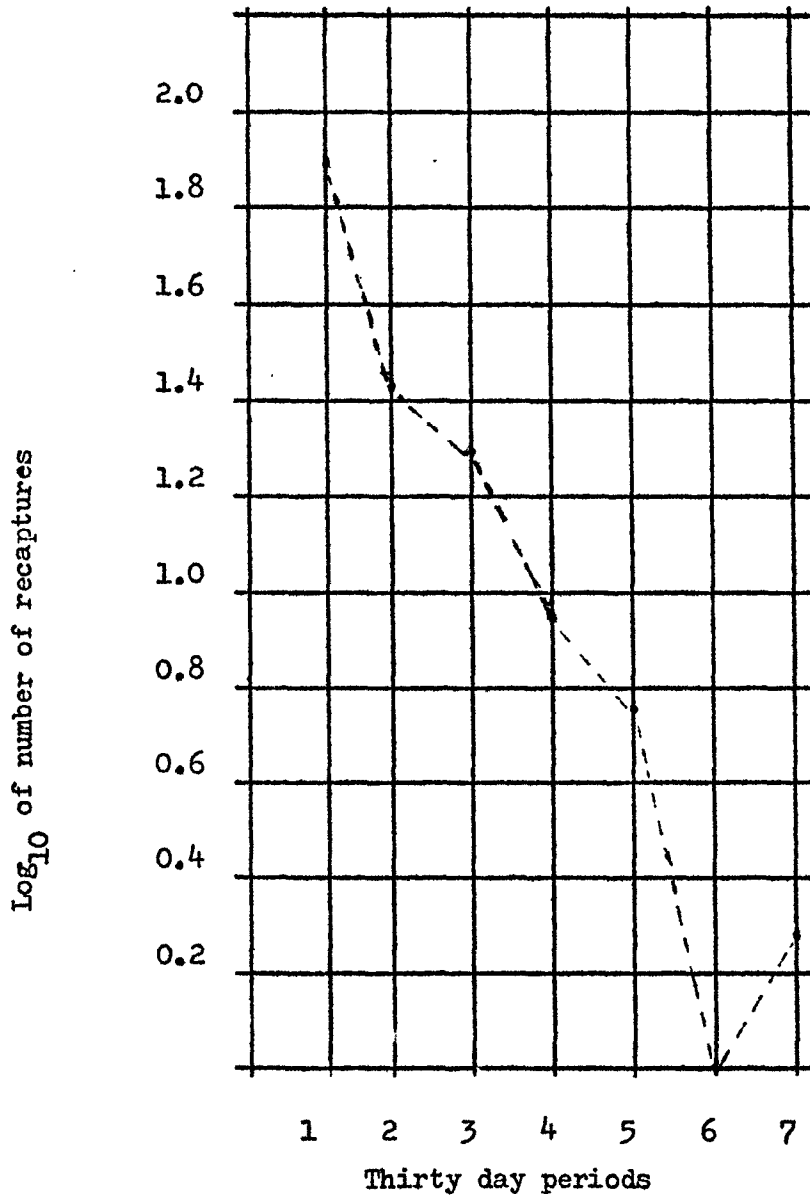


FIGURE 2. NUMBERS OF RECAPTURED REDFISH
BY THIRTY DAY PERIODS.

(see Table V for actual values)

SHEEPSHEAD, Archosargus probatocephalus (Walbaum)

A total of 55 sheepshead were tagged in Zone I from December 6, 1960, through December 31, 1960. Eighteen fish were recaptured from December 27, 1960, through August 27, 1961, showing a recovery rate of 32.7%. Sheepshead were released in five counties in Zone I. The number of fish tagged and recaptured by county is shown in Table VII.

Only one of the recaptured fish traveled more than 20 miles. This fish, released at Punta Gorda in Charlotte County on December 21, 1960, was recovered at Pine Island in Lee County on January 8, 1961. This rather large individual (total length: 430 mm. at release) traveled 25 miles in 19 days, covering an average distance of 1.32 miles per day.

The longest period that a fish was free was 250 days. This fish was released at the North Jetty in Nokomis (Sarasota County) on December 21, 1960, and recaptured on August 27, 1961, at Siesta Key, Sarasota County, less than ten miles from the point of release. The remaining 16 fish (88.4%) were recaptured within five miles of the point of release.

Table VIII and Figure 3 show the returns by 30 day periods. Here the straight line relationship is not shown when plotting the 30 day periods against the logarithms of the returns. However, the proper relationship becomes evident in the other Zones, where sufficient data is available.

Of the 18 fish recaptured 11 showed a length increment, two showed a length shrinkage and data was not available on the remaining five specimens. Of the two specimens showing a length shrinkage one was free for 30 days and the other 19 days. Table IX lists the 11 specimens with a length increment.

TABLE VII.

NUMBERS OF SHEEPSHEAD RETURNED BY COUNTY

COUNTY	NUMBER TAGGED	NUMBER RECAPTURED	PERCENTAGE
Hernando	0	0	00.0%
Pasco	0	0	00.0%
Pinellas	9	5	55.6%
Hillsborough	12	2	16.7%
Manatee	0	0	00.0%
Sarasota	9	5	55.6%
Charlotte	4	1	25.0%
Lee	0	0	00.0%
Collier	21	5	23.8%
TOTAL	55	18	32.7%

TABLE VIII.

NUMBERS OF SHEEPSHEAD RETURNED BY THIRTY DAY PERIODS

DAYS	NUMBER RECAPTURED	PERCENTAGE RECAPTURED	Log_{10} RECAPTURES (see Figure 3)
1- 30	3	16.7%	0.477
31- 60	2	11.1%	0.301
61- 90	7	38.9%	0.845
91-120	2	11.1%	0.301
121-150	2	11.1%	0.301
151-over	2	11.1%	0.301
TOTAL	18	100.0%	

TABLE IX.

ELEVEN SHEEPSHEAD SHOWING A LENGTH INCREMENT (MM.).

RELEASE		NO. DAYS FREE	LENGTH
DATE	TL		INCREMENT TL
6/XII/60	186	130	45
11/XII/60	251	31	32
9/XII/60	258	73	36
9/XII/60	177	111	55
19/XII/60	266	73	27
21/XII/60	285	7	16
30/XII/60	259	69	18
31/XII/60	250	62	27
31/XII/60	233	72	18
31/XII/60	234	66	9
31/XII/60	225	59	47

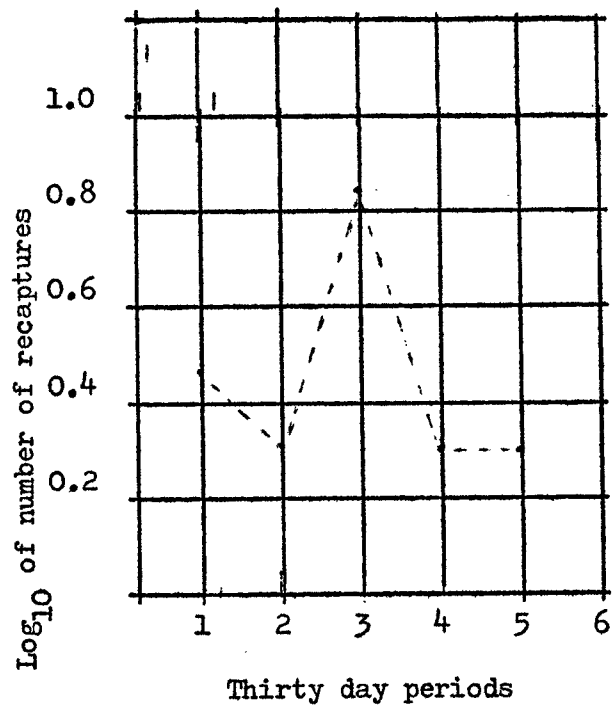


FIGURE 3. NUMBERS OF RECAPTURED SHEEPSHEAD
BY THIRTY DAY PERIODS.
(see Table VII for actual values)

BLACK OR STRIPED MULLET, Mugil cephalus Linn.

Black mullet were tagged and released in Zone I from December 6, 1960, through December 19, 1960. Thirty of 75 fish were recovered (40.0%) from December 16, 1960, through April 15, 1961. There was a discrepancy between the release and recapture identity of one tagged specimen. This specimen was not considered in the compilation of data. The numbers of returns by county in Zone I are shown in Table X.

The greatest distance traveled was approximately 23 miles by a fish released on December 11, 1961, at Sand Key in Boca Ciega Bay, Pinellas County, and recaptured on February 16, 1961, south of Gandy Bridge in Pinellas County. This fish was caught 68 days after release, and traveled an average distance of 0.34 miles per day. The longest period of time that a fish was free was 122 days. It was recaptured less than five miles from the point of release.

64.3% of the mullet were recaptured less than five miles from the point of release, and 96.4% were recaptured less than 20 miles from the point of release. One tag from a black mullet was found entangled in a net. This tag was deducted from the total number of fish tagged. It was not considered in the compilation of data.

Table XI and Figure 4 show the returns by 30 day periods.

Of 30 recaptured black mullet 22 showed a length increment, seven a length shrinkage and data was not available for one specimen. Eleven specimens free for more than 61 days all showed a length increment. These 11 specimens and their respective length increments are shown in Table XII.

TABLE X.
NUMBERS OF MULLET RETURNED BY COUNTY.

COUNTY	NUMBER TAGGED	NUMBER RECAPTURED	PERCENTAGE
Hernando	0	0	00.0%
Pasco	0	0	00.0%
Pinellas	41	13	31.7%
*Hillsborough	2	2	100.0%
Manatee	0	0	00.0%
Sarasota	4	1	25.0%
Charlotte	0	0	00.0%
Lee	28	14	50.0%
TOTAL	75	30	40.0%

* Does not include one tag found entangled in net.

TABLE XI.

NUMBERS OF MULLET RETURNED BY THIRTY DAY PERIODS.

DAYS	NUMBER RECAPTURED	PERCENTAGE RECAPTURED	Log ₁₀ RECAPTURES (see Figure 4)
1- 30	11	36.7%	1.041
31- 60	6	20.0%	0.778
61- 90	9	30.0%	0.954
91-120	3	10.0%	0.447
121-150	1	3.3%	0.000
TOTAL	30	100.0%	

TABLE XII.

LENGTH INCREMENTS (MM.) OF ELVEN BLACK MULLET FREE
FOR MORE THAN 61 DAYS

RELEASE		NO. DAYS FREE	LENGTH INCREMENT TL
DATE	TL		
6/XII/60	387	90	29
6/XII/60	410	111	33
6/XII/60	343	65	22
9/XII/60	371	111	54
9/XII/60	362	68	27
11/XII/60	370	79	17
11/XII/60	366	68	28
11/XII/60	390	81	42
16/XII/60	284	64	24
16/XII/60	305	113	46
16/XII/60	274	122	43

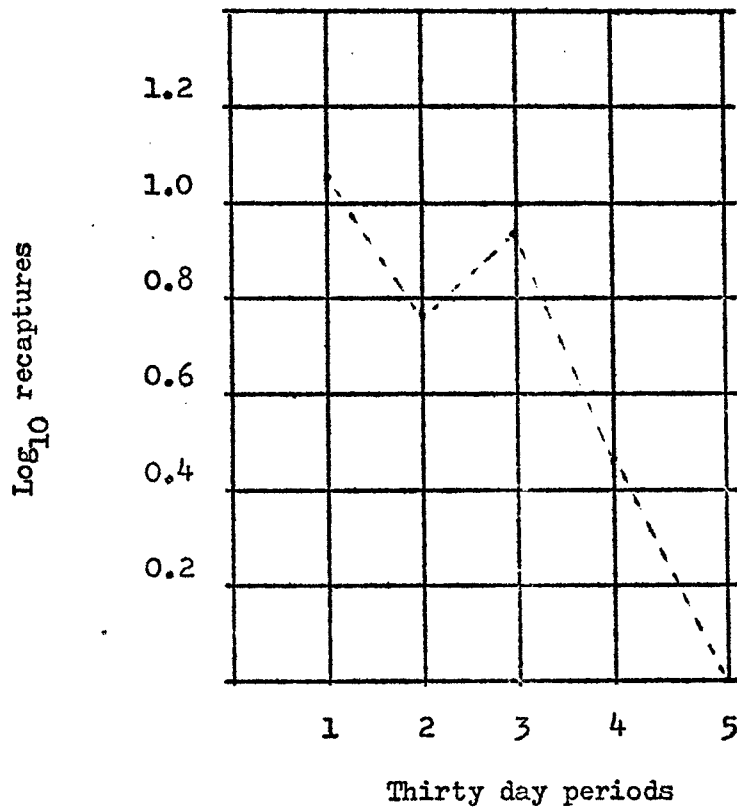


FIGURE 4. NUMBERS OF RECAPTURED BLACK
MULLET BY THIRTY DAY PERIODS.
(see Table IX for actual values.)

MISCELLANEOUS SPECIES

Table XIII lists a number of miscellaneous species of which less than 25 specimens of each species were tagged and released.

Seven of 22 (31.8%) tagged grey snapper, Lutjanus griseus (L.), were recaptured between 15 and 53 days from the release date. There was a discrepancy between the release and recapture identity of one tagged specimen. This specimen was not considered in the compilation of data. Only one of the eight recaptured specimens was caught more than five miles from the release site. This one specimen traveled from Naples Beach to Wiggins Pass a distance of less than ten miles. Seven of the eight recaptured fish showed an average length increment of 11.7 mm. while one specimen free for 15 days exhibited length shrinkage.

One flounder, Paralichthys albiguttus Jordan & Gilbert, free for 69 days was recaptured less than five miles from release. It exhibited a length increment of 10 mm.

One southern sea bass, Centropristes melanus (Ginsburg), free for 57 days was caught about 26 miles from the release site. This specimen showed a length increment of 2 mm.

One sea drum, Pogonias cromis (L.), released in Collier County was free for 26 days and was recaptured less than five miles from the release site. One specimen released in Pasco County and free for 21 days was recaptured less than ten miles from the release site. Both specimens showed a length shrinkage.

One sea catfish, Galeichthys felis (L.), released at New Pass, Sarasota County, and recaptured less than ten miles away in Sarasota Bay 78 days later. Another specimen was free for 81 days before recapture. The exact recapture location was not available. The specimens free for 78 and 81 days showed a length increment of 31 mm. and 36 mm. respectively.

TABLE XIII. DATA FOR MISCELLANEOUS SPECIES

SPECIES	NUMBER TAGGED	NUMBER RETURNED	%	MEAN DISTANCE TRAVELED	MEAN NO. DAYS FREE
Grey Snapper (<u>Lutjanus griseus</u> (L.))	22	7	31.8%	6	33.9
Flounder (<u>Paralichthys albiguttus</u> Jordan & Gilbert)	13	1	7.7%	5	69.0
Sea Bass (<u>Centropristes melanus</u> (Ginsburg))	24	1	4.2%	26	57.0
Sea Drum (<u>Pogonias cromis</u> (L.))	2	2	100.0%	8	23.5
Sea Catfish (<u>Galeichthys felis</u> (L.))	6	2	33.3%	10	79.5
Southern Kingfish (<u>Menticirrhus americanus</u> (L.) <u>sp. inq.</u>)	4	0	00.0%	--	----
Snook (<u>Centropomus undecimalis</u> (Bloch <u>sp. inq.</u>)	3	0	00.0%	--	----
Spadefish (<u>Chaetodipterus faber</u> (Broussonet))	5	0	00.0%	--	----
Silver Mullet (<u>Mugil</u> sp.)	4	0	00.0%	--	----

DISCUSSION

All fishes returned to the Laboratory were identified to species. In Zone I Laboratory identifications differed in three cases from the field identifications. It does not seem likely that the field identifications were in error since the fishes involved (mullet, sheepshead, redfish, snapper) are well-known species, but rather that one of the following two things occurred:

1. There was a recording error, or
2. There was an exchange of tags. To be eligible for a cash award the fish was to be returned with tag attached. Since in at least two cases tags alone were found entangled in nets, it is conceivable that additional tags were found and subsequently attached to fishes.

Even if one included the three cases mentioned above as misidentifications resulting in a 0.9 per cent error of the fishes returned, the data presented here would not be appreciably changed.

Because of the \$1000 bonus award for turning in the first fish captured after midnight December 31, 1960, it has been suggested that some fishes were caught in December and turned in on January 1. Also, it is possible that some fishes caught in December may have been turned in after December 31, 1961, so as to be eligible for awards higher than the \$25 paid for fishes returned in December. With this in mind we analyzed the returns of fishes released after the last day of December, 1960 (see Table XIV). Of 88 fishes tagged after December none were returned within ten days and only one was returned within 14 days of release. In general this is in agreement with the returns of fishes tagged and released in December, 1960.

TABLE XIV.

DATA ON FISHES RELEASED AFTER DECEMBER 31, 1960.

DATE RELEASED	NUMBER RELEASED	SPECIES	NO. DAYS FREE	TOTAL NUMBER RECAPTURED
January 1, 1961	27	Redfish	80)	6
			140)	
			18)	
			58)	
			88)	
109)				
	4	Sheepshead		
	1	Snook		
January 3, 1961	14	Seatrout	13	1
	3	Redfish		
	2	Mangrove Snapper	16	1
January 4, 1961	37	Seatrout	21)	4
			44)	
			68)	
			57)	
TOTAL	88			12

One of the rules of the Schlitz contest was that to be eligible for a cash award all fishes, with the exception of mullets, were to be caught by hook and line. It is very likely that there was some falsification of data concerning the method of capture. However, because of the nature of the program, method of capture was not considered vitally important in our studies on growth, movement and mortality, except where the falsification of data may have been extended beyond the method of capture.

Movement:

Tagged spotted seatrout recaptured in Zone I showed little evidence of movement with more than 98% of the fish traveling less than 20 miles from the release site. This tends to substantiate the findings of Moffett (1961) and Iversen and Moffett (1961), who gave evidence that spotted seatrout populations in west Florida do not migrate great distances although, in some cases, a few fish did move long distances.

Over 96% of the black mullet recaptured were less than 20 miles from the release site. This is in agreement with the findings of Broadhead (1953), Broadhead and Mefford (1956) and Idyll and Sutton (1952). They found that most of the tagged black mullet did not travel far, usually less than 20 miles.

This study indicates that redfish, sheepshead and grey snapper, like the spotted seatrout and the black mullet, do not, with the exception of a few individuals, normally travel great distances. The only recaptured sheepshead which traveled over 10 miles was a specimen originally taken in the Gulf of Mexico and transported to brackish water at Punta Gorda. One possibility for its greater distance traveled, as compared with other recaptured specimens, was that it preferred high salinity waters.

At the time of this writing there was insufficient evidence to draw even tentative conclusions on movements of several other tagged species released in small numbers during this program

Additional data on movement of fishes in Zone I is anticipated with the return of fishes free for relatively long periods of time.

Fishing Mortality:

The following factors probably had an effect on the assessment of fishing mortality:

1. High rewards (\$25 minimum to a possible maximum of \$10,000 per tagged fish).
2. Extensive publicity.
3. Tagged-fish releases were made in areas of heavy fishing pressure.
4. Only the larger fish of a species were tagged.

Table XV summarizes that data on returns for each of the major species tagged.

In the Schlitz program 81 spotted seatrout were tagged in the Pine Island area and at the end of about four months approximately 38.4% of these were returned. Iversen and Moffett (op. cit.) estimate the abundance and mortality of a spotted seatrout population. They reported 5,409 fish tagged and released in the vicinity of Pine Island (Ft. Myers) during the period January 6 through 20, 1961. Recovery rate was 23.1 per cent from January 21 through May 31, 1961, a period of slightly over four months. Evidence is available that not all tagged spotted seatrout recaptured in the study by Iversen and Moffett (op. cit.) were reported to them. This was mainly because of the low reward (\$ 0.75) offered. A Quarterly Report (July 1 - September 30, 1961) from The Marine Laboratory, University of Miami, to the State Board of Conservation, stated that 28 per cent of the tags from the Pine Island area were returned by September 30, 1961. Likewise, because of reasons previously mentioned the Schlitz program probably increased temporarily the number of people fishing.

Thus, we have two tagged fish studies. One with a high monetary return and heavy publicity, the other with more nominal rewards and only the usual public awareness. Returns of 38.4% and 28.0% respectively were noted for these two programs. Using the lower return in mathematical calculations fishing mortality was estimated (Iversen and Moffett, 1961). It appears that a higher return figure and concomitantly higher fishing mortality may now be estimated.

These results are to receive more detailed evaluation.

The rate of recovery of black mullet in Zone I (40.0% in about four months) far exceeds the rate obtained in the tagging program reported by Broadhead and Mefford (op. cit.) in which a State-wide recovery of 22.8% during a five-year period was reported. However, these same workers reported a 37.0 percentage recovery in the Panama City area.

The most amazing rate of recovery in Zone I of the Schlitz program was that of the redfish. 55.6 per cent of the tagged redfish were returned in approximately 6-1/4 months.

Taking into account all species tagged in this program the rate of recovery by October 1, 1961, was approximately 33 per cent.

TABLE XV.

SUMMARY OF DATA ON RETURNS OF CERTAIN SPECIES.

	NUMBER RELEASED	NUMBER RETURNED	% RETURN	MAX. NO. OF MONTHS FREE
Spotted Seatrout	513	119	23.2	8
Redfish	270	150	55.6	6 1/2
Mullet	75	30	40.0	4
Sheepshead	55	18	32.7	8
Snapper	22	7	31.8	2

Growth:

Only general observations on growth have been included in this report. Growth will be discussed more fully in a later report. Several important factors influencing observations on growth in this program were:

1. Because of the nature of the contest only the larger fish of a particular species were tagged. (Scales samples were not used in growth studies).

2. In Zone I fishes turned in as having been caught on January 1 should not be considered since there is evidence that some of these fishes were caught prior to January 1. The reason for turning them in on January 1 was to collect the \$1000 bonus award for turning in the first tagged fish after the "official" opening of the contest.

3. Length shrinkage. Randall (1961) lists five sources which contribute to variations in a series of measurements:

- (a) Error in initial measurements.
- (b) Error in recapture measurement.
- (c) Shrinkage due to starvation.
- (d) Growth.
- (e) Variation in shrinkage after death.

(a) and (b) constituted valid sources of variation throughout the Schlitz program. Human error can cause variations in successive measurements of the same fish by the same person. Larger differences are obtained when the successive measurements are made by different persons, as was sometimes unavoidably the case for the release-recapture measurements in this program.

Variation in shrinkage after death probably accounted for most of the shrinkages observed in the Schlitz Tagging Program. Several observers have reported that a definite shrinkage does occur due to desiccation, icing, or freezing. Randall (op. cit.) measured 17 convict surgeonfish following partial drying and/or freezing. These fish were all 1-7 mm. shorter than when first measured. In a

marking experiment with Yellowtail Flounders, Lux (1960) measured recaptured fish in a landed condition. He noted a mean shrinkage of 1.16% for fish caught two weeks after release. In an experiment to show these effects more directly, Lux (op. cit.) measured 72 live Yellowtail Flounders, then froze and remeasured the fish. All fish were shorter at the second measurement, with the mean shrinkage being 1.47% of the total length. Similar results were obtained by Moffett (1959), who showed the mean shrinkage of seatrout (Cynoscion nebulosus) after preservation on ice was 2 mm. (0.61%) and the shrinkage after freezing was 5 mm. (1.53%). In Zone II of the Schlitz Tagging Program (preliminary analysis) total mean shrinkage for barracuda was 8.51 mm. (1.35%). A much higher value was shown (1.92%) for fish recaptured within 30 days of the time of release.

Another important source of variation in measurement was not considered by Randall (op. cit.). This was damage to fish. Damaged fish should be eliminated from consideration in growth studies.

Improvements in the 1961-1962 Tagging Program:

As was previously mentioned the 1960-61 tagging program was considered to be that of a pilot program because there was little time available for adequate planning before tagging started. With the cooperation of the sponsor several modifications and improvements have been scheduled for the 1961-62 program, through which more meaningful data may be obtained. It is hoped that these improvements will facilitate the valid assessment of several parameters in the forthcoming program. The following modifications have been introduced this year:

1. The employment of a single team (a biologist and an assistant) to handle the tagging program should eliminate any gross discrepancies from the data, and provide more accurate length measurements.
2. Since there was an indication during last year's tagging that some fish may have been held for several days in order to collect the \$1000 first-fish-award, this award has been eliminated from the 1961-62 program.

3. Some tagged fish undoubtedly will be caught prior to the official opening of the contest on January 1, 1962. In the 1960-61 contest these fish were worth \$25 to the catcher; this year the fish will be worth the full reward regardless of the early capture date.
4. Experimental work (length shrinkage studies, mortality experiments with tagged and untagged fishes, etc.) will be conducted.
5. A higher number of fishes will be tagged.

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II NOTES ON TAGGING SALT WATER FISHES IN SOUTH FLORIDA

(ZONE II)

INTRODUCTION

The tagging of salt water fish in South Florida commenced in January 1961. The program, sponsored by the Jos. Schlitz Brewing Company, was organized as described in the first part of this report. The reader is referred to that section for details concerning the sponsorship, publicity, supervision, methods and materials.

The purpose of this section of the paper is to report the results to date (December 1, 1961) of the 1960-61 fish tagging program conducted in Zone II. As in Zone I, certain tentative suggestions and conclusions have been made regarding the nature of the results. One must bear in mind, however, that these conclusions are based on the results of only one season of tagging. It is quite probable that the forthcoming program will confirm and strengthen some of these conclusions, and disprove and invalidate others.

TAGGING IN ZONE II

Zone II extends from Everglades City to the northern Indian River County Line. This excludes Everglades National Park, since park service policy prohibited the tagging of fishes in that area.

A total of 999 fishes were tagged in Zone II from January 8, 1961 through January 31, 1961. This figure does not include one fish in which an apparent discrepancy had occurred in the release-recapture data. Tagged fishes were recovered from January 14, 1961 through September 9, 1961.

RESULTS BY SPECIES

SPOTTED SEATROUT, Cynoscion nebulosus (Cuvier):

A total of 74 seatrout were released in five of the eight counties of Zone II from January 8, 1961 through January 28, 1961. Eleven of these tagged fish were returned (14.9%) from February 18, 1961 through August 10, 1961. The numbers of this species tagged and recaptured in Zone II by county are listed in Table XVI.

As in the other zones, little tendency was shown for movement of long distances. 77.8% of the recaptured seatrout in Zone II were recovered less than five miles from the point of release, with only one fish travelling a distance of twenty miles. This fish was released in Manatee Bay in Monroe County on January 28, 1961, and recaptured at Goulds Canal on March 30, 1961. The distance was travelled in 62 days, with an average speed of 0.32 miles per day.

Only two seatrout were recaptured (18.2%) in Zone II within thirty days of release, whereas in Zone I 42 of the 119 fish (35.3%) were recovered within thirty days. No fish were returned in Zone II until 27 days of freedom had elapsed.

The longest period of time that a seatrout was free was 212 days. This fish was recaptured 1 1/2 miles from the point of release. It was the only seatrout in which a substantial length increment was shown. Table XVII shows the length changes of the eight fish for which data is available.

TABLE XVI
SEATROUT TAGGED AND RECAPTURED IN ZONE II

COUNTY	NUMBER TAGGED	NUMBER RECAPTURED	PERCENTAGE
Indian River	2	0	00.0
St. Lucie	25	4	16.0
Martin	0	0	00.0
Palm Beach	0	0	00.0
Broward	1	0	00.0
Dade	22	5	22.7
Monroe	31	2	6.5
Collier	0	0	00.0
TOTAL	74	11	14.9

TABLE XVII

EIGHT RECAPTURED SEATROUT SHOWING CHANGES IN LENGTH (MM.)

DATE	RELEASE		NO. DAYS FREE	CHANGE IN LENGTH	
	SL	TL		SL	TL
22/1/61	302	357	28	-9	-11
22/1/61	303	356	28	-5	-10
22/1/61	257	305	109	-4	-7
28/1/61	355	413	62	-4	-1
11/1/61	315	371	40	-3	1
13/1/61	354	417	96	6	-
10/1/61	356	419	-	9	8
11/1/61	289	343	212	52	56

MANGROVE SNAPPER, Lutianus griseus (Linn.):

Over half the fishes tagged in Zone II were mangrove snappers. 532 snappers were tagged from January 8, 1961 through January 31, 1961. 121 of these were recaptured (22.7%) from January 30, 1961 through April 29, 1961. The numbers of this species tagged and recaptured by county are listed in Table XVIII.

The greatest distance travelled was only twenty miles, by a fish released at Port Everglades in Ft. Lauderdale (Broward Co.) on January 24, 1961 and recaptured at MacArthur Causeway in Miami (Dade County) on March 1, 1961, 37 days after release. The mangrove snapper travelled an average distance of 0.54 miles per day. This is the only instance in which a fish travelled more than ten miles. 97.5% of the recovered fish were captured less than five miles from the point of release. The longest period of time that a fish was free was 101 days.

In one instance there was a discrepancy in the release-recapture identity of a specimen released as a snapper. This individual is not included in the total number of released fish.

More than two-thirds of the snappers were recovered between 16 and 45 days of release (30 days). See Tables XIX, XX, and Figure XXI for returns by five and thirty day periods.

Most of the length changes were increases, with an average increment of 7.5 mm. Among the 61 fish with available length data twelve shrinkages were noted. Table XXII lists the ten specimens showing the greatest amount of length increment (mm.).

TABLE XVIII
SNAPPER TAGGED AND RECAPTURED IN ZONE II

COUNTY	NUMBER TAGGED	NUMBER RECAPTURED	PERCENTAGE
Indian River	54	10	18.5
St. Lucie	0	0	00.0
Martin	15	4	26.7
Palm Beach	82	31	37.8
Broward	64	17	26.6
Dade	121	42	34.7
Monroe	196	17	8.7
Collier	0	0	00.0
TOTAL	532	121	22.7

TABLE XIX

Mangrove Snapper (Lutianus griseus, Linn.)

Returns by five day periods.

DAYS	NUMBER RECAPTURED	%	DAYS	NUMBER RECAPTURED	%
1- 5	1	0.8	56-60	2	1.7
6-10	8	6.7	61-65	2	1.7
11-15	7	5.9	66-70	3	2.5
16-20	12	10.1	71-75	1	0.8
21-25	16	13.4	76-80	1	0.8
26-30	16	13.4	81-85	1	0.8
31-35	12	10.1	86-90	0	0.0
36-40	15	12.6	91-95	1	0.8
41-45	12	10.1	96-100	1	0.8
46-50	4	3.4	101-105	1	0.8
51-55	3	2.5	Total	119	100.0

TABLE XX

Returns by thirty day periods

DAYS	NUMBER RECAPTURED	%
0-30	60	50.4
31-60	48	40.3
61-90	8	6.7
91-120	3	2.5
Total	119	100.0

FIGURE XXI Mangrove Snapper (*Lutianus griseus*, Linn.)
Returns by five day periods

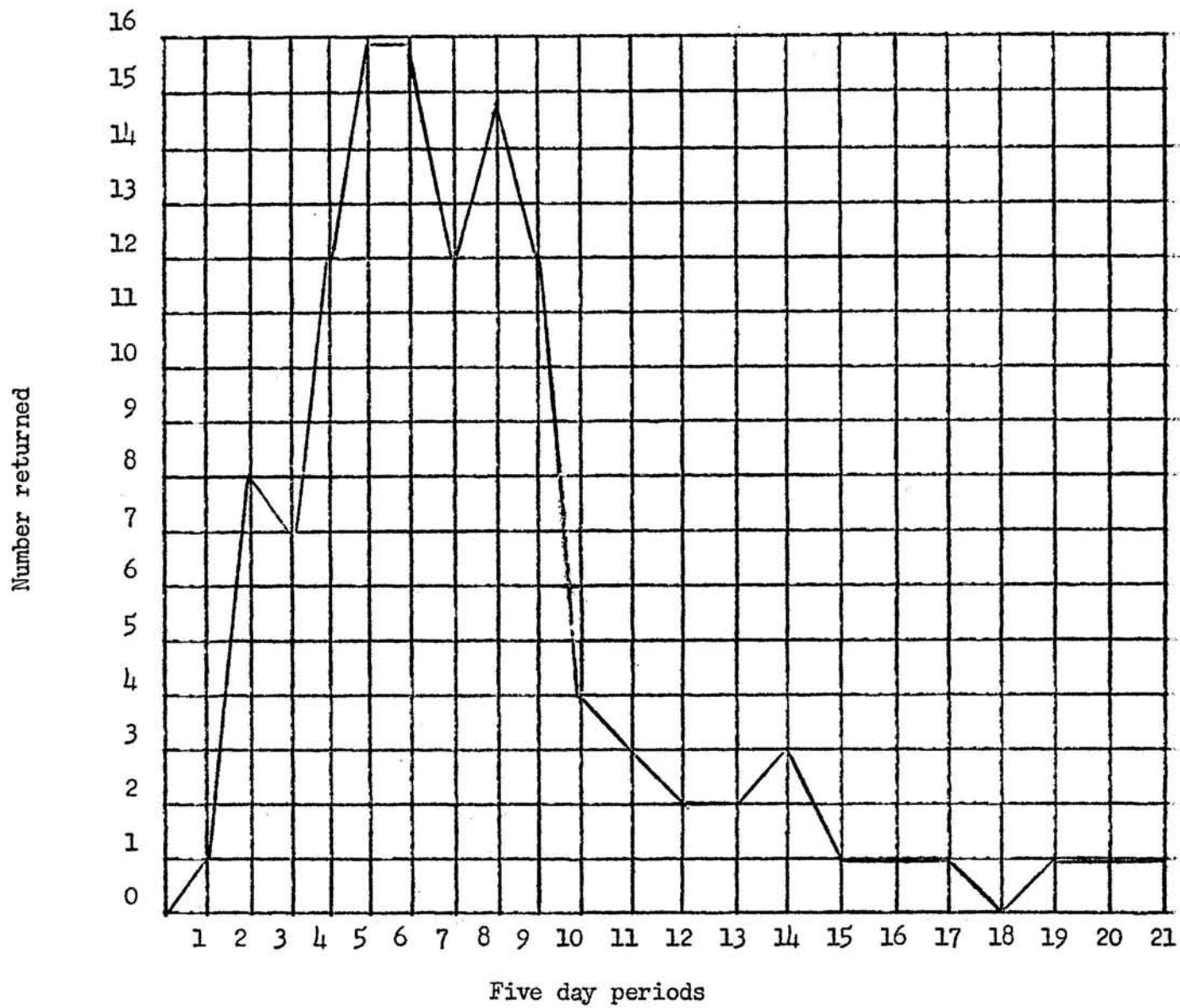


TABLE XXII
 TEN RECAPTURED SNAPPERS SHOWING THE GREATEST
 LENGTH INCREMENT (MM.)

RELEASE		NO. DAYS FREE	LENGTH
DATE	TL		INCREMENT TL
31/1/61	187	48	13
22/1/61	255	34	13
24/1/61	192	38	13
24/1/61	279	40	14
15/1/61	255	26	15
14/1/61	304	19	17
15/1/61	255	94	28
28/1/61	206	54	31
15/1/61	186	-	36
15/1/61	192	-	60

GREAT BARRACUDA, Sphyraena barracuda (Shaw):

A total of 202 barracuda were tagged in Zone II. Two of these individuals were tagged at Snapper Point on Goulds Canal (Dade County) on January 8, 1961, and one was tagged at the same location on January 23, 1961. None of these three individuals was recaptured. The remaining 199 fish were tagged in Monroe County from January 31, 1961 through February 15, 1961, the majority being released in the vicinity of Key Largo. Tagged fish were caught from February 13, 1961 through July 7, 1961. 31 of the 202 tagged fish were recaptured during this time, with a recovery rate of 15.6%.

The greatest distance travelled was 32 miles, by a fish released on February 12, 1961 and recaptured on May 20, 1961, 98 days later. This fish travelled an average distance of 0.32 miles per day. The longest period of time that a fish was free was 157 days. It was recaptured less than ten miles from the point of release. Table XXIII shows the returns by 30 day periods.

Only two fish (6.5%) travelled a net distance greater than 10 miles. 77.4% of the recovered barracuda were captured less than five miles from the point of release.

Measurements were recorded for 27 of the 31 recaptured barracudas. An increase in length took place in five fish, whereas 22 of the 27 fish showed a decrease. Table XXIV shows the changes in length for the recaptured fish.

TABLE XXIII

NUMBERS OF BARRACUDAS RETURNED BY 30 DAY PERIODS

DAYS	NUMBER RECAPTURED	PERCENTAGE
0-30	8	25.8
31-60	12	38.7
61-90	4	12.9
91-120	5	16.1
121-150	1	3.2
151-180	1	3.2
TOTAL	31	100.0

TABLE XXIV

CHANGES IN LENGTH OF RECAPTURED BARRACUDA

RELEASE TL (MM.)	NO. DAYS FREE	GROWTH (MM.)
593	115	33
842	130	28
657	110	13
520	111	10
542	85	05
401	56	-01
392	50	-02
644	29	-04
507	97	-04
542	85	-05
585	45	-09
380	6	-09
695	24	-10
715	12	-10
706	35	-11
526	32	-11
498	50	-13
470	21	-13
750	75	-14
742	14	-16
761	13	-16
730	39	-17
811	81	-19
732	19	-21
886	54	-33
920	38	-38
696	98	-44

Mean Length at Release 632 mm.

Mean Shrinkage 8.51 mm.

Standard Deviation 17.0 mm.

Percent Shrinkage 1.35%

SHEEPSHEAD, Archosargus probatocephalus (Walbaum):

69 sheepshead were tagged in Zone II from January 10, 1961 through January 19, 1961. In addition, one fish was tagged on January 28, 1961, making a total of 70 sheepshead released in Zone II. Tagged fish were caught from January 14, 1961, through September 9, 1961. 27 of the released fish (38.6%) were recovered. The numbers of sheepshead tagged and recaptured by county are listed in Table XXV.

The greatest distance travelled was 13 miles, by a fish released in the St. Lucie River in Martin County on January 16, 1961 and recaptured at Jensen Beach in Martin County on February 1, 1961. The distance was travelled in 17 days, with an average speed of 0.76 miles per day. The longest period of time that a sheepshead was free was 243 days. This fish was recaptured less than five miles from the point of release.

No tendency was shown for the movement of long distances. 84.5% of the recaptured fish travelled less than 10 miles and 80.8% of the fish showed a movement of less than five miles. These results are in keeping with those obtained in other zones.

12 of the 26 sheepshead (45.2%) were recaptured within 30 days of release. Table XXVI and Figure XXVII show the returns by 30 day periods.

Of the 27 recaptured sheepshead 13 showed a length increment, three showed a decrement, and data was not available for 11 specimens. Table XXVIII shows the 16 sheepshead for which data is available, along with their respective changes in length.

TABLE XXV
SHEEPSHEAD TAGGED AND RECAPTURED
ZONE II

COUNTY	NUMBER TAGGED	NUMBER RECAPTURED	PERCENTAGE
Indian River	27	6	22.2
St. Lucie	18	14	77.8
Martin	11	7	63.6
Palm Beach	13	0	00.0
Broward	0	0	00.0
Dade	0	0	00.0
Monroe	1	0	00.0
Collier	0	0	00.0
TOTAL	70	27	38.6

TABLE XXVI

NUMBERS OF SHEEPSHEAD RETURNED BY THIRTY DAY PERIODS

DAYS	NUMBER RECAPTURED	PERCENTAGE RECAPTURED	Log_{10} RECAPTURES (see Figure XXVII)
0-30	12	46.2	1.079
31-60	5	19.2	0.699
61-90	2	7.7	0.301
91-120	3	11.5	0.477
121-150	1	3.8	0.000
151-180	0	0.0	-
181-210	1	3.8	0.000
211-240	1	3.8	0.000
241-over	1	3.8	0.000
TOTAL	26	100.0	

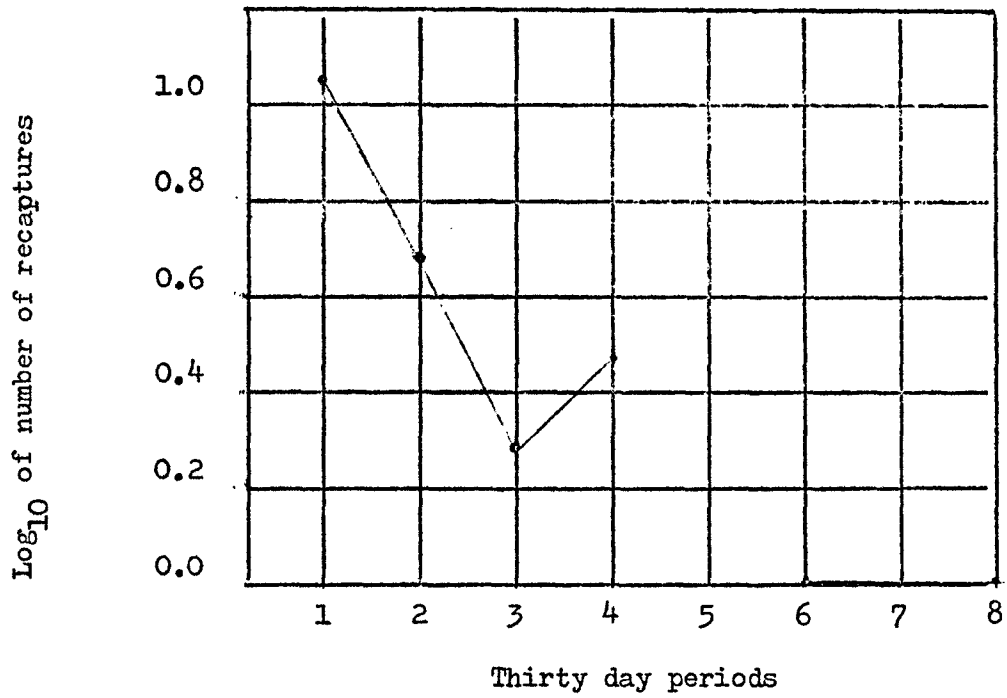


FIGURE XXVII NUMBER OF RECAPTURED SHEEPSHEAD BY
THIRTY DAY PERIODS
(see Table XXVI for actual values)

TABLE XXVIII

SIXTEEN RECAPTURED SHEEPSHEAD SHOWING
 AMOUNT OF CHANGE IN TOTAL LENGTH (MM.)

RELEASE		NO. DAYS	LENGTH
DATE	TL	FREE	CHANGE
11/1/61	245	17	55
14/1/61	250	61	25
14/1/61	258	52	25
10/1/61	264	22	25
16/1/61	272	55	22
11/1/61	241	16	20
10/1/61	274	6	16
10/1/61	250	5	15
10/1/61	238	32	14
11/1/61	202	22	9
13/1/61	203	47	8
13/1/61	226	203	4
10/1/61	241	243	2
11/1/61	263	240	-1
11/1/61	202	15	-5
16/1/61	236	17	-8

MISCELLANEOUS SPECIES.

Table XXIX lists a number of miscellaneous species of which less than 26 specimens of each species were tagged and released.

Five of the 26 tagged black mullet, Mugil cephalus (L.) were recaptured (19.2%) between 7 and 47 days from the release date. None of the recaptured mullet were caught more than five miles from the release site. Three of the recaptured fish showed increments of 16, 23, and 28 mm. One specimen, at large only seven days, showed a shrinkage of 10 mm. Data was not available for the remaining specimen.

Six of the eighteen tagged redfish Sciaenops ocellatus (L.), were recaptured (33.3%) between 21 and 76 days from the release date. None of the recaptured redfish were caught more than five miles from the release site. The three recaptured fish for which data was available showed an average increment of 19 mm.

Ten of the 17 tagged sea drum, Pogonia^s cromis (L.) were recaptured (58.8%) between 3 and 125 days from the release date. Only one of the recaptured sea drums was caught more than five miles from the point of release. This one specimen travelled fourteen miles from Vero Beach to Fort Pierce in 88 days, averaging 0.16 miles per day. The change in length of the recaptured sea drum ranged from -18 mm. to 20 mm., with an average length change of +0.3 mm.

Two snook, Centropomus undecimalis (Bloch), free for 62 and 63 days, were both caught less than five miles from the release site. One specimen showed a length increment of 6 mm. Growth data was not available for the other.

Two whiting, Menticirrhus americanus (L.), were tagged at Fort Pierce. Both fish were recaptured. Recapture data (measurements and location) were not available for one specimen which was free for 69 days. The other, free for 7 days, showed a shrinkage of 14 mm. This specimen was caught less than five miles from the release site.

One red grouper, Epenephelus morio (Cuv. & Val.), free for 60 days, was recaptured less than five miles from the release site. It exhibited a shrinkage of 2 mm.

One sea catfish, Galeichthys felis (L.) was returned in Zone II. However, a discrepancy was involved in the release-recapture identities and this specimen was not considered in the compilation of data.

TABLE XXIX. DATA FOR MISCELLANEOUS SPECIES IN ZONE II

SPECIES	NUMBER TAGGED	NUMBER RETURNED	%	MEAN DISTANCE TRAVELLED	MEAN NO. DAYS FREE
Snook <u>Centropomus undecimalis</u> (L.) <u>sp. inq.</u>	24	2	8.3	<5	62.5
Black Mullet <u>Mugil cephalus</u> (L.)	26	5	19.2	<5	21.4
Redfish <u>Sciaenops ocelatus</u> (L.)	18	6	33.3	<5	53.8
Sea Drum <u>Pogonia^S cromis</u> (L.)	17	10	58.8	<6	49.3
Red Grouper <u>Epenephelus morio</u> (Cuv. & Val.)	6	1	16.7	<5	60.0
Whiting <u>Menticirrhus americanus</u> (L.) <u>sp. inq.</u>	2	2	100.0	<5	38.0
Grunt <u>Haemulon</u> sp.	2	0	00.0	-	-
Porgy <u>Calamus</u> sp.	4	0	00.0	-	-
Sea Catfish <u>Galeichthys felis</u> (L.)	1	0	00.0	-	-
Sand Trout <u>Cynoscion arenarius</u> (Ginsburg)	7	0	00.0	-	-
Permit <u>Trachinotus falcatus</u> (L.)	1	0	00.0	-	-
Bluefish <u>Pomatomus saltatrix</u> (L.)	2	0	00.0	-	-
Croaker	11	0	00.0	-	-

DISCUSSION

In one instance a discrepancy was noted between the release and recapture identities of an individual. This specimen was recorded as a mangrove snapper, Lutianus griseus (L.) at release, and as a sea catfish, Galeichthys felis (L.) when returned to the laboratory after recapture. It is doubtful that the field identification was in error in the case of such widely differing species. A more plausible explanation would be either a recording error or an exchange of tags. The latter possibility has been expanded in the discussion section of the Zone I report. In all such cases, including the one mentioned above, the specimens involved were not considered in the compilation of data.

As in Zone I a \$1,000 bonus was offered for the first fish captured after the start of the contest (in the case of Zone II, midnight, January 31, 1961). After this date the entries became eligible for higher cash awards than the \$25 paid for fishes returned in January. It has been suggested that some fishes caught in January were withheld until after the opening date in order to be eligible for the bonus and the larger cash awards. The returns listed below during the ten day period from January 27, 1961 through February 5, 1961 indicates that such was indeed the case.

<u>DATE</u>	<u>No. FISH RETURNED</u>
January 27, 1961	1
January 28, 1961	1
January 29, 1961	0
January 30, 1961	1
January 31, 1961	2
February 1, 1961	16
February 2, 1961	3
February 3, 1961	2
February 4, 1961	3
February 5, 1961	4

Since this introduced a substantial bias into the recapture data the possibility has been precluded from the forthcoming program by the elimination of the \$1,000 bonus award.

Movement:

Spotted seatrout showed little evidence of extensive movement in Zone II, with 77.8% of the recaptured fish travelling less than five miles, and only one fish of the eleven recaptured specimens travelling a distance of twenty miles. These results are in keeping with those of Zone I, and substantiate the findings of Iversen and Tabb (1960), who suggest the existence of separate subpopulations of seatrout largely on the basis of age and growth data.

Mangrove snappers in Zone II showed an even smaller tendency for movement from the release site. Of the 121 recaptured fish only one fish travelled more than ten miles, with 97.5% of the recovered fish being captured less than five miles from the point of release.

Only two barracudas travelled a net distance greater than ten miles. 77.4% of the recovered fish were captured less than five miles from the point of release. This is in agreement with the study of Springer and McErlean (1961), who reported an "insignificant net movement" in 73.3% of the recaptured barracudas.

It appears from this study that sheephead, redfish, drums and black mullet likewise do not display a tendency for the movement of great distances. However, with the return of fishes free for relatively longer periods of time additional data, along with exceptions to the above indications, may quite possibly occur.

Table XXX shows the movement of fishes in Zone II for species of which more than five specimens have been recovered.

Fishing Mortality:

The discussion section of Zone I lists the factors which had a probable effect on the assessment of fishing mortality in that zone. These factors are

generally applicable in Zone II also. However, even after these factors have been properly weighed the rate of returns appears higher than usually obtained in tagging programs. Future evaluation of the factors involved may indicate that the estimates of fishing mortality are greater than is generally supposed.

The rate of recovery of seatrout in Zone II (14.9%) is considerably smaller than the rate of 23.2% obtained in Zone I. The fact that the trout released in Zone I were subject to an additional month of high tourist visitation may partially account for the difference.

The recovery rate of mangrove snappers at some of the specific release locations was considerably higher than the overall rate. 19 of the 40 fish released at Palm Beach were recaptured (47.5%) and 11 of the 17 released at Snapper Point on the Goulds Canal in Dade County were recaptured (64.7%). In contrast to this only 17 of the 196 snappers (8.7%) released in the Florida Keys (Monroe County) were recaptured. This low rate can possibly be attributed to both the lower fishing pressure and the increased predation in this area. Moreover, where greater predatory pressure exists (such as from the barracuda in the Florida Keys) an additional mortality due to tagging is often encountered (Ricker, 1948. Beverton & Holt, 1957). This mortality may also have substantially affected the rate of returns.

TABLE XXX
MOVEMENT OF FISHES IN ZONE II

SPECIES	NUMBER TAGGED	NUMBER RECAPTURED	MOVEMENT			GREATEST DISTANCE TRAVELLED
			< 20 mi.	< 10 mi.	< 5 mi.	
Mangrove Snapper	532	121	100%	98.3%	97.5%	20 mi.
Barracuda	202	31	93.5%	93.5%	77.4%	32 mi.
Sheepshead	70	26	100%	84.6%	80.8%	13 mi.
Seatrout	74	11	100%	88.9%	77.8%	20 mi.
Sea Drum	17	10	100%	90%	90%	14 mi.
Redfish	18	6	100%	100%	100%	5 mi.
Black Mullet	26	5	100%	100%	100%	5 mi.

The recovery rate of 15.6% for the barracuda is more than twice that of 6.4% obtained by Springer and McErlean (1961). Besides the reasons already proposed, another reason for the observed difference may in this case be the fact that the lower rate obtained by Springer and McErlean included the results from dart tags, which in this program proved unsatisfactory for the tagging of barracudas. Only 3.0% of the barracudas tagged with darts were returned, whereas 8.1% of the disc-tagged fish were returned.

Springer and McErlean (op. cit.) did not consider it advisable to tag specimens less than 400 mm. in total length, and discontinued this practice due to lack of returns in their program. However, the recovery rate for fish in the 300-400 mm. length class in the Schlitz program was 13.4% not appreciably lower than the overall rate of 15.6% for barracudas.

On November 14, 1961, a barracuda tagged (Petersen tag) by Springer and McErlean (op. cit.) was caught off the Village of West End, Grand Bahama Island, by Mrs. Mildred Caliguiri. The total length of this fish when released at Molasses Reef, Key Largo, Florida, on November 11, 1960, was 679 mm. At recapture, according to Mrs. Caliguiri, the total length of the specimen measured 2 feet 7 inches and weighed 6 1/4 pounds. The fish had travelled a distance of approximately 150 miles.

The overall rate of recovery for all fishes in Zone II was 21.5%. Figure XXXI summarizes the data on returns for each of the major species tagged.

Growth:

The length of each fish was recorded both at release and upon return to the laboratory after recapture. In some cases damage to the recaptured individuals eliminated them from consideration of growth data.

One of the more striking factors in the length analyses was the observed shrinkage which occurred among several species. The barracudas were the most notable in this respect, showing a mean shrinkage of 8.51 mm. (1.35%) for all recaptured individuals. A value of 1.92% was obtained for specimens recaptured

within thirty days of release. The section on growth in the Zone I report discusses this phenomenon more fully, comparing the above results to those of similar programs. Experiments are currently being conducted to examine these effects more closely.

Improvements in the 1961-62 tagging program:

The improvements outlined in the discussion section of Zone I will be applicable to all zones in the forthcoming tagging program.

TABLE XXXI

SUMMARY OF DATA ON RETURNS OF CERTAIN SPECIES

SPECIES	NUMBER RELEASED	NUMBER RETURNED	% RETURNED	MAX. NO. OF MONTHS FREE
Mangrove Snapper	532	121	22.7%	3
Great Barracuda	202	31	15.6%	5
Sheepshead	70	26	38.6%	8
Seatrout	74	11	14.9%	7

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