

TAGGING STUDY OF BLACK SEA BASS
IN NEW JERSEY OCEAN WATERS

PRELIMINARY RESULTS

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JANUARY, 2004

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THIS PROJECT WAS PARTIALLY FUNDED BY THE FEDERAL AID TO SPORTFISH
RESTORATION PROGRAM.

ACKNOWLEDGEMENTS

I thank Barry and Susan Gabler, Bill Kleimenhagen, Ron Roshelli and Ray Davis for volunteering to help tag fish for this survey. Division personnel who also participated in tagging data analysis and report preparation include Jeff Carlson, Barry Preim, John Makai, Tom McCloy, Nathan Figley, Jennifer Daetsch, Tony Mazzaella, Stacey Reap and Nancy Loveland.

INTRODUCTION

It is generally recognized that black sea bass (*Centropristis striata*) along the New Jersey coast undergo a migration from deeper, offshore waters to shallow, nearshore habitats during the spring and a reverse, offshore migration to deepwater wintering grounds as ocean waters cool in the fall (Kendall 1977). The inshore migration brings sea bass to shipwrecks and artificial reefs located near the coast.

In 1995, the Division began a tagging study to investigate the migrational patterns of sea bass to better understand seasonal and geographical shifts in distribution.

METHODS

Sea bass were caught with hook and line and tagged in two different ways. About half the fish were caught by party boat anglers and then tagged by Division personnel onboard. The fish tagged in this manner were generally of sub-legal size (<30 cm TL). The other half were caught directly by Division personnel and tagged. This sample included the full array of legal and sub-legal size fish.

Sea bass were tagged during April to November over the period 1995 to 2003. Fish were collected from inshore waters (<20NM offshore) from Manasquan to Cape May inlets.

Floy anchor tags (FD-94) were inserted with a tagging gun through the musculature and between the bony rays under the dorsal fin. Each tag had a unique identification number and a phone number to call to report the date and location of the recapture. Fish were measured to the nearest cm (TL=total length), tagged and returned to the water as quickly as possible. Since most of the reefs were in relatively shallow water 20 to 25 m in depth, few fish suffered prolonged effects related to decompression. A small number of fish were vented to relieve distended air bladders.

RESULTS

Between 1995 and 2003, a total of 16,476 black sea bass were tagged. While tagged fish ranged from 12 to 52 cm TL, the majority were between 18 and 36 cm (Table 1). As of December 2003, a total of 1,086 tagged fish were recaptured and reported. Over 95 percent of the sea bass tag returns came from rod and reel anglers (Table 2). Commercial fisheries reported less than 5 percent of the total returns. Since commercial fisheries represent about _____ percent of the State's sea bass landings annually (), it appears that a large number of recaptured fish are not being reported by commercial fishermen.

The condition of fish upon release was recorded as one of the following:

- (1) submerged immediately
- (2) floated briefly, then submerged
- (3) floated, did not submerge

Of 15,789 fish whose condition was recorded during the study, 235 (1.5 percent) were reported as condition 2 and 250 (1.6 percent) were condition 3 (Table 3). While condition 1 and 3 showed little difference in tag return rate, condition 2 was unexplainably lower. The tag return rate declined with increasing depth at the tagging location (Table 5). The decrease in return rate appears to begin at depths of 80 or 90 feet and accelerates at depths below 111 feet. The data suggest that angler catch and release mortality at depths over 111 feet may be 7 times greater than that at depths shallower than 80 feet. However, there is another possible full or partial explanation for the apparent trend demonstrated by the data. Fish tagged in deeper water may not have been subjected to as much fishing pressure as those tagged inshore and consequently, tag returns would have been lower for this reason instead of increased mortality.

Venting entails deflating the air bladder with a sharp instrument. This technique is sometimes used to relieve pressure from fish brought up from deep water. Division taggers vented 700 sea bass during the survey using the method explained in the October 1993 South Atlantic Update. This technique entailed inserting a hypodermic needle through the body just posterior to the pectoral fin and into the air bladder. Considering all tagged fish, vented fish had a 63 percent lower tag return rate than unvented fish (Table 6), suggesting that venting may have contributed significantly to mortality. Even when examining fish tagged from high risk depths over 80 feet deep, vented fish exhibited the same return rate of 2.6 percent, although the disparity in return rate between unvented and vented declined slightly to 57 percent, further indicating that venting may have increased mortality. The number of fish tagged by year and the tag returns reported by years following tagging are presented in Table 1. The same-year tag return rate was 5.0 percent (Table 8). One-year and two-year return rates declined to 1.6 and 0.3 percent, respectively. Thereafter, return rates from three to eight years were 0.1 percent or less. The fact that many fish were tagged on reef sites, areas that are heavily fished by recreational anglers, probably resulted in high same-year return rates. The number of tags reported is only a portion of the total number of tagged fish that are caught. The actual reporting rate is unknown. Since less than 5 percent of the tagged fish were reported by commercial fishermen, it appears that most commercial fishermen did not report the tagged fish they caught. Another factor that would lead to a lower tag return rate is the shedding of tags. During the study, two fish were caught that had puncture wounds where it appeared tags had been. We suspect that other fish tug at the streamer tags and probably pull some out. The actual tag shedding rate is unknown.

Of 1,086 sea bass tag returns, 877 (80.8 percent) were caught within 10 NM of their tagging location (Table 9). Even for fish at large for 601 to 1000 days, over 52 percent were recaptured within 10 NM of their tagging location. Movements up to 50 NM could include seasonal inshore-offshore (primarily east and west) migrations that do not extend beyond the ocean waters off New Jersey. Between 201 and 400 days, 9.5 percent of tag returns were beyond 50 NM and by 601-1000 days, 14.3 percent of the returns were over 50 NM. Over the course of the survey, only 10 fish (0.9 percent) traveled more than 100 NM. These data strongly suggest that sea bass have a relatively restricted range. While they travel inshore and offshore with the seasons, few make long-distance migrations parallel (north and south) to the coast. These data suggest that black sea bass populations in a given geographical area are largely discrete populations that are directly influenced by both fishing mortality and by management practices in that area only, with little influence received from neighboring populations subject to different fishing pressure and management practices.

The predominant direction tagged fish traveled to their recapture location was NW to NNE (Figure 1). Surprisingly, more fish traveled to the west-northwest (inshore) than to the east-southeast (offshore) even though all of the fish were tagged within 20 NM of shore. The probable reasons for this are that most sportfishing for sea bass occurs closer to shore and commercial fishermen, who fish more distant, offshore waters, probably reported only a small number of the tagged fish they caught. Thus, the directional trends exhibited by the data may be misleading. However, there does appear to be a tendency for more fish to move northward than southward.

Thirty-five sea bass were recaptured more than 50 NM from their tagging location (Table 10). The range of recaptures extended from the waters off Rhode Island to North Carolina, but 15 of the 35 were still within New Jersey waters. Nine fish were recaptured in deep, offshore waters, all during the cold water months, January to April. Of the 20 fish reported outside New Jersey waters, 8 were caught to the north (New York, Rhode Island) and 12 were caught to the south (Maryland, Virginia and North Carolina). Although a small sample, the long distance migrations contradict the general movement pattern which favored the north.

CONCLUSIONS

1. For all size classes over the length of the survey, the tag return rate was 6.6 percent. The tag return rate for legal-size fish (>30 cm) was twice that of undersized fish.
2. The tag return rate for commercial fishermen was below that of rod and reel anglers.
3. Decompression problems for fish that may have led to moratality during tagging increased as depths exceeded 90 feet.
4. Fish that were vented to relieve air bladder pressure had a 60 percent lower return rate than unvented fish, suggesting increased long-term mortality associated with vented fish.
5. Fish released in poor condition exhibited a somewhat reduced return rate when compared to those in good condition, but poor condition fish still had a higher return rate than vented fish.
6. Tag return rates dropped off sharply after the first season, suggesting a high mortality rate, probably due to fishing, and possibly, a high rate of tag shedding.
7. Most sea bass (80 percent) were recaptured within 10 NM of their tagging location. Even after 601 days at large over 50 percent were recaptured within 10 NM, suggesting that sea bass return to familiar summering grounds.
8. Only 0.9 percent of the tag returns came from more than 100 NM, suggesting that the majority of the sea bass population off New Jersey stays and is eventually caught there.

Table 1. The numbers of black sea bass tagged and recaptured and reported broken down by length frequency.

| TL (cm) | Number of Sea Bass | | | Return Percentage 10-cm grouping |
|---------|--------------------|----------|-------------|-------------------------------------|
| | Tagged | Returned | Return Rate | |
| 12 | 1 | - | - | 2.0 |
| 13 | 1 | - | - | |
| 14 | 7 | - | - | |
| 15 | 10 | - | - | |
| 16 | 16 | - | - | |
| 17 | 49 | 1 | 1.7 | |
| 18 | 127 | 3 | 2.4 | |
| 19 | 250 | 3 | 1.2 | |
| 20 | 590 | 14 | 2.4 | |
| 21 | 913 | 27 | 3.0 | |
| 22 | 1265 | 53 | 4.2 | |
| 23 | 1598 | 71 | 4.4 | |
| 24 | 1799 | 103 | 5.7 | |
| 25 | 1689 | 107 | 6.3 | |
| 26 | 1612 | 99 | 6.1 | |
| 27 | 1409 | 128 | 9.1 | |
| 28 | 1389 | 108 | 7.8 | |
| 29 | 858 | 74 | 8.6 | |
| 30 | 886 | 73 | 8.2 | |
| 31 | 544 | 49 | 9.0 | 11.0 |
| 32 | 399 | 33 | 8.3 | |
| 33 | 311 | 41 | 13.2 | |
| 34 | 222 | 28 | 12.6 | |
| 35 | 133 | 19 | 14.2 | |
| 36 | 100 | 16 | 16.0 | |
| 37 | 94 | 12 | 12.8 | |
| 38 | 59 | 4 | 6.8 | |
| 39 | 36 | 6 | 16.6 | |
| 40 | 36 | 4 | 11.1 | |
| 41 | 16 | 2 | 12.5 | 15.9 |
| 42 | 19 | 4 | 21.1 | |
| 43 | 10 | 1 | 10.0 | |
| 44 | 9 | 2 | 22.2 | |
| 45 | 1 | 1 | 100.0 | |
| 46 | 1 | - | - | |
| 47 | 3 | - | - | |
| 48 | 1 | - | - | |
| 49 | - | - | - | |
| 50 | 2 | - | - | |
| 51 | - | - | - | |
| 52 | 1 | - | - | |
| Unknown | 10 | - | - | |
| TOTAL | 16,476 | 1,086 | 6.6 | |

Table 2. Black sea bass tag returns broken down by the method of recapture.

| Capture Method | Number of Tag Returns | Column Percentage |
|----------------|-----------------------|-------------------|
| Rod and Reel | 1,023 | 95.4 |
| Trawl | 9 | 0.8 |
| Fish Trap | 40 | 3.7 |
| Other | 1 | 0.1 |
| Total Known | 1,073 | 100.0 |
| Unknown | 13 | - |

Table 3. The condition of tagged sea bass following release and its influence on recapture rates for all survey years combined.

| Fish Condition | Number of Fish | | Row Percentage |
|------------------------------------|----------------|----------|----------------|
| | Tagged | Returned | |
| (1) submerged immediately | 15,789 | 1,049 | 6.6 |
| (2) floated briefly then submerged | 235 | 8 | 3.4 |
| (3) floated, did not submerge | 250 | 15 | 6.0 |

Table 4. Sea bass tag return rate broken own by tagging depth and fish condition upon release.

| Tagging Depth Range (ft) | Total Fish Tagged | Percentage of Tag Returns by Fish Condition* | | | Combined Return Rate |
|--------------------------|-------------------|--|-----|------|----------------------|
| | | 1 | 2 | 3 | |
| 1-60 | 2,703 | 6.3 | 0 | 5.9 | 6.2 |
| 61-70 | 6,842 | 7.2 | 6.2 | 4.9 | 7.2 |
| 71-80 | 3,094 | 7.2 | 8.7 | 5.3 | 7.2 |
| 81-90 | 2,842 | 6.0 | 3.3 | 13.2 | 6.1 |
| 91-100 | 221 | 5.6 | 0 | 3.7 | 5.0 |
| 101-110 | 148 | 2.8 | 0 | 0 | 2.7 |
| 111+ | 424 | 1.0 | 0 | 0 | 0.9 |

- * 1 = Fish submerged immediately
- 2 = Fish floated, then submerged
- 3 = Fish did not submerge

Table 8. The number and percentage of sea bass tag returns by years following tagging.

| Years Following Tagging | Number of Fish Tagged* | Number of Fish Returned | Row Return Rate |
|-------------------------|------------------------|-------------------------|-----------------|
| 0 | 16,476 | 830 | 5.0 |
| +1 | 13,932 | 224 | 1.6 |
| +2 | 7,461 | 26 | 0.3 |
| +3 | 2,327 | 2 | 0.1 |
| +4 | 2,327 | 2 | 0.1 |
| +5 | 2,252 | 1 | <0.1 |
| +6 | 1,022 | 1 | 0.1 |
| +7 | 396 | 0 | 0 |
| +8 | 387 | 0 | 0 |

* Assumes all tagged fish are kept and not re-released.

Table 9. The distance traveled by tagged sea bass versus the days at large.

| Days at Large Between Tagging and Recapture | Number of tag returns broken down by distance traveled (NM)/(Row Percentage) | | | |
|---|--|---------------|--------------|-------------|
| | 0-10.0 | 10.1-50.0 | 50.1-100.0 | 100.0 + |
| 0-100 | 534 (88.1) | 66 (10.1) | 5 (0.8) | 1 (0.2) |
| 101-200 | 182 (79.5) | 42 (18.3) | 3 (1.3) | 2 (0.9) |
| 201-400 | 114 (67.5) | 39 (23.1) | 11 (6.5) | 5 (3.0) |
| 401-600 | 36 (65.5) | 17 (30.9) | 1 (1.8) | 1 (1.8) |
| 601-1000 | 11 (52.4) | 7 (33.3) | 2 (9.5) | 1 (4.8) |
| 1000+ | 877 (0) | 174 (50.0) | 25 (50.0) | 10 (0) |
| TOTAL | 877 (80.8) | 174 (16.0) | 25 (2.3) | 10 (0.9) |

Table 10. List of sea bass tag returns from over 50NIM

| TAG | RECAPMONTH | RECAPYEAR | REC_METHOD | RECAP_LOC | STATE | DAYS_LARGE | DISTANCENM | DIRECTION |
|-------|------------|-----------|------------|---|-------|------------|------------|-----------|
| 91 | 7 | 2001 | 1 | Parvin Park, Salem County | NJ | 2126 | 59.16 | 329 |
| 156 | 4 | 1996 | 9 | 50 miles off of Ocean City | MD | 189 | 63.60 | 155 |
| 659 | 8 | 1996 | 1 | Gas Barge on Sea Girt Reef | NJ | 318 | 55.60 | 13 |
| 761 | 8 | 1996 | 1 | 2 mi E of Rockaway Jetty, 1 1/2 mi offshore | NY | 316 | 79.30 | 9 |
| 1060 | 2 | 1999 | 2 | Outer Banks near Manteo Bridge | NC | 530 | 186.96 | 193 |
| 1079 | 9 | 2002 | 1 | Range buoy wreck 5 miles off of Barnegat | NJ | 1842 | 61.45 | 37 |
| 1454 | 8 | 1997 | 1 | Long Island Sound | NY | 51 | 129.80 | 21 |
| 1625 | 8 | 1997 | 1 | off jetty near CG Station in Cape May | NJ | 59 | 89.70 | 208 |
| 1886 | 6 | 2001 | 1 | Chaparra Wreck | NJ | 1399 | 57.84 | 36 |
| 4113 | 1 | 2002 | 1 | 14 miles off Manasquan | NJ | 145 | 86.59 | 21 |
| 4216 | 6 | 2003 | 1 | Point Judith, Rhode Island | RI | 741 | 146.06 | 50 |
| 4378 | 3 | 2002 | 2 | off the coast of Virginia | VA | 286 | 153.92 | 208 |
| 5125 | 7 | 2003 | 1 | 19 miles SE of Cape May, NJ | NJ | 780 | 70.34 | 210 |
| 6466 | 6 | 2002 | 1 | 5 miles off Moriches Inlet, Long Island, NY | NY | 375 | 54.63 | 61 |
| 6647 | 10 | 2001 | 9 | off Virginia | VA | 138 | 145.99 | 202 |
| 7735 | 10 | 2001 | 1 | Secret (arb. 8 mi due E of Manasquan) | NJ | 59 | 54.42 | 18 |
| 7821 | 8 | 2002 | 1 | 8 mi off Pt. Lookout, Long Island Atl. Bch Reef | NY | 341 | 80.81 | 16 |
| 7923 | 1 | 2003 | 1 | 80 miles SE of Brielle | NJ | 518 | 65.25 | 94 |
| 8295 | 9 | 2002 | 1 | Between Fire Island Inlet & Jones Beach | NY | 361 | 116.19 | 27 |
| 9208 | 10 | 2003 | 1 | off Brielle | NJ | 761 | 54.28 | 13 |
| 9274 | 8 | 2002 | 1 | Between Montauk Point & Block Island | NY | 318 | 162.06 | 46 |
| 9992 | 9 | 2002 | 1 | Liberty Ship Zane Grey | NC | 329 | 242.99 | 196 |
| 11237 | 2 | 2003 | 2 | Baltimore Canyon | MD | 271 | 93.58 | 172 |
| 11729 | 6 | 2002 | 1 | off Manasquan | NJ | 27 | 58.03 | 25 |
| 12104 | 9 | 2002 | 1 | Liberty Ship Zane Grey | NC | 143 | 251.83 | 196 |
| 12240 | 2 | 2003 | 2 | 70 miles off Cape May in 42 fathoms | NJ | 273 | 63.70 | 146 |
| 12621 | 3 | 2003 | 2 | Baltimore Canyon 80 fathoms | MD | 323 | 98.85 | 176 |
| 12865 | 3 | 2003 | 2 | 48 miles off Chincoteague 40 fathoms | VA | 304 | 88.92 | 184 |
| 12895 | 6 | 2002 | 1 | off Sea Girt | NJ | 42 | 55.67 | 15 |
| 13052 | 3 | 2003 | 2 | off Chincoteague (33 fathoms) | VA | 259 | 87.68 | 187 |
| 14020 | 3 | 2003 | 2 | off Ocean City, MD in 62 fathoms | MD | 308 | 56.59 | 129 |
| 14152 | 5 | 2003 | 1 | Klondike | NJ | 362 | 280.00 | 2 |
| 15171 | 4 | 2003 | 2 | off Baltimore Canyon | MD | 199 | 67.32 | 168 |
| 15208 | 6 | 2003 | 1 | Rockaway Reef | NY | 276 | 80.19 | 12 |
| 18785 | 6 | 2003 | 1 | Little Egg Reef | NJ | 37 | 51.04 | 12 |

Figure 1. Direction traveled by sea bass

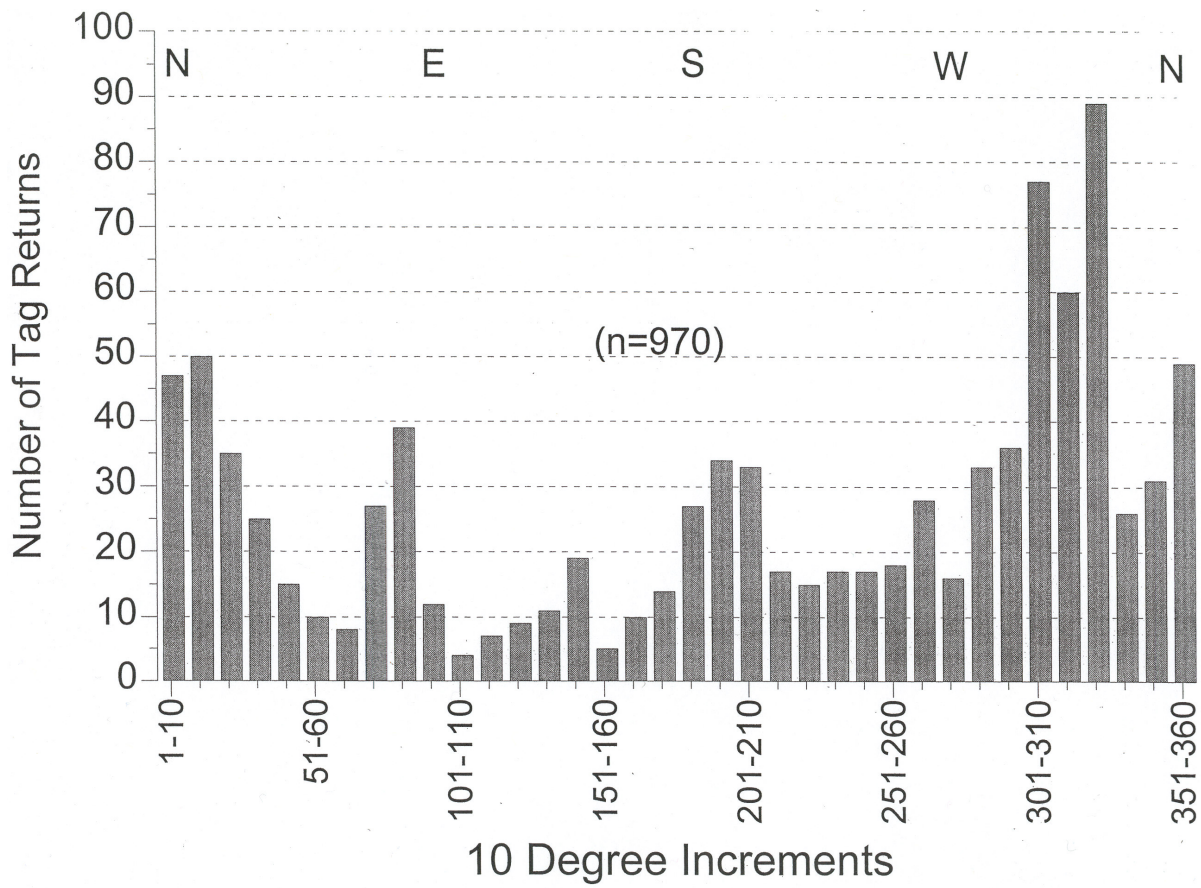


Figure 1. Direction traveled by tagged sea bass.