# Cobia (*Rachycentron canadum*) stock assessment study in the Gulf of Mexico and in the South Atlantic

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# COBIA (*Rachycentron canadum*) STOCK ASSESSMENT STUDY IN THE GULF OF MEXICO AND IN THE SOUTH ATLANTIC

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**Final Report**

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## I. PREFACE

The following information constitutes the Final Report (August 1, 1995 - December 31, 1997) by Mote Marine Laboratory (MML), on the Cobia Stock Assessment Study in the Gulf of Mexico and South Atlantic. This project was conducted by Mote Marine Laboratory and Gulf Coast Research Laboratory under the MARFIN Program.

## II. INTRODUCTION

This study was undertaken as part of an attempt to understand the stock identity of the cobia, *Rachycentron canadum*, in the Gulf of Mexico and South Atlantic. Mote Marine Laboratory (MML) and Gulf Coast Research Laboratory (GCRL) personnel worked together to provide age and growth information, develop an age/length key and obtain data on reproduction of cobia captured off the southeast coast of the United States from North Carolina to the Florida Keys and in the Gulf of Mexico from the Florida Gulf Coast to the coast of Texas. This report outlines our success in achieving the above-mentioned goals.

## III. SPECIMEN AND DATA COLLECTION

During this two-year project, a grand total of 703 (480 females and 223 males) cobia specimens were obtained. Of these fish, 329 were tournament fish (239 females, 90 males). Anglers responded favorably by donating cobia carcasses, even though there were major difficulties in obtaining specimens during Quarters I, II and III due to prolonged, **severe** weather conditions. The numerous hurricanes during August - November, 1995, stirred up so many nutrients in the warm Gulf waters that conditions were favorable for red tide blooms, resulting in massive fish kills along the southwest coast of Florida during 1995; however, 20 females and 10 males were collected during the first two quarters. One tournament was scheduled during Quarter III, but was cancelled and rescheduled because of bad weather. Cold weather (the coldest winter since 1989) and high winds prevailed during much of January, February and March, 1996, so that few specimens could be obtained during that time. Few boats fished the tournament because of the cold weather and high winds, even though 198 boats were registered. In spite of the weather, 25 fish (15 females and 10 males) were caught. In addition to the tournament fish, 37 additional fish were collected from fishers from Sunshine Key and Port Canaveral. These included 21 females and 16 males.

Quarter IV brought better weather and more productive fishing. A total of 191 cobia specimens (131 females, 60 males) were logged in during quarter IV, having been collected from fishers, charter boats and 13 fishing tournaments from which 101 specimens were collected (81 females, 20 males). A total of 136 specimens (95 females and 41 males) were logged in during Quarter V. Of these, 40 were tournament fish (28 females, 12 males), and 96 (67 females, 29 males) were non tournament fish. Of the non-tournament fish, eight undersized cobia were obtained from GCRL; 3 from Texas (1 female, 2 males), 4 from Alabama (3 females, 1 male), and 1 male from the Florida panhandle.

During the fall quarter (Quarter VI), 30 (19 females, 11 males) cobia specimens were logged in, including 5 undersized cobia (2 females, 3 males), caught by MML personnel. Quarter VII brought in 46 more specimens (33 females, 13 males), of which 16 (13 females, 3 males) were tournament fish collected from the Florida east coast. The tournament had been cancelled twice and rescheduled because of bad weather and high winds. During the tournament, a tornado was sighted near the docks where the tournament was held. Two more undersized cobia (both females) were caught by MML personnel.

Quarter VIII yielded 88 cobia (68 females, 20 males). Seventy-four of these were tournament fish (59 females, 15 males), and 6 were undersized fish captured by MML and GCRL personnel. Quarter IX yielded 73 (42 females, 31 males), of which 45 (22 females, 23 males) were tournament fish. Two other tournaments held this quarter, one on the east coast of Florida and one on the west coast, were attended by MML personnel, but no cobia were caught.

The final quarter, Quarter X, yielded 47 cobia specimens (36 females, 11 males). Eighteen of these fish were from tournaments (13 females, 5 males). This brings the grand total for the entire project to 703 cobia (480 females, 223 males) (**Figure 1**). **Table 1** shows tournament fish broken down by area, sex and size range. **Figure 2** shows the size of tournament cobia vs. non-tournament cobia from all areas sampled.

At the beginning of the project, six freezers were purchased and placed at various locations for the collection of cobia carcasses from anglers. These locations were: Harkers Island, NC, Hilton Head, SC,Big Pine Key, FL, Ocean Springs, MI (GCRL), and 2 at Port Aransas, TX. Additional freezer space was secured in 20 walk-in freezers at various fish houses and marina bait shops from Manteo, NC, to Tampa, FL.

**Table 1.** Tournament fish, broken down by area, sex and size range:

| Area | F | Size Range(cm) | M | Size Range(cm) |
|---|---|---|---|---|
| Northern Gulf | 173 | 79.4-158.5 | 51 | 82.5-139.0 |
| Florida Gulf | 5 | 37.0-101.0 | 0 | N/A |
| Florida Atlantic | 30 | 86.0-123.0 | 19 | 83.0-110.0 |
| North and South Carolina | 31 | 94.5-138.5 | 20 | 80.5-110.0 |
| **TOTAL** | **239** | | **90** | |

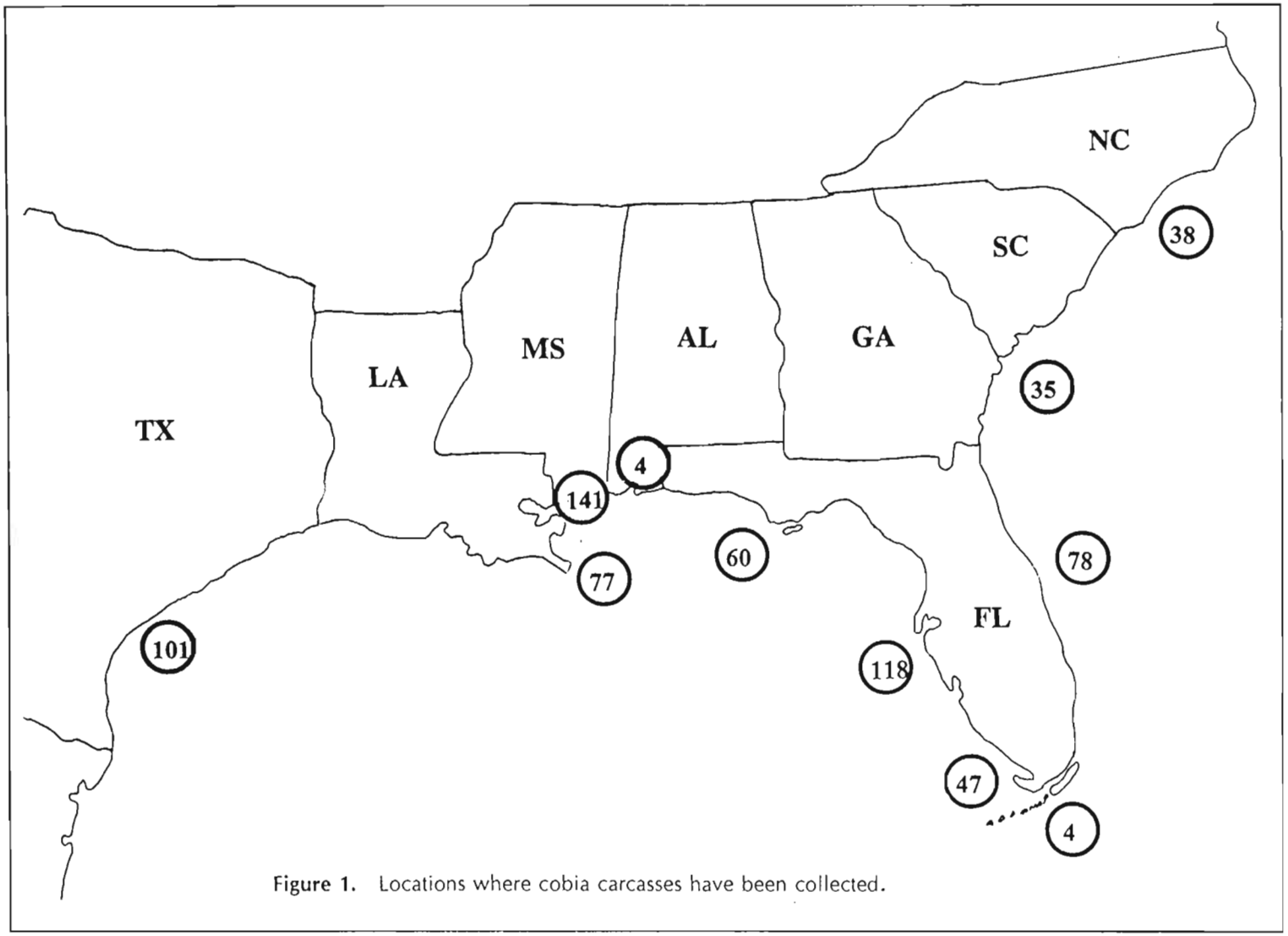



**Figure 1.** Locations where cobia carcasses have been collected.

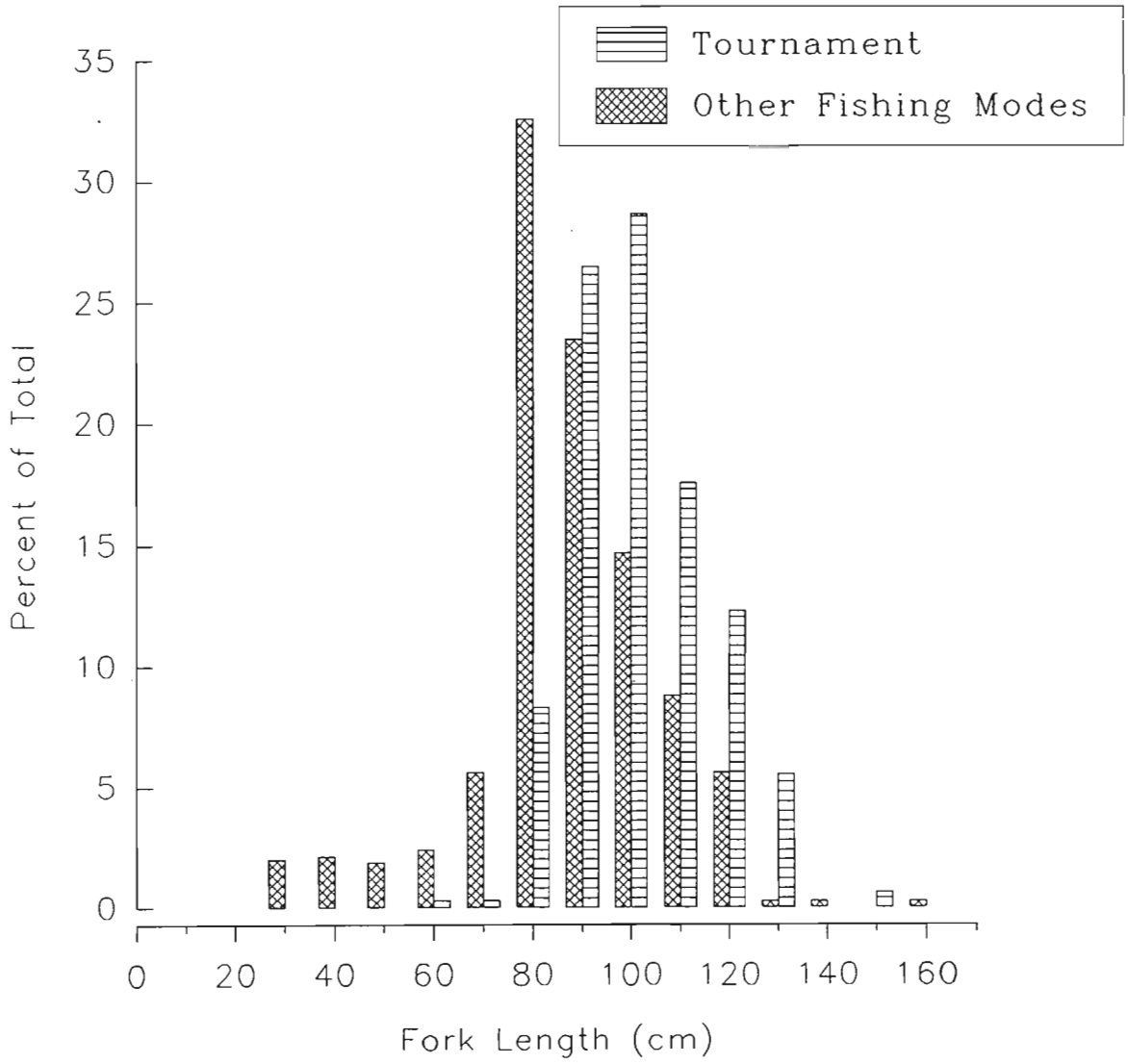



**Figure 2.** Size of cobia collected over the sampling area from tournaments vs. those from anglers.

**Table 2** shows the areas where cobia were caught and the number of females and males collected. In all cases, more females were available than males. Female cobia grow larger than male cobia. Since larger fish are targeted during tournaments, more females would be expected in the samples. Although the samples may be biased toward females in locations where most of the specimens were collected during tournaments, all fish from Texas and the Florida Keys were non-tournament fish, and still exhibited a greater percentage of females.

**Table 2.** Female to male ratio of cobia collected through the sampling area.

| Area | Females | Males |
|---|---|---|
| Texas | 61 (60%) | 40 (40%) |
| Northern Gulf (MS,LA,AL,FL/Pan) | 216 (77%) | 66 (23%) |
| Florida Gulf | 75 (65%) | 41 (35%) |
| Florida Keys | 28 (58%) | 20 (42%) |
| Florida Atlantic | 55 (66%) | 28 (34%) |
| North and South Carolina | 45 (62%) | 28 (38%) |
| **TOTAL** | **480 (68%)** | **223 (32%)** |

Data for the specimens collected during Quarters I-X, are presented as **Table 3**. Length/frequency data are included as **Figures 3 thru 7**. **Figures 3, 4** show the sizes of the female vs. male fish in the study. A breakdown of fish size by sex, month and location appears as **Figures 5 and 6**. **Figure 7** shows the length frequency of female and male cobia by total weight and fork length. Cobia distribution appears to be temperature dependent. Almost all cobia (both female and male) were captured from waters ranging from 20.0 - 30.0°C. **Figure 8** shows water temperature where female and male cobia were caught. Data for fish included in the reproductive portion of this study are included as **Table 4**. **Tables 5, 6 & 7** show the summary statistics by length, total weight and gonad weight for female and male cobia, including both total cobia and tournament cobia. Totals of cobia caught include tournament fish.

Seasonal variations in gonad weight as a percent of total weight for both female and male cobia is illustrated in **Figure 9. Figures 10 - 13** show the same data broken down by month, size and area. **Figure 14** shows gonad weight as percent of total weight for female and male cobia by area. All gonad samples were sent to and processed by GCRL. Results of the analyses are presented in the reproduction section of this report.

**Table 3.** Data from cobia from which biological samples were collected during (8/1/95 - 12/31/97 listed by state - (RR = rod & reel, GN = gill net, TRL = trawl, SP = spear).

| Fish | State | Capture Date | Capture Area | Water Depth (ft) | Water Temp. (C) | Gear Type | Fork Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 117 | FL/ATL | 21-Apr-95 | PALM BEACH | - | - | RR | 110.0 | F |
| 18 | NC | 11-Jun-95 | HARKERS ISLAND | - | - | RR | 108.0 | F |
| 19 | NC | 11-Jun-95 | HARKERS ISLAND | - | - | RR | 119.0 | F |
| 20 | NC | 11-Jun-95 | HARKERS ISLAND | - | - | RR | 116.0 | F |
| 21 | NC | 11-Jun-95 | HARKERS ISLAND | - | - | RR | 133.0 | F |
| 22 | NC | 11-Jun-95 | HARKERS ISLAND | - | - | RR | 122.0 | F |
| 23 | NC | 11-Jun-95 | HARKERS ISLAND | - | - | RR | 107.0 | F |
| 24 | NC | 11-Jun-95 | HARKERS ISLAND | - | - | RR | 130.0 | F |
| 25 | NC | 11-Jun-95 | HARKERS ISLAND | - | - | RR | 130.0 | F |
| 26 | NC | 11-Jun-95 | HARKERS ISLAND | - | - | RR | 127.0 | F |
| 27 | NC | 11-Jun-95 | HARKERS ISLAND | - | - | RR | 130.0 | F |
| 118 | FL/PAN | 13-Aug-95 | PANAMA CITY | - | - | RR | 100.0 | F |
| 119 | FL/PAN | 13-Aug-95 | PANAMA CITY | - | - | RR | 106.0 | F |
| 1 | FL/GULF | 06-Sep-95 | SANIBEL ISLAND | 8.0 | 29.0 | GN | 57.2 | F |
| 2 | FL/GULF | 21-Sep-95 | WACCASASSA BAY | 7.0 | 28.0 | GN | 58.0 | M |
| 316 | TX | 11-Oct-95 | CORPUS CHRISTI | 14.7 | 27.5 | TRL | 40.0 | M |
| 314 | TX | 17-Oct-95 | GALVESTON | 14.0 | - | TRL | 31.0 | M |
| 313 | TX | 17-Oct-95 | GALVESTON | 14.7 | - | TRL | 31.5 | F |
| 3 | FL/GULF | 24-Oct-95 | LONG BOAT KEY | 15.0 | 25.0 | RR | 87.0 | M |
| 4 | FL/GULF | 24-Oct-95 | LONG BOAT KEY | 15.0 | 25.0 | RR | 89.0 | F |
| 5 | FL/KEYS/GULF | 26-Oct-95 | BIG PINE KEY | 52.0 | 29.0 | RR | 85.0 | M |
| 6 | FL/KEYS/GULF | 26-Oct-95 | BIG PINE KEY | 52.0 | 29.0 | RR | 84.5 | M |
| 7 | FL/KEYS/GULF | 26-Oct-95 | BIG PINE KEY | 52.0 | 29.0 | RR | 89.5 | M |
| 8 | FL/GULF | 27-Oct-95 | WACCASASSA BAY | 7.0 | 22.0 | GN | 57.0 | F |
| 317 | AL | 06-Nov-95 | MOBILE | 16.0 | - | TRL | 37.0 | F |
| 318 | AL | 06-Nov-95 | MOBILE | 16.0 | - | TRL | 41.5 | F |
| 319 | AL | 06-Nov-95 | MOBILE | 16.0 | - | TRL | 38.5 | M |
| 320 | AL | 06-Nov-95 | MOBILE | 16.0 | - | TRL | 43.0 | F |
| 315 | FL/PAN | 15-Nov-95 | APALACHICOLA | 16.2 | - | TRL | 38.0 | M |
| 9 | FL/GULF | 26-Nov-95 | BUNCHE BEACH | 5.0 | 20.5 | RR | 82.0 | F |
| 16 | FL/GULF | 28-Nov-95 | FT. MYERS BEACH | 5.0 | 20.5 | RR | 91.5 | M |
| 17 | FL/GULF | 28-Nov-95 | FT. MYERS BEACH | 5.0 | 20.5 | RR | 86.5 | F |
| 15 | FL/GULF | 04-Dec-95 | BUNCHE BEACH | 5.0 | 20.5 | RR | 86.5 | F |
| 12 | FL/GULF | 04-Dec-95 | BUNCHE BEACH | 6.0 | 20.5 | RR | 102.0 | F |
| 11 | FL/GULF | 05-Dec-95 | BUNCHE BEACH | 3.0 | 20.5 | RR | 122.0 | F |
| 13 | FL/GULF | 05-Dec-95 | BUNCHE BEACH | 6.0 | 20.5 | RR | 94.0 | F |
| 14 | FL/GULF | 05-Dec-95 | BUNCHE BEACH | 7.0 | 20.5 | RR | 89.0 | M |
| 10 | FL/GULF | 06-Dec-95 | LONGBOAT KEY | 17.0 | 17.0 | RR | 82.0 | M |
| 28 | FL/GULF | 15-Dec-95 | SARASOTA | 4.0 | 13.3 | RR | 84.0 | M |

**Table 3 (continued).** Data from cobia from which biological samples were collected during (8/1/95 - 12/31/97) listed by state - (RR = rod & reel, GN = gill net, TRL = trawl, SP = spear).

| Fish | State | Capture Date | Capture Area | Water Depth (ft) | Water Temp. (C) | Gear Type | Fork Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 30 | FL/GULF | 16-Dec-95 | FT. MYERS BEACH | 5.0 | 13.3 | RR | 87.6 | F |
| 29 | FL/GULF | 18-Dec-95 | FT. MYERS BEACH | 5.0 | 13.3 | RR | 84.0 | M |
| 31 | FL/ATL | 16-Jan-96 | PORT CANAVERAL | - | - | RR | 88.0 | M |
| 32 | FL/ATL | 16-Jan-96 | PORT CANAVERAL | - | - | RR | 104.0 | F |
| 59 | FL/KEYS/GULF | 20-Jan-96 | KEY WEST | 12.0 | 22.5 | RR | 82.0 | F |
| 52 | FL/KEYS/GULF | 02-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 73.0 | M |
| 48 | FL/KEYS/ATL | 10-Feb-96 | SUNSHINE KEY | 40.0 | 22.5 | RR | 73.0 | F |
| 49 | FL/KEYS/ATL | 10-Feb-96 | SUNSHINE KEY | 40.0 | 22.5 | RR | 84.0 | M |
| 50 | FL/KEYS/ATL | 10-Feb-96 | SUNSHINE KEY | 40.0 | 22.5 | RR | 90.5 | M |
| 36 | FL/KEYS/GULF | 21-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 71.0 | F |
| 56 | FL/KEYS/GULF | 22-Feb-96 | SUNSHINE KEY | 9.0 | 22.5 | RR | 87.5 | M |
| 55 | FL/KEYS/GULF | 22-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 86.0 | M |
| 60 | FL/KEYS/GULF | 23-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 84.5 | M |
| 61 | FL/KEYS/GULF | 23-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 90.0 | M |
| 37 | FL/KEYS/GULF | 24-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 88.0 | F |
| 38 | FL/KEYS/GULF | 24-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 100.5 | M |
| 39 | FL/KEYS/GULF | 24-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 86.5 | M |
| 40 | FL/KEYS/GULF | 24-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 81.0 | F |
| 41 | FL/KEYS/GULF | 24-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 83.0 | F |
| 42 | FL/KEYS/GULF | 24-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 91.5 | M |
| 43 | FL/KEYS/GULF | 24-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 82.5 | F |
| 44 | FL/KEYS/GULF | 24-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 99.0 | F |
| 45 | FL/KEYS/GULF | 25-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 82.5 | F |
| 46 | FL/KEYS/GULF | 25-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 93.0 | F |
| 47 | FL/KEYS/GULF | 25-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 92.5 | F |
| 51 | FL/KEYS/GULF | 25-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 91.0 | F |
| 53 | FL/KEYS/GULF | 25-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 96.5 | F |
| 62 | FL/ATL | 25-Feb-96 | PORT CANAVERAL | 70.0 | - | RR | 112.0 | F |
| 63 | FL/ATL | 25-Feb-96 | PORT CANAVERAL | 70.0 | - | RR | 93.5 | F |
| 64 | FL/ATL | 25-Feb-96 | PORT CANAVERAL | 70.0 | - | RR | 91.5 | F |
| 65 | FL/ATL | 25-Feb-96 | PORT CANAVERAL | 70.0 | - | RR | 93.0 | M |
| 66 | FL/ATL | 25-Feb-96 | PORT CANAVERAL | 70.0 | - | RR | 87.0 | M |
| 67 | FL/ATL | 25-Feb-96 | PORT CANAVERAL | 70.0 | - | RR | 98.5 | F |
| 57 | FL/KEYS/GULF | 26-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 71.5 | F |
| 58 | FL/KEYS/GULF | 26-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 80.0 | M |
| 54 | FL/KEYS/GULF | 27-Feb-96 | SUNSHINE KEY | 10.0 | 22.5 | RR | 70.0 | F |
| 33 | FL/KEYS/GULF | 27-Feb-96 | SUNSHINE KEY | 72.0 | 22.5 | RR | 70.5 | M |

**Table 3 (continued).** Data from cobia from which biological samples were collected during (8/1/95 - 12/31/97) listed by state - (RR = rod & reel, GN = gill net, TRL = trawl, SP = spear).

| Fish | State | Capture Date | Capture Area | Water Depth (ft) | Water Temp. (C) | Gear Type | Fork Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 34 | FL/KEYS/GULF | 27-Feb-96 | SUNSHINE KEY | 72.0 | 22.5 | RR | 87.0 | M |
| 35 | FL/KEYS/GULF | 27-Feb-96 | SUNSHINE KEY | 72.0 | 22.5 | RR | 91.0 | F |
| 115 | FL/KEYS/GULF | 28-Feb-96 | SUNSHINE KEY | 9.0 | - | RR | 86.5 | F |
| 114 | FL/KEYS/GULF | 28-Feb-96 | SUNSHINE KEY | - | - | RR | 105.0 | F |
| 112 | FL/KEYS/GULF | 15-Mar-96 | SUNSHINE KEY | 10.0 | - | RR | 77.0 | F |
| 94 | FL/ATL | 16-Mar-96 | PORT CANAVERAL | 118.0 | 20.0 | RR | 96.5 | F |
| 95 | FL/ATL | 16-Mar-96 | PORT CANAVERAL | 118.0 | 20.0 | RR | 107.0 | F |
| 98 | FL/ATL | 16-Mar-96 | PORT CANAVERAL | 118.0 | 20.0 | RR | 98.5 | F |
| 96 | FL/ATL | 17-Mar-96 | PORT CANAVERAL | 70.0 | 20.0 | RR | 113.0 | M |
| 97 | FL/ATL | 17-Mar-96 | PORT CANAVERAL | - | 20.0 | RR | 96.5 | M |
| 435 | FL/GULF | 20-Mar-96 | PALM HARBOR | 6.0 | - | RR | 79.0 | F |
| 93 | FL/ATL | 29-Mar-96 | PORT CANAVERAL | 50.0 | 20.0 | RR | 94.0 | F |
| 74 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | 25.0 | 20.0 | RR | 118.0 | F |
| 80 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | 35.0 | 20.0 | RR | 87.0 | F |
| 75 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | 40.0 | 20.0 | RR | 101.0 | F |
| 69 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | 43.0 | 20.0 | RR | 94.0 | F |
| 70 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | 45.0 | 20.0 | RR | 94.5 | M |
| 77 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | 50.0 | 20.0 | RR | 100.0 | M |
| 78 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | 50.0 | 20.0 | RR | 93.0 | M |
| 83 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | 50.0 | 20.0 | RR | 107.5 | M |
| 73 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | 52.0 | 20.0 | RR | 92.0 | F |
| 81 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | 52.0 | 20.0 | RR | 94.5 | M |
| 72 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | 55.0 | 20.0 | RR | 105.5 | F |
| 71 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | 56.0 | 20.0 | RR | 90.5 | F |
| 68 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | 58.0 | 20.0 | RR | 110.0 | M |
| 76 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | 58.0 | 20.0 | RR | 109.5 | M |
| 89 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | 59.0 | 20.0 | RR | 93.0 | F |
| 91 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | 75.0 | 20.0 | RR | 96.0 | M |
| 90 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | 80.0 | 20.0 | RR | 92.0 | F |
| 88 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | 98.0 | 20.0 | RR | 123.0 | F |
| 92 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | 118.0 | 20.0 | RR | 86.0 | F |
| 79 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | - | 20.0 | RR | 84.0 | M |
| 82 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | - | 20.0 | RR | 98.0 | F |
| 84 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | - | 20.0 | RR | 86.5 | F |
| 85 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | - | 20.0 | RR | 104.5 | F |
| 86 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | - | 20.0 | RR | 103.0 | M |
| 87 | FL/ATL | 30-Mar-96 | PORT CANAVERAL | - | 20.0 | RR | 96.0 | F |

**Table 3 (continued).** Data from cobia from which biological samples were collected during (8/1/95 - 12/31/97) listed by state - (RR = rod & reel, GN = gill net, TRL = trawl, SP = spear).

| Fish | State | Capture Date | Capture Area | Water Depth (ft) | Water Temp. (C) | Gear Type | Fork Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 113 | FL/KEYS/GULF | 30-Mar-96 | SUNSHINE KEY | 50.0 | - | RR | 80.5 | F |
| 116 | FL/KEYS/GULF | 30-Mar-96 | SUNSHINE KEY | - | - | RR | 72.0 | F |
| 100 | FL/GULF | 04-Apr-96 | TARPON SPRINGS | 5.0 | 20.8 | GN | 88.0 | M |
| 99 | FL/GULF | 05-Apr-96 | TARPON SPRINGS | 5.0 | 21.0 | GN | 67.0 | M |
| 110 | FL/ATL | 06-Apr-96 | PORT CANAVERAL | - | - | RR | 107.0 | F |
| 111 | FL/ATL | 06-Apr-96 | PORT CANAVERAL | - | - | RR | 129.0 | F |
| 106 | FL/ATL | 07-Apr-96 | PORT CANAVERAL | - | - | RR | 90.0 | F |
| 107 | FL/ATL | 07-Apr-96 | PORT CANAVERAL | - | - | RR | 110.0 | F |
| 101 | FL/GULF | 11-Apr-96 | SARASOTA | 9.0 | 19.1 | GN | 72.5 | M |
| 102 | FL/GULF | 11-Apr-96 | SARASOTA | 9.0 | 20.0 | GN | 81.5 | M |
| 103 | FL/GULF | 12-Apr-96 | SARASOTA | 9.0 | 19.8 | GN | 70.0 | F |
| 104 | FL/ATL | 12-Apr-96 | PORT CANAVERAL | 21.0 | - | RR | 95.0 | F |
| 109 | FL/ATL | 12-Apr-96 | PORT CANAVERAL | 21.0 | - | RR | 112.0 | F |
| 461 | FL/PAN | 13-Apr-96 | PANAMA CITY | 140.0 | - | RR | 91.8 | F |
| 105 | FL/ATL | 13-Apr-96 | PORT CANAVERAL | - | - | RR | 83.0 | M |
| 108 | FL/ATL | 13-Apr-96 | PORT CANAVERAL | - | - | RR | 109.0 | F |
| 458 | FL/PAN | 19-Apr-96 | PANAMA CITY | - | - | RR | 89.6 | M |
| 459 | FL/PAN | 19-Apr-96 | PANAMA CITY | - | - | RR | 90.7 | F |
| 227 | FL/ATL | 20-Apr-96 | PORT CANAVERAL | 35.0 | - | RR | 94.0 | M |
| 212 | FL/ATL | 21-Apr-96 | PORT CANAVERAL | 30.0 | - | RR | 85.0 | F |
| 219 | FL/ATL | 21-Apr-96 | PORT CANAVERAL | 30.0 | - | RR | 83.0 | F |
| 220 | FL/ATL | 21-Apr-96 | PORT CANAVERAL | 30.0 | - | RR | 89.0 | M |
| 474 | FL/PAN | 21-Apr-96 | PANAMA CITY | 140.0 | - | RR | 107.8 | F |
| 218 | FL/ATL | 21-Apr-96 | PORT CANAVERAL | - | - | RR | 92.0 | F |
| 120 | FL/GULF | 25-Apr-96 | SARASOTA | 17.0 | 21.0 | RR | 116.0 | F |
| 121 | FL/GULF | 25-Apr-96 | SARASOTA | 25.0 | 21.0 | RR | 109.0 | F |
| 122 | FL/GULF | 25-Apr-96 | SARASOTA | 25.0 | 21.0 | RR | 85.5 | F |
| 123 | FL/GULF | 25-Apr-96 | TAMPA BAY | 7.0 | 24.1 | GN | 69.5 | M |
| 124 | FL/GULF | 26-Apr-96 | SARASOTA | 17.0 | 21.0 | GN | 101.5 | F |
| 125 | FL/GULF | 26-Apr-96 | SARASOTA | 17.0 | 21.0 | GN | 82.0 | F |
| 154 | MS | 27-Apr-96 | HORN ISLAND | 5.0 | - | RR | 97.3 | F |
| 148 | LA | 27-Apr-96 | CHANDELEUR ISLAND | 8.0 | - | RR | 109.6 | F |
| 149 | LA | 27-Apr-96 | CHANDELEUR ISLAND | 8.0 | - | RR | 97.1 | F |
| 150 | LA | 27-Apr-96 | CHANDELEUR ISLAND | 8.0 | - | RR | 90.0 | M |
| 152 | LA | 27-Apr-96 | CHANDELEUR ISLAND | 8.0 | - | RR | 99.0 | F |
| 153 | LA | 27-Apr-96 | CHANDELEUR ISLAND | 8.0 | - | RR | 107.5 | F |
| 156 | LA | 27-Apr-96 | CHANDELEUR ISLAND | 10.0 | - | RR | 115.2 | F |

**Table 3 (continued).** Data from cobia from which biological samples were collected during (8/1/95 - 12/31/97) listed by state - (RR = rod & reel, GN = gill net, TRL = trawl, SP = spear).

| Fish | State | Capture Date | Capture Area | Water Depth (ft) | Water Temp. (C) | Gear Type | Fork Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 157 | LA | 27-Apr-96 | CHANDELEUR ISLAND | 10.0 | - | RR | 111.1 | F |
| 158 | MS | 27-Apr-96 | PETIT BOIS ISLAND | 10.0 | - | RR | 128.1 | F |
| 159 | LA | 27-Apr-96 | CHANDELEUR ISLAND | 11.0 | - | RR | 138.5 | F |
| 155 | MS | 27-Apr-96 | HORN ISLAND | 12.0 | - | RR | 122.6 | F |
| 160 | LA | 27-Apr-96 | CHANDELEUR ISLAND | 12.0 | - | RR | 133.0 | F |
| 161 | LA | 27-Apr-96 | CHANDELEUR ISLAND | 12.0 | - | RR | 128.6 | F |
| 453 | FL/PAN | 27-Apr-96 | PANAMA CITY | 140.0 | - | RR | 121.0 | F |
| 454 | FL/PAN | 27-Apr-96 | PANAMA CITY | 140.0 | - | RR | 109.0 | F |
| 455 | FL/PAN | 27-Apr-96 | PANAMA CITY | 140.0 | - | RR | 121.0 | F |
| 456 | FL/PAN | 27-Apr-96 | PANAMA CITY | 140.0 | - | RR | 86.0 | M |
| 457 | FL/PAN | 27-Apr-96 | PANAMA CITY | 140.0 | - | RR | 119.0 | F |
| 147 | LA | 27-Apr-96 | CHANDELEUR ISLAND | - | - | RR | 125.4 | F |
| 476 | FL/PAN | 28-Apr-96 | PANAMA CITY | 140.0 | - | RR | 111.7 | F |
| 126 | FL/GULF | 01-May-96 | ANCLOTE KEY | 4.0 | 22.5 | GN | 36.5 | M |
| 127 | FL/GULF | 01-May-96 | ANCLOTE KEY | 4.0 | 22.5 | GN | 72.0 | F |
| 128 | FL/GULF | 01-May-96 | ANCLOTE KEY | 6.0 | 22.8 | GN | 74.0 | F |
| 228 | FL/KEYS/GULF | 02-May-96 | SUNSHINE KEY | 72.0 | - | RR | 99.0 | F |
| 229 | FL/KEYS/GULF | 02-May-96 | SUNSHINE KEY | 72.0 | - | RR | 88.0 | M |
| 230 | FL/KEYS/GULF | 02-May-96 | SUNSHINE KEY | 72.0 | - | RR | 93.0 | M |
| 259 | MS | 03-May-96 | BILOXI | 8.0 | - | RR | 158.5 | F |
| 170 | LA | 03-May-96 | CHANDELEUR ISLAND | 10.0 | - | RR | 106.5 | F |
| 171 | LA | 03-May-96 | CHANDELEUR ISLAND | 10.0 | - | RR | 115.0 | F |
| 172 | LA | 03-May-96 | CHANDELEUR ISLAND | 10.0 | - | RR | 115.0 | F |
| 174 | MS | 03-May-96 | HORN ISLAND | 10.0 | - | RR | 96.5 | F |
| 175 | MS | 03-May-96 | HORN ISLAND | 10.0 | - | RR | 92.5 | F |
| 168 | MS | 03-May-96 | HORN ISLAND | 11.0 | - | RR | 103.0 | F |
| 169 | MS | 03-May-96 | HORN ISLAND | 11.0 | - | RR | 105.0 | F |
| 181 | MS | 03-May-96 | HORN ISLAND | 11.0 | - | RR | 98.3 | M |
| 173 | LA | 03-May-96 | CHANDELEUR ISLAND | 12.0 | - | RR | 116.5 | F |
| 231 | FL/KEYS/GULF | 03-May-96 | SUNSHINE KEY | 86.0 | - | RR | 106.0 | F |
| 162 | MS | 03-May-96 | BILOXI | - | - | RR | 93.0 | M |
| 163 | MS | 03-May-96 | BILOXI | - | - | RR | 95.5 | F |
| 164 | MS | 03-May-96 | BILOXI | - | - | RR | 104.5 | F |
| 165 | MS | 03-May-96 | BILOXI | - | - | RR | 103.5 | F |
| 166 | MS | 03-May-96 | BILOXI | - | - | RR | 101.5 | F |
| 167 | MS | 03-May-96 | BILOXI | - | - | RR | 104.5 | F |
| 176 | MS | 03-May-96 | BILOXI | - | - | RR | 102.0 | F |

**Table 3 (continued).** Data from cobia from which biological samples were collected during (8/1/95 - 12/31/97) listed by state - (RR = rod & reel, GN = gill net, TRL = trawl, SP = spear).

| Fish | State | Capture Date | Capture Area | Water Depth (ft) | Water Temp. (C) | Gear Type | Fork Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 177 | MS | 03-May-96 | BILOXI | - | - | RR | 98.5 | F |
| 178 | MS | 03-May-96 | BILOXI | - | - | RR | 98.8 | F |
| 179 | MS | 03-May-96 | BILOXI | - | - | RR | 85.0 | F |
| 180 | LA | 03-May-96 | CHANDELEUR ISLAND | - | - | RR | 135.0 | F |
| 260 | MS | 03-May-96 | BILOXI | - | - | RR | 155.5 | F |
| 190 | LA | 04-May-96 | CHANDELEUR ISLAND | 7.0 | - | RR | 105.0 | M |
| 192 | LA | 04-May-96 | CHANDELEUR ISLAND | 7.0 | - | RR | 99.2 | F |
| 193 | LA | 04-May-96 | CHANDELEUR ISLAND | 7.0 | - | RR | 107.8 | F |
| 194 | LA | 04-May-96 | CHANDELEUR ISLAND | 9.0 | - | RR | 93.5 | F |
| 195 | LA | 04-May-96 | CHANDELEUR ISLAND | 9.0 | - | RR | 98.7 | F |
| 187 | LA | 04-May-96 | CHANDELEUR ISLAND | 10.0 | - | RR | 123.0 | F |
| 188 | LA | 04-May-96 | CHANDELEUR ISLAND | 10.0 | - | RR | 104.0 | F |
| 189 | LA | 04-May-96 | CHANDELEUR ISLAND | 10.0 | - | RR | 126.0 | F |
| 199 | LA | 04-May-96 | CHANDELEUR ISLAND | 10.0 | - | RR | 100.0 | F |
| 200 | LA | 04-May-96 | CHANDELEUR ISLAND | 10.0 | - | RR | 95.5 | F |
| 201 | LA | 04-May-96 | CHANDELEUR ISLAND | 10.0 | - | RR | 131.0 | F |
| 183 | LA | 04-May-96 | CHANDELEUR ISLAND | 11.0 | - | RR | 106.5 | F |
| 184 | LA | 04-May-96 | CHANDELEUR ISLAND | 11.0 | - | RR | 109.6 | F |
| 185 | LA | 04-May-96 | CHANDELEUR ISLAND | 11.0 | - | RR | 114.6 | F |
| 196 | LA | 04-May-96 | CHANDELEUR ISLAND | 12.0 | - | RR | 119.5 | F |
| 197 | LA | 04-May-96 | CHANDELEUR ISLAND | 12.0 | - | RR | 120.8 | F |
| 198 | LA | 04-May-96 | CHANDELEUR ISLAND | 12.0 | - | RR | 118.4 | F |
| 191 | MS | 04-May-96 | HORN ISLAND | 13.0 | - | RR | 102.6 | F |
| 186 | LA | 04-May-96 | CURLEW RIGS, LA | 27.0 | - | RR | 106.0 | F |
| 182 | MS | 04-May-96 | BILOXI | - | - | RR | 87.0 | M |
| 203 | LA | 05-May-96 | CHANDELEUR ISLAND | 10.0 | - | RR | 123.0 | F |
| 204 | LA | 05-May-96 | CHANDELEUR ISLAND | 10.0 | - | RR | 114.0 | F |
| 205 | LA | 05-May-96 | CHANDELEUR ISLAND | 10.0 | - | RR | 134.5 | F |
| 206 | LA | 05-May-96 | CHANDELEUR ISLAND | 10.0 | - | RR | 131.2 | F |
| 151 | LA | 05-May-96 | CHANDELEUR ISLAND | 12.0 | - | RR | 108.5 | F |
| 202 | LA | 05-May-96 | CHANDELEUR ISLAND | 12.0 | - | RR | 90.0 | F |
| 207 | MS | 05-May-96 | CHANDELEUR ISLAND | 12.0 | - | RR | 98.5 | F |
| 208 | LA | 05-May-96 | CHANDELEUR ISLAND | 12.0 | - | RR | 128.0 | F |
| 209 | LA | 05-May-96 | CHANDELEUR ISLAND | 12.0 | - | RR | 129.5 | F |
| 210 | LA | 05-May-96 | CHANDELEUR ISLAND | 12.0 | - | RR | 110.0 | F |
| 211 | LA | 05-May-96 | CHANDELEUR ISLAND | 12.0 | - | RR | 117.5 | F |
| 146 | SC | 08-May-96 | HH SOUTH BEACH | 10.0 | 22.0 | RR | 96.5 | M |

**Table 3 (continued).** Data from cobia from which biological samples were collected during (8/1/95 - 12/31/97) listed by state - (RR = rod & reel, GN = gill net, TRL = trawl, SP = spear).

| Fish | State | Capture Date | Capture Area | Water Depth (ft) | Water Temp. (C) | Gear Type | Fork Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 216 | FL/GULF | 08-May-96 | YANKEE TOWN | 7.0 | 26.8 | GN | 69.0 | M |
| 217 | FL/GULF | 08-May-96 | YANKEE TOWN | 7.0 | 26.8 | GN | 74.0 | M |
| 145 | SC | 10-May-96 | HH TIRE REEF | 50.0 | 22.0 | RR | 91.0 | M |
| 221 | SC | 10-May-96 | HH TIRE REEF | 50.0 | 22.0 | RR | 117.0 | F |
| 463 | FL/PAN | 12-May-96 | PANAMA CITY | 140.0 | - | RR | 121.0 | F |
| 300 | TX | 14-May-96 | PORT ARANSAS | 325.0 | 25.7 | RR | 89.5 | M |
| 297 | TX | 15-May-96 | PORT ARANSAS | 325.0 | 25.7 | RR | 104.8 | M |
| 298 | TX | 15-May-96 | PORT ARANSAS | 325.0 | 25.7 | RR | 83.8 | M |
| 144 | SC | 16-May-96 | HH TIRE REEF | 60.0 | 22.0 | RR | 117.0 | F |
| 222 | SC | 16-May-96 | HH TIRE REEF | 60.0 | 22.0 | RR | 116.0 | F |
| 129 | FL/GULF | 19-May-96 | BRADENTON | 5.0 | - | RR | 93.0 | F |
| 223 | SC | 21-May-96 | HH TIRE REEF | 35.0 | 22.0 | RR | 118.0 | F |
| 308 | TX | 21-May-96 | PORT ARANSAS | 325.0 | 25.7 | RR | 99.4 | M |
| 296 | TX | 21-May-96 | PORT ARANSAS | 325.0 | 25.8 | RR | 91.4 | M |
| 301 | TX | 21-May-96 | PORT ARANSAS | 325.0 | 25.8 | RR | 86.4 | M |
| 302 | TX | 21-May-96 | PORT ARANSAS | 325.0 | 25.8 | RR | 95.6 | M |
| 304 | TX | 21-May-96 | PORT ARANSAS | 325.0 | 25.8 | RR | 85.1 | M |
| 305 | TX | 21-May-96 | PORT ARANSAS | 325.0 | 25.8 | RR | 94.0 | M |
| 306 | TX | 21-May-96 | PORT ARANSAS | 325.0 | 25.8 | RR | 85.4 | M |
| 307 | TX | 21-May-96 | PORT ARANSAS | 325.0 | 25.8 | RR | 88.3 | M |
| 130 | SC | 22-May-96 | BROAD RIVER | 20.0 | 22.0 | RR | 101.0 | M |
| 131 | SC | 22-May-96 | EAGLE'S NEST REEF | 65.0 | 22.0 | RR | 113.0 | F |
| 132 | SC | 22-May-96 | BETSY ROSS REEF | - | 22.0 | RR | 102.0 | F |
| 133 | SC | 22-May-96 | EAGLE'S NEST REEF | - | 22.0 | RR | 110.0 | M |
| 134 | SC | 22-May-96 | HH TIRE REEF | - | 22.0 | RR | 107.0 | M |
| 135 | SC | 22-May-96 | EAGLE'S NEST REEF | - | 22.0 | RR | 99.0 | M |
| 136 | SC | 22-May-96 | L BUOY | - | 22.0 | RR | 98.5 | M |
| 137 | SC | 22-May-96 | HH TIRE REEF | - | 22.0 | RR | 104.0 | M |
| 138 | SC | 22-May-96 | HH TIRE REEF | - | 22.0 | RR | 97.0 | M |
| 139 | SC | 22-May-96 | SAVANNA TOWER | - | 22.0 | RR | 102.0 | M |
| 140 | SC | 22-May-96 | HILTON HEAD | - | 22.0 | RR | 95.5 | M |
| 278 | TX | 22-May-96 | PORT ARANSAS | 325.0 | 25.8 | RR | 121.9 | F |
| 299 | TX | 22-May-96 | PORT ARANSAS | 325.0 | 25.8 | RR | 87.0 | M |
| 392 | TX | 22-May-96 | PORT ARANSAS | - | 25.8 | RR | 88.3 | M |
| 142 | SC | 24-May-96 | BROAD RIVER | 25.0 | 22.0 | RR | 80.5 | M |
| 261 | MS | 24-May-96 | BILOXI | - | - | RR | 125.1 | F |
| 262 | MS | 24-May-96 | BILOXI | - | - | RR | 90.2 | F |

**Table 3 (continued).** Data from cobia from which biological samples were collected during (8/1/95 - 12/31/97) listed by state - (RR = rod & reel, GN = gill net, TRL = trawl, SP = spear).

| Fish | State | Capture Date | Capture Area | Water Depth (ft) | Water Temp. (C) | Gear Type | Fork Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 263 | MS | 24-May-96 | BILOXI | - | - | RR | 123.1 | F |
| 141 | SC | 25-May-96 | BROAD RIVER | 12.0 | 22.0 | RR | 104.0 | M |
| 143 | SC | 25-May-96 | BROAD RIVER | 40.0 | 22.0 | RR | 84.5 | M |
| 215 | FL/ATL | 25-May-96 | PORT CANAVERAL | 20.5 | - | RR | 94.0 | M |
| 214 | FL/ATL | 25-May-96 | PORT CANAVERAL | 120.0 | - | RR | 99.0 | M |
| 213 | FL/ATL | 25-May-96 | PORT CANAVERAL | 130.0 | - | RR | 94.5 | M |
| 237 | NC | 26-May-96 | HARKERS ISLAND | 20.0 | - | RR | 101.0 | M |
| 255 | SC | 26-May-96 | HILTON HEAD | 30.0 | - | RR | 117.5 | F |
| 238 | NC | 26-May-96 | SHACKLEFORD ISLAND | - | - | RR | 127.0 | F |
| 239 | NC | 26-May-96 | HARKERS ISLAND | - | - | RR | 132.0 | F |
| 240 | NC | 26-May-96 | HARKERS ISLAND | - | - | RR | 106.0 | F |
| 241 | NC | 26-May-96 | HARKERS ISLAND | - | - | RR | 100.0 | M |
| 460 | FL/PAN | 30-May-96 | PANAMA CITY | 140.0 | - | RR | 98.8 | F |
| 282 | TX | 01-Jun-96 | PORT ARANSAS | 325.0 | 27.3 | RR | 85.4 | M |
| 283 | TX | 02-Jun-96 | PORT ARANSAS | 325.0 | 27.3 | RR | 83.8 | F |
| 284 | TX | 02-Jun-96 | PORT ARANSAS | 325.0 | 27.3 | RR | 93.4 | F |
| 285 | TX | 02-Jun-96 | PORT ARANSAS | 325.0 | 27.3 | RR | 102.2 | F |
| 286 | TX | 02-Jun-96 | PORT ARANSAS | 325.0 | 27.3 | RR | 118.8 | F |
| 224 | FL/GULF | 05-Jun-96 | TARPON SPRINGS | - | - | GN | 57.0 | M |
| 225 | FL/ATL | 08-Jun-96 | PORT CANAVERAL | 55.0 | - | RR | 104.5 | F |
| 226 | FL/ATL | 08-Jun-96 | PORT CANAVERAL | 90.0 | - | RR | 109.0 | F |
| 242 | NC | 08-Jun-96 | HARKERS ISLAND | - | - | RR | 120.0 | F |
| 243 | NC | 08-Jun-96 | HARKERS ISLAND | - | - | RR | 101.0 | F |
| 244 | NC | 08-Jun-96 | HARKERS ISLAND | - | - | RR | 127.0 | F |
| 245 | NC | 08-Jun-96 | HARKERS ISLAND | - | - | RR | 107.0 | F |
| 246 | NC | 08-Jun-96 | HARKERS ISLAND | - | - | RR | 99.0 | F |
| 247 | NC | 08-Jun-96 | HARKERS ISLAND | - | - | RR | 121.0 | F |
| 248 | NC | 08-Jun-96 | HARKERS ISLAND | - | - | RR | 114.0 | F |
| 249 | NC | 08-Jun-96 | HARKERS ISLAND | - | - | RR | 114.0 | F |
| 250 | NC | 08-Jun-96 | HARKERS ISLAND | - | - | RR | 120.0 | F |
| 251 | NC | 08-Jun-96 | HARKERS ISLAND | - | - | RR | 118.0 | F |
| 252 | NC | 08-Jun-96 | HARKERS ISLAND | - | - | RR | 134.0 | F |
| 236 | NC | 09-Jun-96 | NEWPORT BEACH | - | - | RR | 85.0 | M |
| 235 | NC | 10-Jun-96 | NEWPORT BEACH | 20.0 | - | RR | 85.0 | M |
| 477 | FL/PAN | 15-Jun-96 | PANAMA CITY | 140.0 | - | RR | 144.7 | F |
| 234 | FL/GULF | 17-Jun-96 | SARASOTA | 3.0 | 30.4 | GN | 80.0 | F |
| 232 | FL/GULF | 17-Jun-96 | TAMPA | 35.0 | - | RR | 84.0 | M |

**Table 3 (continued).** Data from cobia from which biological samples were collected during (8/1/95 - 12/31/97) listed by state - (RR = rod & reel, GN = gill net, TRL = trawl, SP = spear).

| Fish | State | Capture Date | Capture Area | Water Depth (ft) | Water Temp. (C) | Gear Type | Fork Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 233 | FL/GULF | 17-Jun-96 | TAMPA | 35.0 | - | RR | 111.0 | F |
| 462 | FL/PAN | 22-Jun-96 | PANAMA CITY | - | - | RR | 90.5 | M |
| 464 | FL/PAN | 23-Jun-96 | PANAMA CITY | - | - | RR | 88.7 | M |
| 465 | FL/PAN | 23-Jun-96 | PANAMA CITY | - | - | RR | 98.0 | F |
| 466 | FL/PAN | 23-Jun-96 | PANAMA CITY | - | - | RR | 118.4 | M |
| 303 | TX | 27-Jun-96 | PORT ARANSAS | 325.0 | 28.5 | RR | 90.8 | M |
| 288 | TX | 28-Jun-96 | PORT ARANSAS | 325.0 | 28.5 | RR | 91.4 | M |
| 253 | FL/GULF | 28-Jun-96 | CRYSTAL RIVER | 8.0 | 31.0 | GN | 56.0 | F |
| 280 | TX | 29-Jun-96 | PORT ARANSAS | 325.0 | 28.5 | RR | 117.5 | F |
| 281 | TX | 29-Jun-96 | PORT ARANSAS | 325.0 | 28.5 | RR | 84.5 | F |
| 287 | TX | 29-Jun-96 | PORT ARANSAS | 325.0 | 28.5 | RR | 83.2 | M |
| 264 | MS | 02-Jul-96 | GULFPORT | - | - | RR | 92.0 | F |
| 265 | MS | 02-Jul-96 | GULFPORT | - | - | RR | 89.8 | F |
| 267 | MS | 03-Jul-96 | GULFPORT | - | - | RR | 105.5 | F |
| 268 | MS | 03-Jul-96 | GULFPORT | - | - | RR | 92.2 | F |
| 269 | MS | 03-Jul-96 | GULFPORT | - | - | RR | 88.8 | F |
| 270 | MS | 05-Jul-96 | GULFPORT | - | - | RR | 101.3 | M |
| 271 | MS | 05-Jul-96 | GULFPORT | - | - | RR | 100.0 | F |
| 272 | MS | 05-Jul-96 | GULFPORT | - | - | RR | 97.0 | M |
| 273 | MS | 05-Jul-96 | GULFPORT | - | - | RR | 100.0 | F |
| 274 | MS | 05-Jul-96 | GULFPORT | - | - | RR | 120.1 | F |
| 275 | MS | 06-Jul-96 | GULFPORT | - | - | RR | 122.2 | F |
| 276 | MS | 06-Jul-96 | GULFPORT | - | - | RR | 123.0 | M |
| 277 | MS | 06-Jul-96 | GULFPORT | - | - | RR | 102.1 | F |
| 289 | TX | 07-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 118.8 | F |
| 290 | TX | 07-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 92.7 | M |
| 291 | TX | 07-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 91.4 | M |
| 292 | TX | 07-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 87.6 | M |
| 293 | TX | 07-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 92.1 | M |
| 294 | TX | 07-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 102.9 | M |
| 295 | TX | 07-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 115.6 | F |
| 257 | FL/GULF | 08-Jul-96 | HILLSBOROUGH BAY | 4.0 | - | RR | 90.0 | F |
| 258 | FL/GULF | 08-Jul-96 | HILLSBOROUGH BAY | 50.0 | - | RR | 84.5 | M |
| 256 | FL/GULF | 08-Jul-96 | SARASOTA | - | - | RR | 88.0 | F |
| 325 | TX | 11-Jul-96 | PORT ARANSAS | - | 29.0 | RR | 95.3 | M |
| 327 | TX | 16-Jul-96 | PORT ARANSAS | 55.0 | 29.0 | RR | 104.1 | F |
| 328 | TX | 16-Jul-96 | PORT ARANSAS | 55.0 | 29.0 | RR | 116.2 | F |

**Table 3 (continued).** Data from cobia from which biological samples were collected during (8/1/95 - 12/31/97) listed by state - (RR = rod & reel, GN = gill net, TRL = trawl, SP = spear).

| Fish | State | Capture Date | Capture Area | Water Depth (ft) | Water Temp. (C) | Gear Type | Fork Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 329 | TX | 16-Jul-96 | PORT ARANSAS | 55.0 | 29.0 | RR | 90.5 | F |
| 330 | TX | 16-Jul-96 | PORT ARANSAS | 55.0 | 29.0 | RR | 100.3 | F |
| 332 | TX | 16-Jul-96 | PORT ARANSAS | 55.0 | 29.0 | RR | 109.9 | F |
| 333 | TX | 16-Jul-96 | PORT ARANSAS | 55.0 | 29.0 | RR | 99.1 | F |
| 335 | TX | 16-Jul-96 | PORT ARANSAS | 55.0 | 29.0 | RR | 83.2 | M |
| 390 | TX | 16-Jul-96 | PORT ARANSAS | 55.0 | 29.0 | RR | 111.8 | F |
| 389 | TX | 16-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 83.2 | F |
| 391 | TX | 16-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 106.0 | F |
| 254 | FL/GULF | 16-Jul-96 | HILLSBOROUGH BAY | 50.0 | - | RR | 93.0 | F |
| 266 | FL/GULF | 16-Jul-96 | HILLSBOROUGH BAY | 50.0 | - | RR | 87.0 | M |
| 334 | TX | 17-Jul-96 | PORT ARANSAS | 55.0 | 29.0 | RR | 81.9 | F |
| 331 | TX | 17-Jul-96 | PORT ARANSAS | 120.0 | 29.0 | RR | 79.4 | F |
| 336 | TX | 17-Jul-96 | PORT ARANSAS | 120.0 | 29.0 | RR | 118.4 | F |
| 338 | TX | 17-Jul-96 | PORT ARANSAS | 120.0 | 29.0 | RR | 124.5 | F |
| 339 | TX | 17-Jul-96 | PORT ARANSAS | 120.0 | 29.0 | RR | 88.3 | F |
| 309 | FL/GULF | 17-Jul-96 | HILLSBOROUGH BAY | 50.0 | - | RR | 86.0 | F |
| 310 | FL/GULF | 17-Jul-96 | HILLSBOROUGH BAY | 50.0 | - | RR | 91.0 | M |
| 321 | MS | 18-Jul-96 | OCEAN SPRINGS | - | - | RR | 76.0 | M |
| 322 | MS | 19-Jul-96 | BILOXI | - | - | RR | 123.0 | F |
| 323 | MS | 19-Jul-96 | BILOXI | - | - | RR | 125.0 | F |
| 324 | MS | 22-Jul-96 | OCEAN SPRINGS | 3.0 | - | RR | 96.5 | F |
| 326 | TX | 24-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 101.0 | F |
| 341 | TX | 24-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 121.9 | F |
| 342 | TX | 24-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 95.6 | F |
| 343 | TX | 24-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 86.0 | M |
| 344 | TX | 24-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 101.3 | F |
| 279 | TX | 25-Jul-96 | PORT ARANSAS | - | 25.8 | RR | 105.4 | M |
| 345 | TX | 25-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 121.9 | F |
| 346 | TX | 25-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 94.0 | M |
| 347 | TX | 25-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 97.8 | F |
| 348 | TX | 25-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 85.1 | F |
| 349 | TX | 25-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 94.0 | M |
| 350 | TX | 25-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 120.7 | F |
| 351 | TX | 25-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 100.3 | F |
| 352 | TX | 25-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 89.2 | F |
| 353 | TX | 25-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 106.0 | F |
| 354 | TX | 25-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 87.9 | F |

**Table 3 (continued).** Data from cobia from which biological samples were collected during (8/1/95 - 12/31/97) listed by state - (RR = rod & reel, GN = gill net, TRL = trawl, SP = spear).

| Fish | State | Capture Date | Capture Area | Water Depth (ft) | Water Temp. (C) | Gear Type | Fork Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 355 | TX | 25-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 108.9 | F |
| 356 | TX | 25-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 90.2 | F |
| 357 | TX | 26-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 100.0 | F |
| 358 | TX | 26-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 109.9 | F |
| 359 | TX | 26-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 104.8 | F |
| 360 | TX | 26-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 89.5 | F |
| 361 | TX | 26-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 102.2 | F |
| 362 | TX | 26-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 97.8 | F |
| 363 | TX | 26-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 108.6 | F |
| 364 | TX | 26-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 87.9 | F |
| 365 | TX | 26-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 107.6 | F |
| 366 | TX | 26-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 99.1 | F |
| 367 | TX | 26-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 93.3 | M |
| 368 | TX | 26-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 87.9 | F |
| 369 | TX | 26-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 89.9 | M |
| 370 | TX | 26-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 86.4 | F |
| 371 | TX | 26-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 101.3 | F |
| 372 | TX | 26-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 91.8 | M |
| 373 | TX | 26-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 95.6 | F |
| 374 | TX | 26-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 128.3 | F |
| 375 | TX | 26-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 117.5 | F |
| 376 | TX | 26-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 99.4 | F |
| 377 | TX | 28-Jul-96 | PORT ARANSAS | 80.0 | 29.0 | RR | 105.7 | F |
| 378 | TX | 28-Jul-96 | PORT ARANSAS | 80.0 | 29.0 | RR | 101.3 | M |
| 379 | TX | 28-Jul-96 | PORT ARANSAS | 80.0 | 29.0 | RR | 94.6 | M |
| 380 | TX | 28-Jul-96 | PORT ARANSAS | 80.0 | 29.0 | RR | 90.8 | F |
| 381 | TX | 28-Jul-96 | PORT ARANSAS | 80.0 | 29.0 | RR | 104.5 | F |
| 382 | TX | 28-Jul-96 | PORT ARANSAS | 80.0 | 29.0 | RR | 87.9 | M |
| 383 | TX | 30-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 97.2 | M |
| 384 | TX | 30-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 88.6 | M |
| 385 | TX | 30-Jul-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 115.6 | F |
| 311 | FL/GULF | 30-Jul-96 | HILLSBOROUGH BAY | 41.0 | - | RR | 89.0 | F |
| 312 | FL/GULF | 30-Jul-96 | HILLSBOROUGH BAY | 41.0 | - | RR | 86.0 | F |
| 469 | FL/PAN | 03-Aug-96 | PANAMA CITY | 140.0 | - | RR | 104.0 | F |
| 386 | TX | 07-Aug-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 84.5 | F |
| 387 | TX | 07-Aug-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 83.8 | M |
| 388 | TX | 07-Aug-96 | PORT ARANSAS | 325.0 | 29.0 | RR | 86.0 | F |

**Table 3 (continued).** Data from cobia from which biological samples were collected during (8/1/95 - 12/31/97) listed by state - (RR = rod & reel, GN = gill net, TRL = trawl, SP = spear).

| Fish | State | Capture Date | Capture Area | Water Depth (ft) | Water Temp. (C) | Gear Type | Fork Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 337 | TX | 07-Aug-96 | PORT ARANSAS | 325.0 | - | RR | 81.6 | M |
| 398 | MS | 08-Aug-96 | OCEAN SPRINGS | 30.0 | - | RR | 102.0 | F |
| 399 | MS | 08-Aug-96 | OCEAN SPRINGS | 30.0 | - | RR | 103.0 | F |
| 400 | MS | 08-Aug-96 | OCEAN SPRINGS | 30.0 | - | RR | 95.0 | F |
| 401 | MS | 08-Aug-96 | OCEAN SPRINGS | 35.0 | - | RR | 65.5 | F |
| 402 | MS | 08-Aug-96 | SHIP ISLAND | 35.0 | - | RR | 89.3 | M |
| 470 | FL/PAN | 11-Aug-96 | PANAMA CITY | 140.0 | - | RR | 91.5 | F |
| 471 | FL/PAN | 11-Aug-96 | PANAMA CITY | 140.0 | - | RR | 92.4 | M |
| 472 | FL/PAN | 11-Aug-96 | PANAMA CITY | 140.0 | - | RR | 89.5 | M |
| 393 | FL/GULF | 14-Aug-96 | SARASOTA BAY | - | 31.0 | RR | 78.0 | F |
| 467 | FL/PAN | 17-Aug-96 | PANAMA CITY | 140.0 | - | RR | 95.2 | M |
| 475 | FL/PAN | 24-Aug-96 | PANAMA CITY | 140.0 | - | RR | 88.2 | F |
| 468 | FL/PAN | 01-Sep-96 | PANAMA CITY | 140.0 | - | RR | 103.0 | F |
| 394 | FL/GULF | 05-Sep-96 | CHARLOTTE HARBOR | 6.0 | 30.1 | GN | 67.0 | F |
| 473 | FL/PAN | 14-Sep-96 | PANAMA CITY | 140.0 | - | RR | 82.0 | M |
| 403 | MS | 14-Sep-96 | OFF COASTAL MS | - | - | RR | 82.5 | M |
| 404 | MS | 14-Sep-96 | OFF COASTAL MS | - | - | RR | 92.5 | F |
| 405 | MS | 15-Sep-96 | OFF COASTAL MS | - | - | RR | 99.0 | M |
| 406 | MS | 15-Sep-96 | OFF COASTAL MS | - | - | RR | 102.0 | F |
| 407 | MS | 15-Sep-96 | OFF COASTAL MS | - | - | RR | 84.2 | M |
| 408 | MS | 15-Sep-96 | OFF COASTAL MS | - | - | RR | 93.0 | F |
| 409 | MS | 15-Sep-96 | OFF COASTAL MS | - | - | RR | 97.6 | F |
| 410 | MS | 15-Sep-96 | OFF COASTAL MS | - | - | RR | 95.6 | F |
| 411 | MS | 15-Sep-96 | OFF COASTAL MS | - | - | RR | 113.0 | F |
| 412 | MS | 15-Sep-96 | OFF COASTAL MS | - | - | RR | 96.5 | F |
| 413 | MS | 15-Sep-96 | OFF COASTAL MS | - | - | RR | 108.5 | F |
| 414 | MS | 15-Sep-96 | OFF COASTAL MS | - | - | RR | 95.3 | F |
| 415 | LA | 15-Sep-96 | WEST OF MS RIVER | - | - | RR | 87.5 | F |
| 416 | LA | 15-Sep-96 | WEST OF MS RIVER | - | - | RR | 89.0 | M |
| 340 | MS | 19-Sep-96 | OCEAN SPRINGS | 18.0 | - | RR | 96.0 | F |
| 395 | FL/ATL | 21-Sep-96 | PORT CANAVERAL | 120.0 | - | RR | 91.0 | M |
| 396 | FL/ATL | 21-Sep-96 | PORT CANAVERAL | 120.0 | - | RR | 102.0 | M |
| 397 | FL/ATL | 21-Sep-96 | PORT CANAVERAL | 120.0 | - | RR | 83.0 | M |
| 652 | MS | 24-Sep-96 | SHIP ISLAND | 35.0 | - | RR | 83.5 | M |
| 417 | FL/GULF | 27-Sep-96 | LONGBOAT KEY | 18.0 | 28.0 | RR | 92.0 | F |
| 418 | FL/GULF | 27-Sep-96 | LONGBOAT KEY | 18.0 | 28.0 | RR | 81.5 | M |
| 419 | FL/GULF | 30-Sep-96 | LONGBOAT KEY | 18.0 | 29.0 | RR | 89.0 | F |

**Table 3 (continued).** Data from cobia from which biological samples were collected during (8/1/95 - 12/31/97) listed by state - (RR = rod & reel, GN = gill net, TRL = trawl, SP = spear).

| Fish | State | Capture Date | Capture Area | Water Depth (ft) | Water Temp. (C) | Gear Type | Fork Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 420 | FL/GULF | 01-Oct-96 | LONGBOAT KEY | 17.0 | 29.0 | RR | 94.0 | F |
| 421 | FL/GULF | 01-Oct-96 | LONGBOAT KEY | 17.0 | 29.0 | RR | 80.5 | F |
| 422 | FL/GULF | 01-Oct-96 | LONGBOAT KEY | 17.0 | 29.0 | RR | 85.0 | F |
| 423 | FL/GULF | 01-Oct-96 | LIDO KEY | 17.0 | 29.0 | RR | 82.0 | M |
| 424 | FL/GULF | 02-Oct-96 | LONGBOAT KEY | 18.0 | 29.0 | RR | 94.0 | F |
| 425 | FL/GULF | 02-Oct-96 | LONGBOAT KEY | 18.0 | 29.0 | RR | 89.5 | F |
| 426 | FL/GULF | 04-Oct-96 | SARASOTA | 18.0 | 28.0 | RR | 89.0 | M |
| 427 | FL/GULF | 04-Oct-96 | SARASOTA | 18.0 | 28.0 | RR | 97.0 | F |
| 428 | FL/GULF | 06-Oct-96 | SARASOTA | 18.0 | 27.0 | RR | 83.0 | M |
| 429 | FL/GULF | 06-Oct-96 | SARASOTA | 18.0 | 27.0 | RR | 102.0 | F |
| 430 | FL/GULF | 06-Oct-96 | SARASOTA | 18.0 | 27.0 | RR | 85.0 | F |
| 431 | FL/GULF | 06-Oct-96 | SARASOTA | 18.0 | 27.0 | RR | 87.5 | F |
| 432 | FL/GULF | 22-Oct-96 | LONGBOAT KEY | 6.0 | 23.3 | GN | 44.0 | F |
| 433 | FL/GULF | 27-Oct-96 | SARASOTA | - | 26.0 | RR | 86.0 | F |
| 434 | FL/GULF | 27-Oct-96 | SARASOTA | - | 26.0 | RR | 89.0 | F |
| 436 | FL/GULF | 31-Oct-96 | SARASOTA | 30.0 | 26.0 | RR | 99.5 | F |
| 448 | FL/GULF | 01-Nov-96 | PALMETTO | 45.0 | - | SP | 86.0 | M |
| 437 | FL/GULF | 02-Nov-96 | ALAN FISHER REEF | 31.0 | 27.0 | RR | 100.5 | F |
| 439 | FL/GULF | 05-Nov-96 | LONGBOAT KEY | 18.0 | 24.0 | RR | 82.0 | F |
| 440 | FL/GULF | 05-Nov-96 | LONGBOAT KEY | 18.0 | 24.0 | RR | 92.0 | F |
| 438 | FL/GULF | 05-Nov-96 | ALAN FISHER REEF | 31.0 | 24.0 | RR | 89.0 | M |
| 442 | FL/GULF | 06-Nov-96 | LONGBOAT KEY | 18.0 | 25.0 | RR | 86.0 | M |
| 441 | FL/GULF | 08-Nov-96 | DONALD ROEHR REEF | 21.0 | 25.0 | RR | 82.0 | M |
| 443 | FL/GULF | 19-Nov-96 | LONGBOAT KEY | 8.0 | 19.9 | GN | 61.0 | F |
| 444 | FL/GULF | 19-Nov-96 | LONGBOAT KEY | 8.0 | 19.9 | GN | 62.0 | M |
| 445 | FL/GULF | 19-Nov-96 | LONGBOAT KEY | 8.0 | 20.0 | GN | 39.5 | M |
| 446 | FL/GULF | 19-Nov-96 | LONGBOAT KEY | 8.0 | 20.0 | GN | 41.5 | M |
| 447 | FL/GULF | 21-Nov-96 | SARASOTA | 70.0 | 22.0 | RR | 101.0 | F |
| 451 | FL/KEYS/GULF | 25-Nov-96 | N.OF CONTENT KEY | 16.0 | - | RR | 89.5 | F |
| 452 | FL/KEYS/GULF | 25-Nov-96 | N.OF CONTENT KEY | 16.0 | - | RR | 86.5 | F |
| 449 | FL/GULF | 03-Dec-96 | SARASOTA D6 | 104.0 | 20.0 | RR | 127.0 | M |
| 450 | FL/KEYS/GULF | 02-Feb-97 | UPPER HARBOR KEY | 8.0 | - | RR | 79.5 | M |
| 478 | FL/GULF | 06-Mar-97 | LONGBOAT KEY | 5.0 | 25.1 | GN | 35.5 | F |
| 498 | FL/GULF | 06-Mar-97 | BIG PINE KEY | 50.0 | - | RR | 100.0 | F |
| 499 | FL/GULF | 06-Mar-97 | BIG PINE KEY | 50.0 | - | RR | 86.0 | M |
| 479 | FL/GULF | 25-Mar-97 | LONGBOAT KEY | 7.0 | 24.0 | GN | 47.0 | F |
| 488 | FL/ATL | 29-Mar-97 | COCOA BEACH | 30.0 | 22.0 | RR | 86.0 | M |

**Table 3 (continued).** Data from cobia from which biological samples were collected during (8/1/95 - 12/31/97) listed by state - (RR = rod & reel, GN = gill net, TRL = trawl, SP = spear).

| Fish | State | Capture Date | Capture Area | Water Depth (ft) | Water Temp. (C) | Gear Type | Fork Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 482 | FL/ATL | 29-Mar-97 | COCOA BEACH | 40.0 | 22.0 | RR | 89.0 | F |
| 489 | FL/ATL | 29-Mar-97 | COCOA BEACH | 40.0 | 22.0 | RR | 117.0 | F |
| 485 | FL/ATL | 29-Mar-97 | COCOA BEACH | 50.0 | 22.0 | RR | 107.0 | F |
| 486 | FL/ATL | 29-Mar-97 | COCOA BEACH | 50.0 | 22.0 | RR | 106.0 | F |
| 487 | FL/ATL | 29-Mar-97 | COCOA BEACH | 50.0 | 22.0 | RR | 96.0 | F |
| 480 | FL/ATL | 29-Mar-97 | COCOA BEACH | 52.0 | 22.0 | RR | 98.0 | F |
| 481 | FL/ATL | 29-Mar-97 | COCOA BEACH | 52.0 | 22.0 | RR | 94.0 | F |
| 490 | FL/ATL | 29-Mar-97 | COCOA BEACH | 55.0 | 22.0 | RR | 90.5 | F |
| 484 | FL/ATL | 29-Mar-97 | COCOA BEACH | 75.0 | 22.0 | RR | 96.0 | F |
| 483 | FL/ATL | 29-Mar-97 | COCOA BEACH | 80.0 | 22.0 | RR | 89.0 | M |
| 493 | FL/ATL | 29-Mar-97 | COCOA BEACH | 80.0 | 22.0 | RR | 107.0 | M |
| 494 | FL/ATL | 29-Mar-97 | COCOA BEACH | 80.0 | 22.0 | RR | 116.0 | F |
| 495 | FL/ATL | 29-Mar-97 | COCOA BEACH | 80.0 | 22.0 | RR | 98.5 | F |
| 492 | FL/ATL | 29-Mar-97 | COCOA BEACH | 85.0 | 22.0 | RR | 102.0 | F |
| 491 | FL/ATL | 29-Mar-97 | COCOA BEACH | - | 22.0 | RR | 100.0 | F |
| 496 | FL/GULF | 03-Apr-97 | HUDSON CHANNEL | 9.0 | 20.4 | GN | 70.4 | F |
| 497 | FL/ATL | 10-Apr-97 | ISLAMORADA | - | - | RR | 114.3 | F |
| 599 | FL/PAN | 19-Apr-97 | NW FLORIDA | - | - | RR | 98.0 | F |
| 600 | FL/PAN | 19-Apr-97 | NW FLORIDA | - | - | RR | 100.0 | M |
| 601 | FL/PAN | 19-Apr-97 | NW FLORIDA | - | - | RR | 109.6 | F |
| 602 | FL/PAN | 19-Apr-97 | NW FLORIDA | - | - | RR | 98.0 | F |
| 603 | FL/PAN | 19-Apr-97 | NW FLORIDA | - | - | RR | 112.0 | F |
| 604 | FL/PAN | 19-Apr-97 | NW FLORIDA | - | - | RR | 124.6 | F |
| 605 | FL/PAN | 19-Apr-97 | NW FLORIDA | - | - | RR | 110.2 | F |
| 606 | FL/PAN | 19-Apr-97 | NW FLORIDA | - | - | RR | 113.0 | F |
| 607 | FL/PAN | 19-Apr-97 | NW FLORIDA | - | - | RR | 118.1 | F |
| 608 | FL/PAN | 19-Apr-97 | NW FLORIDA | - | - | RR | 118.0 | F |
| 609 | FL/PAN | 19-Apr-97 | NW FLORIDA | - | - | RR | 91.9 | M |
| 610 | FL/PAN | 19-Apr-97 | NW FLORIDA | - | - | RR | 108.7 | F |
| 611 | FL/PAN | 19-Apr-97 | NW FLORIDA | - | - | RR | 109.9 | F |
| 612 | FL/PAN | 19-Apr-97 | NW FLORIDA | - | - | RR | 112.2 | F |
| 613 | FL/PAN | 19-Apr-97 | NW FLORIDA | - | - | RR | 96.0 | M |
| 614 | FL/PAN | 19-Apr-97 | NW FLORIDA | - | - | RR | 102.3 | M |
| 615 | FL/PAN | 19-Apr-97 | NW FLORIDA | - | - | RR | 104.0 | M |
| 616 | FL/PAN | 19-Apr-97 | NW FLORIDA | - | - | RR | 112.4 | F |
| 617 | FL/PAN | 19-Apr-97 | NW FLORIDA | - | - | RR | 99.0 | M |
| 526 | AL | 02-May-97 | SAND ISLAND | 6.0 | - | RR | 125.0 | F |

**Table 3 (continued).** Data from cobia from which biological samples were collected during (8/1/95 - 12/31/97) listed by state - (RR = rod & reel, GN = gill net, TRL = trawl, SP = spear).

| Fish | State | Capture Date | Capture Area | Water Depth (ft) | Water Temp. (C) | Gear Type | Fork Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 518 | LA | 02-May-97 | CHANDELEUR ISLAND | 8.0 | - | RR | 101.0 | F |
| 529 | MS | 02-May-97 | ISLE OF CAPRICE BAR | 8.0 | - | RR | 120.4 | F |
| 527 | MS | 02-May-97 | ISLE OF CAPRICE BAR | 10.0 | - | RR | 120.5 | F |
| 528 | MS | 02-May-97 | ISLE OF CAPRICE BAR | 10.0 | - | RR | 120.6 | F |
| 511 | LA | 02-May-97 | CHANDELEUR ISLAND | 12.0 | - | RR | 133.2 | F |
| 525 | LA | 02-May-97 | CHANDELEUR ISLAND | 12.0 | - | RR | 112.0 | F |
| 512 | FL/PAN | 02-May-97 | DESTIN | 30.0 | - | RR | 101.0 | M |
| 513 | FL/PAN | 02-May-97 | DESTIN | 30.0 | - | RR | 103.4 | M |
| 502 | MS | 02-May-97 | OFF MS | 35.0 | - | RR | 100.3 | F |
| 515 | LA | 02-May-97 | CHANDELEUR ISLAND | 35.0 | - | RR | 130.0 | F |
| 516 | LA | 02-May-97 | CHANDELEUR ISLAND | 35.0 | - | RR | 121.0 | F |
| 517 | LA | 02-May-97 | CHANDELEUR ISLAND | 35.0 | - | RR | 111.0 | F |
| 503 | LA | 02-May-97 | CHANDELEUR ISLAND | - | - | RR | 122.5 | F |
| 504 | MS | 02-May-97 | OFF MS | - | - | RR | 109.0 | F |
| 505 | MS | 02-May-97 | OFF MS | - | - | RR | 108.0 | F |
| 506 | MS | 02-May-97 | OFF MS | - | - | RR | 110.0 | F |
| 507 | MS | 02-May-97 | OFF MS | - | - | RR | 124.0 | F |
| 508 | MS | 02-May-97 | HORN ISLAND | - | - | RR | 102.0 | F |
| 509 | MS | 02-May-97 | OFF MS | - | - | RR | 104.0 | M |
| 510 | MS | 02-May-97 | OFF MS | - | - | RR | 121.5 | F |
| 514 | FL/PAN | 02-May-97 | DESTIN | - | - | RR | 102.5 | F |
| 519 | MS | 02-May-97 | PETIT BOIS ISLAND | - | - | RR | 106.5 | M |
| 520 | MS | 02-May-97 | PETIT BOIS ISLAND | - | - | RR | 108.0 | M |
| 521 | MS | 02-May-97 | PETIT BOIS ISLAND | - | - | RR | 105.0 | M |
| 522 | MS | 02-May-97 | OFF MS | - | - | RR | 111.0 | M |
| 523 | MS | 02-May-97 | OFF MS | - | - | RR | 118.5 | F |
| 524 | MS | 02-May-97 | OFF MS | - | - | RR | 117.5 | F |
| 530 | MS | 02-May-97 | PETIT BOIS ISLAND | - | - | RR | 102.0 | M |
| 531 | FL/PAN | 02-May-97 | DESTIN | - | - | RR | 102.5 | F |
| 544 | MS | 03-May-97 | ISLE OF CAPRICE BAR | 8.0 | - | RR | 121.8 | F |
| 545 | MS | 03-May-97 | ISLE OF CAPRICE BAR | 8.0 | - | RR | 115.5 | F |
| 559 | MS | 03-May-97 | ISLE OF CAPRICE BAR | 8.0 | - | RR | 128.6 | F |
| 534 | MS | 03-May-97 | ISLE OF CAPRICE BAR | 9.0 | - | RR | 119.3 | F |
| 548 | MS | 03-May-97 | HORN ISLAND | 12.0 | - | RR | 112.0 | F |
| 549 | MS | 03-May-97 | HORN ISLAND | 12.0 | - | RR | 121.5 | F |
| 556 | LA | 03-May-97 | CHANDELEUR ISLAND | 12.0 | - | RR | 120.0 | F |
| 566 | MS | 03-May-97 | PETIT BOIS RIGS | 32.0 | - | RR | 110.2 | F |

**Table 3 (continued).** Data from cobia from which biological samples were collected during (8/1/95 - 12/31/97) listed by state - (RR = rod & reel, GN = gill net, TRL = trawl, SP = spear).

| Fish | State | Capture Date | Capture Area | Water Depth (ft) | Water Temp. (C) | Gear Type | Fork Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 539 | LA | 03-May-97 | CHANDELEUR ISLAND | 62.0 | - | RR | 115.5 | F |
| 550 | MS | 03-May-97 | OFF MS | 180.0 | - | RR | 121.7 | F |
| 551 | MS | 03-May-97 | OFF MS | 180.0 | - | RR | 106.5 | F |
| 552 | MS | 03-May-97 | OFF MS | 180.0 | - | RR | 103.4 | M |
| 532 | MS | 03-May-97 | HORN ISLAND | - | - | RR | 110.5 | F |
| 533 | MS | 03-May-97 | ISLE OF CAPRICE BAR | - | - | RR | 116.0 | F |
| 535 | MS | 03-May-97 | PETIT BOIS ISLAND | - | - | RR | 110.0 | M |
| 536 | MS | 03-May-97 | PETIT BOIS ISLAND | - | - | RR | 107.0 | M |
| 537 | MS | 03-May-97 | PETIT BOIS ISLAND | - | - | RR | 109.0 | F |
| 538 | LA | 03-May-97 | CHANDELEUR ISLAND | - | - | RR | 105.5 | F |
| 540 | LA | 03-May-97 | CHANDELEUR ISLAND | - | - | RR | 120.5 | F |
| 541 | LA | 03-May-97 | CHANDELEUR ISLAND | - | - | RR | 105.0 | F |
| 542 | LA | 03-May-97 | CHANDELEUR ISLAND | - | - | RR | 107.0 | F |
| 546 | MS | 03-May-97 | HORN ISLAND | - | - | RR | 115.0 | F |
| 553 | MS | 03-May-97 | HORN ISLAND | - | - | RR | 117.0 | F |
| 554 | MS | 03-May-97 | HORN ISLAND | - | - | RR | 110.0 | F |
| 555 | MS | 03-May-97 | OFF MS | - | - | RR | 132.0 | M |
| 557 | LA | 03-May-97 | CHANDELEUR ISLAND | - | - | RR | 94.6 | M |
| 558 | MS | 03-May-97 | HORN ISLAND | - | - | RR | 94.5 | F |
| 560 | MS | 03-May-97 | HORN ISLAND | - | - | RR | 101.5 | F |
| 564 | LA | 04-May-97 | CHANDELEUR ISLAND | 8.0 | - | RR | 127.0 | F |
| 562 | MS | 04-May-97 | HORN ISLAND | 12.0 | - | RR | 123.1 | F |
| 543 | MS | 04-May-97 | HORN ISLAND | - | - | RR | 111.5 | F |
| 547 | MS | 04-May-97 | HORN ISLAND | - | - | RR | 123.5 | F |
| 561 | MS | 04-May-97 | HORN ISLAND | - | - | RR | 109.8 | F |
| 563 | MS | 04-May-97 | HORN ISLAND | - | - | RR | 105.0 | F |
| 501 | FL/GULF | 06-May-97 | HUDSON CHANNEL | 9.0 | 23.9 | GN | 47.0 | M |
| 500 | FL/GULF | 06-May-97 | ARIPEKA CHANNEL | 9.0 | 24.1 | GN | 67.0 | F |
| 565 | MS | 07-May-97 | HORN ISLAND | 6.0 | - | RR | 114.4 | F |
| 567 | MS | 07-May-97 | HORN ISLAND | 6.0 | - | RR | 87.7 | F |
| 574 | SC | 08-May-97 | HILTON HEAD | - | - | RR | 115.5 | F |
| 575 | SC | 08-May-97 | HILTON HEAD | - | - | RR | 105.5 | M |
| 576 | SC | 08-May-97 | HILTON HEAD | - | - | RR | 110.0 | F |
| 647 | FL/PAN | 10-May-97 | NW FLORIDA | - | - | RR | 92.6 | M |
| 577 | FL/GULF | 14-May-97 | SANIBEL ISLAND | 8.0 | 27.9 | GN | 52.5 | M |
| 618 | MS | 14-May-97 | HORN ISLAND BAR | 4.0 | - | RR | 94.3 | F |
| 619 | MS | 14-May-97 | HORN ISLAND BAR | 4.0 | - | RR | 79.4 | F |

**Table 3 (continued).** Data from cobia from which biological samples were collected during (8/1/95 - 12/31/97) listed by state - (RR = rod & reel, GN = gill net, TRL = trawl, SP = spear).

| Fish | State | Capture Date | Capture Area | Water Depth (ft) | Water Temp. (C) | Gear Type | Fork Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 569 | SC | 21-May-97 | HILTON HEAD | - | - | RR | 117.0 | F |
| 570 | SC | 21-May-97 | HILTON HEAD | - | - | RR | 113.5 | F |
| 571 | SC | 21-May-97 | HILTON HEAD | - | - | RR | 88.5 | M |
| 572 | SC | 21-May-97 | HILTON HEAD | - | - | RR | 90.0 | M |
| 573 | SC | 21-May-97 | HILTON HEAD | - | - | RR | 94.5 | F |
| 568 | FL/GULF | 27-May-97 | SARASOTA BAY | 6.0 | - | RR | 87.0 | M |
| 579 | NC | 31-May-97 | SHACKLEFORD BANKS | 22.0 | - | RR | 95.0 | F |
| 578 | NC | 31-May-97 | CAPE LOOKOUT | 37.0 | - | RR | 138.5 | F |
| 582 | NC | 01-Jun-97 | CAPE LOOKOUT | 23.0 | - | RR | 105.5 | F |
| 581 | NC | 01-Jun-97 | CAPE LOOKOUT | 35.0 | - | RR | 138.5 | F |
| 580 | NC | 01-Jun-97 | CAPE LOOKOUT | - | - | RR | 103.0 | F |
| 587 | SC | 14-Jun-97 | BROAD RIVER | 30.0 | - | RR | 86.0 | M |
| 588 | SC | 14-Jun-97 | BROAD RIVER | 30.0 | - | RR | 91.0 | M |
| 592 | SC | 14-Jun-97 | BROAD RIVER | 30.0 | - | RR | 85.5 | M |
| 589 | SC | 16-Jun-97 | BROAD RIVER | 30.0 | - | RR | 90.0 | M |
| 591 | SC | 20-Jun-97 | BROAD RIVER | 25.0 | - | RR | 81.0 | M |
| 590 | SC | 21-Jun-97 | BROAD RIVER | 25.0 | - | RR | 87.0 | M |
| 620 | FL/PAN | 21-Jun-97 | OFF PENSACOLA | 300.0 | - | RR | 93.7 | M |
| 621 | FL/PAN | 21-Jun-97 | OFF PENSACOLA | 300.0 | - | RR | 107.8 | M |
| 623 | FL/PAN | 21-Jun-97 | OFF PENSACOLA | 1200.0 | - | RR | 97.6 | F |
| 622 | FL/PAN | 21-Jun-97 | OFF PENSACOLA | 1800.0 | - | RR | 98.3 | M |
| 624 | FL/PAN | 21-Jun-97 | OFF PENSACOLA | - | - | RR | - | M |
| 625 | FL/PAN | 21-Jun-97 | OFF PENSACOLA | - | - | RR | 139.0 | M |
| 626 | FL/PAN | 21-Jun-97 | OFF PENSACOLA | - | - | RR | 108.6 | M |
| 583 | FL/GULF | 23-Jun-97 | SARASOTA | 45.0 | - | RR | 108.0 | F |
| 627 | MS | 27-Jun-97 | SHIP ISLAND | 30.0 | - | RR | 83.2 | F |
| 628 | MS | 27-Jun-97 | SHIP ISLAND | 30.0 | - | RR | 96.5 | F |
| 594 | NC | 29-Jun-97 | MANTEO | - | - | RR | 123.0 | F |
| 584 | FL/GULF | 30-Jun-97 | TAMPA BAY | - | - | RR | 98.0 | F |
| 595 | NC | 30-Jun-97 | MANTEO | - | - | RR | 102.0 | F |
| 593 | NC | 01-Jul-97 | MANTEO | - | - | RR | 125.0 | F |
| 585 | FL/GULF | 02-Jul-97 | ANCLOTE KEY | 10.0 | 30.1 | GN | 65.0 | M |
| 629 | MS | 03-Jul-97 | GULFPORT SHIP CHANL | 20.0 | - | RR | 85.5 | F |
| 632 | MS | 03-Jul-97 | OFF MS | 65.0 | - | RR | 101.4 | M |
| 633 | MS | 03-Jul-97 | OFF MS | 65.0 | - | RR | 123.5 | F |
| 631 | MS | 03-Jul-97 | OFF MS | 80.0 | - | RR | 97.5 | F |
| 596 | NC | 03-Jul-97 | MANTEO | - | - | RR | 127.0 | F |

**Table 3 (continued).** Data from cobia from which biological samples were collected during (8/1/95 - 12/31/97) listed by state - (RR = rod & reel, GN = gill net, TRL = trawl, SP = spear).

| Fish | State | Capture Date | Capture Area | Water Depth (ft) | Water Temp. (C) | Gear Type | Fork Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 630 | MS | 03-Jul-97 | OFF MS | - | - | RR | 103.6 | M |
| 586 | FL/GULF | 04-Jul-97 | SOUTH SKYWAY | 8.0 | - | RR | 114.3 | M |
| 634 | MS | 05-Jul-97 | S. OF SHIP ISLAND | 25.0 | - | RR | 135.0 | F |
| 635 | LA | 05-Jul-97 | OFF LA | 200.0 | - | RR | 92.9 | M |
| 597 | NC | 05-Jul-97 | MANTEO | - | - | RR | 113.0 | M |
| 639 | MS | 06-Jul-97 | OFF MS | 62.0 | - | RR | 114.1 | M |
| 637 | LA | 06-Jul-97 | WEST OF MS RIVER | 150.0 | - | RR | 90.0 | M |
| 638 | LA | 06-Jul-97 | WEST OF MS RIVER | 150.0 | - | RR | 106.5 | M |
| 636 | MS | 06-Jul-97 | OFF MS | - | - | RR | 87.5 | F |
| 640 | MS | 09-Jul-97 | GULFPORT SHIP CHANL | 20.0 | - | RR | 91.4 | F |
| 641 | MS | 15-Jul-97 | GULFPORT SHIP CHANL | 30.0 | - | RR | 93.0 | F |
| 642 | MS | 15-Jul-97 | GULFPORT SHIP CHANL | 30.0 | - | RR | 87.8 | F |
| 598 | FL/GULF | 17-Jul-97 | HUDSON | 5.5 | 31.3 | GN | 48.0 | M |
| 643 | MS | 24-Jul-97 | GULFPORT SHIP CHANL | 30.0 | - | RR | 98.0 | F |
| 644 | MS | 24-Jul-97 | GULFPORT SHIP CHANL | 30.0 | - | RR | 99.0 | F |
| 645 | MS | 24-Jul-97 | GULFPORT SHIP CHANL | 30.0 | - | RR | 96.5 | F |
| 646 | FL/PAN | 26-Jul-97 | S. OF PENSACOLA | - | - | RR | 163.9 | F |
| 648 | FL/GULF | 17-Aug-97 | MANATEE RIVER, MOUTH | 5.0 | - | RR | 101.0 | F |
| 649 | FL/GULF | 17-Aug-97 | TAMPA BAY | 40.0 | - | RR | 39.7 | F |
| 650 | FL/GULF | 17-Aug-97 | TAMPA BAY | 40.0 | - | RR | 95.0 | F |
| 651 | FL/GULF | 17-Aug-97 | TAMPA BAY | 40.0 | - | RR | 37.0 | F |
| 654 | FL/GULF | 21-Aug-97 | ANCLOTE | 6.0 | 31.0 | GN | 56.7 | F |
| 655 | FL/GULF | 22-Aug-97 | SKYWAY SOUTH | 12.0 | - | RR | 86.0 | M |
| 653 | FL/ATL | 30-Aug-97 | PORT CANAVERAL | 75.0 | - | RR | 93.0 | F |
| 656 | FL/GULF | 10-Sep-97 | APOLLO BEACH | 42.0 | - | RR | 121.0 | F |
| 657 | MS | 31-Jul-97 | GULFPORT SHIP CHANNE | 10.0 | - | RR | 104.8 | F |
| 658 | MS | 31-Jul-97 | GULFPORT SHIP CHANNE | 10.0 | - | RR | 90.8 | F |
| 659 | MS | 05-Aug-97 | SHIP ISLAND/MS | 30.0 | - | RR | 88.9 | F |
| 660 | MS | 05-Aug-97 | SHIP ISLAND/MS | 30.0 | - | RR | 98.4 | M |
| 661 | MS | 05-Aug-97 | SHIP ISLAND/MS | 30.0 | - | RR | 88.9 | M |
| 662 | MS | 05-Aug-97 | SHIP ISLAND/MS | 30.0 | - | RR | 92.7 | F |
| 663 | MS | 07-Aug-97 | PASCAGOULA SHIP CHAN | 20.0 | - | RR | 114.3 | M |
| 664 | MS | 14-Aug-97 | SHIP ISLAND/MS | 30.0 | - | RR | 106.7 | F |
| 665 | MS | 14-Aug-97 | SHIP ISLAND/MS | 30.0 | - | RR | 95.9 | F |
| 666 | LA | 13-Sep-97 | SW CHANDELEUR ISLAND | 30.0 | - | RR | 104.0 | F |
| 667 | LA | 13-Sep-97 | SW CHANDELEUR ISLAND | 30.0 | - | RR | 97.0 | F |
| 668 | LA | 13-Sep-97 | MAIN PASS,MS RIVER | 60.0 | - | RR | 96.5 | F |

Table 3 (continued). Data from cobia from which biological samples were collected during (8/1/95 - 12/31/97) listed by state - (RR = rod & reel, GN = gill net, TRL = trawl, SP = spear).

| Fish | State | Capture Date | Capture Area | Water Depth (ft) | Water Temp. (C) | Gear Type | Fork Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 669 | LA | 13-Sep-97 | MAIN PASS,MS RIVER | 40.0 | - | RR | 96.0 | F |
| 670 | LA | 13-Sep-97 | CURLEW RIGS | 45.0 | - | RR | 89.0 | M |
| 671 | LA | 13-Sep-97 | E.MONKEY BAYOU/LA | 35.0 | - | RR | 115.0 | F |
| 672 | MS | 13-Sep-97 | MR.GUS RIGS, MS | 12.0 | - | RR | 108.0 | M |
| 673 | MS | 13-Sep-97 | MR.GUS RIGS, MS | 120.0 | - | RR | 97.0 | M |
| 674 | LA | 13-Sep-97 | BLOCK 107, LA | 62.0 | - | RR | 114.0 | F |
| 675 | LA | 14-Sep-97 | MAIN PASS RIGS,MS RI | 60.0 | - | RR | 104.0 | F |
| 676 | LA | 14-Sep-97 | MAIN PASS RIGS,MS RI | 60.0 | - | RR | 96.0 | F |
| 677 | LA | 14-Sep-97 | BLOCK 103 CHAND.ISL | 60.0 | - | RR | 102.5 | F |
| 678 | LA | 14-Sep-97 | BLOCK 103 CHAND.ISL | 60.0 | - | RR | 95.0 | M |
| 679 | MS | 14-Sep-97 | OFF SHORE, MS | 60.0 | - | RR | 115.5 | F |
| 680 | MS | 14-Sep-97 | OFF SHORE, MS | 60.0 | - | RR | 114.0 | F |
| 681 | LA | 14-Sep-97 | E.MONKEY BAYOU/LA | 35.0 | - | RR | 118.0 | F |
| 682 | MS | 14-Sep-97 | PASCAGOULA SHIP CH | 30.0 | - | RR | 97.0 | M |
| 683 | MS | 14-Sep-97 | PASCAGOULA SHIP CH | 30.0 | - | RR | 94.0 | F |
| 684 | FL/GULF | 09-Oct-97 | SARASOTA | 25.0 | 27.8 | RR | 101.0 | F |
| 685 | FL/GULF | 09-Oct-97 | SARASOTA | 18.0 | 27.8 | RR | 87.0 | F |
| 686 | FL/GULF | 10-Nov-97 | SARASOTA | 47.0 | 21.3 | RR | 114.0 | F |
| 687 | FL/GULF | 18-Nov-97 | SARASOTA | 7.0 | 0.9 | RR | 76.5 | F |
| 688 | FL/GULF | 25-Nov-97 | LONGBOAT KEY | 18.0 | 20.4 | RR | 87.0 | F |
| 689 | FL/KEYS/GULF | 17-Oct-97 | BIG PINE KEY | 50.0 | - | RR | 84.5 | F |
| 690 | FL/KEYS/GULF | 17-Oct-97 | BIG PINE KEY | 50.0 | - | RR | 84.5 | F |
| 691 | FL/KEYS/GULF | 17-Oct-97 | BIG PINE KEY | 50.0 | - | RR | 90.5 | F |
| 692 | FL/KEYS/GULF | 17-Oct-97 | BIG PINE KEY | 50.0 | - | RR | 93.3 | M |
| 693 | FL/GULF | 26-Nov-97 | LONGBOAT KEY | 17.0 | 20.7 | RR | 86.0 | F |
| 694 | FL/GULF | 26-Nov-97 | LONGBOAT KEY | 17.0 | - | RR | 83.5 | F |
| 695 | FL/GULF | 26-Nov-97 | LONGBOAT KEY | 17.0 | - | RR | 83.0 | F |
| 696 | FL/GULF | 03-Dec-97 | LONGBOAT KEY | 4.5 | 19.6 | GN | 71.0 | F |
| 697 | FL/GULF | 03-Dec-97 | LONGBOAT KEY | 5.5 | 19.8 | GN | 69.5 | M |
| 698 | FL/ATL | 04-Dec-97 | PONCE INLET | 72.5 | - | RR | 96.0 | F |
| 699 | FL/ATL | 04-Dec-97 | PONCE INLET | 72.5 | - | RR | 114.0 | F |
| 700 | FL/ATL | 04-Dec-97 | PONCE INLET | 72.5 | - | RR | 120.5 | F |
| 701 | FL/ATL | 04-Dec-97 | PONCE INLET | 72.5 | - | RR | 108.0 | M |
| 702 | FL/GULF | 05-Dec-97 | LONGBOAT KEY | 17.0 | 20.5 | RR | 99.0 | F |
| 703 | FL/GULF | 16-Dec-97 | NEW PASS | - | 17.5 | RR | 117.0 | F |

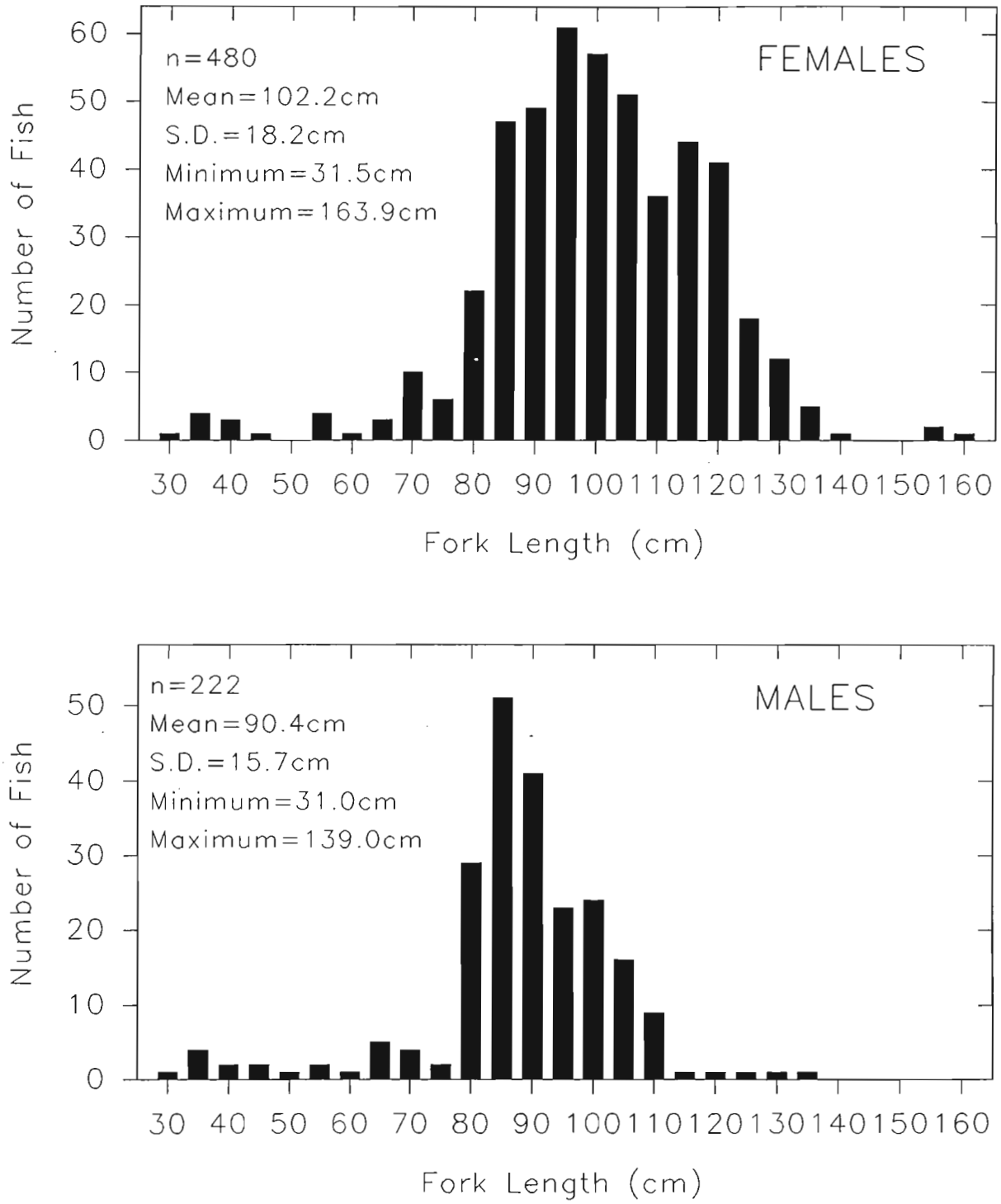



**Figure 3.** Length/frequency histograms of female and male cobia samples from all locations. *(Length of one male unavailable)*

# COBIA DATA SHEET

**AREA:** S. Atlantic & Gulf of Mexico **SUB AREA:** Gulf States & SE States **PERIOD:** 8/1/95-12/31/97: Quarters I-X

**GEAR TYPE:** Rod & Reel, Gill Net, Trawl & Spear **SAMPLER:** MML, GCRL & U of TX **MEASUREMENT:** FL

| CM | MALE | FEM | CM | MALE | FEM | CM | MALE | FEM | CM | MALE | FEM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 39 | 2 | | 79 | | 3 | 119 | | 3 |
| 0 | | | 40 | 1 | 1 | 80 | 2 | 2 | 120 | | 9 |
| | | | | 1 | | | 2 | 2 | | | 11 |
| 2 | | | 42 | | 1 | 82 | 7 | 5 | 122 | | 9 |
| | | | | | 1 | | 7 | 8 | | 1 | 10 |
| 4 | | | 44 | | 1 | 84 | 8 | 4 | 124 | | 1 |
| | | | | | | | 11 | 7 | | | 7 |
| 6 | | | 46 | | | 86 | 10 | 7 | 126 | | 1 |
| | | | | 1 | 1 | | 9 | 10 | | 1 | 5 |
| 8 | | | 48 | 1 | | 88 | 11 | 12 | 128 | | 2 |
| | | | | | | | 9 | 8 | | | 3 |
| 10 | | | 50 | | | 90 | 10 | 9 | 130 | | 5 |
| | | | | | | | 9 | 9 | | | 2 |
| 12 | | | 52 | 1 | | 92 | 6 | 10 | 132 | 1 | 1 |
| | | | | | | | 9 | 12 | | | 3 |
| 14 | | | 54 | | | 94 | 6 | 12 | 134 | | 1 |
| | | | | | | | 8 | 5 | | | 3 |
| 16 | | | 56 | | 1 | 96 | 4 | 17 | 136 | | |
| | | | | 1 | 3 | | 6 | 10 | | | |
| 18 | | | 58 | 1 | | 98 | 3 | 11 | 138 | 1 | 2 |
| | | | | | | | 6 | 19 | | | 1 |
| 20 | | | 60 | | | 100 | 3 | 11 | 140 | | |
| | | | | | 1 | | 7 | 10 | | | |
| 22 | | | 62 | 1 | | 102 | 5 | 17 | 142 | | |
| | | | | | | | 4 | 5 | | | |
| 24 | | | 64 | | | 104 | 5 | 7 | 144 | | |
| | | | | 1 | | | 5 | 13 | | | 1 |
| 26 | | | 66 | | 1 | 106 | 2 | 11 | 146 | | |
| | | | | 1 | 2 | | 3 | 9 | | | |
| 28 | | 1 | 68 | | | 108 | 5 | 7 | 148 | | |
| | | | | 2 | | | 1 | 11 | | | |
| 30 | | | 70 | 1 | 3 | 110 | 5 | 16 | 150 | | |
| | 1 | | | 1 | 2 | | 1 | 4 | | | |
| 32 | | 1 | 72 | | 3 | 112 | | 9 | 152 | | |
| | | | | 2 | 1 | | 2 | 4 | | | |
| 34 | | | 74 | 1 | 1 | 114 | 3 | 9 | 154 | | |
| | | | | | | | | 10 | | | |
| 36 | | 2 | 76 | 1 | 1 | 116 | | 9 | 156 | | 1 |
| | 1 | 1 | | | 1 | | | 7 | | | |
| 38 | 1 | | 78 | | 1 | 118 | 1 | 15 | 158 | | |
| | | | | | | | | | 159 | | 1 |
| | | | | | | | | | 164 | | 1 |

| | MALE | FEM | ALL |
|---|---|---|---|
| TOTAL | 222 | 480 | 702 |

**CM = CENTIMETER MIDPOINT: IE 30CM=296-305MM, LENGTHS: FL=FORK, TL=TOTAL**

**Figure 4.** Cobia Data Sheet (8/1/95 - 12/31/97). *(Length of one male unavailable)*

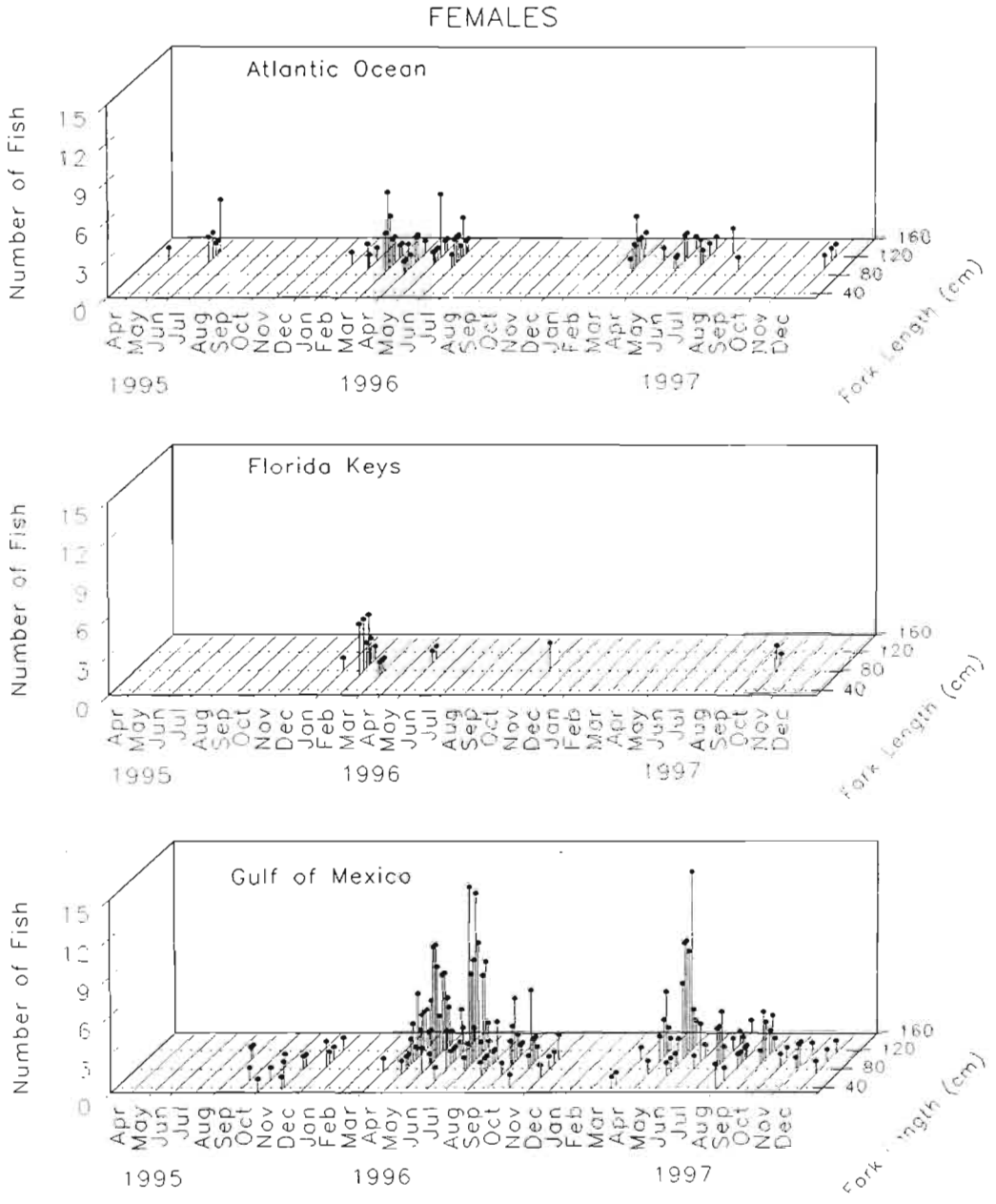



**Figure 5.** Length/frequency of female cobia by month and location.

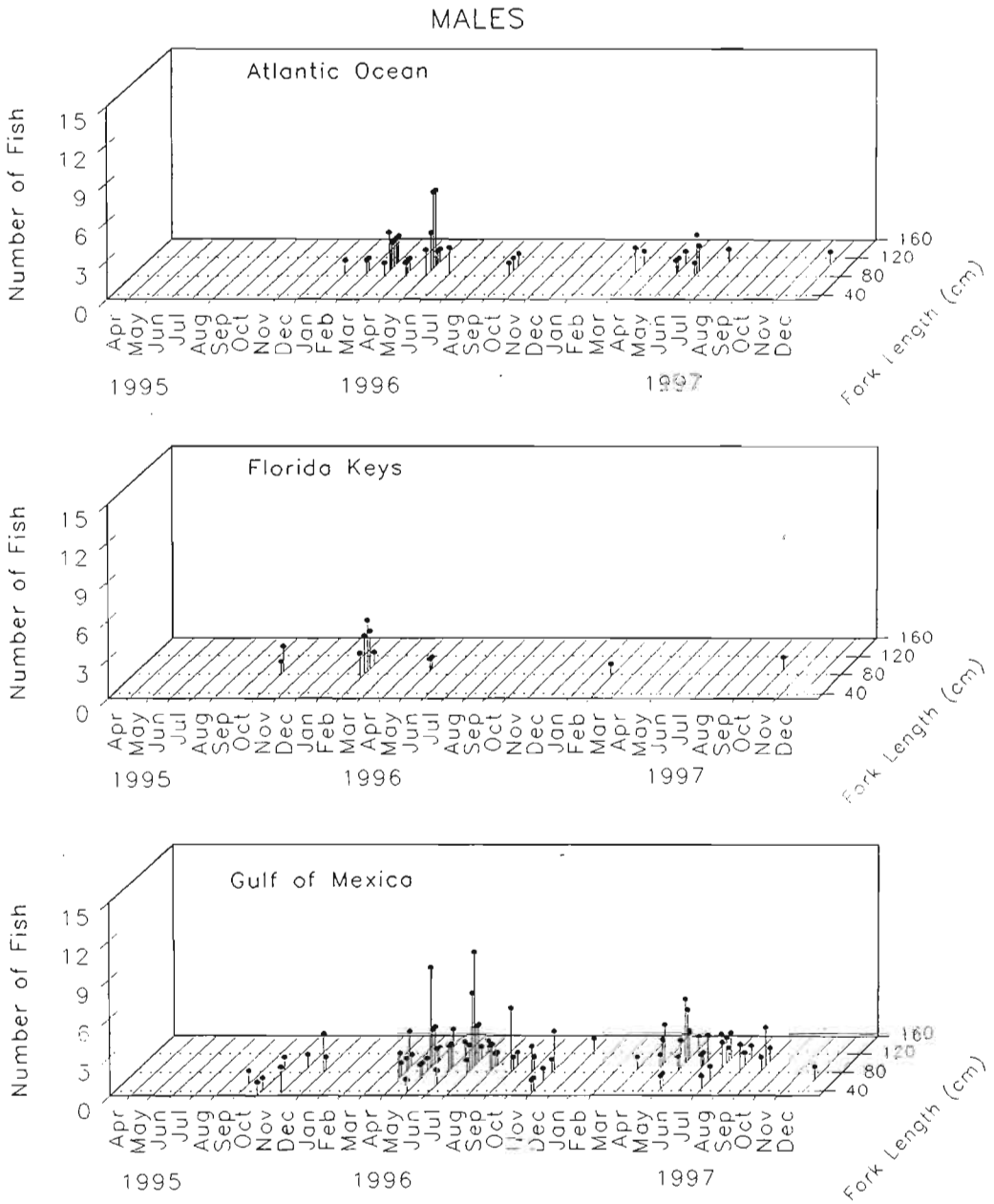



**Figure 6.** Length/frequency of male cobia by month and location.

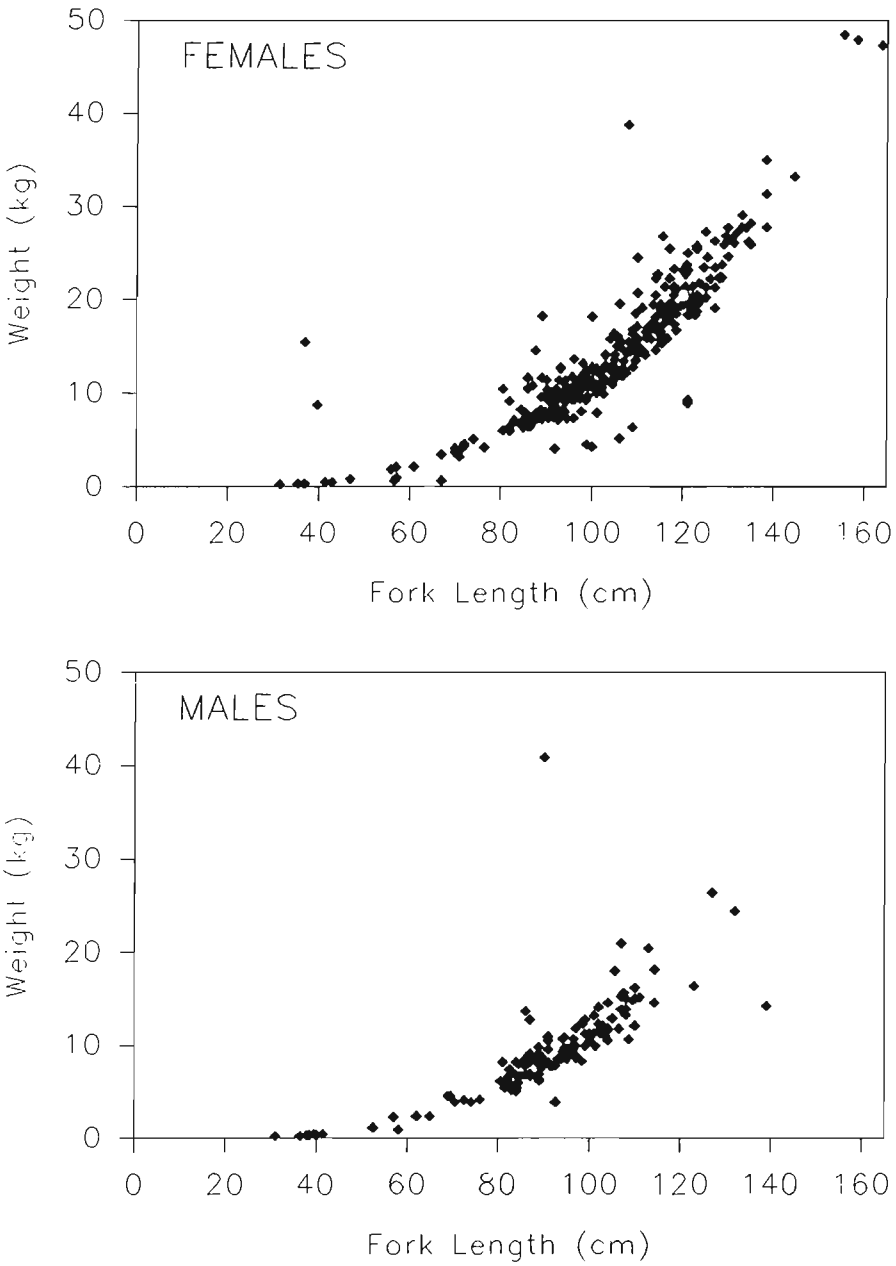



**Figure 7.** Length/frequency of female and male cobia by total weight and fork length.

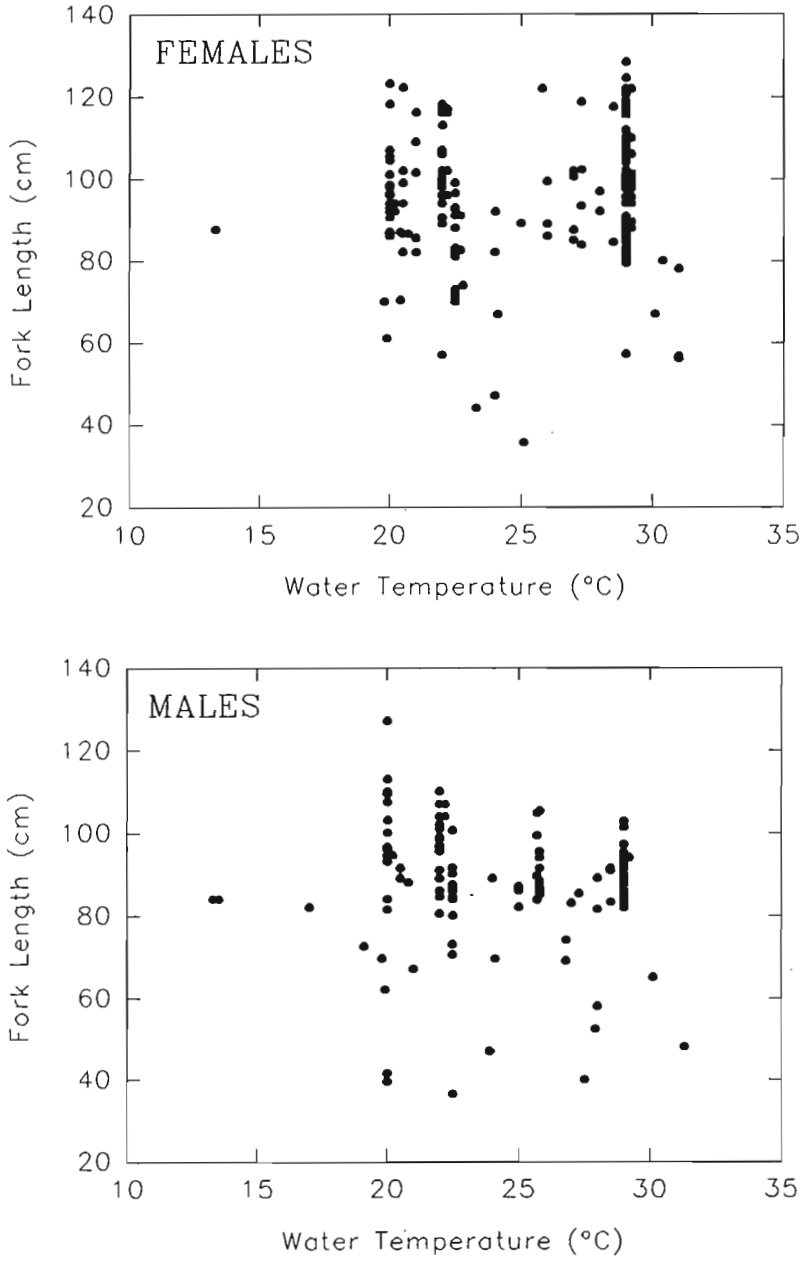



**Figure 8.** Water temperatures (°C) where female and male cobia were captured.

**Table 4.** Data for cobia specimens used in reproduction section of study (F = females, M = males).

| State/Coast | Capture Date | Fork Length (cm) | Fish Weight (lbs) | Fish Weight (kgs) | Gonad Weight (g) | Sex |
|---|---|---|---|---|---|---|
| FL/GULF | 06-Sep-95 | 57.2 | 2.10 | .95 | 12.14 | F |
| FL/GULF | 21-Sep-95 | 58.0 | 2.00 | .91 | 5.00 | M |
| FL/GULF | 24-Oct-95 | 87.0 | 14.70 | 6.67 | 36.20 | M |
| FL/GULF | 24-Oct-95 | 89.0 | 16.50 | 7.48 | 27.86 | F |
| FL/KEYS/GULF | 26-Oct-95 | 84.5 | 14.50 | 6.58 | 9.55 | M |
| FL/KEYS/GULF | 26-Oct-95 | 85.0 | 14.75 | 6.69 | 12.81 | M |
| FL/KEYS/GULF | 26-Oct-95 | 89.5 | 17.75 | 8.05 | 77.79 | M |
| FL/GULF | 27-Oct-95 | 57.0 | 4.60 | 2.09 | 13.20 | F |
| FL/GULF | 26-Nov-95 | 82.0 | 13.00 | 5.90 | 33.70 | F |
| FL/GULF | 28-Nov-95 | 86.5 | 14.50 | 6.58 | 63.70 | F |
| FL/GULF | 28-Nov-95 | 91.5 | 17.00 | 7.71 | 25.04 | M |
| FL/GULF | 04-Dec-95 | 86.5 | 14.00 | 6.35 | 54.06 | F |
| FL/GULF | 04-Dec-95 | 102.0 | 24.00 | 10.89 | 98.77 | F |
| FL/GULF | 05-Dec-95 | 89.0 | 19.50 | 8.85 | 19.15 | M |
| FL/GULF | 05-Dec-95 | 94.0 | 25.00 | 11.34 | 92.00 | F |
| FL/GULF | 05-Dec-95 | 122.0 | 47.00 | 21.32 | 221.43 | F |
| FL/GULF | 06-Dec-95 | 82.0 | 13.12 | 5.95 | 18.49 | M |
| FL/GULF | 15-Dec-95 | 84.0 | 18.00 | 8.16 | 10.66 | M |
| FL/GULF | 16-Dec-95 | 87.6 | 17.00 | 7.71 | 65.40 | F |
| FL/GULF | 18-Dec-95 | 84.0 | 15.00 | 6.80 | 13.44 | M |
| FL/KEYS/GULF | 20-Jan-96 | 82.0 | 20.00 | 9.07 | 54.70 | F |
| FL/KEYS/GULF | 02-Feb-96 | 73.0 | - | - | 3.60 | M |
| FL/KEYS/ATL | 10-Feb-96 | 90.5 | - | - | 13.50 | M |
| FL/KEYS/ATL | 10-Feb-96 | 84.0 | - | - | 14.40 | M |
| FL/KEYS/ATL | 10-Feb-96 | 73.0 | - | - | 29.00 | F |
| FL/KEYS/GULF | 21-Feb-96 | 71.0 | 7.00 | 3.18 | 28.80 | F |
| FL/KEYS/GULF | 22-Feb-96 | 86.0 | - | - | 19.60 | M |
| FL/KEYS/GULF | 22-Feb-96 | 87.5 | - | - | 50.30 | M |
| FL/KEYS/GULF | 23-Feb-96 | 90.0 | - | - | 45.80 | M |
| FL/KEYS/GULF | 23-Feb-96 | 84.5 | - | - | 53.50 | M |
| FL/KEYS/GULF | 24-Feb-96 | 86.5 | - | - | 28.90 | M |
| FL/KEYS/GULF | 24-Feb-96 | 91.5 | - | - | 35.90 | M |
| FL/KEYS/GULF | 24-Feb-96 | 83.0 | - | - | 41.00 | F |
| FL/KEYS/GULF | 24-Feb-96 | 82.5 | - | - | 54.70 | F |
| FL/KEYS/GULF | 24-Feb-96 | 81.0 | - | - | 62.40 | F |
| FL/KEYS/GULF | 24-Feb-96 | 100.5 | - | - | 64.40 | M |
| FL/KEYS/GULF | 24-Feb-96 | 88.0 | - | - | 74.60 | F |
| FL/KEYS/GULF | 24-Feb-96 | 99.0 | - | - | 105.80 | F |
| FL/ATL | 25-Feb-96 | 87.0 | - | - | 21.20 | M |

**Table 4 (continued).** Data for cobia specimens used in reproduction section of study (F = females, M = males).

| State/Coast | Capture Date | Fork Length (cm) | Fish Weight (lbs) | Fish Weight (kgs) | Gonad Weight (g) | Sex |
|---|---|---|---|---|---|---|
| FL/KEYS/GULF | 25-Feb-96 | 96.5 | - | - | 27.50 | F |
| FL/ATL | 25-Feb-96 | 93.0 | - | - | 29.90 | M |
| FL/KEYS/GULF | 25-Feb-96 | 82.5 | - | - | 42.50 | F |
| FL/KEYS/GULF | 25-Feb-96 | 91.0 | - | - | 77.60 | F |
| FL/KEYS/GULF | 25-Feb-96 | 92.5 | - | - | 97.50 | F |
| FL/KEYS/GULF | 25-Feb-96 | 93.0 | - | - | 98.30 | F |
| FL/ATL | 25-Feb-96 | 112.0 | - | - | 158.80 | F |
| FL/ATL | 25-Feb-96 | 91.5 | 16.50 | 7.48 | 74.60 | F |
| FL/ATL | 25-Feb-96 | 93.5 | 18.00 | 8.16 | 92.20 | F |
| FL/KEYS/GULF | 26-Feb-96 | 80.0 | - | - | 10.50 | M |
| FL/KEYS/GULF | 26-Feb-96 | 71.5 | 9.00 | 4.08 | 31.40 | F |
| FL/KEYS/GULF | 27-Feb-96 | 70.5 | 8.50 | 3.86 | 5.40 | M |
| FL/KEYS/GULF | 27-Feb-96 | 70.0 | 9.00 | 4.08 | 30.50 | F |
| FL/KEYS/GULF | 27-Feb-96 | 87.0 | 18.00 | 8.16 | 21.40 | M |
| FL/KEYS/GULF | 27-Feb-96 | 91.0 | 20.00 | 9.07 | 93.60 | F |
| FL/KEYS/GULF | 28-Feb-96 | 86.5 | - | - | 89.30 | F |
| FL/KEYS/GULF | 28-Feb-96 | 105.0 | - | - | 131.40 | F |
| FL/KEYS/GULF | 15-Mar-96 | 77.0 | - | - | 25.40 | F |
| FL/ATL | 16-Mar-96 | 98.5 | - | - | 129.50 | F |
| FL/ATL | 16-Mar-96 | 107.0 | - | - | 174.70 | F |
| FL/ATL | 17-Mar-96 | 113.0 | 45.00 | 20.41 | 211.00 | M |
| FL/ATL | 29-Mar-96 | 94.0 | 20.00 | 9.07 | 99.40 | F |
| FL/KEYS/GULF | 30-Mar-96 | 72.0 | 9.50 | 4.31 | 27.10 | F |
| FL/ATL | 30-Mar-96 | 84.0 | 12.80 | 5.81 | 25.20 | M |
| FL/ATL | 30-Mar-96 | 86.0 | 15.00 | 6.80 | 84.00 | F |
| FL/ATL | 30-Mar-96 | 86.5 | 15.60 | 7.08 | 67.90 | F |
| FL/ATL | 30-Mar-96 | 90.5 | 16.00 | 7.26 | 86.40 | F |
| FL/ATL | 30-Mar-96 | 92.0 | 18.60 | 8.44 | 127.40 | F |
| FL/ATL | 30-Mar-96 | 93.0 | 18.80 | 8.53 | 27.60 | M |
| FL/ATL | 30-Mar-96 | 96.0 | 20.40 | 9.25 | 45.00 | M |
| FL/ATL | 30-Mar-96 | 94.0 | 21.00 | 9.53 | 103.00 | F |
| FL/ATL | 30-Mar-96 | 94.5 | 21.40 | 9.71 | 49.20 | M |
| FL/ATL | 30-Mar-96 | 93.0 | 21.60 | 9.80 | 112.00 | F |
| FL/ATL | 30-Mar-96 | 96.0 | 22.40 | 10.16 | 158.60 | F |
| FL/ATL | 30-Mar-96 | 100.0 | 23.00 | 10.43 | 58.90 | M |
| FL/KEYS/GULF | 30-Mar-96 | 80.5 | 23.00 | 10.43 | 131.00 | F |
| FL/ATL | 30-Mar-96 | 92.0 | 23.00 | 10.43 | 156.70 | F |
| FL/ATL | 30-Mar-96 | 98.0 | 23.20 | 10.52 | 131.70 | F |
| FL/ATL | 30-Mar-96 | 87.0 | 23.70 | 10.75 | 206.00 | F |

**Table 4 (continued).** Data for cobia specimens used in reproduction section of study (F = females, M = males).

| State/Coast | Capture Date | Fork Length (cm) | Fish Weight (lbs) | Fish Weight (kgs) | Gonad Weight (g) | Sex |
|---|---|---|---|---|---|---|
| FL/ATL | 30-Mar-96 | 94.5 | 23.80 | 10.80 | 111.10 | M |
| FL/ATL | 30-Mar-96 | 103.0 | 26.60 | 12.07 | 127.40 | M |
| FL/ATL | 30-Mar-96 | 101.0 | 27.80 | 12.61 | 121.50 | F |
| FL/ATL | 30-Mar-96 | 104.5 | 28.60 | 12.97 | 175.40 | F |
| FL/ATL | 30-Mar-96 | 109.5 | 32.60 | 14.79 | 96.60 | M |
| FL/ATL | 30-Mar-96 | 107.5 | 34.40 | 15.60 | 131.80 | M |
| FL/ATL | 30-Mar-96 | 105.5 | 35.40 | 16.06 | 175.30 | F |
| FL/ATL | 30-Mar-96 | 110.0 | 35.60 | 16.15 | 127.20 | M |
| FL/ATL | 30-Mar-96 | 123.0 | 41.20 | 18.69 | 232.00 | F |
| FL/ATL | 30-Mar-96 | 118.0 | 51.20 | 23.22 | 275.00 | F |
| FL/GULF | 04-Apr-96 | 88.0 | - | - | 37.40 | M |
| FL/GULF | 05-Apr-96 | 67.0 | - | - | 5.10 | M |
| FL/ATL | 06-Apr-96 | 107.0 | - | - | 228.00 | F |
| FL/ATL | 06-Apr-96 | 129.0 | 57.00 | 25.85 | 159.00 | F |
| FL/ATL | 07-Apr-96 | 90.0 | - | - | 131.00 | F |
| FL/ATL | 07-Apr-96 | 110.0 | - | - | 327.00 | F |
| FL/GULF | 11-Apr-96 | 72.5 | 9.00 | 4.08 | 29.20 | M |
| FL/GULF | 11-Apr-96 | 81.5 | 13.00 | 5.90 | 23.80 | M |
| FL/GULF | 12-Apr-96 | 70.0 | 8.00 | 3.63 | 27.40 | F |
| FL/ATL | 12-Apr-96 | 95.0 | 22.00 | 9.98 | 110.50 | F |
| FL/ATL | 12-Apr-96 | 112.0 | 35.00 | 15.88 | 212.00 | F |
| FL/ATL | 13-Apr-96 | 83.0 | - | - | 7.50 | M |
| FL/ATL | 13-Apr-96 | 109.0 | - | - | 261.00 | F |
| FL/ATL | 20-Apr-96 | 94.0 | 23.50 | 10.66 | 75.60 | M |
| FL/ATL | 21-Apr-96 | 85.0 | - | - | 61.20 | F |
| FL/ATL | 21-Apr-96 | 83.0 | - | - | 86.90 | F |
| FL/ATL | 21-Apr-96 | 92.0 | - | - | 114.80 | F |
| FL/ATL | 21-Apr-96 | 89.0 | - | - | 115.20 | M |
| FL/GULF | 25-Apr-96 | 69.5 | 10.00 | 4.54 | 33.40 | M |
| FL/GULF | 25-Apr-96 | 85.5 | 17.00 | 7.71 | 214.00 | F |
| FL/GULF | 25-Apr-96 | 109.0 | 37.00 | 16.78 | 61.20 | F |
| FL/GULF | 25-Apr-96 | 116.0 | 47.00 | 21.32 | 395.00 | F |
| FL/GULF | 26-Apr-96 | 82.0 | - | - | 78.80 | F |
| FL/GULF | 26-Apr-96 | 101.5 | - | - | 558.00 | F |
| LA | 27-Apr-96 | 111.1 | - | - | 618.10 | F |
| LA | 27-Apr-96 | 90.0 | 17.80 | 8.07 | 103.50 | M |
| MS | 27-Apr-96 | 97.3 | 20.50 | 9.30 | 229.80 | F |
| LA | 27-Apr-96 | 99.0 | 21.20 | 9.62 | 419.60 | F |
| LA | 27-Apr-96 | 97.1 | 21.40 | 9.71 | 202.10 | F |

**Table 4 (continued).** Data for cobia specimens used in reproduction section of study (F = females, M = males).

| State/Coast | Capture Date | Fork Length (cm) | Fish Weight (lbs) | Fish Weight (kgs) | Gonad Weight (g) | Sex |
|---|---|---|---|---|---|---|
| LA | 27-Apr-96 | 107.5 | 26.70 | 12.11 | 232.50 | F |
| LA | 27-Apr-96 | 115.2 | 33.70 | 15.29 | 224.70 | F |
| MS | 27-Apr-96 | 122.6 | 40.30 | 18.28 | 553.60 | F |
| LA | 27-Apr-96 | 109.6 | 40.70 | 18.46 | 698.60 | F |
| MS | 27-Apr-96 | 128.1 | 49.50 | 22.45 | 530.90 | F |
| LA | 27-Apr-96 | 125.4 | 54.00 | 24.49 | 737.50 | F |
| LA | 27-Apr-96 | 133.0 | 61.10 | 27.71 | 847.70 | F |
| LA | 27-Apr-96 | 138.5 | 61.10 | 27.71 | 1037.10 | F |
| FL/GULF | 01-May-96 | 36.5 | .50 | .23 | .50 | M |
| FL/GULF | 01-May-96 | 72.0 | 10.00 | 4.54 | 40.70 | F |
| FL/GULF | 01-May-96 | 74.0 | 11.00 | 4.99 | 46.70 | F |
| FL/KEYS/GULF | 02-May-96 | 88.0 | - | - | 52.60 | M |
| FL/KEYS/GULF | 02-May-96 | 93.0 | - | - | 116.40 | M |
| FL/KEYS/GULF | 02-May-96 | 99.0 | - | - | 126.20 | F |
| MS | 03-May-96 | 98.8 | - | - | 63.80 | F |
| MS | 03-May-96 | 85.0 | - | - | 182.00 | F |
| MS | 03-May-96 | 104.5 | - | - | 275.50 | F |
| MS | 03-May-96 | 101.5 | - | - | 276.90 | F |
| MS | 03-May-96 | 95.5 | - | - | 287.60 | F |
| MS | 03-May-96 | 102.0 | - | - | 335.70 | F |
| MS | 03-May-96 | 98.5 | - | - | 400.50 | F |
| MS | 03-May-96 | 103.5 | - | - | 411.60 | F |
| MS | 03-May-96 | 92.5 | 15.60 | 7.08 | 101.50 | F |
| MS | 03-May-96 | 104.5 | 24.00 | 10.89 | 662.00 | F |
| MS | 03-May-96 | 96.5 | 25.00 | 11.34 | 385.10 | F |
| LA | 03-May-96 | 106.5 | 25.90 | 11.75 | 653.20 | F |
| MS | 03-May-96 | 103.0 | 30.90 | 14.02 | 478.10 | F |
| MS | 03-May-96 | 105.0 | 31.00 | 14.06 | 517.50 | F |
| LA | 03-May-96 | 116.5 | 34.90 | 15.83 | 656.50 | F |
| LA | 03-May-96 | 115.0 | 36.50 | 16.56 | 831.80 | F |
| LA | 03-May-96 | 115.0 | 41.60 | 18.87 | 479.00 | F |
| FL/KEYS/GULF | 03-May-96 | 106.0 | 43.00 | 19.50 | 240.70 | F |
| LA | 03-May-96 | 135.0 | 62.00 | 28.12 | 1544.60 | F |
| LA | 04-May-96 | 95.5 | 20.40 | 9.25 | 660.80 | F |
| LA | 04-May-96 | 93.5 | 22.10 | 10.02 | 538.30 | F |
| LA | 04-May-96 | 99.2 | 23.40 | 10.61 | 234.80 | F |
| MS | 04-May-96 | 102.6 | 25.20 | 11.43 | 259.90 | F |
| LA | 04-May-96 | 106.5 | 26.30 | 11.93 | 472.10 | F |
| LA | 04-May-96 | 98.7 | 27.30 | 12.38 | 773.70 | F |

**Table 4 (continued).** Data for cobia specimens used in reproduction section of study (F = females, M = males).

| State/Coast | Capture Date | Fork Length (cm) | Fish Weight (lbs) | Fish Weight (kgs) | Gonad Weight (g) | Sex |
|---|---|---|---|---|---|---|
| LA | 04-May-96 | 100.0 | 28.10 | 12.75 | 761.00 | F |
| LA | 04-May-96 | 109.6 | 29.60 | 13.43 | 697.20 | F |
| LA | 04-May-96 | 107.8 | 31.40 | 14.24 | 923.00 | F |
| LA | 04-May-96 | 106.0 | 34.60 | 15.69 | 714.40 | F |
| LA | 04-May-96 | 104.0 | 34.70 | 15.74 | 665.60 | F |
| LA | 04-May-96 | 114.6 | 36.20 | 16.42 | 607.00 | F |
| LA | 04-May-96 | 118.4 | 36.80 | 16.69 | 684.30 | F |
| LA | 04-May-96 | 119.5 | 45.80 | 20.77 | 1509.60 | F |
| LA | 04-May-96 | 126.0 | 48.90 | 22.18 | 1280.90 | F |
| LA | 04-May-96 | 120.8 | 52.30 | 23.72 | 1151.50 | F |
| LA | 04-May-96 | 123.0 | 56.70 | 25.72 | 631.60 | F |
| LA | 04-May-96 | 131.0 | 58.80 | 26.67 | 1509.70 | F |
| MS | 05-May-96 | 98.5 | 20.20 | 9.16 | 355.30 | F |
| LA | 05-May-96 | 90.0 | 20.80 | 9.43 | 619.70 | F |
| LA | 05-May-96 | 108.5 | 31.80 | 14.42 | 857.40 | F |
| LA | 05-May-96 | 114.0 | 38.10 | 17.28 | 980.80 | F |
| LA | 05-May-96 | 117.5 | 41.00 | 18.60 | 809.90 | F |
| LA | 05-May-96 | 123.0 | 43.90 | 19.91 | 802.80 | F |
| LA | 05-May-96 | 128.0 | 49.00 | 22.23 | 831.00 | F |
| LA | 05-May-96 | 110.0 | 53.90 | 24.45 | 494.00 | F |
| LA | 05-May-96 | 131.2 | 57.40 | 26.04 | 937.40 | F |
| LA | 05-May-96 | 134.5 | 57.70 | 26.17 | 1241.60 | F |
| LA | 05-May-96 | 129.5 | 59.10 | 26.81 | 847.80 | F |
| FL/GULF | 08-May-96 | 74.0 | 8.50 | 3.86 | 28.20 | M |
| FL/GULF | 08-May-96 | 69.0 | 10.00 | 4.54 | 94.70 | M |
| SC | 08-May-96 | 96.5 | 23.50 | 10.66 | 129.00 | M |
| SC | 10-May-96 | 91.0 | 23.00 | 10.43 | 251.00 | M |
| SC | 10-May-96 | 117.0 | 43.00 | 19.50 | 356.00 | F |
| SC | 16-May-96 | 117.0 | 40.00 | 18.14 | 314.00 | F |
| SC | 16-May-96 | 116.0 | 40.00 | 18.14 | 595.00 | F |
| FL/GULF | 19-May-96 | 93.0 | 27.70 | 12.56 | 487.00 | F |
| TX | 22-May-96 | 88.3 | - | - | 153.49 | M |
| SC | 22-May-96 | 95.5 | - | - | 410.00 | M |
| SC | 22-May-96 | 102.0 | - | - | 734.00 | F |
| TX | 22-May-96 | 121.9 | - | - | 1373.70 | F |
| SC | 22-May-96 | 97.0 | 26.00 | 11.79 | 678.00 | M |
| SC | 22-May-96 | 98.5 | 27.00 | 12.25 | 427.00 | M |
| SC | 22-May-96 | 99.0 | 28.00 | 12.70 | 735.00 | M |
| SC | 22-May-96 | 101.0 | 29.00 | 13.15 | 736.00 | M |

**Table 4 (continued).** Data for cobia specimens used in reproduction section of study (F = females, M = males).

| State/Coast | Capture Date | Fork Length (cm) | Fish Weight (lbs) | Fish Weight (kgs) | Gonad Weight (g) | Sex |
|---|---|---|---|---|---|---|
| SC | 22-May-96 | 102.0 | 31.00 | 14.06 | 677.00 | M |
| SC | 22-May-96 | 104.0 | 32.00 | 14.51 | 545.00 | M |
| SC | 22-May-96 | 110.0 | 33.00 | 14.97 | 410.00 | M |
| SC | 22-May-96 | 107.0 | 33.50 | 15.20 | 676.00 | M |
| SC | 22-May-96 | 113.0 | 37.00 | 16.78 | 1307.00 | F |
| SC | 24-May-96 | 80.5 | 13.50 | 6.12 | 149.00 | M |
| SC | 25-May-96 | 84.5 | 13.00 | 5.90 | 328.00 | M |
| FL/ATL | 25-May-96 | 94.0 | 20.50 | 9.30 | 393.90 | M |
| SC | 25-May-96 | 104.0 | 26.00 | 11.79 | 630.00 | M |
| FL/GULF | 05-Jun-96 | 57.0 | 5.00 | 2.27 | 18.50 | M |
| FL/ATL | 08-Jun-96 | 104.5 | 28.60 | 12.97 | 621.00 | F |
| FL/ATL | 08-Jun-96 | 109.0 | 33.00 | 14.97 | 596.00 | F |
| FL/GULF | 17-Jun-96 | 80.0 | - | - | 290.00 | F |
| FL/GULF | 28-Jun-96 | 56.0 | 4.05 | 1.84 | 10.42 | F |
| TX | 07-Jul-96 | 91.4 | - | - | 93.78 | M |
| TX | 07-Jul-96 | 92.7 | - | - | 157.27 | M |
| TX | 07-Jul-96 | 92.1 | - | - | 169.98 | M |
| TX | 07-Jul-96 | 102.9 | - | - | 238.50 | M |
| FL/GULF | 08-Jul-96 | 88.0 | 16.50 | 7.48 | 66.60 | F |
| FL/GULF | 08-Jul-96 | 84.5 | 17.50 | 7.94 | 242.00 | M |
| FL/GULF | 08-Jul-96 | 90.0 | 25.00 | 11.34 | 360.00 | F |
| TX | 11-Jul-96 | 95.3 | - | - | 209.93 | M |
| TX | 16-Jul-96 | 83.2 | - | - | 113.67 | M |
| TX | 16-Jul-96 | 104.1 | - | - | 120.10 | F |
| TX | 16-Jul-96 | 83.2 | - | - | 137.64 | F |
| TX | 16-Jul-96 | 111.8 | - | - | 412.53 | F |
| TX | 16-Jul-96 | 116.2 | - | - | 461.22 | F |
| TX | 16-Jul-96 | 90.5 | - | - | 533.96 | F |
| FL/GULF | 16-Jul-96 | 87.0 | 28.00 | 12.70 | 313.00 | M |
| FL/GULF | 16-Jul-96 | 93.0 | 28.00 | 12.70 | 626.00 | F |
| FL/GULF | 17-Jul-96 | 86.0 | 23.00 | 10.43 | 487.00 | F |
| FL/GULF | 17-Jul-96 | 91.0 | 24.00 | 10.89 | 232.00 | M |
| MS | 19-Jul-96 | 125.0 | 44.50 | 20.18 | 408.20 | F |
| MS | 19-Jul-96 | 123.0 | 56.00 | 25.40 | 897.40 | F |
| TX | 24-Jul-96 | 86.0 | - | - | 78.13 | M |
| TX | 24-Jul-96 | 95.6 | - | - | 383.93 | F |
| TX | 24-Jul-96 | 101.3 | - | - | 393.67 | F |
| TX | 24-Jul-96 | 101.0 | - | - | 473.99 | F |
| TX | 24-Jul-96 | 121.9 | - | - | 895.59 | F |

**Table 4 (continued).** Data for cobia specimens used in reproduction section of study (F = females, M = males).

| State/Coast | Capture Date | Fork Length (cm) | Fish Weight (lbs) | Fish Weight (kgs) | Gonad Weight (g) | Sex |
|---|---|---|---|---|---|---|
| TX | 25-Jul-96 | 89.2 | - | - | 60.37 | F |
| TX | 25-Jul-96 | 87.9 | - | - | 68.16 | F |
| TX | 25-Jul-96 | 97.8 | - | - | 87.04 | F |
| TX | 25-Jul-96 | 94.0 | - | - | 150.91 | M |
| TX | 25-Jul-96 | 105.4 | - | - | 153.49 | M |
| TX | 25-Jul-96 | 94.0 | - | - | 154.40 | M |
| TX | 25-Jul-96 | 85.1 | - | - | 205.29 | F |
| TX | 25-Jul-96 | 100.3 | - | - | 390.10 | F |
| TX | 25-Jul-96 | 108.9 | - | - | 439.69 | F |
| TX | 25-Jul-96 | 106.0 | - | - | 565.22 | F |
| TX | 25-Jul-96 | 121.9 | - | - | 643.07 | F |
| TX | 25-Jul-96 | 120.7 | - | - | 674.06 | F |
| TX | 26-Jul-96 | 102.2 | - | - | 96.64 | F |
| TX | 26-Jul-96 | 97.8 | - | - | 139.16 | F |
| TX | 26-Jul-96 | 89.9 | - | - | 143.78 | M |
| TX | 26-Jul-96 | 108.6 | - | - | 151.07 | F |
| TX | 26-Jul-96 | 93.3 | - | - | 154.44 | M |
| TX | 26-Jul-96 | 91.8 | - | - | 157.74 | M |
| TX | 26-Jul-96 | 89.5 | - | - | 162.60 | F |
| TX | 26-Jul-96 | 109.9 | - | - | 247.81 | F |
| TX | 26-Jul-96 | 100.0 | - | - | 318.36 | F |
| TX | 26-Jul-96 | 117.5 | - | - | 370.09 | F |
| TX | 26-Jul-96 | 128.3 | - | - | 372.77 | F |
| TX | 26-Jul-96 | 87.9 | - | - | 429.14 | F |
| TX | 26-Jul-96 | 107.6 | - | - | 484.44 | F |
| TX | 26-Jul-96 | 99.4 | - | - | 523.56 | F |
| TX | 26-Jul-96 | 104.8 | - | - | 565.02 | F |
| TX | 26-Jul-96 | 99.1 | - | - | 707.58 | F |
| TX | 28-Jul-96 | 87.9 | - | - | 179.46 | M |
| TX | 28-Jul-96 | 90.8 | - | - | 224.78 | F |
| TX | 28-Jul-96 | 94.6 | - | - | 265.51 | M |
| TX | 28-Jul-96 | 101.3 | - | - | 279.44 | M |
| TX | 28-Jul-96 | 105.7 | - | - | 421.83 | F |
| TX | 28-Jul-96 | 104.5 | - | - | 567.91 | F |
| TX | 30-Jul-96 | 97.2 | - | - | 109.90 | M |
| TX | 30-Jul-96 | 115.6 | - | - | 690.35 | F |
| FL/GULF | 30-Jul-96 | 89.0 | 25.50 | 11.57 | 207.00 | F |
| FL/GULF | 30-Jul-96 | 86.0 | 25.50 | 11.57 | 547.00 | F |
| TX | 07-Aug-96 | 84.5 | - | - | 107.53 | F |

**Table 4 (continued).** Data for cobia specimens used in reproduction section of study (F = females, M = males).

| State/Coast | Capture Date | Fork Length (cm) | Fish Weight (lbs) | Fish Weight (kgs) | Gonad Weight (g) | Sex |
|---|---|---|---|---|---|---|
| TX | 07-Aug-96 | 83.8 | - | - | 172.23 | M |
| FL/ATL | 21-Sep-96 | 83.0 | 16.00 | 7.26 | 44.80 | M |
| FL/ATL | 21-Sep-96 | 91.0 | 18.00 | 8.16 | 55.70 | M |
| FL/ATL | 21-Sep-96 | 102.0 | 27.00 | 12.25 | 146.70 | M |
| MS | 24-Sep-96 | 83.5 | - | - | 18.10 | M |
| FL/GULF | 27-Sep-96 | 81.5 | 11.90 | 5.40 | 44.40 | M |
| FL/GULF | 27-Sep-96 | 92.0 | 18.30 | 8.30 | 69.10 | F |
| FL/GULF | 30-Sep-96 | 89.0 | 15.70 | 7.12 | 57.20 | F |
| FL/GULF | 01-Oct-96 | 80.5 | 13.10 | 5.94 | 41.60 | F |
| FL/GULF | 01-Oct-96 | 82.0 | 13.30 | 6.03 | 21.50 | M |
| FL/GULF | 01-Oct-96 | 85.0 | 15.60 | 7.08 | 53.20 | F |
| FL/GULF | 01-Oct-96 | 94.0 | 19.70 | 8.94 | 61.70 | F |
| FL/GULF | 02-Oct-96 | 89.5 | 17.00 | 7.71 | 71.10 | F |
| FL/GULF | 02-Oct-96 | 94.0 | 22.60 | 10.25 | 195.70 | F |
| FL/GULF | 04-Oct-96 | 89.0 | 15.20 | 6.89 | 36.40 | M |
| FL/GULF | 04-Oct-96 | 97.0 | 22.60 | 10.25 | 78.30 | F |
| FL/GULF | 22-Oct-96 | 44.0 | - | - | 2.70 | F |
| FL/GULF | 31-Oct-96 | 99.5 | 26.25 | 11.91 | 80.80 | F |
| FL/GULF | 05-Nov-96 | 82.0 | 14.10 | 6.40 | 35.00 | F |
| FL/GULF | 05-Nov-96 | 89.0 | 19.34 | 8.77 | 110.40 | M |
| FL/GULF | 05-Nov-96 | 92.0 | 22.10 | 10.02 | 77.40 | F |
| FL/GULF | 06-Nov-96 | 86.0 | 17.00 | 7.71 | 26.40 | M |
| FL/GULF | 08-Nov-96 | 82.0 | 14.30 | 6.49 | 19.80 | M |
| FL/GULF | 19-Nov-96 | 39.5 | .94 | .43 | .00 | M |
| FL/GULF | 19-Nov-96 | 41.5 | .94 | .43 | .00 | M |
| FL/GULF | 19-Nov-96 | 61.0 | 4.69 | 2.13 | 11.90 | F |
| FL/GULF | 19-Nov-96 | 62.0 | 5.19 | 2.35 | .70 | M |
| FL/GULF | 21-Nov-96 | 101.0 | 17.19 | 7.80 | 85.50 | F |
| FL/GULF | 03-Dec-96 | 127.0 | 58.00 | 26.31 | 120.00 | M |
| FL/GULF | 06-Mar-97 | 35.5 | .69 | .31 | 2.60 | F |
| FL/GULF | 25-Mar-97 | 47.0 | 1.80 | .82 | 4.50 | F |
| FL/ATL | 29-Mar-97 | 100.0 | - | - | 184.00 | F |
| FL/ATL | 29-Mar-97 | 86.0 | 18.50 | 8.39 | 53.00 | M |
| FL/ATL | 29-Mar-97 | 89.0 | 20.00 | 9.07 | 47.00 | M |
| FL/ATL | 29-Mar-97 | 96.0 | 22.00 | 9.98 | 92.00 | F |
| FL/ATL | 29-Mar-97 | 90.5 | 22.00 | 9.98 | 123.00 | F |
| FL/ATL | 29-Mar-97 | 94.0 | 24.00 | 10.89 | 85.00 | F |
| FL/ATL | 29-Mar-97 | 96.0 | 24.00 | 10.89 | 125.00 | F |
| FL/ATL | 29-Mar-97 | 98.5 | 25.00 | 11.34 | 223.00 | F |

**Table 4 (continued).** Data for cobia specimens used in reproduction section of study (F = females, M = males).

| State/Coast | Capture Date | Fork Length (cm) | Fish Weight (lbs) | Fish Weight (kgs) | Gonad Weight (g) | Sex |
|---|---|---|---|---|---|---|
| FL/ATL | 29-Mar-97 | 102.0 | 27.00 | 12.25 | 152.00 | F |
| FL/ATL | 29-Mar-97 | 98.0 | 29.00 | 13.15 | 193.00 | F |
| FL/ATL | 29-Mar-97 | 107.0 | 32.00 | 14.51 | 264.00 | F |
| FL/ATL | 29-Mar-97 | 106.0 | 33.50 | 15.20 | 194.00 | F |
| FL/ATL | 29-Mar-97 | 116.0 | 35.00 | 15.88 | 333.00 | F |
| FL/ATL | 29-Mar-97 | 89.0 | 40.00 | 18.14 | 56.00 | F |
| FL/ATL | 29-Mar-97 | 107.0 | 46.00 | 20.87 | 130.00 | M |
| FL/ATL | 29-Mar-97 | 117.0 | 49.00 | 22.23 | 1044.00 | F |
| FL/GULF | 06-May-97 | 47.0 | - | - | 4.40 | M |
| FL/GULF | 06-May-97 | 67.0 | 1.41 | .64 | 20.00 | F |
| SC | 21-May-97 | 88.5 | 18.00 | 8.16 | 252.00 | M |
| SC | 21-May-97 | 94.5 | 23.00 | 10.43 | 1012.00 | F |
| SC | 21-May-97 | 117.0 | 42.50 | 19.28 | 1072.00 | F |
| SC | 21-May-97 | 113.5 | 42.75 | 19.39 | 1662.00 | F |
| SC | 21-May-97 | 90.0 | 90.00 | 40.82 | 310.00 | M |
| FL/GULF | 27-May-97 | 87.0 | 20.00 | 9.07 | 213.30 | M |
| NC | 31-May-97 | 95.0 | 22.00 | 9.98 | 245.00 | F |
| NC | 31-May-97 | 138.5 | 77.00 | 34.93 | 954.00 | F |
| NC | 01-Jun-97 | 103.0 | 31.00 | 14.06 | 673.00 | F |
| NC | 01-Jun-97 | 105.5 | 33.00 | 14.97 | 1581.00 | F |
| NC | 01-Jun-97 | 138.5 | 69.00 | 31.30 | 1209.00 | F |
| FL/GULF | 23-Jun-97 | 108.0 | 32.00 | 14.51 | 566.00 | F |
| MS | 27-Jun-97 | 96.5 | - | - | 32.60 | F |
| MS | 27-Jun-97 | 83.2 | - | - | 48.10 | F |
| FL/GULF | 02-Jul-97 | 65.0 | 5.10 | 2.31 | 55.20 | M |
| MS | 15-Jul-97 | 87.8 | 17.30 | 7.85 | 60.60 | F |
| MS | 15-Jul-97 | 93.0 | 21.50 | 9.75 | 316.60 | F |
| MS | 24-Jul-97 | 96.5 | 21.00 | 9.53 | 105.10 | F |
| MS | 24-Jul-97 | 99.0 | 24.00 | 10.89 | 74.30 | F |
| MS | 24-Jul-97 | 98.0 | 24.50 | 11.11 | 468.40 | F |
| FL/GULF | 17-Aug-97 | 39.7 | 19.10 | 8.66 | 476.00 | F |
| FL/GULF | 17-Aug-97 | 95.0 | 21.30 | 9.66 | 403.00 | F |
| FL/GULF | 17-Aug-97 | 101.0 | 27.00 | 12.25 | 266.00 | F |
| FL/GULF | 17-Aug-97 | 37.0 | 34.00 | 15.42 | 147.00 | F |
| FL/GULF | 21-Aug-97 | 56.7 | 1.40 | .64 | 9.70 | F |
| FL/ATL | 30-Aug-97 | 93.0 | 20.75 | 9.41 | 76.00 | F |
| FL/GULF | 10-Sep-97 | 121.0 | 55.00 | 24.95 | 1130.00 | F |
| MS | 31-Jul-97 | 90.8 | 17.50 | 7.94 | - | F |
| MS | 31-Jul-97 | 104.8 | 36.00 | 16.33 | - | F |
| MS | 05-Aug-97 | 88.9 | 21.00 | 9.53 | - | F |

**Table 4 (continued).** Data for cobia specimens used in reproduction section of study (F = females, M = males).

| State/Coast | Capture Date | Fork Length (cm) | Fish Weight (lbs) | Fish Weight (kgs) | Gonad Weight (g) | Sex |
|---|---|---|---|---|---|---|
| MS | 05-Aug-97 | 88.9 | 21.50 | 9.75 | - | M |
| MS | 05-Aug-97 | 92.7 | 25.00 | 11.34 | - | F |
| MS | 05-Aug-97 | 98.4 | 27.50 | 12.47 | - | M |
| MS | 07-Aug-97 | 114.3 | 32.00 | 14.51 | 212.6 | M |
| MS | 14-Aug-97 | 95.9 | 16.00 | 7.26 | 58.7 | F |
| MS | 14-Aug-97 | 106.7 | 26.00 | 11.79 | 280.2 | F |
| LA | 13-Sep-97 | 89.0 | 14.00 | 6.35 | - | M |
| MS | 13-Sep-97 | 97.0 | 19.60 | 8.89 | - | M |
| LA | 13-Sep-97 | 96.5 | 20.70 | 9.39 | - | F |
| LA | 13-Sep-97 | 96.0 | 23.10 | 10.48 | - | F |
| LA | 13-Sep-97 | 104.0 | 24.30 | 11.02 | - | F |
| LA | 13-Sep-97 | 97.0 | 24.90 | 11.29 | - | F |
| MS | 13-Sep-97 | 108.0 | 29.10 | 13.20 | - | M |
| LA | 13-Sep-97 | 114.0 | 32.20 | 14.61 | - | F |
| LA | 13-Sep-97 | 115.0 | 34.60 | 15.69 | - | F |
| MS | 14-Sep-97 | 94.0 | 17.40 | 7.89 | - | F |
| LA | 14-Sep-97 | 95.0 | 18.80 | 8.53 | - | M |
| LA | 14-Sep-97 | 96.0 | 20.30 | 9.21 | - | F |
| MS | 14-Sep-97 | 97.0 | 21.80 | 9.89 | - | M |
| LA | 14-Sep-97 | 102.5 | 25.60 | 11.61 | - | F |
| LA | 14-Sep-97 | 104.0 | 27.20 | 12.34 | - | F |
| MS | 14-Sep-97 | 115.5 | 35.40 | 16.06 | - | F |
| MS | 14-Sep-97 | 114.0 | 39.70 | 18.01 | - | F |
| LA | 14-Sep-97 | 118.0 | 47.10 | 21.36 | - | F |
| FL/GULF | 09-Oct-97 | 87.0 | 15.50 | 7.03 | 66.9 | F |
| FL/GULF | 09-Oct-97 | 101.0 | 27.00 | 12.25 | 157.9 | F |
| FL/KEYS/ | 17-Oct-97 | 84.5 | 15.00 | 6.80 | - | F |
| FL/KEYS/ | 17-Oct-97 | 84.5 | 18.00 | 8.16 | - | F |
| FL/KEYS/ | 17-Oct-97 | 90.5 | 20.00 | 9.07 | - | F |
| FL/KEYS/ | 17-Oct-97 | 93.3 | - | - | - | M |
| FL/GULF | 10-Nov-97 | 114.0 | 45.00 | 20.41 | 152.4 | F |
| FL/GULF | 18-Nov-97 | 76.5 | 9.13 | 4.14 | 25.2 | F |
| FL/GULF | 25-Nov-97 | 87.0 | 15.00 | 6.80 | 59.0 | F |
| FL/GULF | 26-Nov-97 | 86.0 | 14.00 | 6.35 | 53.0 | F |
| FL/GULF | 26-Nov-97 | 83.5 | 15.00 | 6.80 | 49.0 | F |
| FL/GULF | 26-Nov-97 | 83.0 | 15.50 | 7.03 | 62.0 | F |
| FL/GULF | 03-Dec-97 | 71.0 | - | - | 32.0 | F |
| FL/GULF | 03-Dec-97 | 69.5 | - | - | 8.0 | M |
| FL/ATL | 04-Dec-97 | 96.0 | 24.00 | 10.89 | 82.0 | F |
| FL/ATL | 04-Dec-97 | 108.0 | 33.00 | 14.97 | 65.0 | M |
| FL/ATL | 04-Dec-97 | 120.5 | 50.00 | 22.68 | 263.0 | F |
| FL/ATL | 04-Dec-97 | 114.0 | - | - | 190.0 | F |
| FL/GULF | 05-Dec-97 | 99.0 | - | - | - | F |
| FL/GULF | 16-Dec-97 | 117.0 | 56.00 | 25.40 | - | F |

**Table 5.** Summary statistics for fork length (cm) for female & male cobia by sampling area. *(Length of one male unavailable)*

| | Fork Length (cm) | | | | |
|---|---|---|---|---|---|
| **Females** | **Total Atlantic** | **Total FL Keys** | **Total Gulf** | **Tournament Atlantic** | **Tournament Gulf** |
| n | 100 | 28 | 352 | 60 | 178 |
| Mean | 108.2 | 86.0 | 101.8 | 108.7 | 108.8 |
| S.D. | 13.6 | 9.9 | 19.0 | 13.9 | 15.4 |
| Minimum | 83.0 | 70.0 | 31.5 | 86.5 | 37.0 |
| Maximum | 138.5 | 106.0 | 163.9 | 138.5 | 158.5 |
| **Males** | | | | | |
| n | 56 | 20 | 146 | 39 | 50 |
| Mean | 95.5 | 86.2 | 89.0 | 95.4 | 100.8 |
| S.D. | 8.8 | 6.9 | 18.1 | 8.6 | 11.4 |
| Minimum | 80.5 | 70.5 | 31.0 | 80.5 | 82.5 |
| Maximum | 113.0 | 100.5 | 139.0 | 110.0 | 139.0 |

**Table 6.** Summary statistics by weight (lbs) for female & male cobia by sampling area.

| | Weight (lbs) | | | | |
|---|---|---|---|---|---|
| **Females** | **Total Atlantic** | **Total FL Keys** | **Total Gulf** | **Tournament Atlantic** | **Tournament Gulf** |
| n | 77 | 11 | 255 | 57 | 161 |
| Mean | 37.3 | 17.6 | 30.5 | 37.4 | 35.6 |
| S.D. | 15.6 | 10.1 | 16.4 | 16.0 | 14.1 |
| Minimum | 15.0 | 7.0 | 0.5 | 15.6 | 15.6 |
| Maximum | 85.5 | 43.0 | 106.8 | 85.5 | 106.8 |
| **Males** | | | | | |
| n | 44 | 5 | 87 | 38 | 37 |
| Mean | 26.3 | 14.7 | 18.5 | 25.6 | 23.9 |
| S.D. | 12.6 | 3.8 | 10.7 | 12.9 | 7.6 |
| Minimum | 12.8 | 8.5 | 0.5 | 12.8 | 11.8 |
| Maximum | 90.0 | 18.0 | 58.0 | 90.0 | 53.7 |

**Table 7.** Summary statistics of gonad weight (g) for female & male cobia by area.

| | Gonad Weight (g) | | | | |
|---|---|---|---|---|---|
| **Females** | **Total Atlantic** | **Total FL Keys** | **Total Gulf** | **Tournament Atlantic** | **Tournament Gulf** |
| n | 63 | 23 | 167 | 39 | 64 |
| Mean | 337.2 | 74.8 | 390.2 | 432.4 | 617.3 |
| S.D. | 384.5 | 51.0 | 345.7 | 455.5 | 341.7 |
| Minimum | 56.0 | 25.4 | 2.6 | 56.0 | 63.8 |
| Maximum | 1,662.0 | 240.7 | 1,544.6 | 1,662.0 | 1,544.6 |
| **Males** | | | | | |
| n | 40 | 18 | 55 | 31 | 2 |
| Mean | 238.5 | 35.4 | 96.7 | 278.5 | 60.8 |
| S.D. | 233.0 | 30.0 | 88.0 | 247.6 | 60.4 |
| Minimum | 7.5 | 3.6 | 0.0 | 25.2 | 18.1 |
| Maximum | 736.0 | 116.4 | 313.0 | 736.0 | 103.5 |

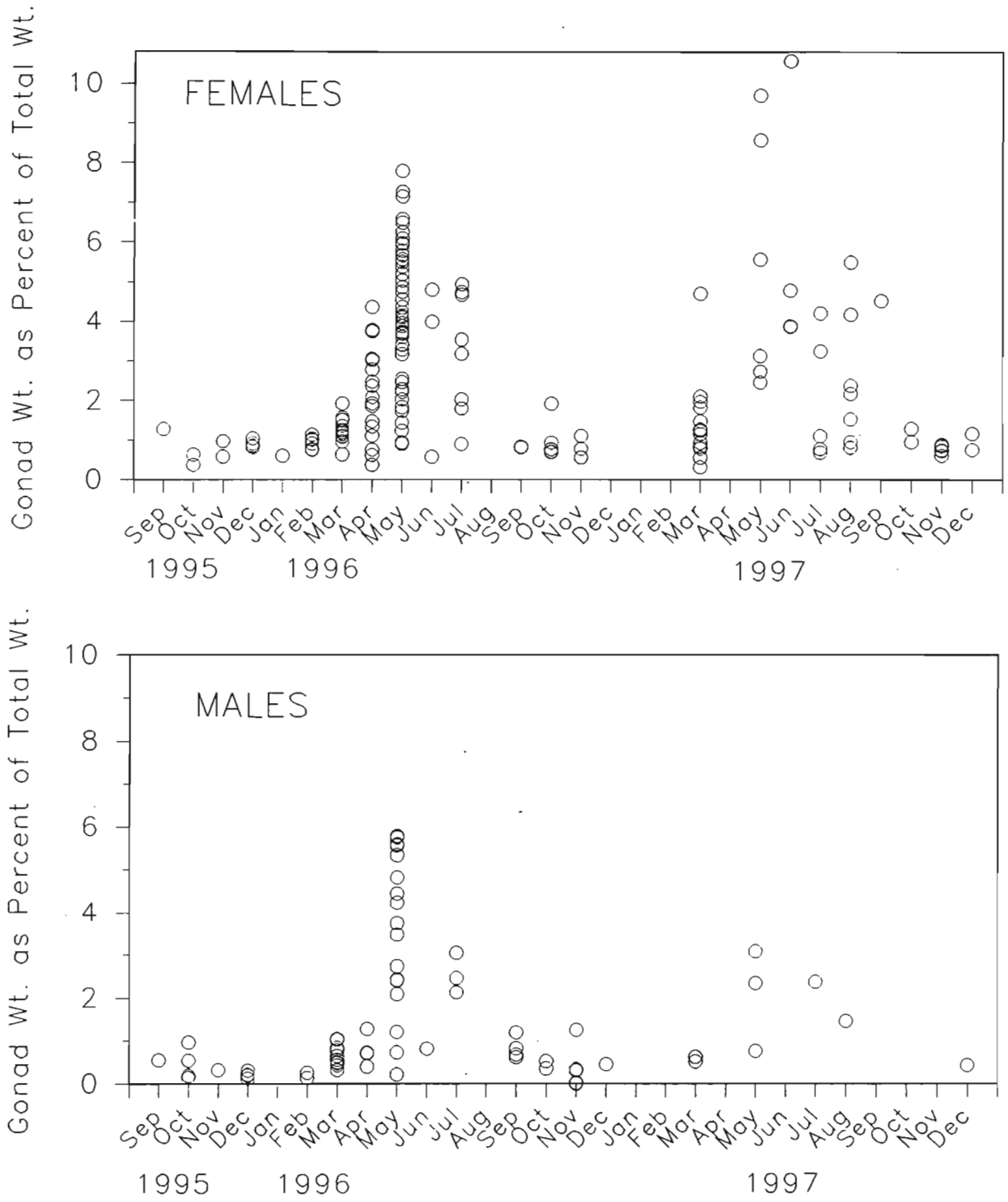



**Figure 9.** Seasonal variations of gonad weight as percent of total weight for female and male cobia.

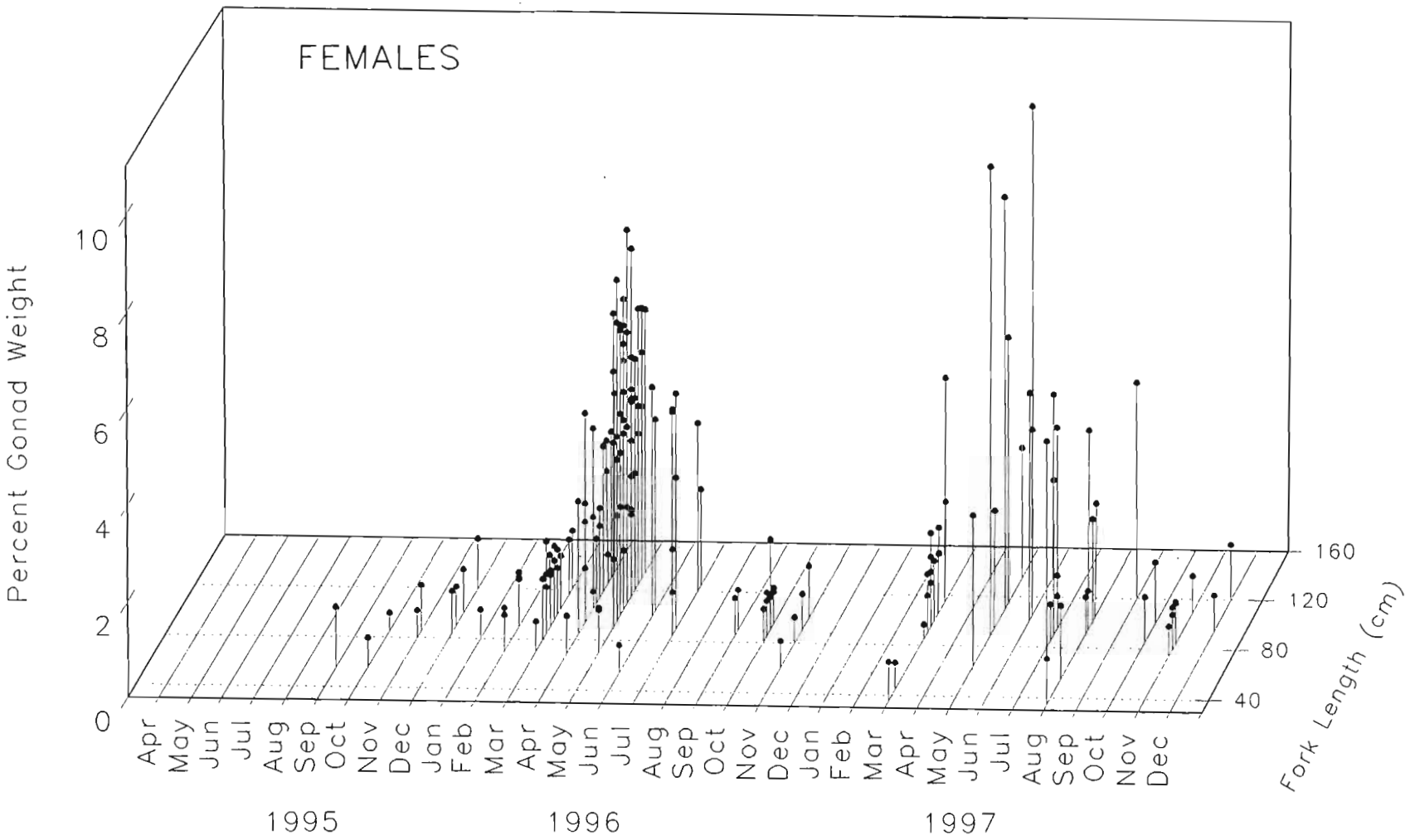



**Figure 10.** Percent gonad weight in relation to total body weight for female cobia by fork length (cm) and month of capture.

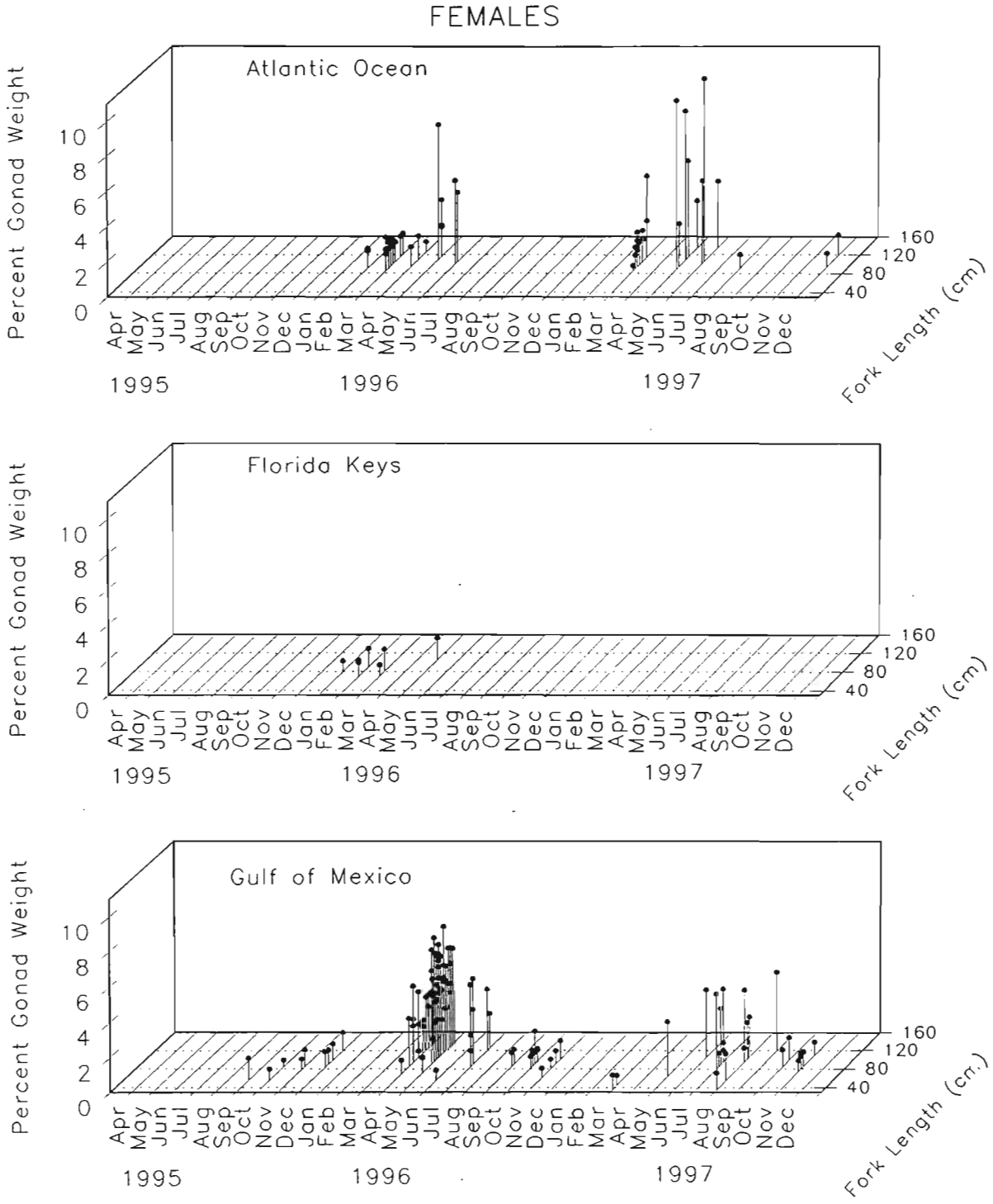



**Figure 11.** Percent gonad weight in relation to total body weight for female cobia by fork length (cm), month of capture and area.

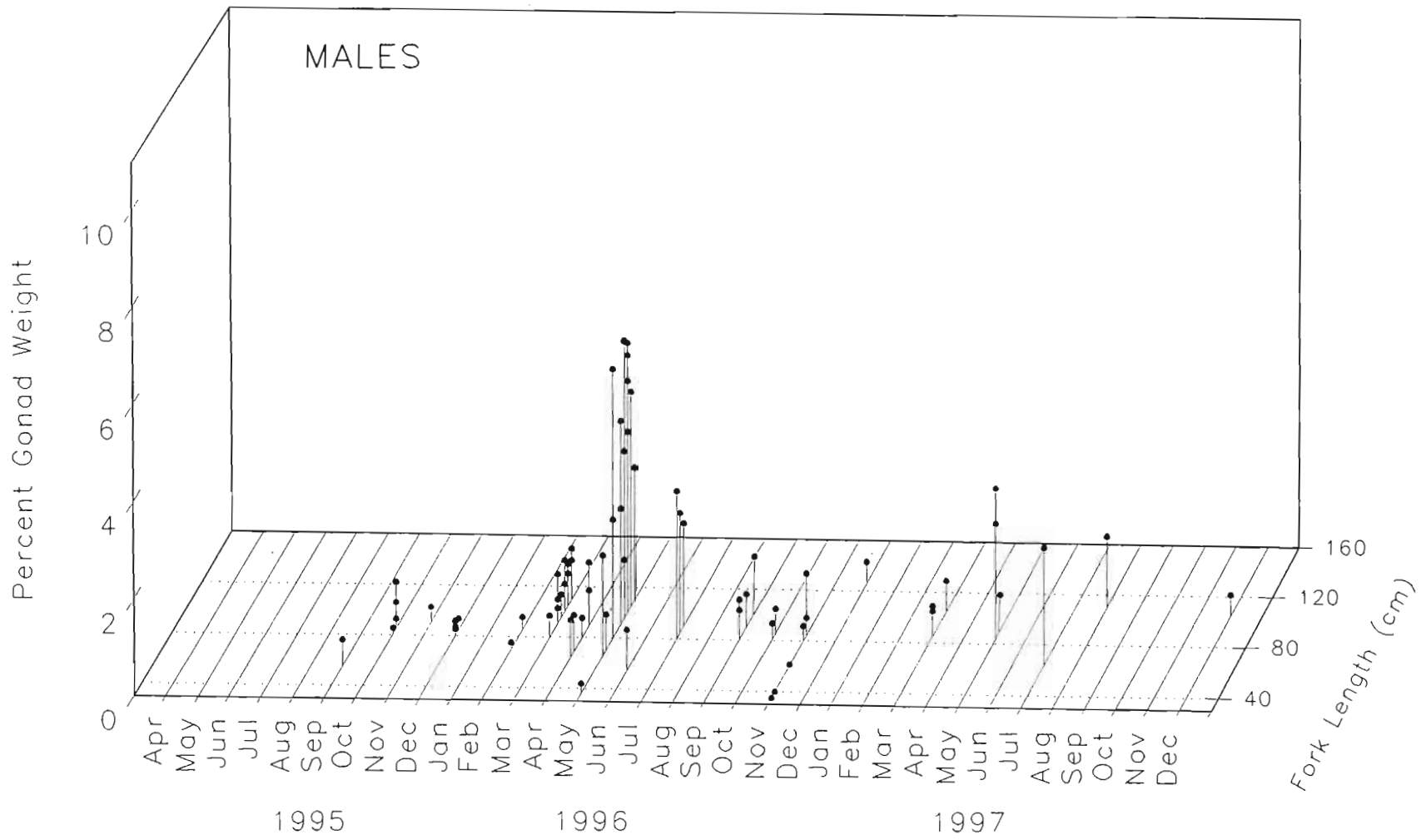



**Figure 12.** Percent gonad weight in relation to total body weight for male cobia by fork length (cm) and month of capture.

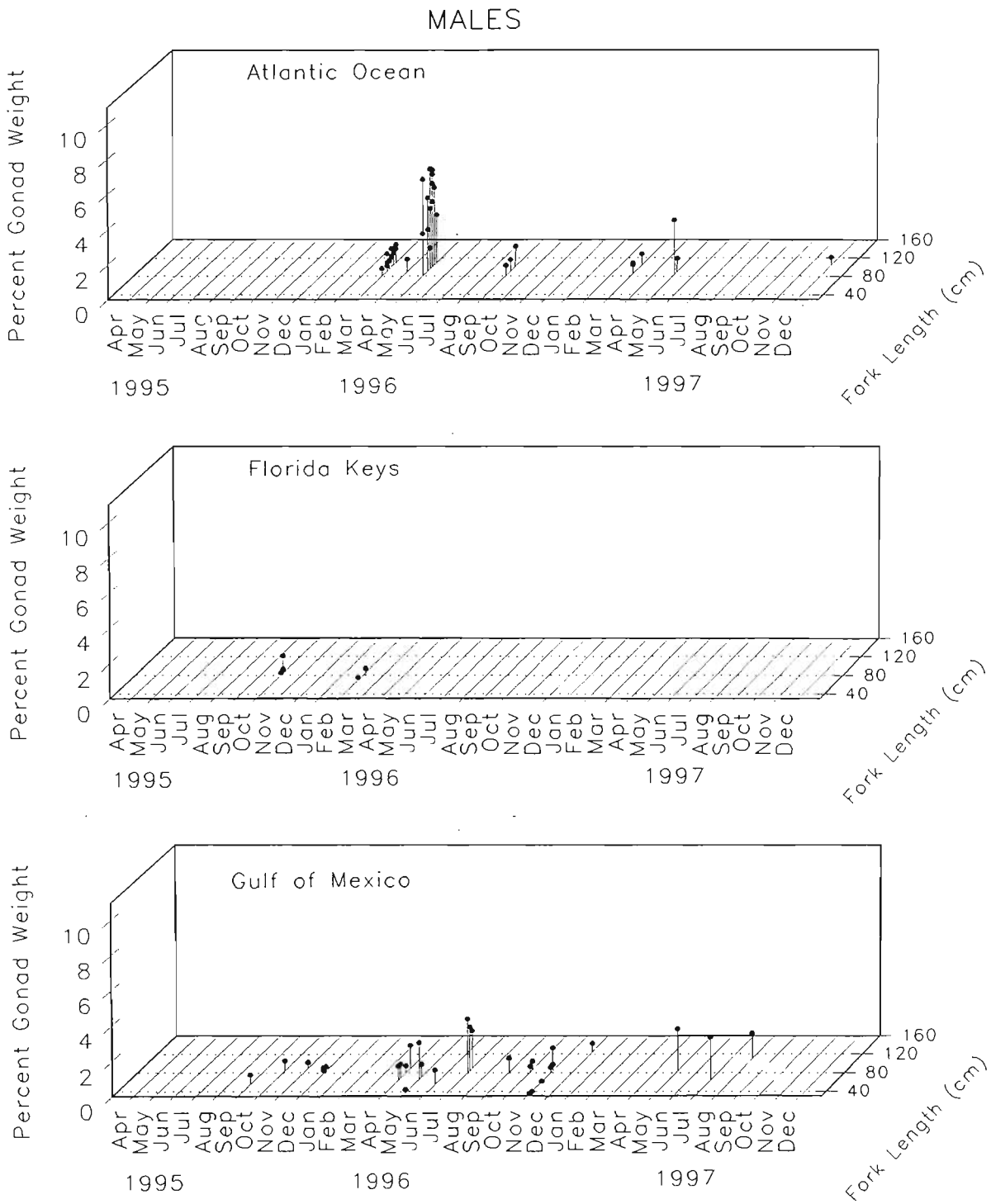



**Figure 13.** Percent gonad weight in relation to total body weight for male cobia by fork length (cm), month of capture and area.

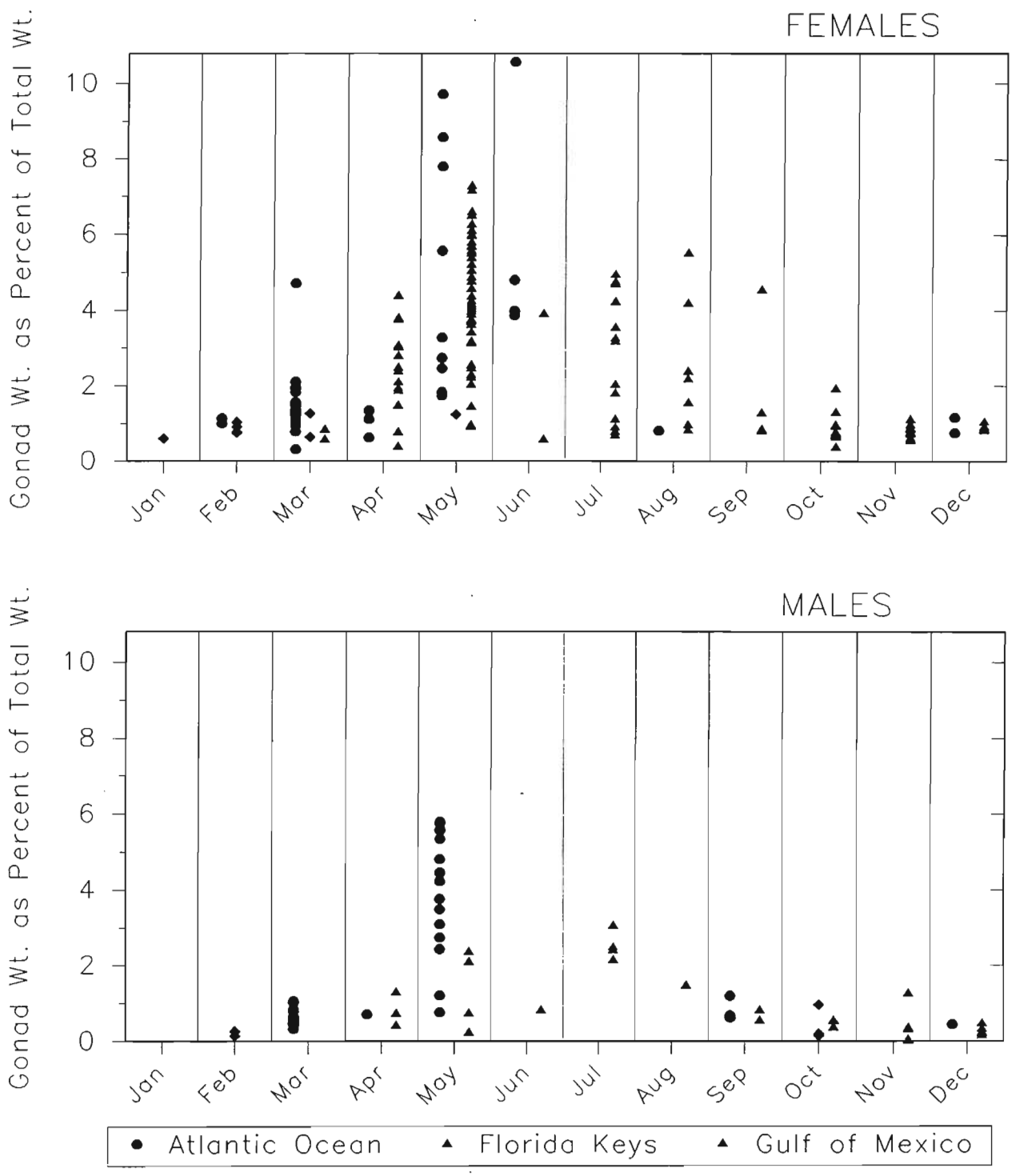



**Figure 14.** Gonad weight as percent of total weight for female and male cobia by area.

## Otolith Tally

# COBIA OTOLITH TALLY SHEET

**AREA:** South Atlantic and Gulf of Mexico **PERIOD:** 8/1/95-12/31/97 Quarters I-X

| SEX AND FORK LENGTH INTERVAL (CM) | ATLANTIC NC SC FL EAST COAST | EAST GULF FL KEYS FL | NORTH GULF AL MISS LA FL PAN | WEST GULF TX | TOTAL | SEX AND FORK LENGTH INTERVAL (CM) | ATLANTIC NC SC FL EAST COAST | EAST GULF FL KEYS FL | NORTH GULF AL MISS LA FL PAN | WEST GULF TX | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FEMALE | | | | | | MALE | | | | | |
| 0-20 | | | | | | 0-20 | | | | | |
| 21-30 | | | | | | 21-30 | | | | | |
| 31-40 | | 3 | 1 | 1 | 5 | 31-40 | | 2 | 2 | 2 | 6 |
| 41-50 | | 2 | 2 | | 4 | 41-50 | | 3 | | | 3 |
| 51-60 | | 4 | | | 4 | 51-60 | | 3 | | | 3 |
| 61-70 | | 6 | 1 | | 7 | 61-70 | | 6 | | | 6 |
| 71-80 | | 13 | 1 | 1 | 15 | 71-80 | | 6 | 1 | | 7 |
| 81-90 | 8 | 38 | 13 | 15 | 74 | 81-90 | 19 | 31 | 16 | 18 | 84 |
| 91-100 | 26 | 21 | 53 | 13 | 113 | 91-100 | 20 | 7 | 19 | 15 | 61 |
| 101-110 | 24 | 10 | 57 | 16 | 107 | 101-110 | 15 | 1 | 20 | 5 | 41 |
| 111-120 | 24 | 4 | 43 | 9 | 80 | 111-120 | 2 | 1 | 4 | | 7 |
| 121-130 | 13 | 2 | 33 | 6 | 54 | 121-130 | | 1 | 1 | | 2 |
| 131-140 | 5 | | 8 | | 13 | 131-140 | | | 2 | | 2 |
| 141-150 | | | 1 | | 1 | 141-150 | | | | | |
| 151-160 | | | 2 | | 2 | 151-160 | | | | | |
| 161-170 | | | 1 | | 1 | 161-170 | | | | | |
| 171-180 | | | | | | 171-180 | | | | | |
| 181-190 | | | | | | 181-190 | | | | | |

**Figure 15.** Number of cobia otoliths collected from start through December 31, 1997 and segregated by fish size, sex and geographic location.
*(Length of one male unavailable)*

## IV. PUBLICITY

As part of the publicity campaign to obtain cobia carcasses from fishers in Florida, press releases were periodically sent to local sports writers. Articles appeared in various newspapers throughout the two-year project. Please see **Appendix A** for examples of the publicity campaign and newspaper articles which are listed below.

Quarter II
- The Fort Myers News-Press by Byron Stout (November 26, 1995)
- The Pelican Press (Sarasota, Florida) by Bob Ardren (December 7, 1995)
- The Sarasota Herald-Tribune in the "Floridoors" Section (December 10,1995)
- The Key West Citizen by Kevin Brockway (no example)

Quarter III
- Florida Today (Brevard County)
- The Key West Citizen by Sea Grant Marine Extension Agent, Douglas Gregory

Quarter IV
- The Tampa Tribune by Bill Sargent
- The Sarasota Herald-Tribune in "On the Gulf Coast" section by Steve Gibson (May 21, 1996)

Quarter V
- The Pelican Press (Sarasota, Florida) by Bob Ardren (August 15, 1996)
- The Southwest Florida Fishing News (September, 1996)

Quarter VI
- The Pelican Press (Sarasota, Florida) by Bob Ardren - 2 articles (October 10,1996 and November 7, 1996)
- The Sarasota Herald-Tribune by Steve Gibson (January 1, 1997)

Quarter VIII
- The Georgia Times-Union by Joe Jularits (Jacksonville, Florida - May 18,1997)

Quarter IX
- The East Bay Breeze - Tampa Metropolitan Area, Apollo Beach, Florida Edition, "Angler's Almanac" section by Dan Scopes (June 25, 1997)
- The Suncoast News - four editions, by Nick Stubbs
  - Tampa Metro Area Countryside/Dunedin Edition
  - Palm Harbor/Tarpon Springs Edition
  - East Lake/Oldsmar Edition
  - New Port Richey/Port Richey Edition

*(Quarters VII and X did not have any newspaper articles)*

During the month of July, 1996, MML P.I., Karen Burns, gave two interviews on 570 WINS News radio and on the Captain Sergio Fishing show on an affiliate station of 570, briefly describing the project and requesting help from fishers in collecting cobia carcasses from fish caught in Tampa Bay, Florida. The request for help from fishers was also made on the Mel Berman radio fishing show.

In August of 1996, Teresa DeBruler of MML, gave a talk to the Florida Conservation Association of Manatee County (FCA) on the cobia project. in September of 1996, she gave another talk to the Englewood Rotary Cub.

## V. AGE AND GROWTH

### Materials and Methods

*Sampling Protocol*:
Cobia otoliths (sagittae) were used to determine age and growth. Seven hundred and three otoliths were collected and analyzed from the Gulf of Mexico and the South Atlantic. Data taken during collection of otoliths included date, sex, size, capture location, gear type and water temperature from cobia captured off North and South Carolina, South Florida, the Florida Keys, the northern Gulf of Mexico and Texas. Water depth was also recorded. Specimens were obtained from fishing tournaments, charter boat captains, recreational and commercial fishers. MML personnel collected samples from the Carolinas, South Florida and the Florida Keys. GCRL personnel obtained samples from the northern Gulf. Texas samples were obtained by a graduate student from the University of Texas from charter boat captains fishing off Port Aransas.

The length-weight relationships for males and females were described using the model: weight = $aFL^b$, where weight = total body weight and FL = fork length (mm). Analyses of covariance (Ott, 1977) were used to test for differences between regressions.

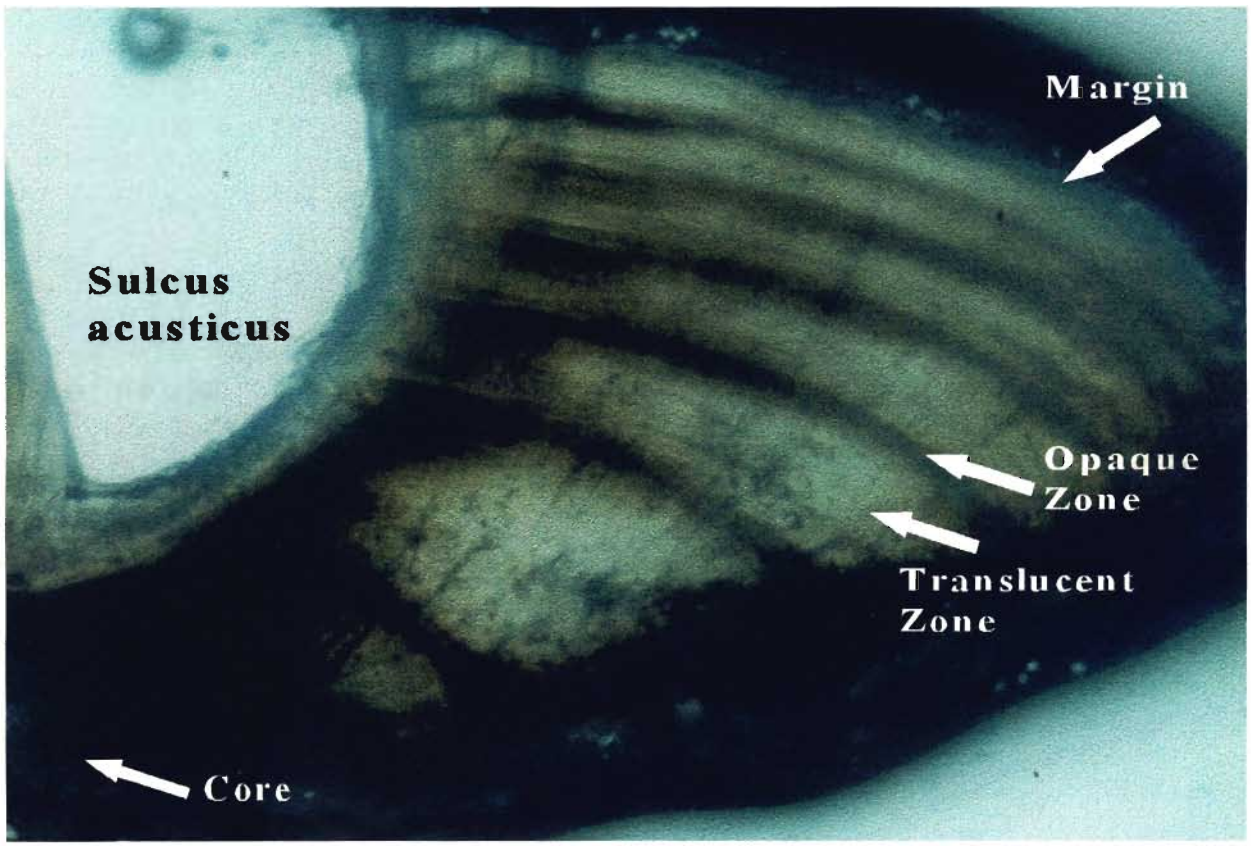
*Otolith Processing Protocol*:
Otoliths (sagittae) were removed by making a cross cut in the cranium with a hack saw. Sagittae were removed from the sacculi, rinsed with water, blotted, air dried and stored in labelled glass vials until processed. The left sagitta was used for age determination except when broken, lost, damaged during processing, or unreadable; in these instances, the right sagitta was substituted. When the left sagitta was processed, the right was archived. During year one, otoliths were embedded in Crystal Bond 509.

In year two, otoliths were embedded in plastic molds filled with Araldite CY 8702 epoxy encapsulating resin plus a hardener. This second year procedure was preferred because it reduced otolith damage during cutting. The resin was not as brittle as the Crystal Bond and provided better protection for the otolith.

Otoliths were cut using a Buehler Isomet low-speed saw with a diamond blade. Otoliths were sectioned (0.5 - 0.7 mm) transversely through the core. Sections were mounted on glass slides using Flo-Texx Mounting Medium, and allowed to dry for 12 hours. Finished slides were viewed using a stereo dissection microscope with transmitted light at 30/40X magnification.

Age was estimated by counting opaque zones in sections as annuli, counting from the core to the outer edge (margin). Franks and McBee (1991) verified that opaque zones delineated annuli. The appearance of the margin was recorded as either opaque or translucent (Wilson *et al.*, 1987). In an effort to deter any bias during examination, sections were read without reference to sample source, sex, fish size, or date of catch. All sections were independently read once by two readers, followed by a joint reading in an effort to resolve any differences between counts. Disagreement in counts usually involved the presence or absence of an annulus on the otolith margin. After all the otoliths were read, those with different counts were re-examined. In most cases an agreement was reached and an age was assigned to the fish. In those cases where disagreements could not be reconciled, the otoliths were discarded and not included in the analysis.

Figure 16 of the ventral lobe a thin sectioned cobia saggital otolith, shows the sulcus, core, opaque zone and translucent zone.



## Results

*Age/Length*:
A total of 703 cobia, (480 females and 223 males) from North Carolina to Texas were sampled. Fish were grouped by geographic region, the Carolinas, Florida Atlantic coast, Florida Gulf coast, northern Gulf and Texas coast. Female cobia (n = 45) collected off the Carolinas ranged in size from 940.5 - 1380.5 mm FL, mean = 1155.7 mm, and weighed 48.40 - 188.10 kg, mean = 98.70 kg. Male cobia (n = 28 mm) from the same locations ranged 800.50 -1130.0 mm FL, mean = 950.70 mm, and weighed 28.60-198.0 kg, mean = 59.95 kg. A total of 83 cobia, (55 females and 28 males) were sampled from the Florida Atlantic coast. Females ranged from 830.0-1290.0 mm FL, mean = 1000.83 mm, and weighed 33-125.40 kg, mean = 62.04 kg. Males ranged from 830.0-1130.0 mm FL, mean = 960.0 mm, and weighed 28.16-101.20 kg, mean = 55.9 kg. Cobia captured off the Florida Gulf coast ranged from 350.0-1270.0 mm FL, mean = 820.26 mm. Females (n = 75), measured 350.5-1220.0 mm FL, mean = 850.35 mm while males (n = 41) measured 360.5-1270.0 mm, mean = 760.6 mm. Females weighed 1.518-123.20 kg, mean = 44.88 kg, while males weighed 1.1-127.60 kg, mean = 40.41 kg. Northern Gulf females (n = 216) ranged 370-1630.9 mm FL, mean = 1050.40 mm, and weighed 1.65-234.96 kg, mean = 69.43 kg. Male cobia (n = 66) from this region, ranged in length from 380-1390 mm FL, mean = 970.30 mm, and weighed from 1.65-118.14 kg, mean = 48.38 kg. Cobia (61 females and 40 males) collected off Texas, ranged 310.0-1280.3 mm FL, mean = 950.80 mm. Females ranged from 310.50-1280.30 mm FL, mean = 950.80 mm, while males varied 310.0-1050.40 mm, mean = 950.80 mm. Weights were not available for most of the Texas fish.

Length/frequency distributions for females and males were markedly different, with females larger than males at all locations (**See Figures 3-7**). Female cobia were significantly larger than male cobia (Mann-Whitney U test).

More female (n = 480) than male (n = 223) cobia were collected at all of the sampling stations. Samples from areas where most of the fish were collected from tournaments, might be expected to be biased toward females, which are larger; however, the sex ratio for non-tournament cobia also was not 1:1. The sex ratio at most locations was approximately 2:1 in favor of the females, with the exception of the northern Gulf, where the ratio was 3:1.

For each coast ANOVA's were performed to test for differences in the slopes of length/weight (log transformed) regression lines between the sexes. The slopes were not statistically different for any of the coasts. (The p-values of the slopes were: 0.6252-Carolinas; 0.2655-Florida Atlantic; 0.4130-Florida Gulf; and 0.8847-Northern Gulf.

Length-weight regressions were calculated for both male and female cobia by each geographic area, the Carolinas, Florida east coast, Florida west coast and northern Gulf of Mexico. Regressions were calculated using linear regression of log10- transformed data. Slopes and elevations of the regressions were compared by analysis of covariance (Snedecor and Cochran, 1967), (**Figures 17-20, Tables 8, 9 and 10**).

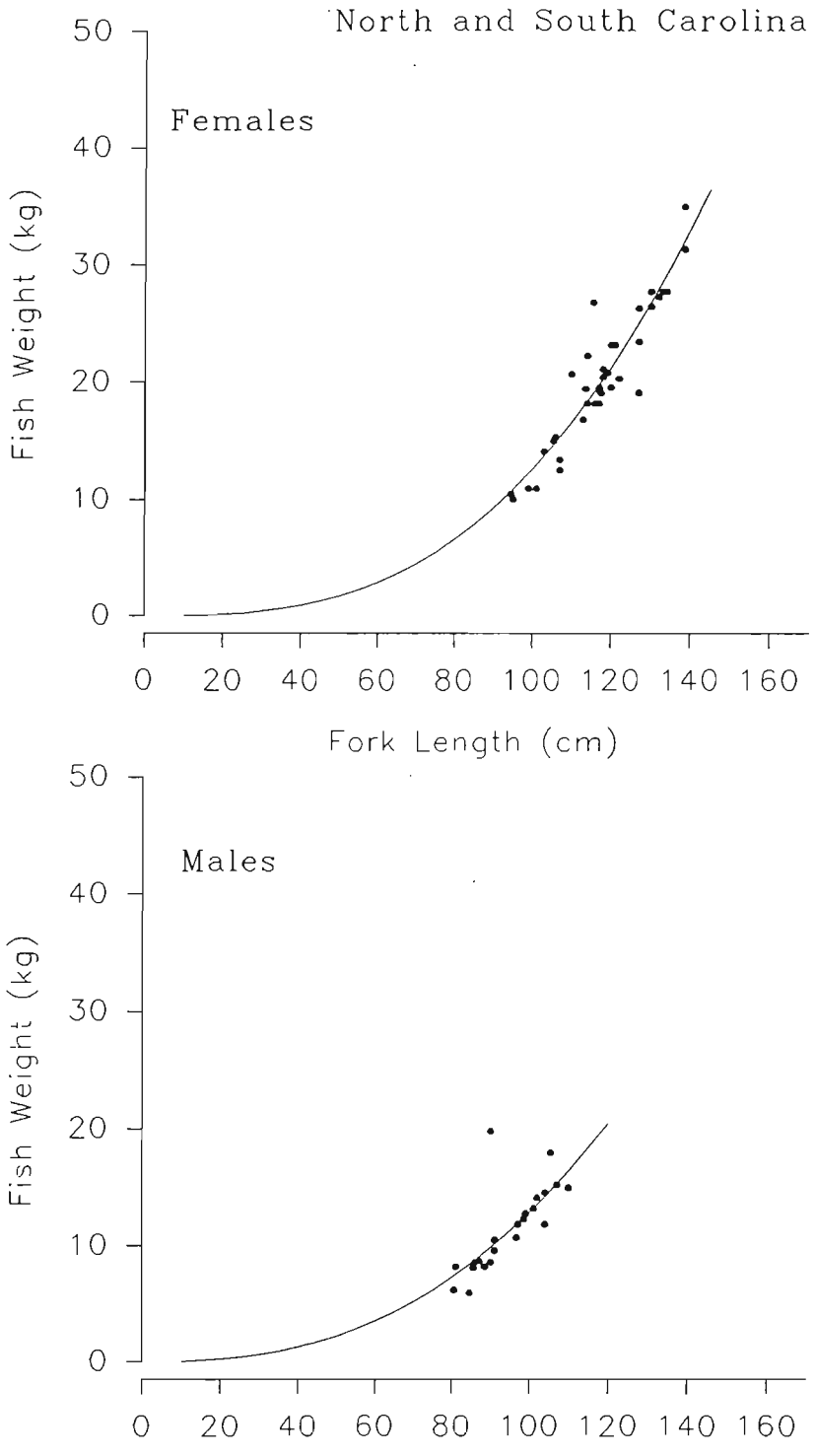



**Figure 17.** Weight and Length for cobia captured off North and South Carolina.

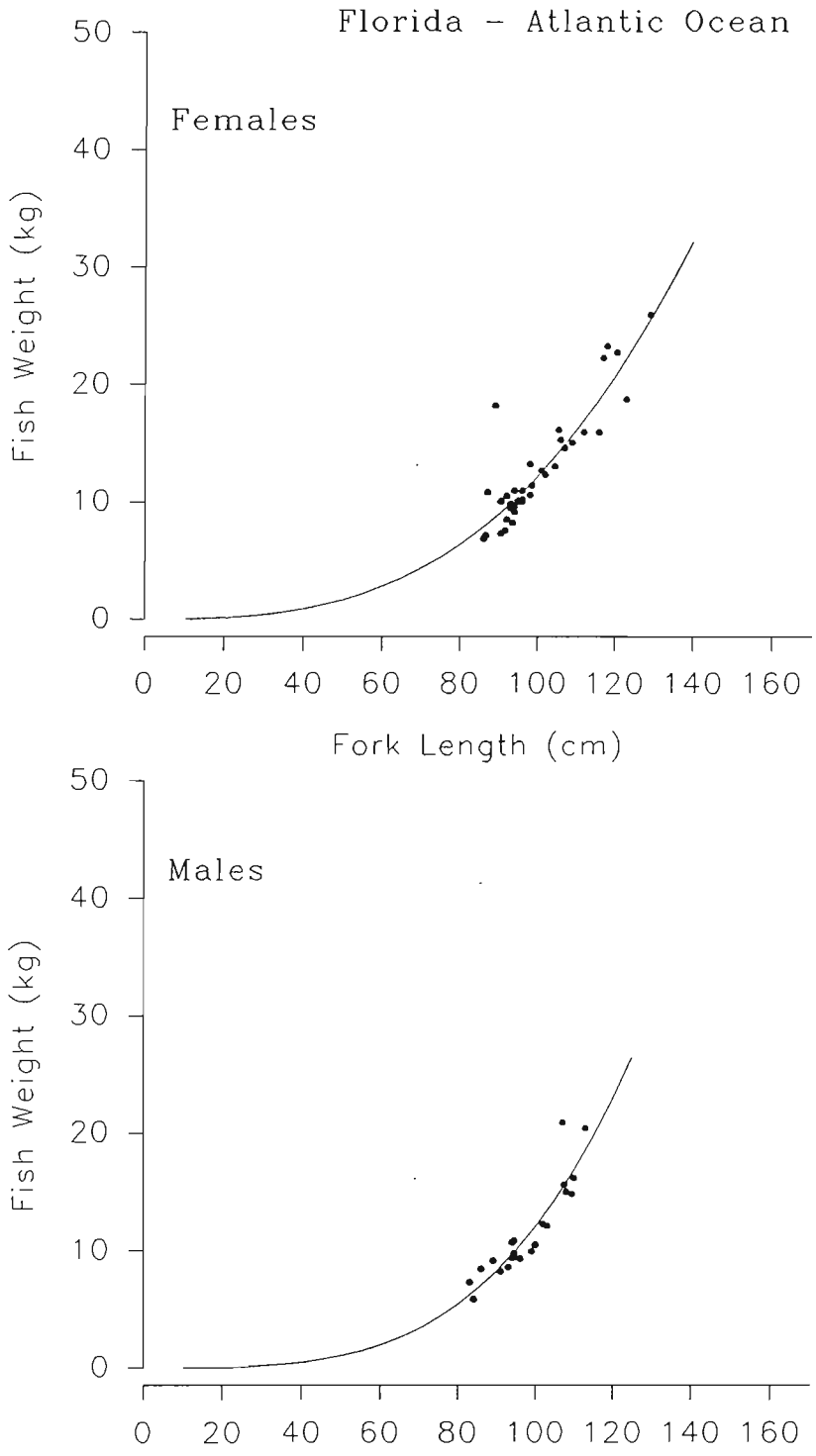



**Figure 18.** Weight and Length for cobia captured off the east coast of Florida.

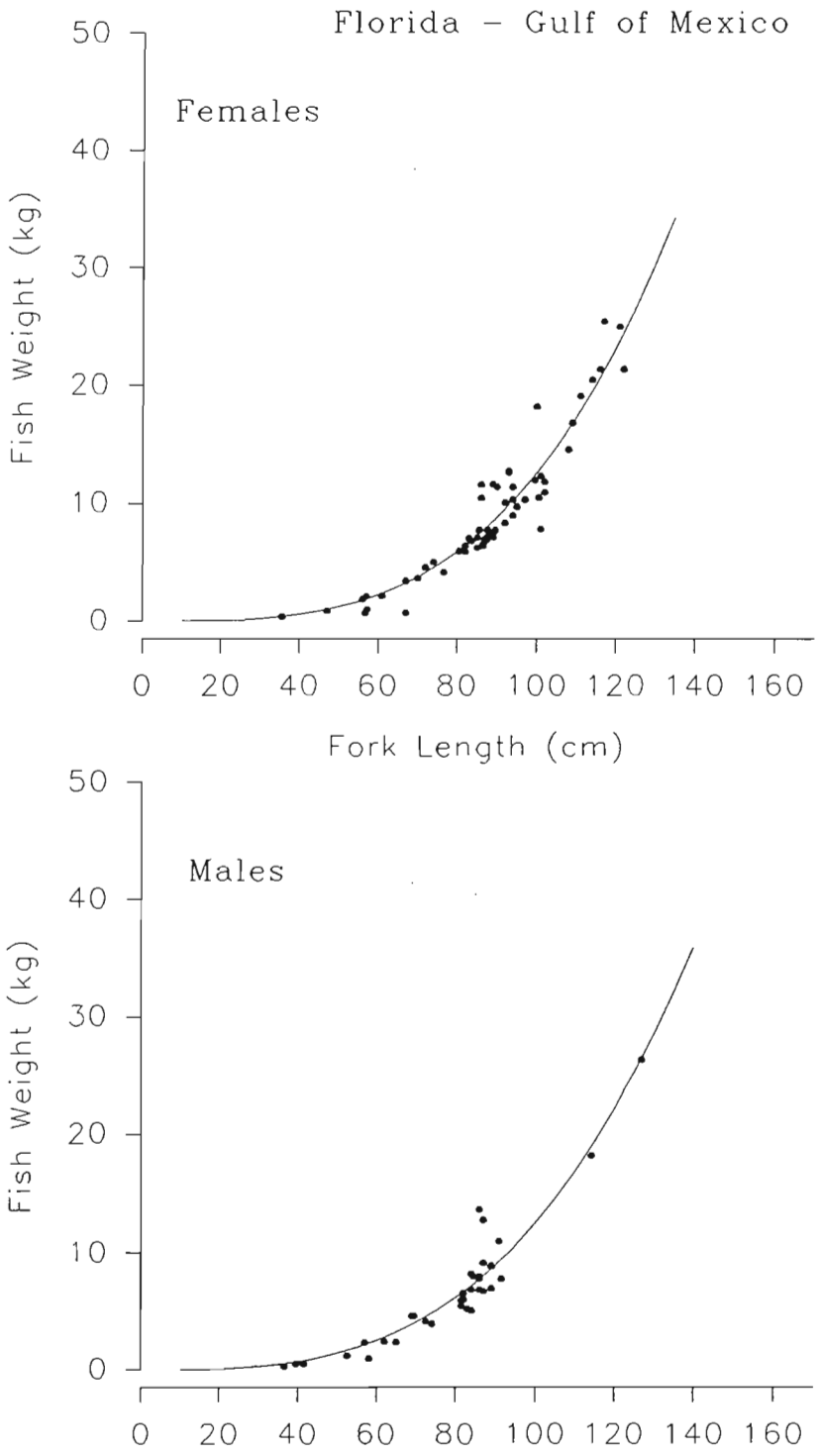



**Figure 19.** Weight and Length for cobia captured off Florida Gulf coast.

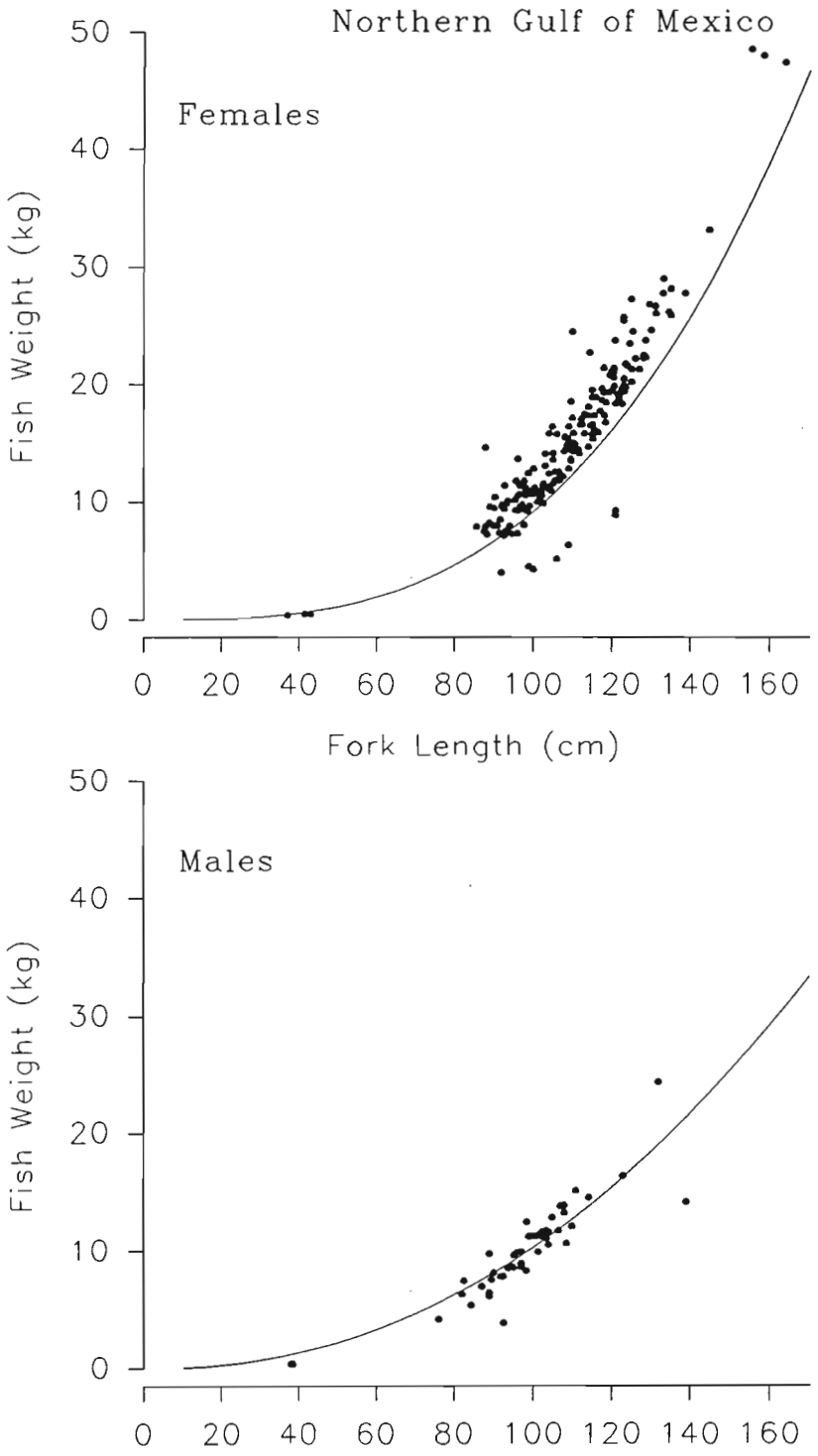



**Figure 20.** Weight and Length for cobia captured in the Northern Gulf of Mexico.

**Table 8.** Length (mmFL)/Weight (kg) data for female cobia sampled off the southeastern United States used in age/growth determination.

| Location | n | Size Range (mmFL) | Mean Size | Weight Range (kg) | Mean Weight |
|---|---|---|---|---|---|
| Carolinas | 45 | 940.5-1380.5 | 1155.7 | 48.4-188.1 | 98.7 |
| FL Atlantic | 55 | 830.0-1290.0 | 1000.8 | 33.0-125.4 | 62.0 |
| FL Keys | 28 | 700.0-1060.0 | 86.0 | 15.4-94.6 | 38.6 |
| FL Gulf | 75 | 350.5-1270.0 | 820.3 | 1.5-123.2 | 44.9 |
| N. Gulf | 216 | 370.0-1630.9 | 1050.4 | 1.7-235.0 | 69.4 |
| Texas | 61 | 310.5-1280.3 | 950.8 | N/A | N/A |

**Table 9.** Length (mmFL)/Weight (kg) data for male cobia sampled off the southeastern United States used in age/growth determination.

| Location | n | Size Range (mmFL) | Mean Size | Weight Range (kg) | Mean Weight |
|---|---|---|---|---|---|
| Carolinas | 28 | 800.5-1130.0 | 950.7 | 28.6-198.0 | 59.9 |
| FL Atlantic | 28 | 830.0-1130.0 | 960.0 | 28.1-101.2 | 55.9 |
| FL Keys | 20 | 700.5-1000.5 | 86.2 | 18.7-39.6 | 14.7 |
| FL Gulf | 41 | 360.5-1220.0 | 760.6 | 1.1-127.6 | 40.4 |
| N. Gulf | 66 | 380.0-1390.0 | 970.3 | 1.6-118.1 | 48.3 |
| Texas | 20 | 310.0-1050.4 | 950.8 | 1.1-1.6 | 1.3 |

**Table 10.** Power curve relation of length/weight of female and male cobia by location.

| Females | a | b | $r^2$ |
|---|---|---|---|
| Carolinas | 0.236 | 2.8633 | .858 |
| Florida Atlantic | 0.021 | 2.8909 | .793 |
| Florida Gulf | 0.00179 | 3.42034 | .900 |
| Northern Gulf | 0.00811 | 3.06541 | .884 |
| Males | | | |
| Carolinas | 0.103 | 2.548 | .513 |
| Florida Atlantic | 0.000970 | 3.545877 | .822 |
| Florida Gulf | 0.00619 | 3.15110 | .899 |
| Northern Gulf | 0.371 | 2.221 | .773 |

Age/length keys for both female and male cobia were constructed. This was accomplished by combining observed age at length for each sex following Ricker, 1975). Cobia (n = 605, 413 females and 192 males) were aged and divided into 50 mm length intervals. Age distribution, represented as percent, was calculated for each size interval. Results from this study agree with those of both Franks in the northern Gulf, and Smith off the Carolinas. Gulf cobia appear to grow faster than those off the Carolinas; however, fish off the Carolinas appear to live longer than their Gulf counterparts. From these data, it appears that older fish are not abundant in the Gulf of Mexico, and that Gulf fishers are fishing younger fish than their counterparts off the Carolinas. Age/length keys (**Appendix B: Tables 1 through 6**) were constructed by location. Separate keys were made for female and male cobia because female cobia grow larger and faster than their male counterparts.

*Marginal Increment Analysis*:
Marginal increment analysis was performed for validation of annuli following Crabtree *et al.*, (1996). Each ring represented an annual event with the minimum occurring in July (**Figure 21**). This figure represents all data. Opaque zones were validated as annuli, i.e. plotting monthly percentage frequencies of otoliths with opaque margins (Barger, 1985; Fable *et al.*, 1987; Beckman *et al.*, 1990). Additional analyses were conducted to determine if annulus formation varied by geographic location or if differences exist between age classes. In **Figure 22 and 23**, each individual fish is shown by location and season. Data from the Carolinas and Texas are incomplete because fish were only collected a few months of the year. **Figure 24a and 24b** shows the standard error for the marginal increment index by sampling location and month. Annulus formation was also analyzed by age. Marginal increments of individual cobia by age was plotted in **Figures 25a and 25b**.

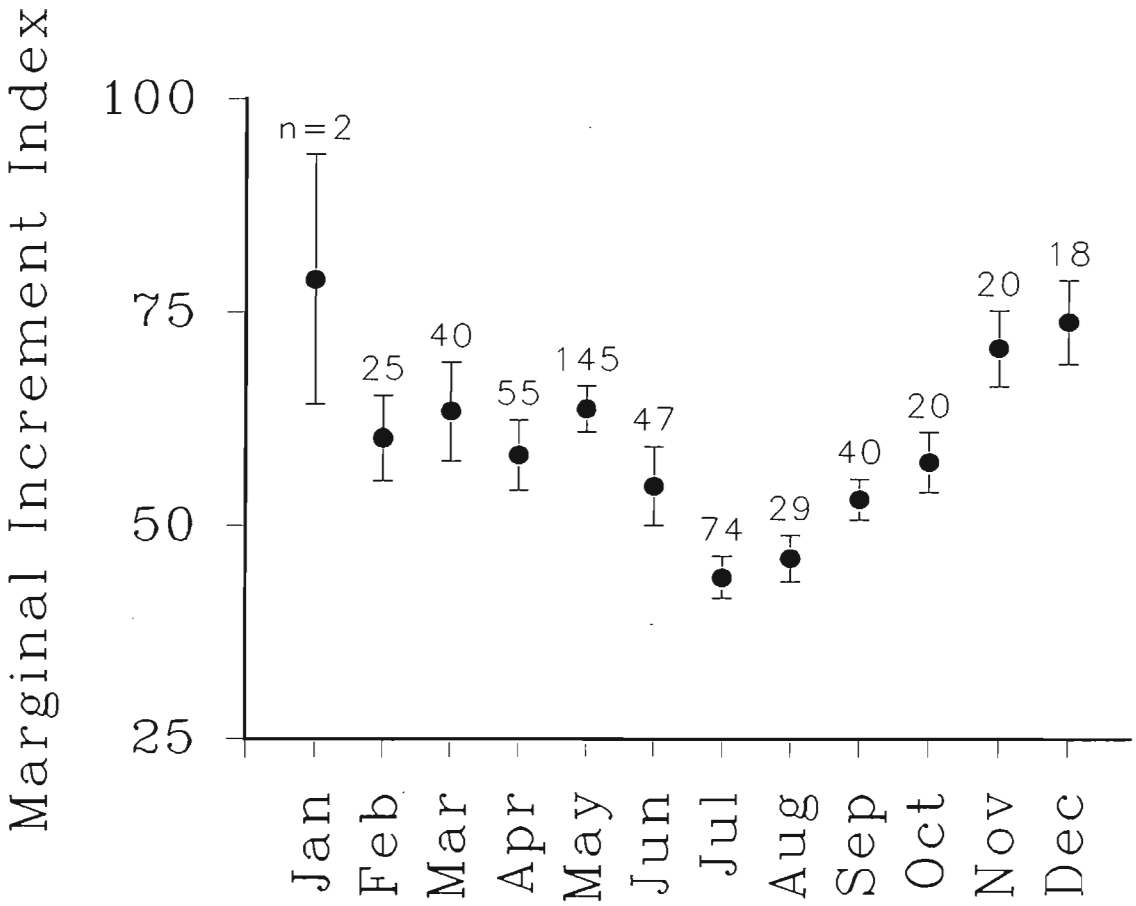



**Figure 21.** Marginal increment index for cobia verifying that otolith rings are annuli.

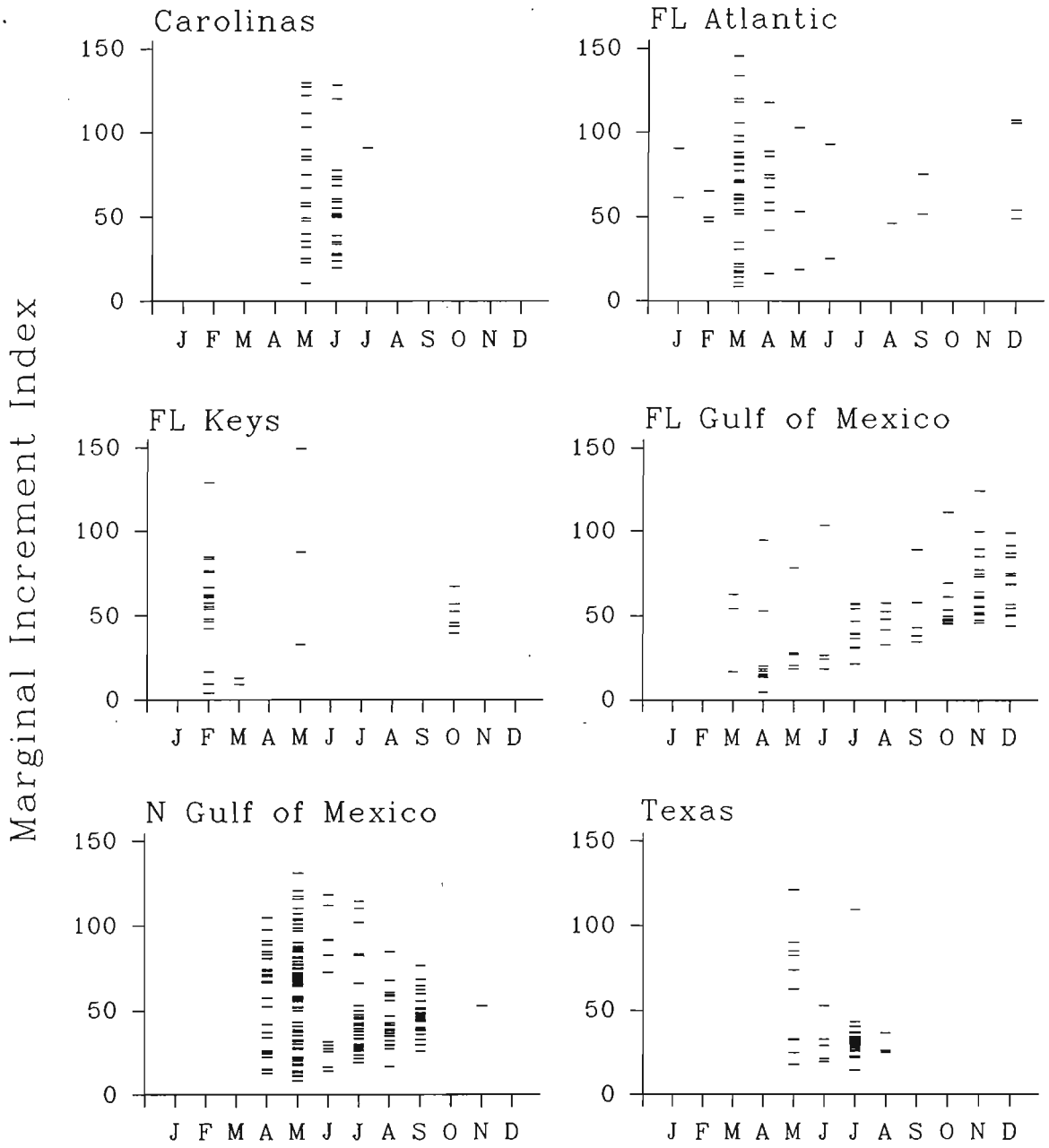



**Figure 22.** Marginal increment of cobia otoliths by capture location.

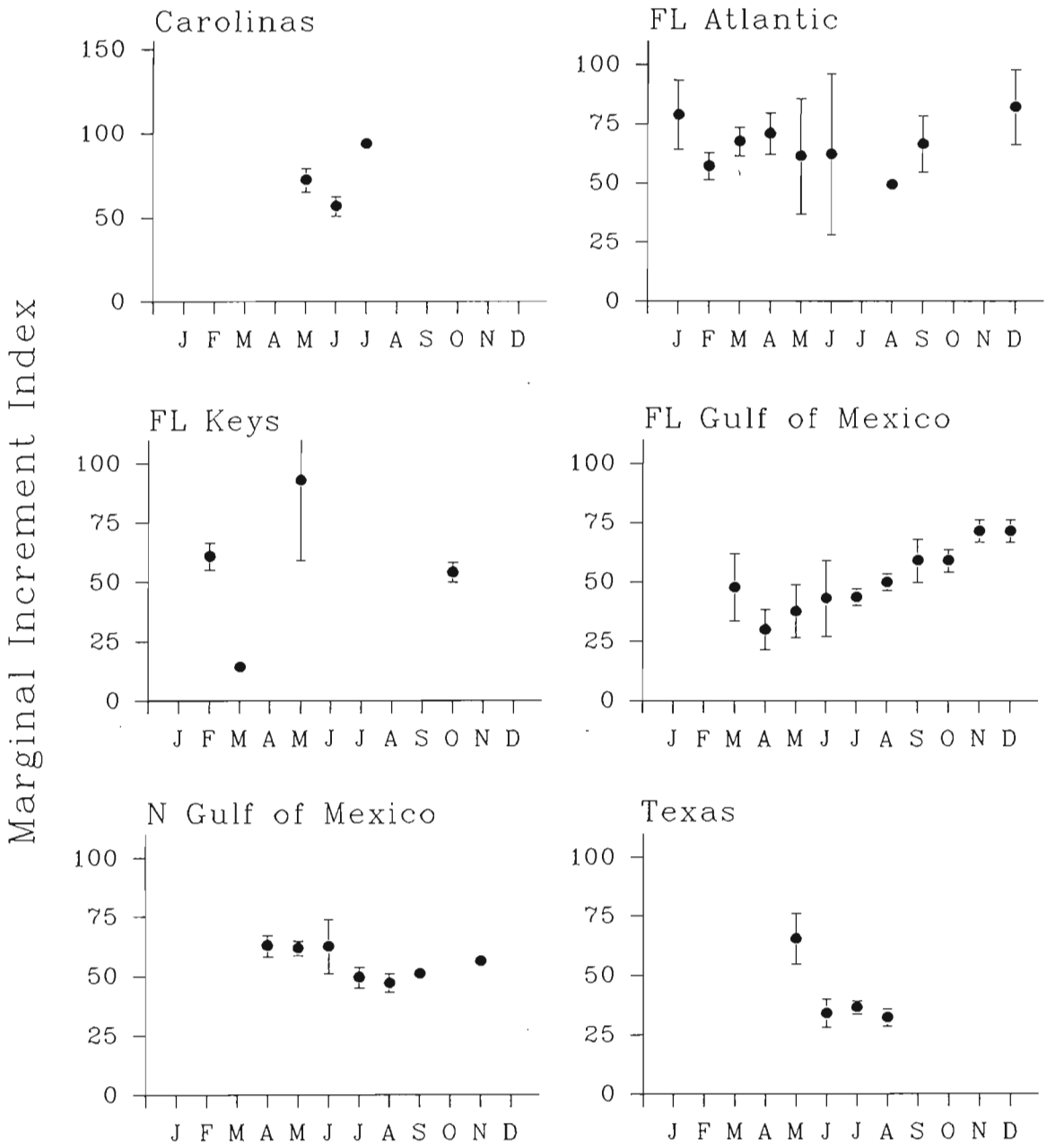



**Figure 23.** Marginal increment mean by month for cobia by capture location.

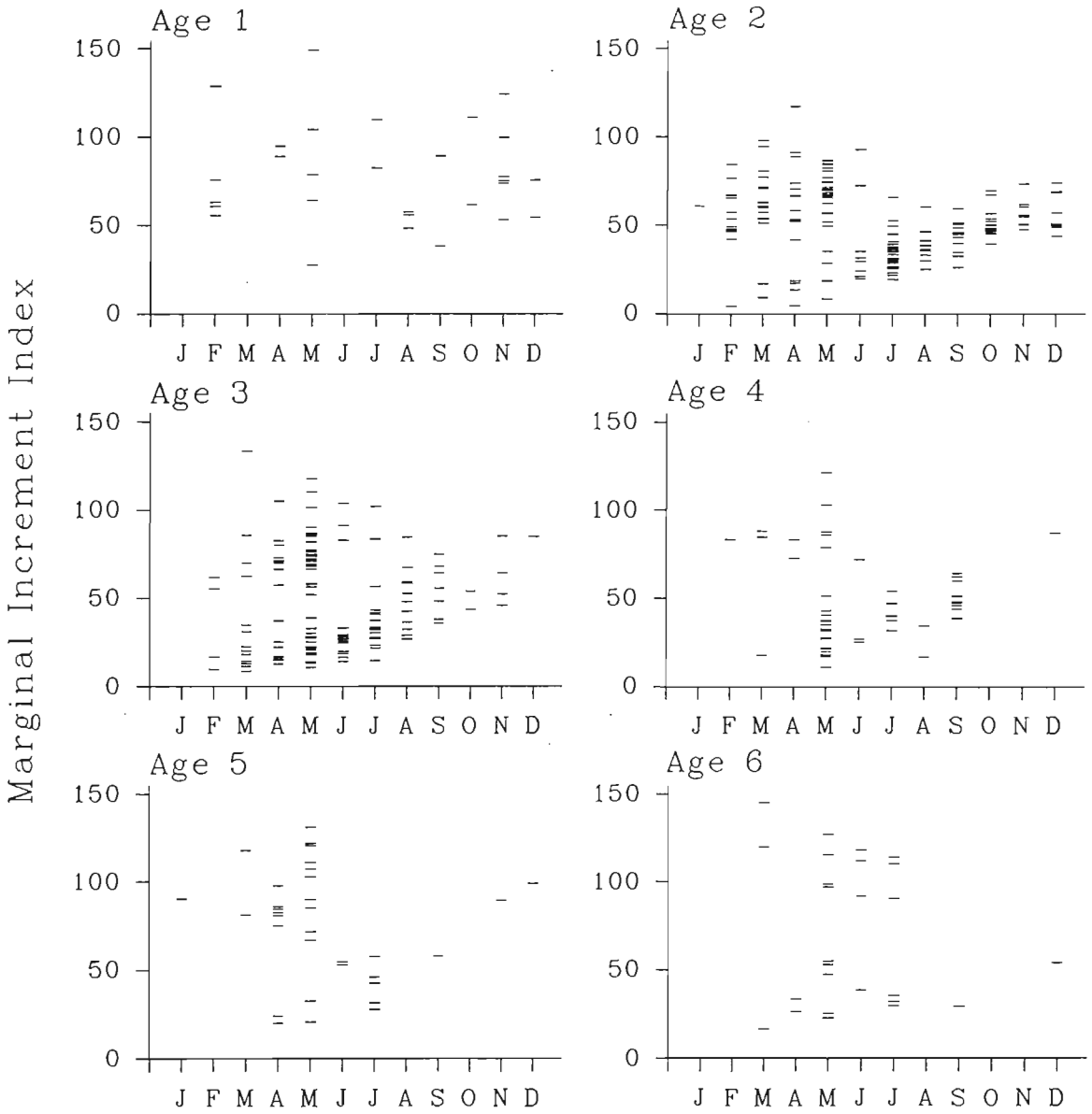



**Figure 24a.** Marginal increment of cobia otoliths by age class.

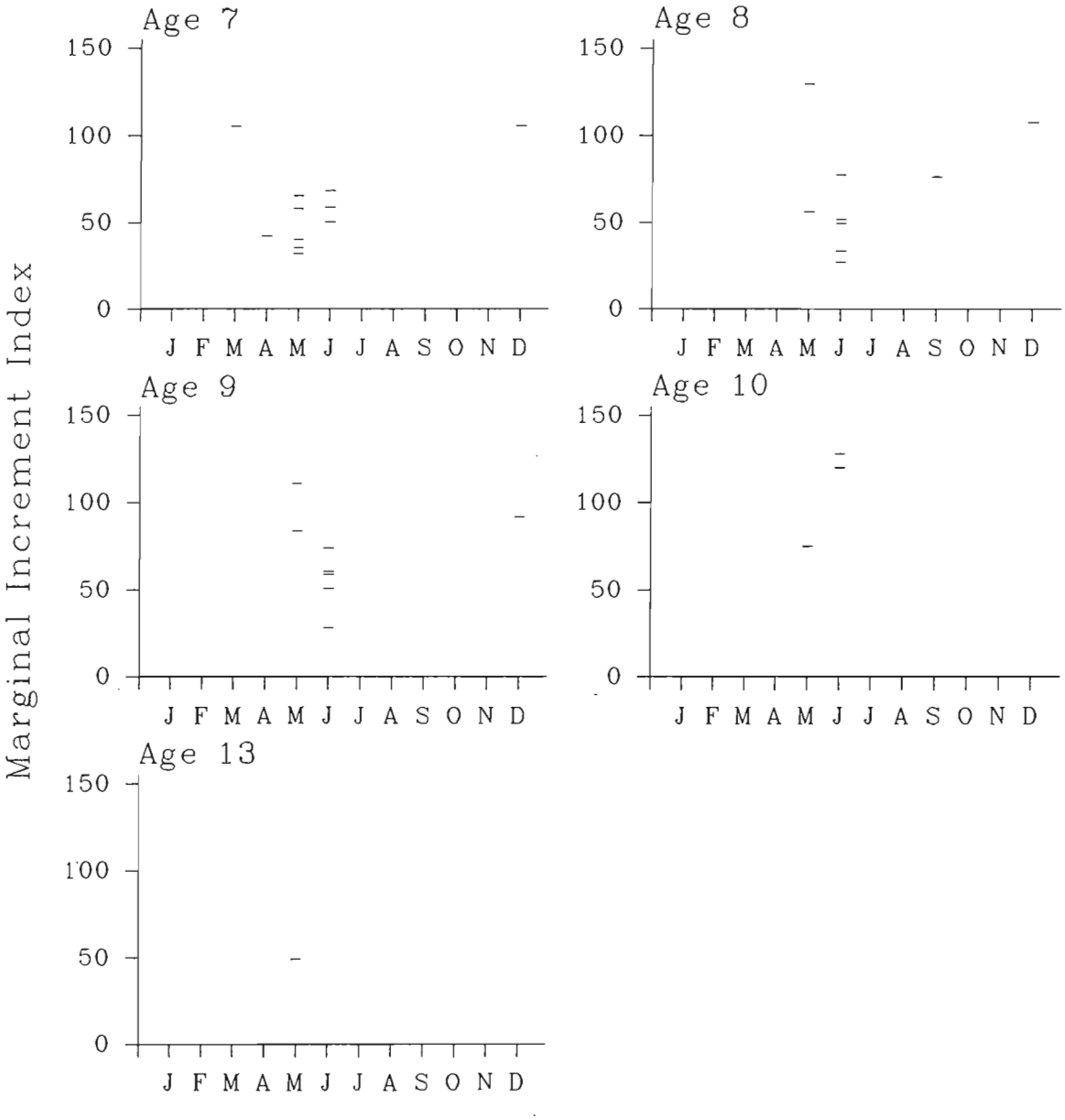



**Figure 24b.** Marginal increment of cobia otoliths by age class.

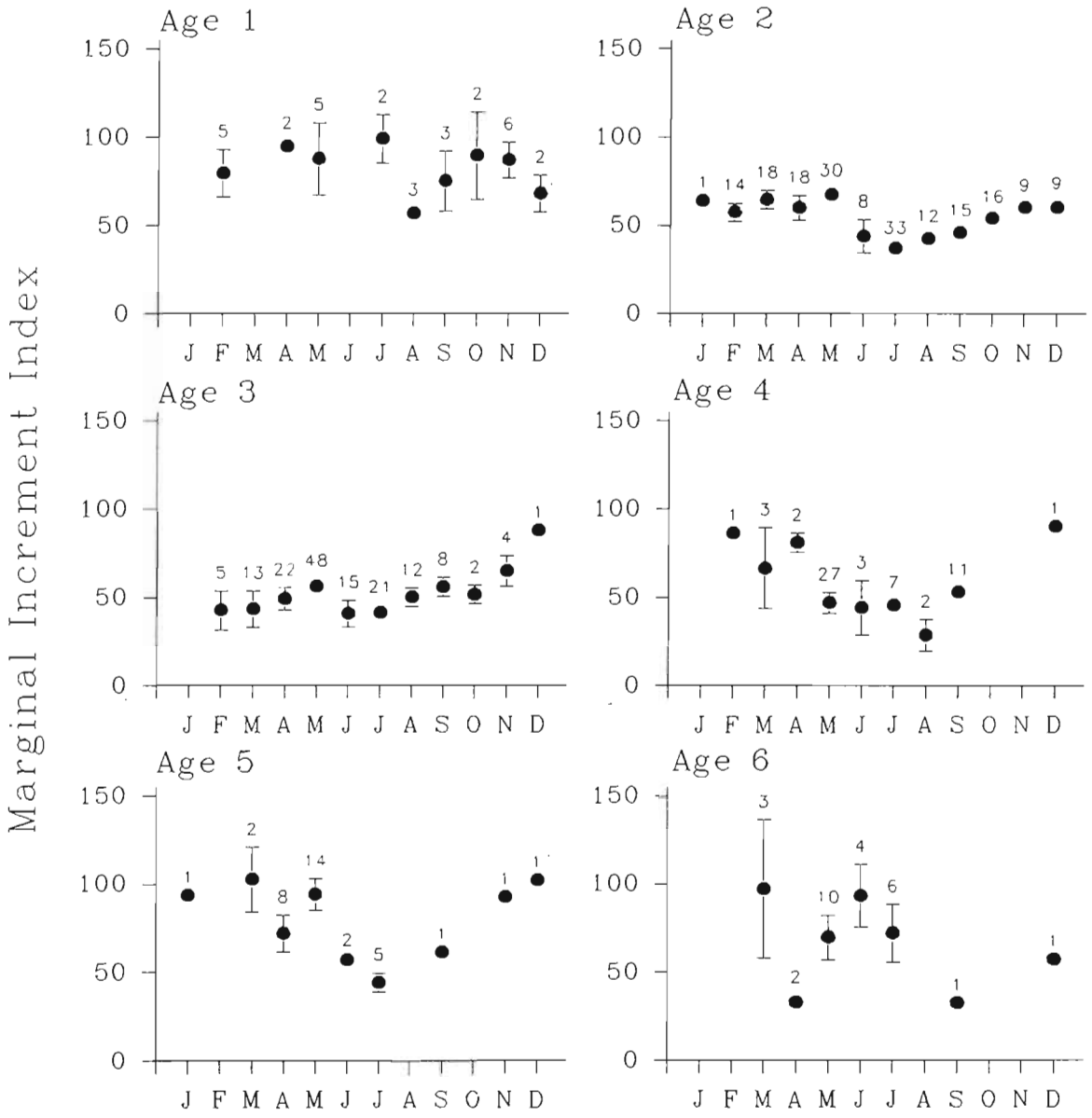



**Figure 25a.** Marginal increment mean for cobia by age class.

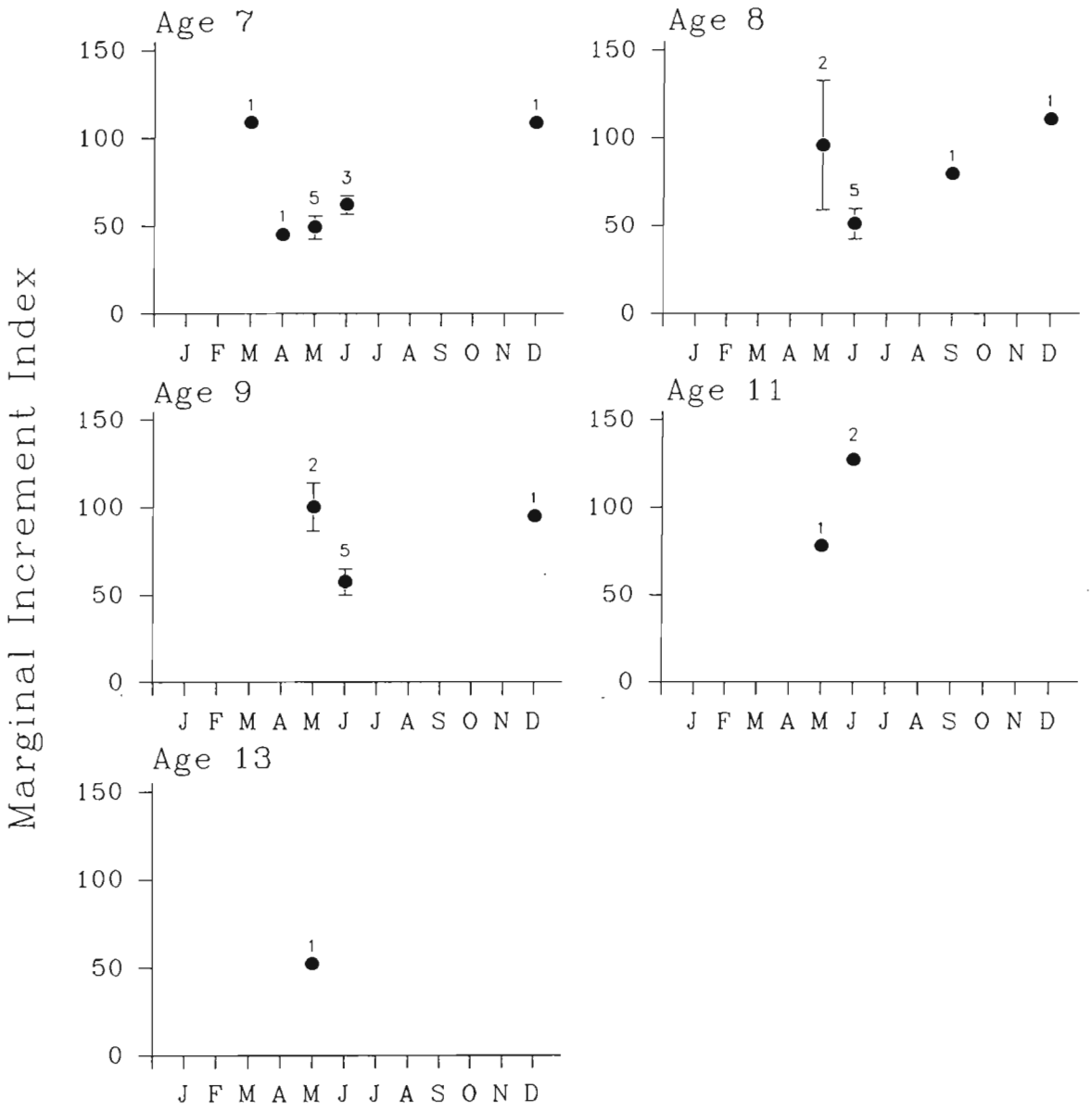



**Figure 25b.** Marginal increment mean for cobia by age class.

**Table 11** shows the parameter estimates for the von Bertalanffy growth model for cobia from each of the sampling locations. **Figures 26 through 31 and Table 12** show the observed and predicted lengths of female and male cobia from all sampling locations. High variation of sizes in the 0-1 year old age groups at some sites was the result of a lack of small fish in the sample.

**Table 11.** Von Bertalanffy parameters for both female and male cobia by location.

| | n | $L_\infty$ | K | $t_o$ |
|---|---|---|---|---|
| N. and S. Carolina | 39 | 162.2 | .085 | -8.596 |
| Florida Atlantic | 46 | 133.3 | .182 | -4.664 |
| Florida Keys | 21 | 117.7 | .230 | -3.846 |
| Florida Gulf | 72 | 147.3 | .245 | -1.551 |
| Northern Gulf | 194 | 130.2 | .461 | -.968 |
| Texas | 41 | 183.9 | .125 | -3.621 |
| N. and S. Carolina | 22 | 104.6 | .536 | -1.085 |
| Florida Atlantic | 24 | 113.8 | .195 | -5.681 |
| Florida Keys | 17 | 165.1 | .075 | -7.674 |
| Florida Gulf | 37 | 122.5 | .294 | -1.347 |
| Northern Gulf | 63 | 113.2 | .550 | -.759 |
| Texas | 29 | 92.9 | 1.430 | -.395 |

The distance from the center of the otolith's core to the distal margin (edge) was measured from the core to the leading edge of each opaque zone, including any distance from the last zone to the section's distal margin. The relationship between otolith radius and fork length (FL) was determined and was used to back-calculate length at earlier ages (Ricker, 1975).

Mean back-calculation (FL) data was used to calculate theoretical growth equations for both sexes. Von Bertalanffy (1938) growth curves were fit by non-linear regression (SAS, 1985) to length-at-age by sex.

All age/length calculations were based on the von Bertalanffy formula:

$$\text{von Bertalanffy:} \quad FL_t = L_\infty \ (1\text{-}e^{-K(t-t_o)})$$

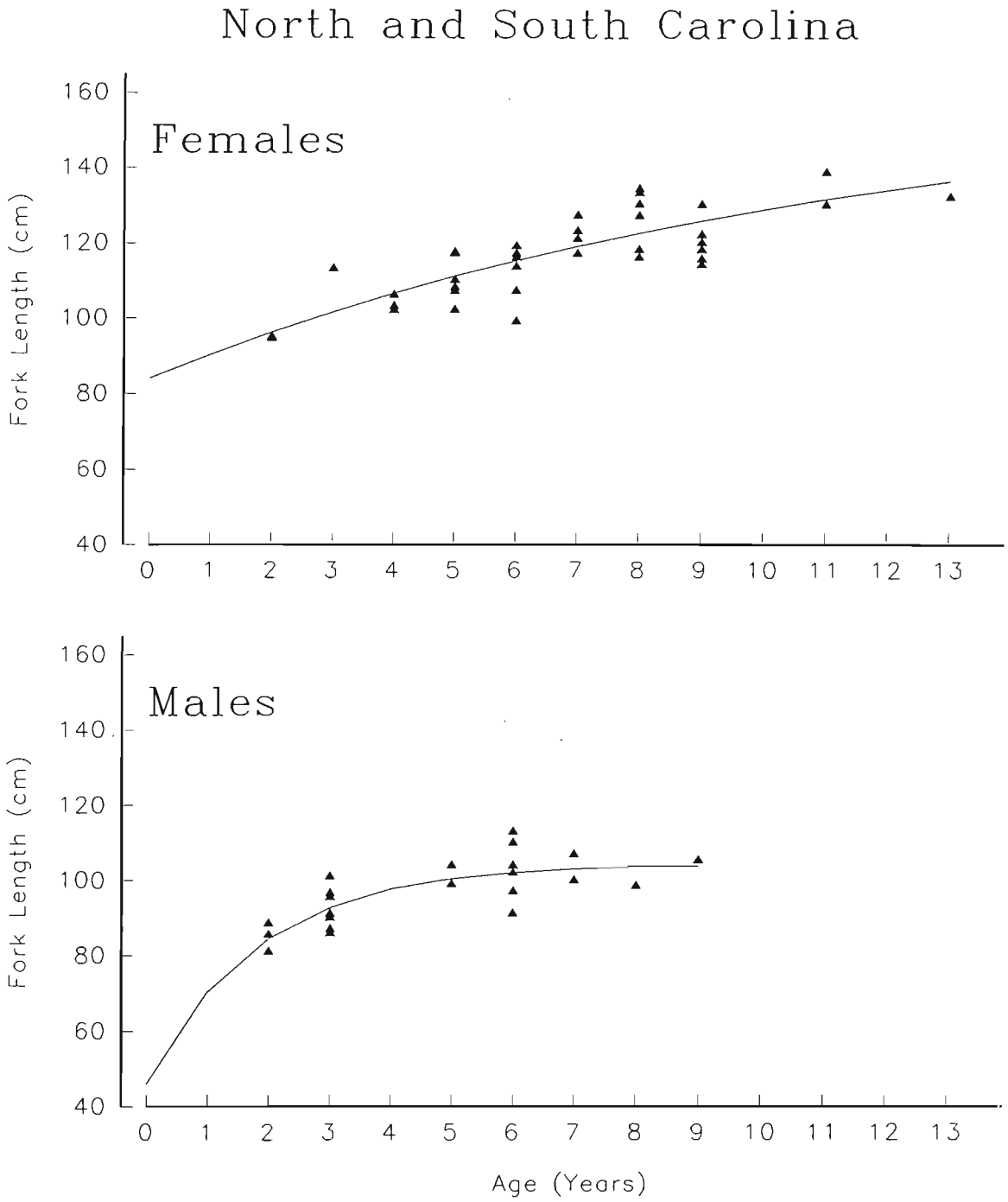



**Figure 26.** Observed (symbols) and predicted lengths (cm) and the von Bertalanffy growth model for female and male cobia from North and South Carolina.

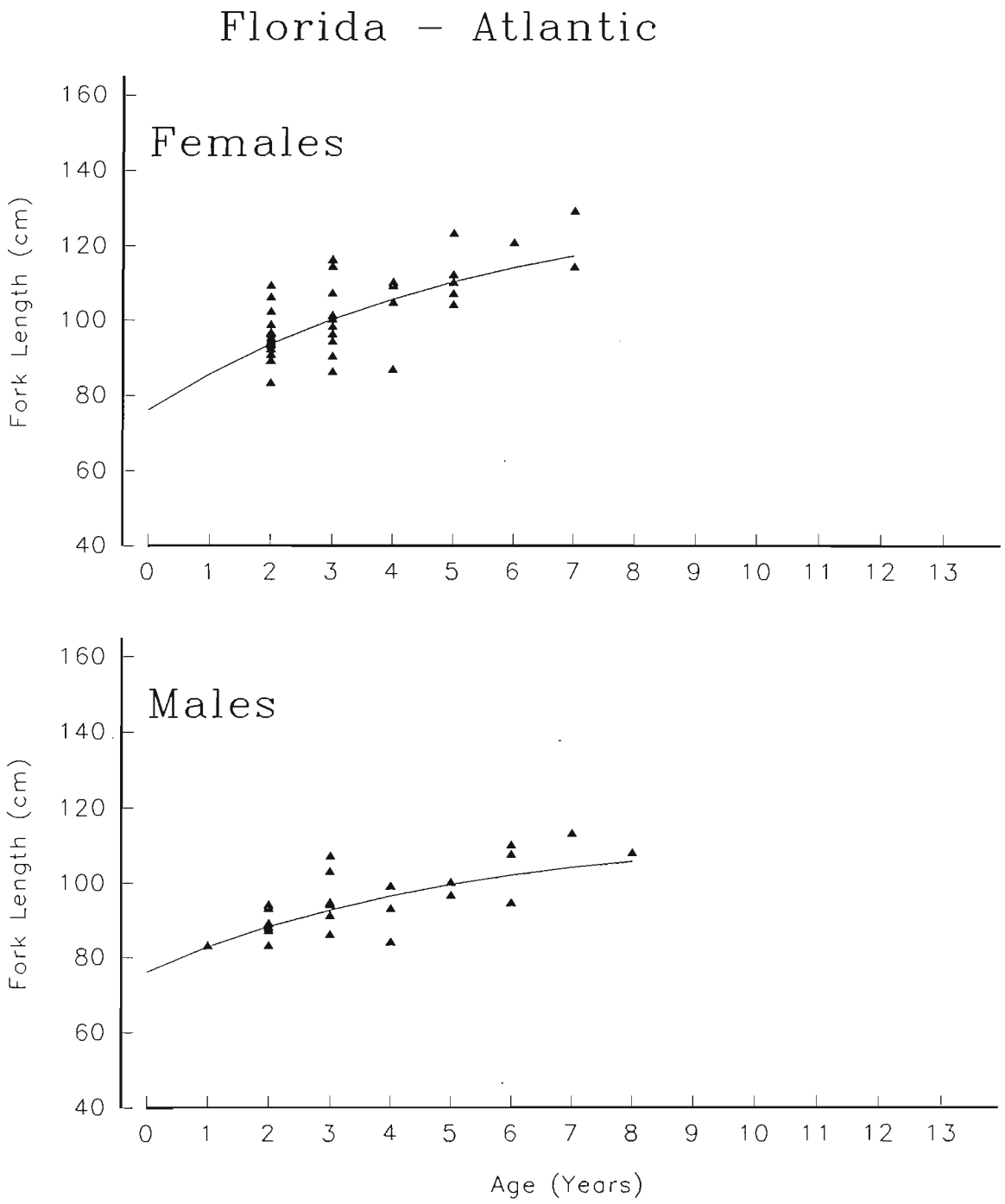



**Figure 27.** Observed (symbols) and predicted lengths (cm) and the von Bertalanffy growth model for female and male cobia from the Florida Atlantic.

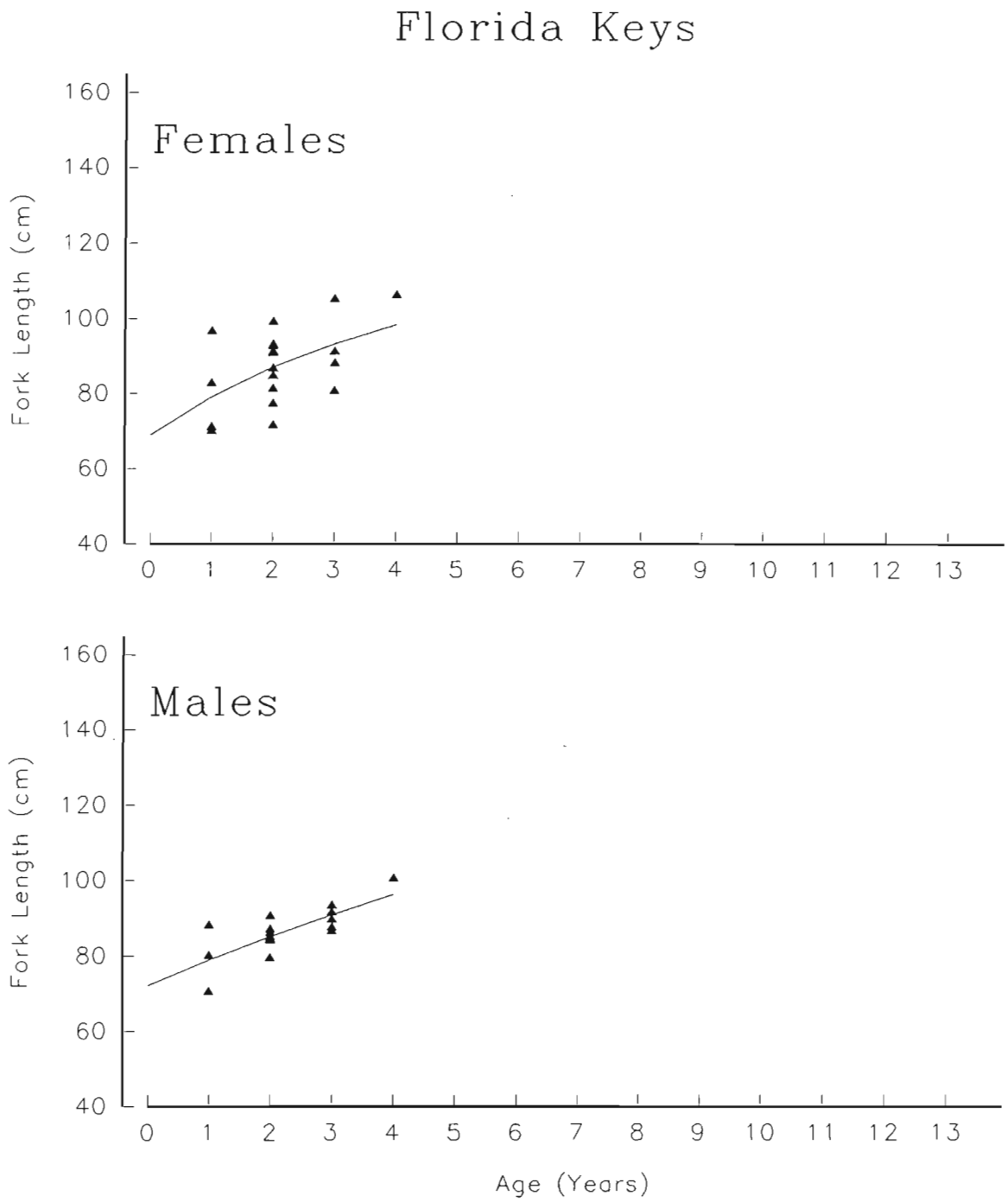



**Figure 28.** Observed (symbols) and predicted lengths (cm) and the von Bertalanffy growth model for female and male cobia from the Florida Keys.

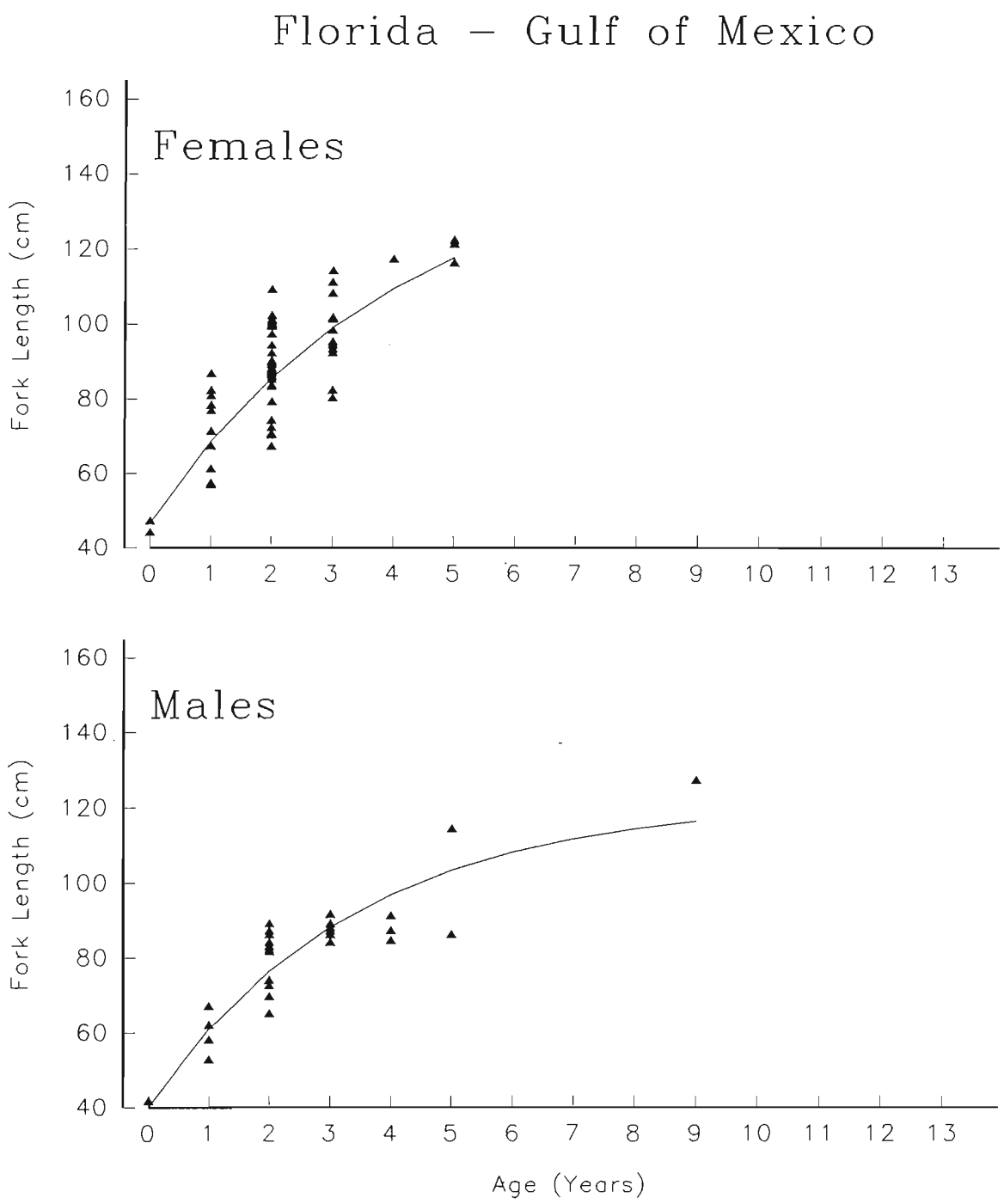



**Figure 29.** Observed (symbols) and predicted lengths (cm) and the von Bertalanffy growth model for female and male cobia from the Florida Gulf of Mexico.

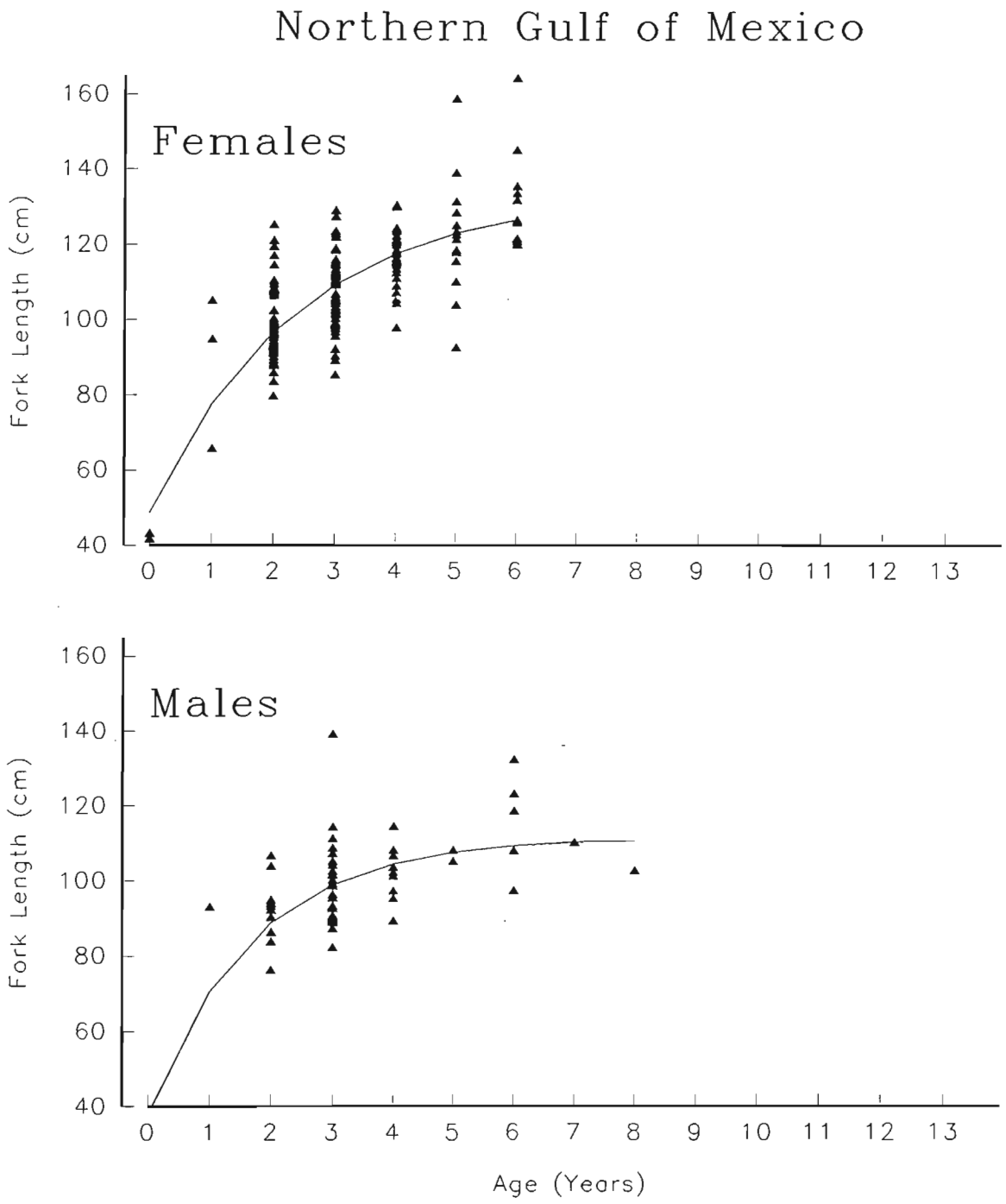



**Figure 30.** Observed (symbols) and predicted lengths (cm) and the von Bertalanffy growth model for female and male cobia from the Northern Gulf of Mexico.

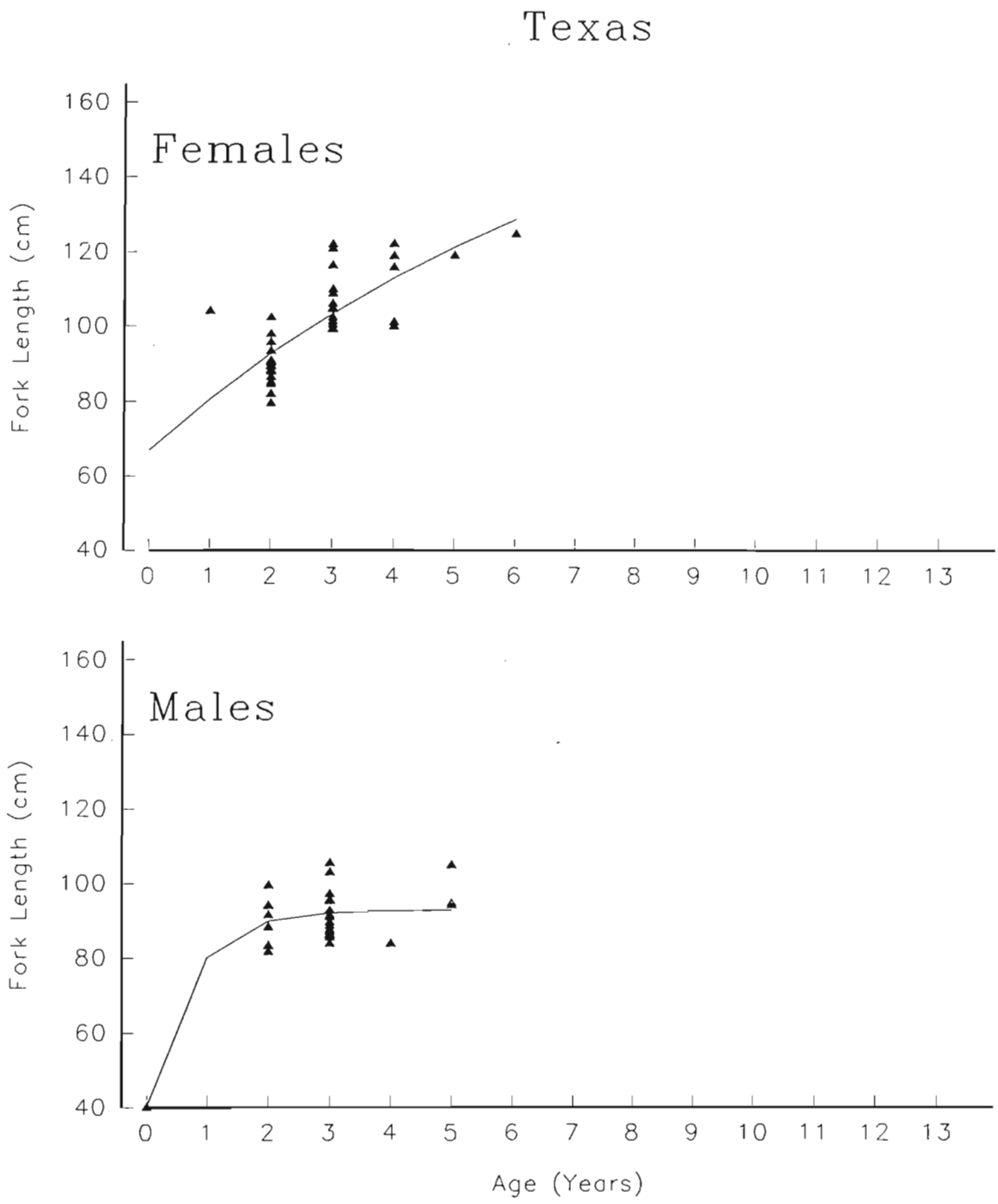



**Figure 31.** Observed (symbols) and predicted lengths (cm) and the von Bertalanffy growth model for female and male cobia from Texas.

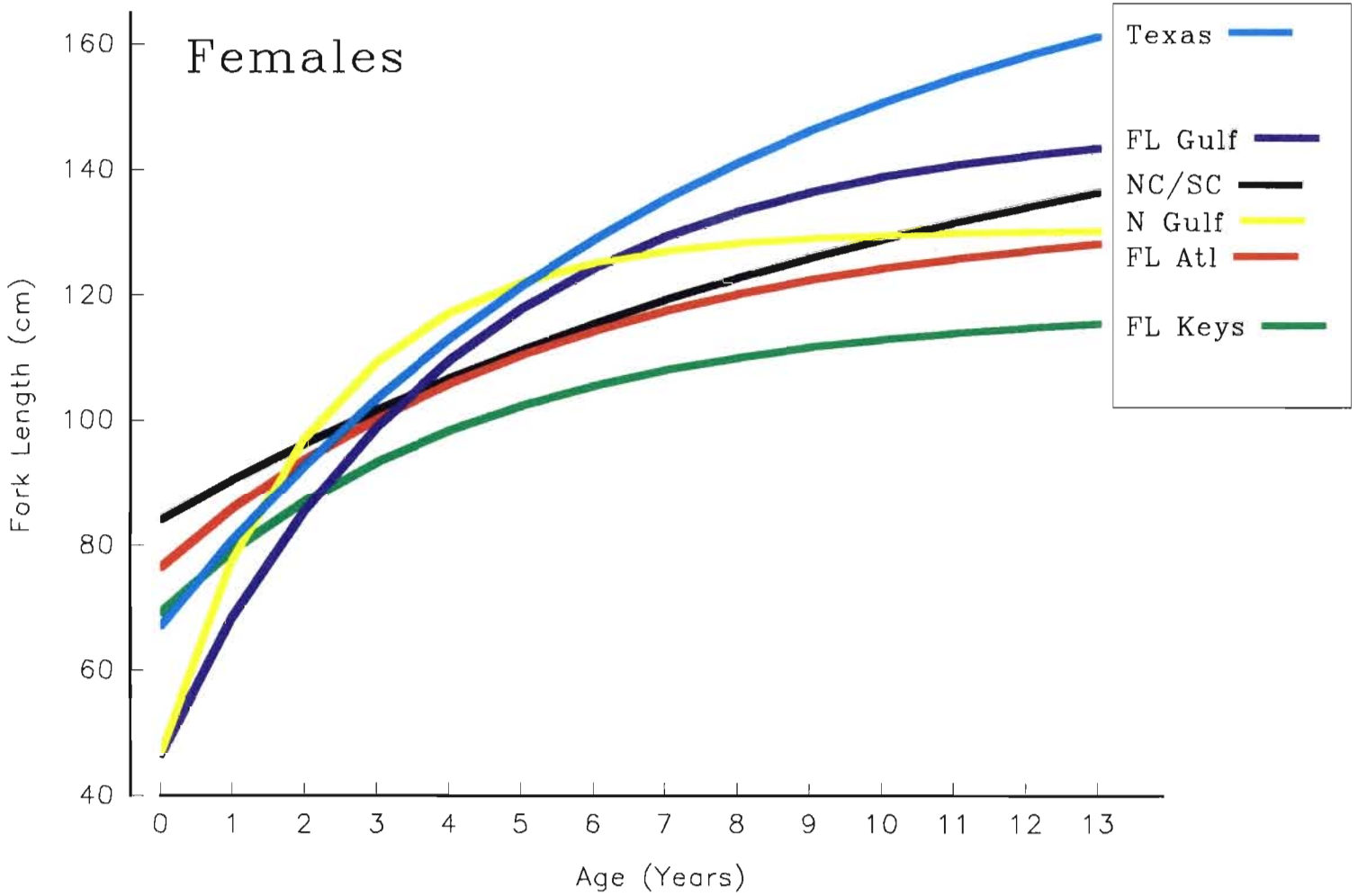



**Figure 32.** Predicted length at age for female cobia at all capture locations calculated from the von Bertalanffy growth equation.

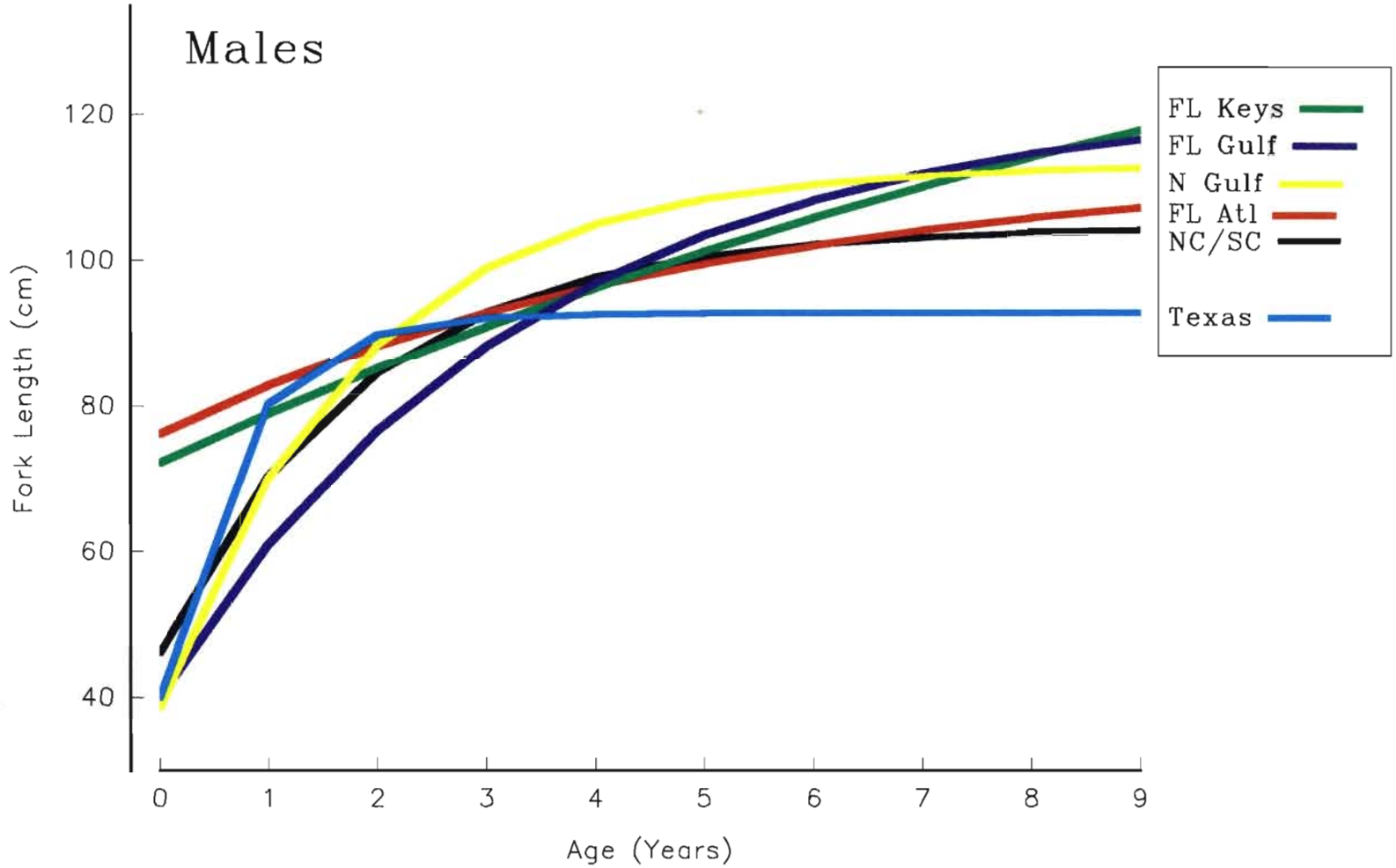



**Figure 33.** Predicted length at age for male cobia at all capture locations calculated from the von Bertalanffy growth equation.

**Table 12.** Observed and predicted length at age by location for female and male cobia.

**FEMALES**

| Age | | Carolinas | | FL-Atl | | FL-Gulf | | FL-Keys | | N-Gulf | | TX | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Obs | Pred | Obs | Pred | Obs | Pred | Obs | Pred | Obs | Pred | Obs | Pred |
| 0 | FL | | 84.1 | | 76.3 | 42.2 | 46.6 | 69.1 | 40.5 | 48.7 | 66.9 | | |
| | n | | | | | 3 | | | | 3 | | | |
| 1 | FL | | 90.4 | | 85.8 | 71.3 | 68.5 | 80.0 | 79.1 | 88.3 | 77.7 | 104.1 | 80.7 |
| | n | | | | | 12 | | 4 | | 3 | | 1 | |
| 2 | FL | 94.8 | 96.3 | 95.3 | 93.7 | 85.3 | 85.6 | 87.5 | 87.0 | 98.1 | 96.7 | 89.2 | 92.8 |
| | n | 2 | | 21 | | 39 | | 12 | | 61 | | 17 | |
| 3 | FL | 113.0 | 101.6 | 99.8 | 100.3 | 97.4 | 99.0 | 91.1 | 93.3 | 107.5 | 109.2 | 106.9 | 103.5 |
| | n | 1 | | 11 | | 14 | | 4 | | 67 | | 15 | |
| 4 | FL | 103.7 | 106.6 | 102.9 | 105.8 | 117.0 | 109.5 | 106.0 | 98.3 | 116.6 | 117.5 | 113.2 | 113.0 |
| | n | 3 | | 5 | | 1 | | 1 | | 32 | | 6 | |
| 5 | FL | 110.3 | 111.1 | 111.3 | 110.3 | 119.7 | 117.7 | | | 122.1 | 122.9 | 118.8 | 121.3 |
| | n | 6 | | 6 | | 3 | | | | 16 | | 1 | |
| 6 | FL | 111.9 | 115.3 | 120.5 | 114.2 | | | | | 131.3 | 126.4 | 124.5 | 128.6 |
| | n | 6 | | 1 | | | | | | 12 | | 1 | |
| 7 | FL | 123.0 | 119.1 | 121.5 | 117.4 | | | | | | | | |
| | n | 5 | | 2 | | | | | | | | | |
| 8 | FL | 126.3 | 122.6 | | | | | | | | | | |
| | n | 6 | | | | | | | | | | | |
| 9 | FL | 119.9 | 125.8 | | | | | | | | | | |
| | n | 6 | | | | | | | | | | | |
| 10 | FL | | 128.8 | | | | | | | | | | |
| | n | | | | | | | | | | | | |
| 11 | FL | 135.7 | 131.5 | | | | | | | | | | |
| | n | 3 | | | | | | | | | | | |
| 12 | FL | | 134.0 | | | | | | | | | | |
| | n | | | | | | | | | | | | |
| 13 | FL | 132.0 | 136.3 | | | | | | | | | | |
| | n | 1 | | | | | | | | | | | |

**Table 12, Continued** Observed and predicted length at age by location for female and male cobia.

**MALES**

| Age | | Carolinas | | FL-Atl | | FL-Gulf | | FL-Keys | | N-Gulf | | TX | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Obs | Pred | Obs | Pred | Obs | Pred | Obs | Pred | Obs | Pred | Obs | Pred |
| 0 | FL | | 46.1 | | 76.2 | 40.5 | 40.0 | | 72.3 | 38.0 | 37.6 | 40.0 | 40.1 |
| | n | | | | | 2 | | | | 1 | | 1 | |
| 1 | FL | | 70.4 | 83.0 | 82.9 | 55.2 | 61.0 | 79.5 | 79.0 | 65.6 | 70.5 | | 80.3 |
| | n | | | 1 | | 5 | | 3 | | 2 | | | |
| 2 | FL | 85.0 | 84.6 | 89.0 | 88.4 | 80.1 | 76.7 | 85.1 | 85.2 | 91.9 | 88.8 | 90.4 | 89.9 |
| | n | 3 | | 6 | | 17 | | 8 | | 10 | | 8 | |
| 3 | FL | 92.4 | 92.9 | 95.9 | 92.9 | 87.4 | 88.3 | 89.7 | 91.0 | 98.4 | 98.9 | 91.6 | 92.2 |
| | n | 7 | | 6 | | 7 | | 5 | | 31 | | 16 | |
| 4 | FL | | 97.7 | 92.0 | 96.6 | 87.5 | 97.0 | 100.5 | 96.3 | 102.0 | 104.5 | 83.8 | 92.8 |
| | n | | | 3 | | 3 | | 1 | | 10 | | 1 | |
| 5 | FL | 101.5 | 100.6 | 98.3 | 99.6 | 100.2 | 103.5 | | | 106.5 | 107.7 | 97.8 | 92.9 |
| | n | 2 | | 2 | | 2 | | | | 2 | | 3 | |
| 6 | FL | 102.8 | 102.2 | 101.6 | 102.2 | | 108.3 | | | 115.6 | 109.4 | | |
| | n | 6 | | 4 | | | | | | 5 | | | |
| 7 | FL | 103.5 | 103.2 | 113.0 | 104.2 | | 111.9 | | | 110.0 | 110.4 | | |
| | n | 2 | | 1 | | | | | | 1 | | | |
| 8 | FL | 98.5 | 103.8 | 108.0 | 105.9 | | 114.6 | | | 102.5 | 110.9 | | |
| | n | 1 | | 1 | | | | | | 1 | | | |
| 9 | FL | 105.5 | 104.1 | | | 127.0 | 116.6 | | | | | | |
| | n | 1 | | | | 1 | | | | | | | |

## Age and Growth Discussion

Female and male cobia grow at different rates. The female cobia grow larger and faster than their male counterparts. There were also differences between Gulf cobia and fish off the Carolinas. In this study , the oldest female cobia captured in the Gulf of Mexico was 6+ years old (**Figure 34**, however, older females have been collected in the northern Gulf by Franks of GCRL (personal communication). Out of 600 fish aged by Franks, he collected three 9 year old females, one 10 year old, and one 11 year old.

Things were different off the Carolinas where out of 73 (45 females) cobia collected, 12 (11 off North Carolina, 1 off South Carolina) were older females 9-13+ years old (**Figure 35**. Work conducted by Smith (1995) of NMFS, Beaufort, found female cobia up to 13 years of age.

In the Gulf of Mexico and off the Carolinas, the oldest male cobia collected in this study, were 9 years old. The oldest males collected by Franks in the northern Gulf were also 9 years old (personal communication) Smith (1995), however, collected a few males at 10, 11, 13 and 14 years of age.

Although, some of the Carolina fish caught in this study, were older than those caught in the Gulf, Gulf fish were larger at age. For example, the 6+ Gulf female (**Figure 34** )131.2 cm FL and weighed 57.4 lbs. While the 13+ Carolina female (**Figure 35**) measured 132 cm FL and weighed 60 lbs.

Results from this study agree with those of both Franks in the northern Gulf, and Smith off the Carolinas. Gulf cobia appear to grow faster than those off the Carolinas; however, fish off the Carolinas appear to live longer than their Gulf counterparts. From these data, it appears that older fish are not abundant in the Gulf of Mexico, and that Gulf fishers are fishing younger fish than their counter parts off the Carolinas.

These results are interesting in light of the fact that tagging studies (Jim Franks, Gulf Coast Research Lab, Don Hammond, South Carolina Fish & Wildlife, personal communication; MML Coastal Pelagic Tagging Program) have shown that there is mixing of cobia from the Gulf of Mexico to and from the South Atlantic and within the Gulf itself. Additional studies to determine the genetic make-up and amount of mixing of cobia in the Gulf and South Atlantic are necessary to resolve these issues for cobia stock assessment.

Figure 34. Otolith from the oldest female cobia (6+ years, 131.2 cm FL, 57.4 lbs.) caught in the Gulf of Mexico, during this study.

Figure 35. Otolith from the oldest female cobia (13+ years, 132 cm FL, 60 lbs.) caught off the Carolinas during this study.

# VI. REPRODUCTIVE BIOLOGY

## Study Area

Cobia were sampled from the southeastern Atlantic Ocean through the northwestern Gulf of Mexico. The sampling sites were divided into five general areas to compare the reproductive biology of cobia throughout the region. These areas were defined as the southeastern Atlantic Ocean (extending down the east coast from Morehead City, North Carolina through Cape Canaveral, Florida), the Florida Keys (Sunshine Key and Big Pine Keys), the northeastern Gulf of Mexico (extending up the west coast of Florida from Ft. Myers to Crystal River), the north central Gulf of Mexico (extending along the Gulf from Destin, Florida, to the Chandelier Islands, Louisiana) and the northwestern Gulf of Mexico (Port Aransas, Texas area).

## Materials and Methods

*Sampling Protocol*:
Cobia were sampled opportunistically from the recreational fishery between December 1995 and December 1997. Sampling teams were present at major cobia fishing tournaments throughout the study area; the majority of the samples taken came from fishing tournaments in the southeastern Atlantic and the north-central Gulf of Mexico. All Texas fish were obtained from a charter boat captain during regular fishing trips. The majority of the cobia sampled from the northeastern Gulf of Mexico and the Florida Keys were captured by non-tournament recreational fishers. Anglers were interviewed to determine the location of capture of each fish. Total length (cm) and total weight (g) were recorded for all cobia sampled. The gonads were excised, weighed to the nearest g and the total volume of water displaced by each gonad was recorded. Sections were removed from the left and right gonads and preserved in 10% neutral buffered formalin for histological inspection. Additionally, a portion of the ovary was removed, weighed and preserved in Gilson's fixative for fecundity analysis.

*Histological Protocol*:
Tissues were placed into individually labeled cassettes and rinsed with running tap water overnight prior to dehydration and embedding in paraffin following standard histological techniques. The paraffin blocks were sectioned at 4 $\mu$m using a rotary microtome. Duplicate slides were prepared for each tissue, resulting in a total of four slides for each cobia specimen (two from the left gonad and two from the right gonad). The slides were stained using Gills I hematoxylin and eosin phloxine (Polyscientific Corporation) following standard histological procedures.

Three separate views of one slide from each side of the gonad of each fish were analyzed to determine maturity stages. Ovarian maturity stages were based on those previously described by Lotz *et al.* (1996) for cobia. The entire ovarian section was examined for the presence of post ovulatory follicles (POF) and oocytes undergoing final oocyte maturation (FOM). POF stages were classified following Hunter *et al.* (1986) and FOM stages were classified following Brown-Peterson *et al.* (1988).

Following inspection of the entire ovarian section, three areas were haphazardly selected from each slide for quantification of oocytes. Oocytes in all stages of development (including atretic oocytes) and POF's were counted at 100x and the percentage of each oocyte stage in the field of view was estimated. Oocyte atresia stages were classified following Hunter and Macewicz (1985a).

The entire testicular section of each cobia was examined to determine the maturity classification for male fish. Three haphazardly selected portions of each section were examined at 100x and 400x to classify all stages of spermatogenesis present. Maturity stages were defined as maturing (all stages of spermatogenesis present, little to no spermatozoa in the lumen of the lobule), mature (all stages of spermatogenesis present, lobules partially full of spermatozoa, no spermatozoa in the sperm duct), ripe (various stages of spermatogenesis present, lobules full or partially full of spermatozoa, spermatozoa evident in the sperm duct) and spent (early spermatogenesis [primary and secondary spermatogonia only], residual spermatozoa in the lobules, no spermatozoa in the sperm duct). Ripe fish were further subdivided into three categories; (1)spermatogenic cysts occurring throughout the testis, (2) spermatogenic cysts occurring only in the peripheral portions of the testis and (3) no spermatogenic cysts in the testis.

*Oocyte Counts and Gonad Development*:
Estimates of batch spawn size were made from oocyte counts of formalin-fixed and Gilson's fixed ovaries. One piece of each ovary (approximately 5g) was removed from each female, weighed to the nearest 0.1g, and placed into separate jars of Gilson's fluid. After 3-4 months the ovarian tissue had been broken down freeing most of the oocytes. Similar sized pieces were fixed in 10% formalin. Oocytes from formalin fixed samples were freed by teasing them away from the ovarian tissue by hand.

Subsequently oocytes were treated the same. All of the oocytes from a sample were then placed in a known volume of water and the number of oocytes greater than 500$\mu$m in the sample was estimated by counts in known volumetric subsamples.

Females were classified into one of four groups based on the size of oocytes in their ovaries. Group 1 ovaries contained no oocytes greater than 400$\mu$m in diameter, group 2 ovaries had some eggs greater than 400 $\mu$m but none were less than 700$\mu$m, group 3 ovaries contained oocytes some of which were greater than 700 $\mu$m but none were greater than 900 $\mu$m, and group 4 ovaries contained some oocytes that were greater than 900$\mu$m in diameter.

Gonosomatic indices (GSI) were determined for both females and males as the total gonad weight to the total somatic weight (Total fish weight minus gonad weight).

## Results

*Spawning Season*:
A total of 164 male cobia and 393 female cobia throughout the region were assessed histologically during the course of this study. **Table 13** shows the number of individuals examined from each area as well as the range of months during which fish were sampled. Most samples were obtained during the reproductive season.

GSI's were calculated for 237 females and 88 males. The seasonal changes in GSI are shown in **Figures 36 and 37**. No differences were noted in GSI seasonality among sites for either males or females. No fish weights were available for cobia collected from the NW Gulf, however, the mean oocyte size groups for the five locations show little evidence for seasonal differences in spawning activity by this measure (**Figure 38**). GSI data combined across locations suggest that peak spawning of cobia occurs during May, June and July (**Figure 39**).

**Table 13.** Numbers of cobia examined histologically from each sampling area.

| Area | N Males | Months Captured | N Females | Months Captured |
|---|---|---|---|---|
| North-central Gulf of Mexico | 48 | April-October | 188 | April-September |
| Northeastern Gulf of Mexico | 43 | February-December | 60 | March-December |
| Florida Keys | 17 | Feb., May, Dec. | 24 | February-June, December |
| Southeastern Atlantic Ocean | 33 | February-May | 62 | February-June, December |
| Northwestern Gulf of Mexico | 23 | May-August | 59 | May-August |
| TOTALS | 164 | | 393 | |

Monthly male maturity stages for all areas are shown in **Tables 14-18**. **Figure 40** illustrates the three ripe categories for male cobia. Although all the fish in **Figure 40** are ripe, **Figure 40c** (no spermatogenic activity) represents a more advanced stage of testicular maturity than **Figure 40a** (spermatogenic activity throughout the testis).

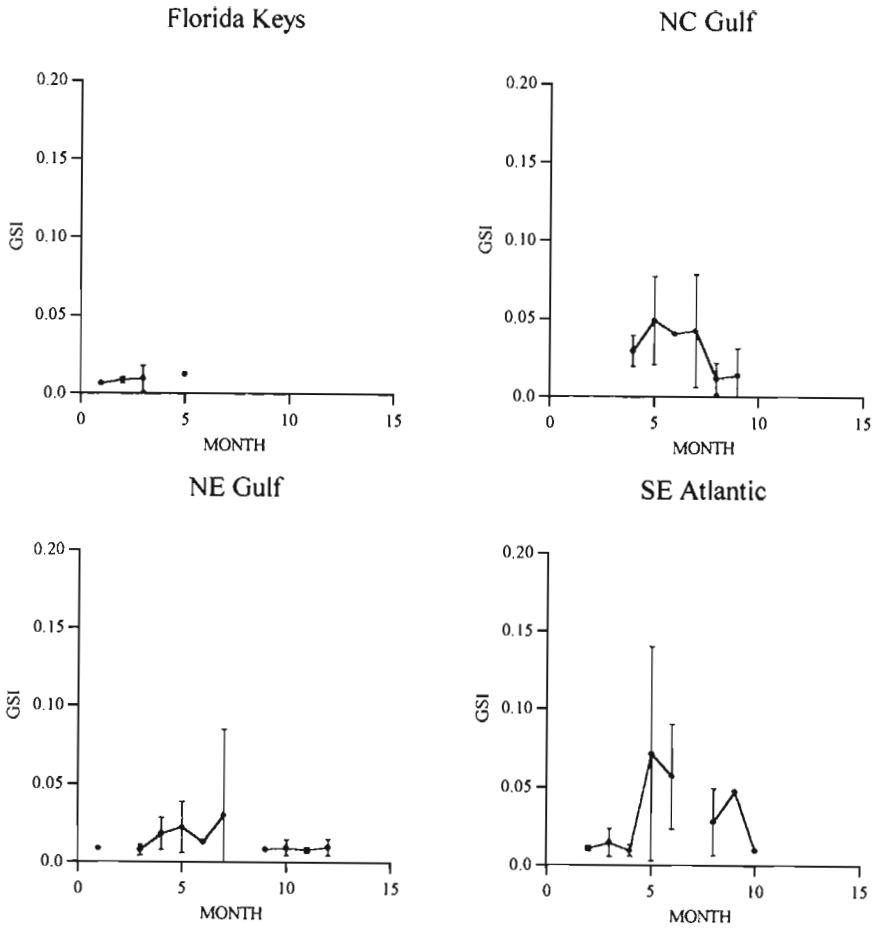



**Figure 36.** Seasonal gonosomatic index for female cobia by locality. Except for the Florida Keys where no females were examined during the primary cobia spawning season, there appear to be no differences in GSI seasonality among the locations. Points represent means and error bars are 95% confidence intervals.

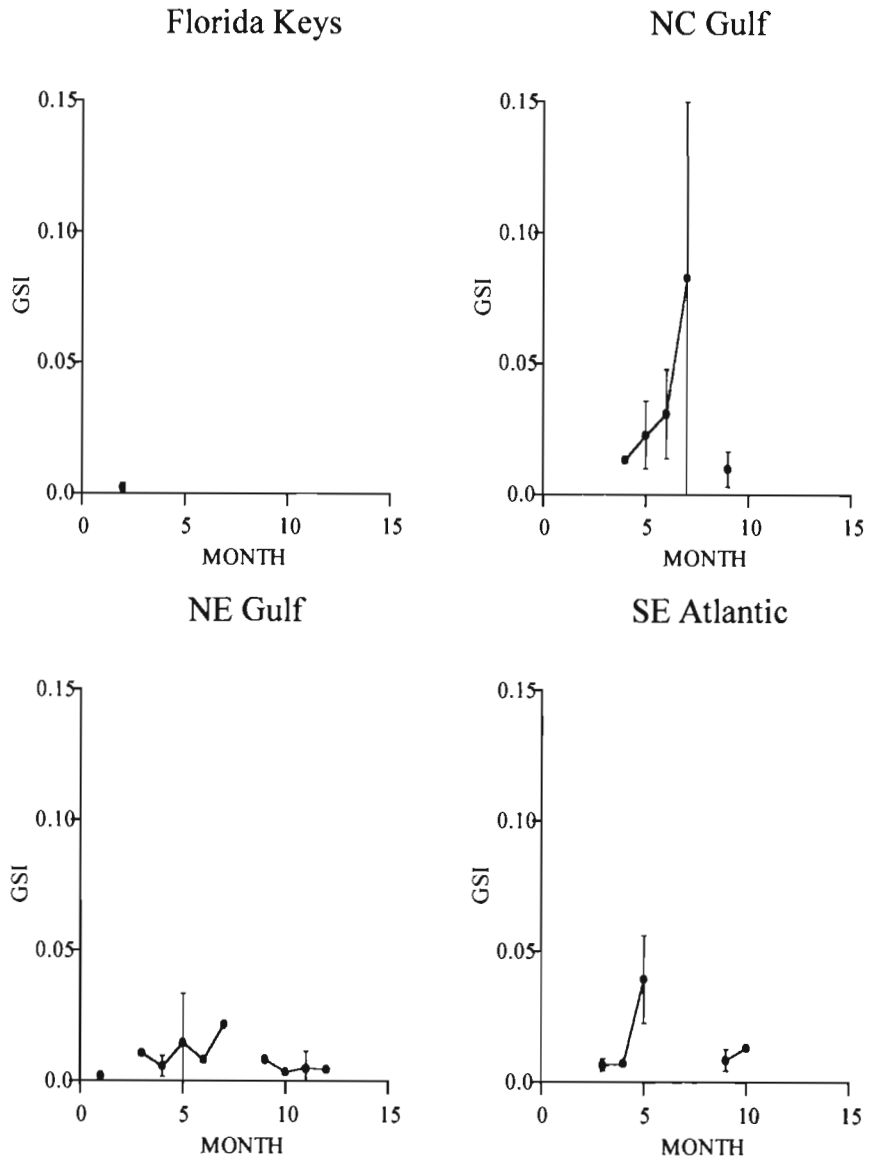
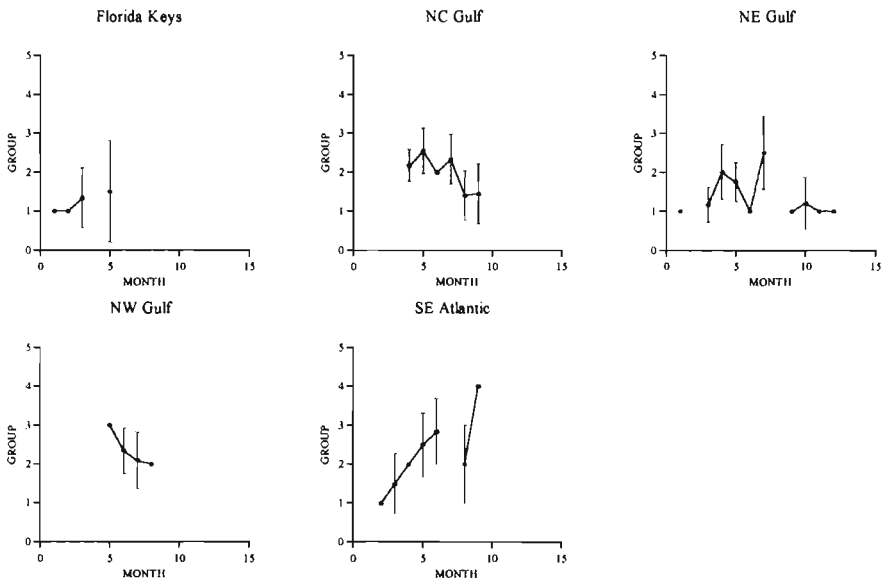



**Figure 37.** Seasonal gonosomatic index for male cobia by locality. There appear to be no differences in GSI seasonality among the locations. Points represent means and error bars are 95% confidence intervals.

**Figure 38.** Mean largest oocyte group by season. There is little evidence of differences in seasonality among the locations. The points are the error bars represent 95% confidence intervals.



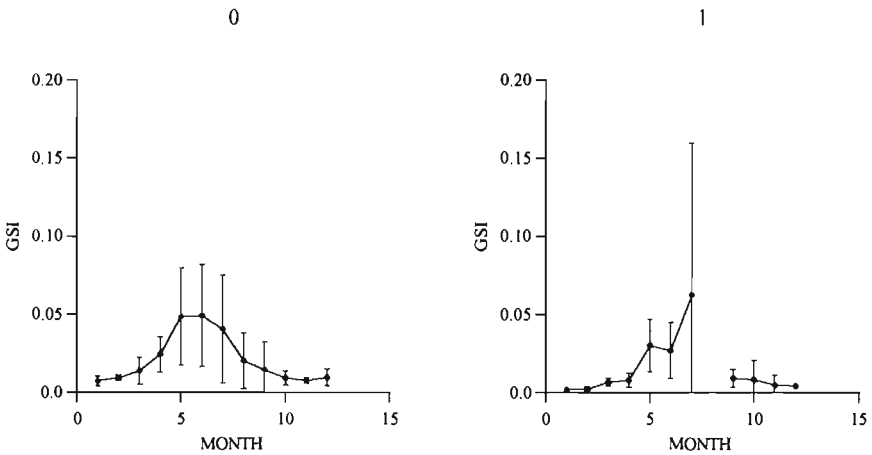




**Figure 39.** Seasonal gonosomatic index for female (0) and male (1) cobia. Peak GSI's occur in May, June and July for both sexes.

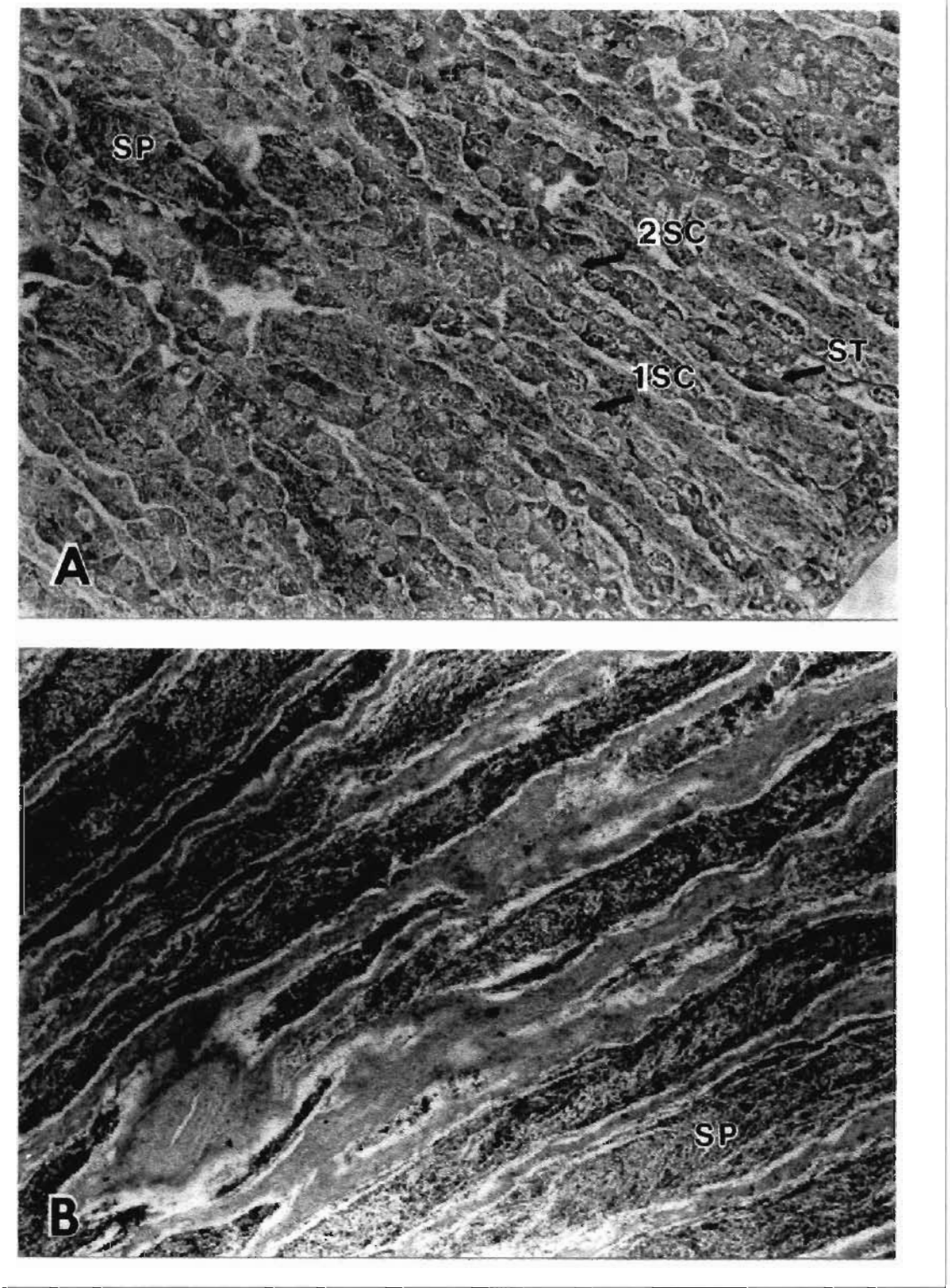



Figure 40. Histological sections of cobia testis in the ripe maturity stage. A. Spermatogenic activity throughout the testis. 53X magnification. B. No spermatogenic activity. 82.5X magnification Key: SP, spermatozoa; ST, spermatids; 2SC, secondary spermatocytes; 1SC, primary spermatocytes.

An intermediate stage of ripeness, with spermatogenic activity in the periphery of the testis only, was also commonly observed. All male cobia examined from the north-central Gulf of Mexico (**Table 14**), the southeastern Atlantic Ocean (**Table 17**), and the northwestern Gulf of Mexico (**Table 18**) were ripe. As the reproductive season progressed in the north-central Gulf of Mexico, ripe males advanced from active spermatogenesis throughout the testis in April and May (**Figure 40a**) to no evidence of spermatogenic activity at the end of the season in September and October (**Figure 40c; Table 14**). Although data are more limited, a similar pattern was seen in cobia from the northwestern Gulf of Mexico (**Table 18**). Cobia were captured from the southeastern Atlantic Ocean during the beginning of the spawning season only, and thus spermatogenic activity was found in all testis examined from that area (**Table 17**). It is interesting to note that cobia captured from the southeastern Atlantic Ocean were in a more advanced stage of testicular maturity during February and March than during April and May. Male fish were captured from the northeastern Gulf of Mexico during all months except January and August, and most fish were ripe from February through December (**Table 15**). Male cobia in the regressed and early developing maturity stages were not found, suggesting male cobia have an extended reproductive season and the testis are rarely in a resting stage. Spent fish were found in November and December only, although a portion of the cobia collected during those months were ripe. The limited sample of male cobia obtained from the Florida Keys (**Table 16**) show a similar extended reproductive season, with the majority of fish captured in February and October classified as ripe. However, samples from the Florida Keys had the highest percentage of maturing and mature males of any other area in this study.

**Table 14.** Percentage of cobia in each testicular maturity stage for the north-central Gulf of Mexico (Destin, FL, to Chandelier Islands, LA). Date from 1996-1997 combined. Spermatogenic activity refers to the presence of spermatogonia, spermatocytes, and spermatids.

| Month | N | Ripe; Spermatogenic Activity Throughout | Ripe; Spermatogenic Activity in Periphery | Ripe; No Spermatogenic Activity |
|---|---|---|---|---|
| April | 1 | 100 | 0 | 0 |
| May | 17 | 88 | 12 | 0 |
| June | 7 | 43 | 57 | 0 |
| July | 8 | 25 | 50 | 25 |
| August | 1 | 0 | 100 | 0 |
| September | 13 | 0 | 0 | 100 |
| October | 1 | 0 | 0 | 100 |

**Table 15.** Percentage of cobia in each testicular maturity stage for the northeastern Gulf of Mexico (Crystal River to Ft. Meyers, FL). Data from 1995-1997 combined. Spermatogenic activity refers to the presence of spermatogonia, spermatocytes, and spermatids.

| Month | N | Maturing | Mature | Ripe; Spermatogenic Activity Throughout | Ripe; Spermatogenic Activity in Periphery | Ripe; No Spermatogenic Activity | Spent |
|---|---|---|---|---|---|---|---|
| February | 2 | 0 | 0 | 50 | 50 | 0 | 0 |
| March | 1 | 0 | 0 | 100 | 0 | 0 | 0 |
| April | 5 | 20 | 20 | 60 | 0 | 0 | 0 |
| May | 5 | 0 | 0 | 60 | 20 | 20 | 0 |
| June | 1 | 0 | 0 | 0 | 100 | 0 | 0 |
| July | 5 | 0 | 0 | 60 | 40 | 0 | 0 |
| August | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| September | 5 | 0 | 0 | 0 | 40 | 60 | 0 |
| October | 3 | 0 | 0 | 0 | 0 | 100 | 0 |
| November | 8 | 0 | 0 | 0 | 12.5 | 25 | 62.5 |
| December | 8 | 0 | 0 | 0 | 12.5 | 37.5 | 50 |

**Table 16.** Percentage of cobia in each testicular maturity stage for the Florida Keys (Sunshine and Big Pine keys). Data from 1996-1997 combined. Spermatogenic activity refers to the presence of spermatogonia, spermatocytes, and spermatids.

| Month | N | Maturing | Mature | Ripe; Spermatogenic Activity Throughout | Ripe; Spermatogenic Activity in Periphery | Ripe; No Spermatogenic Activity | Spent |
|---|---|---|---|---|---|---|---|
| February | 13 | 23 | 24 | 7 | 31 | 7 | 7 |
| May | 1 | 0 | 0 | 0 | 0 | 100 | 0 |
| October | 3 | 0 | 0 | 0 | 33.3 | 33.3 | 33.3 |

**Table 17.** Percentage of cobia in testicular maturity stages from the southeastern Atlantic Ocean (Morehead City, NC, to Cape Canaveral, FL). Data from 1996-1997 combined. Spermatogenic activity refers to the presence of spermatogonia, spermatocytes, and spermatids.

| Month | N | Ripe; Spermatogenic Activity Throughout | Ripe; Spermatogenic Activity in Periphery | Ripe; No Spermatogenic Activity |
|---|---|---|---|---|
| February | 2 | 50 | 50 | 0 |
| March | 11 | 82 | 12 | 0 |
| April | 3 | 100 | 0 | 0 |
| May | 17 | 100 | 0 | 0 |

**Table 18.** Percentage of cobia in each testicular maturity stage for the northwestern Gulf of Mexico (Port Aransas, TX) in 1996. Spermatogenic activity refers to the presence of spermatogonia, spermatocytes, and spermatids.

| Month | N | Ripe; Spermatogenic Activity Throughout | Ripe; Spermatogenic Activity in Periphery | Ripe; No Spermatogenic Activity |
|---|---|---|---|---|
| May | 1 | 100 | 0 | 0 |
| June | 1 | 100 | 0 | 0 |
| July | 19 | 42 | 37 | 21 |
| August | 2 | 50 | 0 | 50 |

The reproductive season of female cobia is shorter than that seen for the males. **Tables 19-23** show the monthly ovarian maturity stages for all areas. The majority of the females were in the late developing stage by April in the north-central Gulf of Mexico (**Table 19**), the northeastern Gulf of Mexico (**Table 20**) and the southeastern Atlantic Ocean (**Table 22**). Limited data from the northwestern Gulf of Mexico (**Table 23**) and the Florida Keys (**Table 21**) do not allow an accurate analysis of the reproductive season from those areas. Ovarian recrudescence began as early as February in both the Florida Keys and the southeastern Atlantic Ocean and females in the late developing stage were apparent in both areas by March. Spent females were first observed in July along the entire Gulf of Mexico (**Tables 19, 20 and 23**), although some females remained in the late developing stage through September.

Females in the regressed stage were found as early as July along the Gulf of Mexico, suggesting a portion of female cobia only spawn during the beginning of the reproductive season (April through June) or some individuals have a short resting period between two major spawning periods, while others remain in spawning condition throughout the entire season.

**Table 19.** Percentage of cobia in each ovarian maturity stage for north-central Gulf of Mexico (Destin, FL, to Chandelier Islands, LA). Data from 1989, 1990, 1996, and 1997 combined. Percentage atresia calculated per development stage for ovaries with alpha- or beta-stage atresia only.

| Stage | April | May | June | July | August | September |
|---|---|---|---|---|---|---|
| N | 20 | 112 | 1 | 25 | 8 | 22 |
| **Early Dev.** | 0 | 4.5 | 0 | 0 | 0 | 0 |
| % atresia | -- | 20 | -- | -- | -- | -- |
| **Mid Dev.** | 10 | 7 | 0 | 4 | 0 | 0 |
| % atresia | 100 | 62 | -- | 0 | -- | -- |
| **Late Dev.** | 90 | 88.5 | 100 | 64 | 37.5 | 18 |
| % atresia | 44 | 38 | 0 | 31 | 33 | 25 |
| **Spent** | 0 | 0 | 0 | 28 | 50 | 23 |
| % atresia | -- | -- | -- | 86 | 100 | 80 |
| **Regressed** | 0 | 0 | 0 | 4 | 12.5 | 59 |
| % atresia | -- | -- | -- | 0 | 0 | 100 |

**Table 20.** Percentage of cobia in each ovarian maturity stage for the northeastern Gulf of Mexico (Crystal River to Ft. Meyers, FL). Data from 1995 - 1997 combined. Percentage atresia calculated per development stage for ovaries with alpha- or beta-stage atresia only.

| Stage | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|
| N | 2 | 7 | 3 | 2 | 6 | 6 | 3 | 11 | 13 | 7 |
| Immature | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 0 |
| Early Dev. | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| % atresia | -- | 50 | -- | -- | -- | -- | -- | -- | -- | -- |
| Mid Dev. | 0 | 14 | 66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| % atresia | -- | 0 | 50 | -- | -- | -- | -- | -- | -- | -- |
| Late Dev. | 0 | 57 | 33 | 50 | 83 | 67 | 33 | 0 | 0 | 0 |
| % atresia | -- | 50 | 0 | 0 | 0 | 50 | 0 | -- | -- | -- |
| Spent | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 18 | 8 | 14 |
| % atresia | -- | -- | -- | -- | 100 | -- | -- | 100 | 100 | 100 |
| Regressed | 100 | 0 | 0 | 0 | 0 | 33 | 66 | 82 | 92 | 86 |
| % atresia | 0 | -- | -- | -- | -- | 50 | 100 | 67 | 42 | 83 |

**Table 21.** Percentage of cobia in each ovarian maturity stage for the Florida Keys (Sunshine and Big Pine keys). Data from 1995 - 1997 combined. Percentage atresia calculated per development stage for ovaries with alpha- or beta-stage atresia only.

| Stage | January | February | March | April | May |
|---|---|---|---|---|---|
| N | 1 | 17 | 3 | 0 | 3 |
| Early Dev. | 0 | 64.7 | 66 | 0 | 33 |
| % atresia | -- | 91 | 50 | -- | 100 |
| Mid Dev. | 0 | 5.9 | 0 | 0 | 0 |
| % atresia | -- | 100 | -- | -- | -- |
| Late Dev. | 0 | 0 | 34 | 0 | 67 |
| % atresia | -- | -- | 100 | -- | 100 |
| Spent | 0 | 0 | 0 | 0 | 0 |
| % atresia | -- | -- | -- | -- | -- |
| Regressed | 100 | 29.4 | 0 | 0 | 0 |
| % atresia | 100 | 20 | -- | -- | -- |

**Table 22.** Percentage of cobia in each ovarian maturity stage for the southeastern Atlantic Ocean (Morehead City, NC, to Cape Canaveral, FL). Data from 1996 - 1997 combined. Percentage atresia calculated per development stage for ovaries with alpha- or beta-stage atresia only.

| Stage | February | March | April | May | June | December |
|---|---|---|---|---|---|---|
| N | 3 | 31 | 10 | 10 | 6 | 2 |
| Early Dev. | 66 | 41.9 | 20 | 0 | 0 | 0 |
| % atresia | 100 | 92 | 0 | 0 | -- | -- |
| Mid Dev. | 34 | 16 | 10 | 0 | 0 | 0 |
| % atresia | 100 | 80 | 100 | -- | -- | -- |
| Late Dev. | 0 | 41.9 | 70 | 100 | 100 | 0 |
| % atresia | -- | 85 | 66 | 60 | 0 | -- |
| Spent | 0 | 0 | 0 | 0 | 0 | 0 |
| % atresia | -- | -- | -- | -- | -- | -- |
| Regressed | 0 | 3.2 | 0 | 0 | 0 | 100 |
| % atresia | -- | 0 | -- | -- | -- | 50 |

**Table 23.** Percentage of cobia in each ovarian maturity stage for the northwestern Gulf of Mexico (Port Aransas, TX) in 1996. Percentage atresia calculated per development stage for ovaries with alpha- or beta-stage atresia only.

| Stage | May | June | July | August |
|---|---|---|---|---|
| N | 1 | 8 | 48 | 2 |
| **Mid Dev.** | 0 | 0 | 4 | 50 |
| % atresia | -- | -- | 50 | 0 |
| **Late Dev.** | 100 | 100 | 73 | 50 |
| % atresia | 0 | 0 | 5.7 | 0 |
| **Spent** | 0 | 0 | 21 | 0 |
| % atresia | -- | -- | 100 | -- |
| **Regressed** | 0 | 0 | 2 | 0 |
| % atresia | -- | -- | 100 | -- |

*Atresia*:
Cobia ovarian tissue showed all stages of atresia throughout the reproductive season. Alpha and beta-stage atresia of yolked oocytes (**Figure 41a**) were most abundant in spent fish but were also found in females in the mid-developing and late developing ovarian stages. Atresia of hydrated oocytes (**Figure 41b**) was only found in ovaries in the late developing and spent stages. Atresia of non-yolked oocytes was more difficult to recognize but was a common occurrence in early developing ovaries (**Tables 21 and 22**). The later stages of atresia (gamma and delta; **Figure 41c**) were found in ovaries in all maturity stages from early developing through regressed.

The spawning success of a fish can be determined, in part, by analysis of atretic oocytes. A low percentage of atresia is common throughout the reproductive season, representing oocytes that did not fully mature. However, a high percentage of late developing females captured from the southeastern Atlantic Ocean in March, April and May exhibited alpha or beta-stage atresia (**Table 22**). This high percentage of atresia suggests many oocytes did not reach final maturation, indicative of reduced spawning success. The relatively low percentage of females with atretic oocytes along the Gulf of Mexico (**Tables 19, 20 and 23**) suggests high spawning success throughout the spawning season in the Gulf of Mexico.

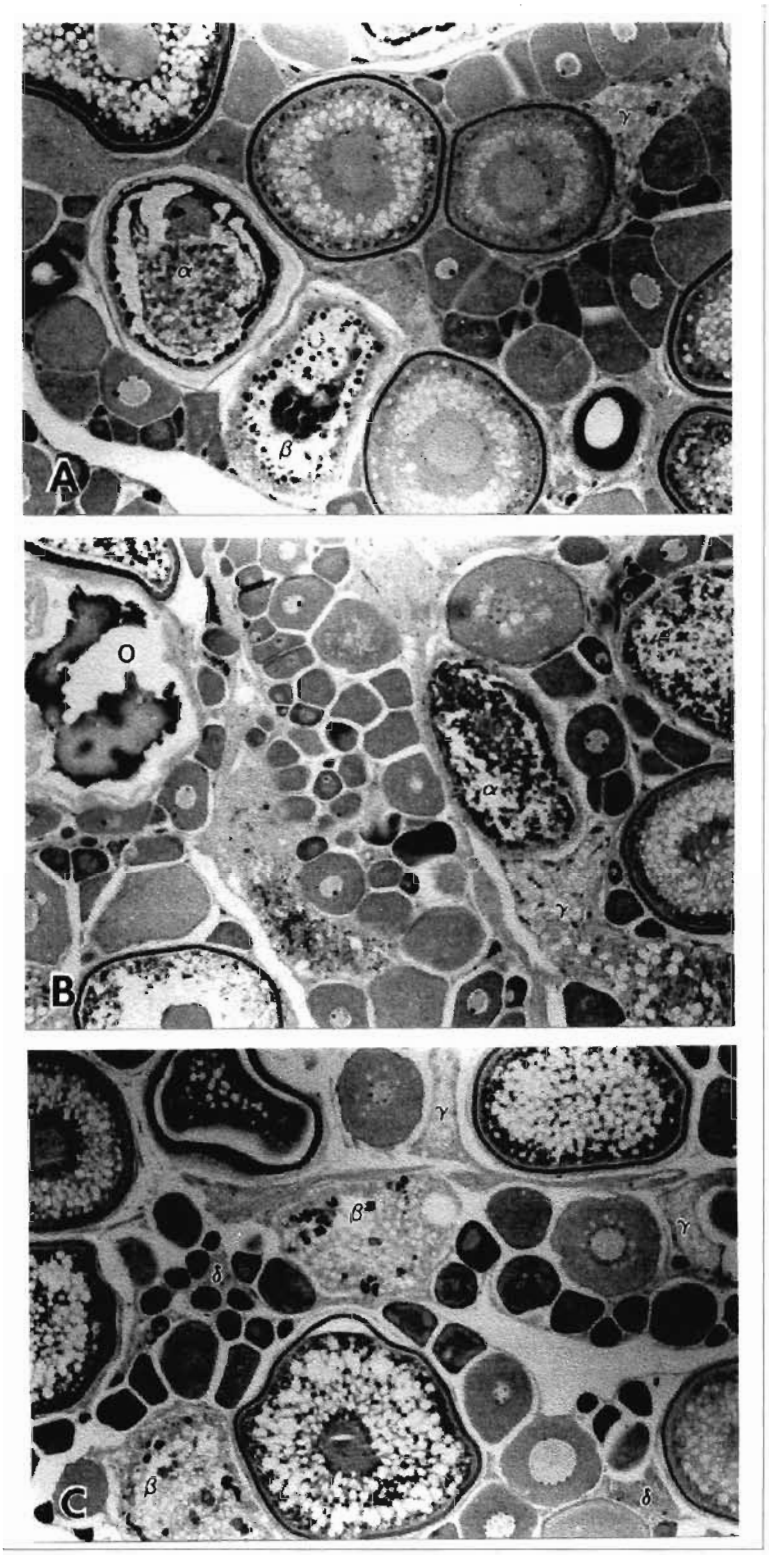



Figure 41. Stages of atresia in cobia ovaries. A. Alpha (α), beta (β), and gamma (γ) stage atresia in a late developing/spent stage ovary. 100x magnification. B. Alpha-stage atresia of a hydrated oocyte (O). 100X magnification. C. Beta (β), gamma (γ) and delta (δ) stages of atresia in a spent ovary. 100X magnification.

*Final Oocyte Maturation*:
Female cobia were found to be undergoing final oocyte maturation (FOM) in all areas sampled with the exception of the Florida Keys. Cobia in early stages of FOM showed the beginning of lipid coalescence (**Figure 42a**). More advanced stages of FOM were identified by complete lipid coalescence and migration of the nucleus to the periphery of the oocyte (**Figure 42b**). The final stages of FOM, the breakdown of the nuclear membrane and yolk coalescence, followed by hydration, were not observed in any sample. Final oocyte maturation appeared to be a relatively synchronous process; most oocytes undergoing FOM within an ovary were in the same FOM stage (**Figure 42c**). The percentage of fully mature oocytes undergoing FOM varied from 5% to 84% of the oocytes within a 100x field of view. Females from the northeastern Gulf of Mexico had the highest mean percentage of mature oocytes undergoing FOM (49%), followed by the north-central Gulf of Mexico (19%), the southeastern Atlantic Ocean (16%) and the northwestern Gulf of Mexico (15%). The mean percentage of females in the late developing ovarian stage undergoing FOM ranged from a high of 59% (n = 16) in the northeastern Gulf of Mexico to a low of 11% (n = 37) in the northwestern Gulf of Mexico; an average of 19% of the females from the north-central Gulf of Mexico (n = 141) and the southeastern Atlantic Ocean (n = 36) were undergoing FOM.

*Spawning Frequency*:
Postovulatory follicles (POF) were found in cobia ovaries from all areas sampled throughout the reproductive season (**Table 24**). However, POF were never abundant in any ovary examined; the greatest density of POF recorded was two POF per 100x field of view. The least commonly observed POF stage was 0-12 hours (**Figure 43a**), occurring in only 16% of all ovaries containing POF. Early-stage POF's were only found in female cobia from the southeastern Atlantic Ocean and the northeastern and north-central Gulf of Mexico. The most commonly observed POF stage was 24 hours (**Figure 43b**), occurring in 51% of all ovaries containing POF. Twenty-four-hour POF's were found in cobia from all areas and were most common in fish from the northeastern and north-central Gulf of Mexico. The 48-hour POF stage (**Figure 43c**) was often difficult to distinguish from gamma and delta-stage atresia, occurred in 33% of all ovaries containing POF and was most commonly found in fish from the northwestern Gulf of Mexico.

*Batch Spawn Size*:
We were unable to collect female cobia that had ovaries containing hydrated eggs so the estimate of spawn size was estimated from the frequency distribution of oocyte diameters in ovaries showing FOMs histologically. Those animals are within 21-24h of spawning. The mode of the largest batch of oocytes in such ovaries was between 700 and 800$\mu$m. The frequency of diameters diminished on either side of the mode providing a symmetrical frequency histogram of oocytes between 500 and 1000$\mu$m (**Figure 44**). We therefore estimated batch spawn size as the number of oocytes greater than 500$\mu$m in ovaries containing oocytes in the final stages maturation.

Initially we compared the spawn size estimates for samples from six females that were fixed in Gilson's to samples from the same fish fixed in formalin. The mean spawn size estimates for six fish was 1,332,080 (SEM=287,273) for formalin fixed samples and 1,704,280 (SEM=576,874). A paired t-test detected no significant differences (t=0.8297,

5df, P=0.4445) in estimated spawn size. In addition there was no indication that one method consistently under estimated relative to the other. The 95% confidence limits for the difference between Gilson's and formalin estimates of the same fish was from 780,900 to 1,525,000 with three differences being positive and three negative. We subsequently chose to use formalin fixed samples for all spawn size estimates.

Nineteen female cobia that had been found to have oocytes in the final stages of maturation. The estimates from each fish are given in **Figure 45**. The estimates range from less than 1,000,000 to over 4,000,000. The mean estimates for each fish range from 654,217 to 3,820,616 and the mean of the mean for the 19 cobia was 1,944,811 (SEM=208,118) with a 95% confidence interval from 1,507,570 to 2,382,053.

Table 24. Percentages of postovulatory follicle (POF) stages in cobia with ovaries in the late developing stage.

| Area | Number with POF | POF Stage | | |
|---|---|---|---|---|
| | | 0-12 hour | 24 hour | 48 hour |
| Southeastern Atlantic Ocean | 13 | 23 | 38 | 38 |
| Florida Keys | 1 | 0 | 100 | 0 |
| Northeastern Gulf of Mexico | 6 | 33 | 67 | 0 |
| North-central Gulf of Mexico | 47 | 17 | 55 | 28 |
| Northwestern Gulf of Mexico | 13 | 0 | 38 | 62 |
| Total Region | 80 | 16 | 51 | 33 |

Two methods were used to estimate the spawning frequency of cobia; the percentage of late developing ovaries containing 0- to 24-hour POF and the percentage of late developing ovaries with oocytes undergoing FOM. Both these methods assume that spawning either has taken place within 24 hours (POF) or will take place within 24 hours (FOM). **Tables 25-27** show estimated monthly spawning frequencies for cobia from all areas except the Florida Keys, and the northeastern Gulf of Mexico, which had insufficient data for this analysis. The spawning frequency of cobia from the north-central Gulf of Mexico (**Table 25**) and the southeastern Atlantic Ocean (**Table 26**) were similar for both the POF and FOM method, averaging one spawn every 3.9 to 5.1 days.

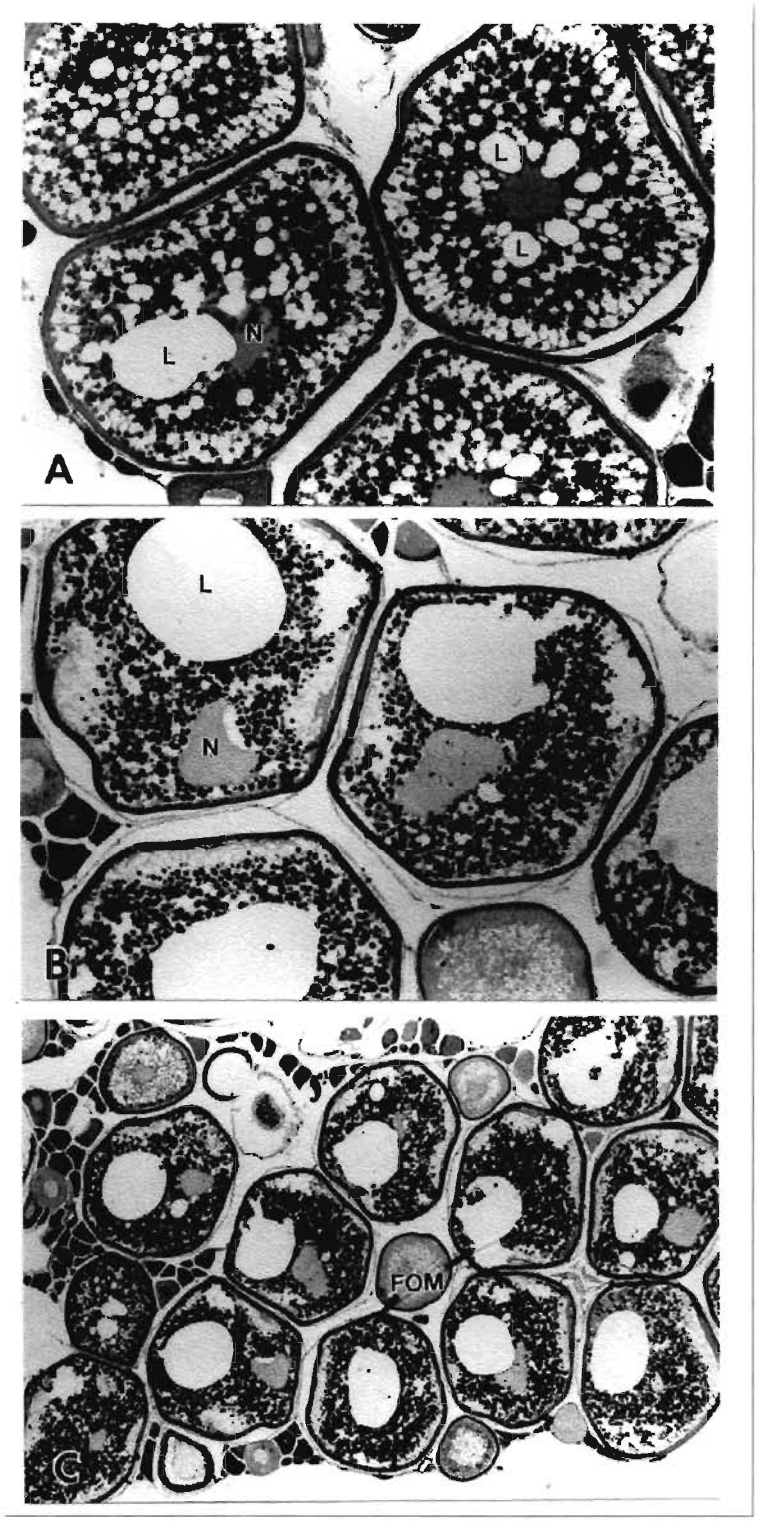



Figure 42. Final oocyte maturation (FOM) in late developing cobia ovaries. A. Early stage of FOM showing initial lipid coalescence (L). 100X magnification. B. More advanced stage of FOM. Lipids have coalesced to form a single large droplet (L) and the nucleus (N) is beginning to migrate to the periphery of the oocyte. 100X magnification. C. Synchrony of FOM. 39X magnification.

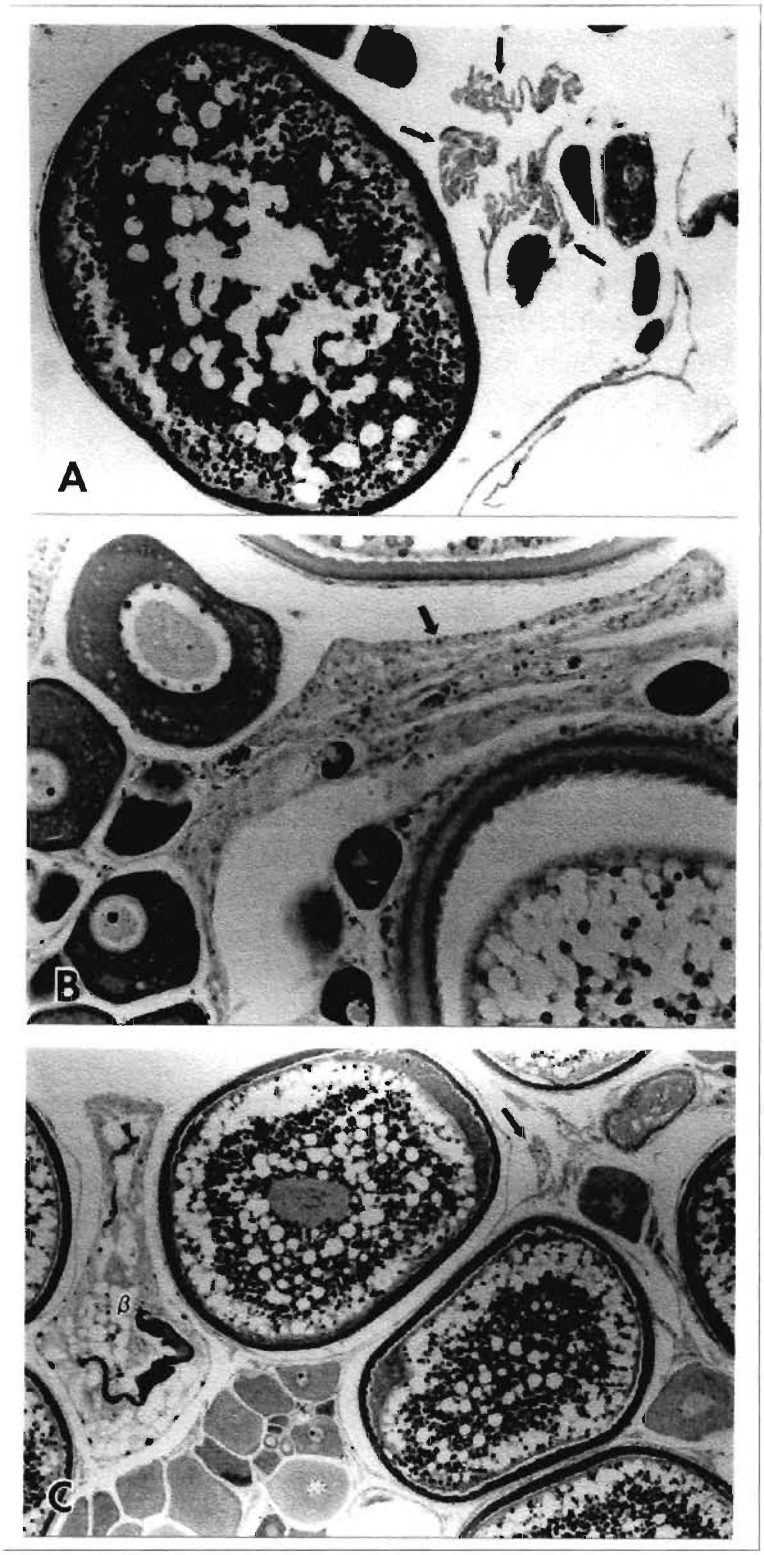



Figure 43. Postovulatory follicles (POF) in late developing cobia ovaries. A. 0- to 12-hour POF (arrows). 125X magnification. B. 24-hour POF (arrow). 324X magnification. C. 48-hour POF (arrow) with early-stage beta atresia apparent (β). 100X magnification.

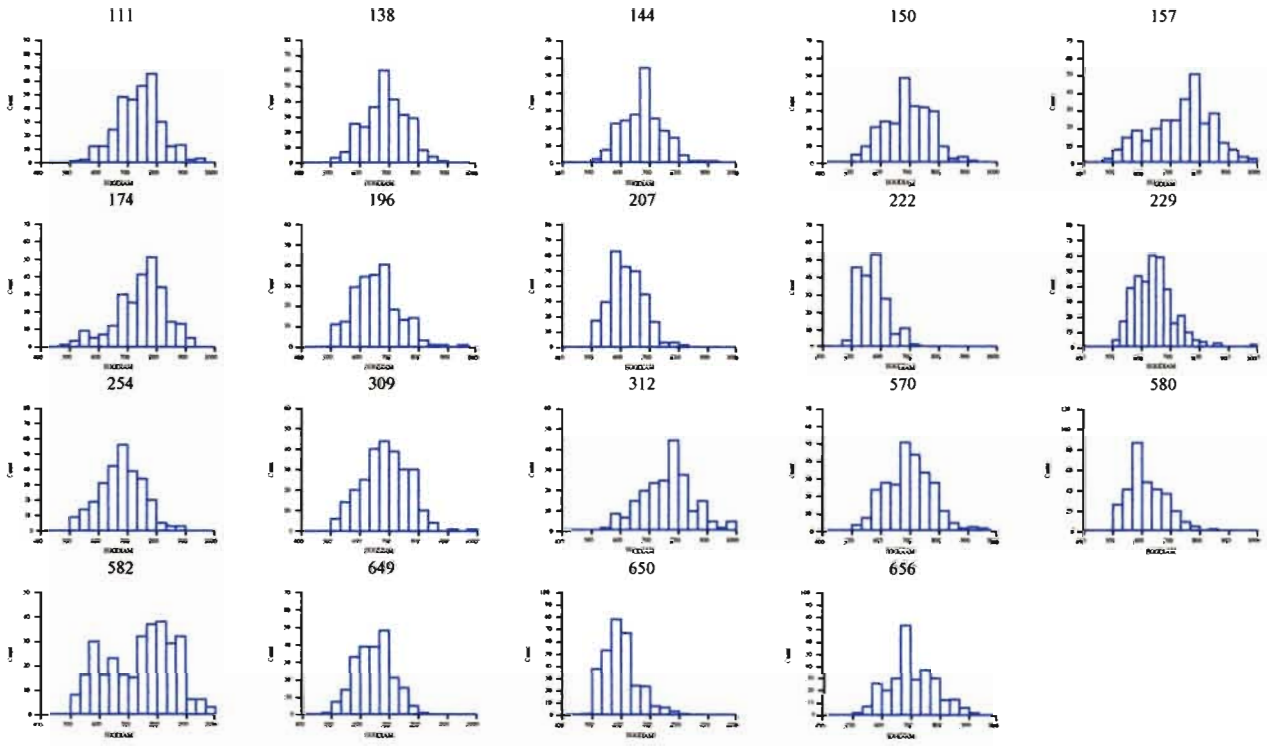



**Figure 44.** Oocyte diameter histograms for 19 fish with ovaries that contained FOM.

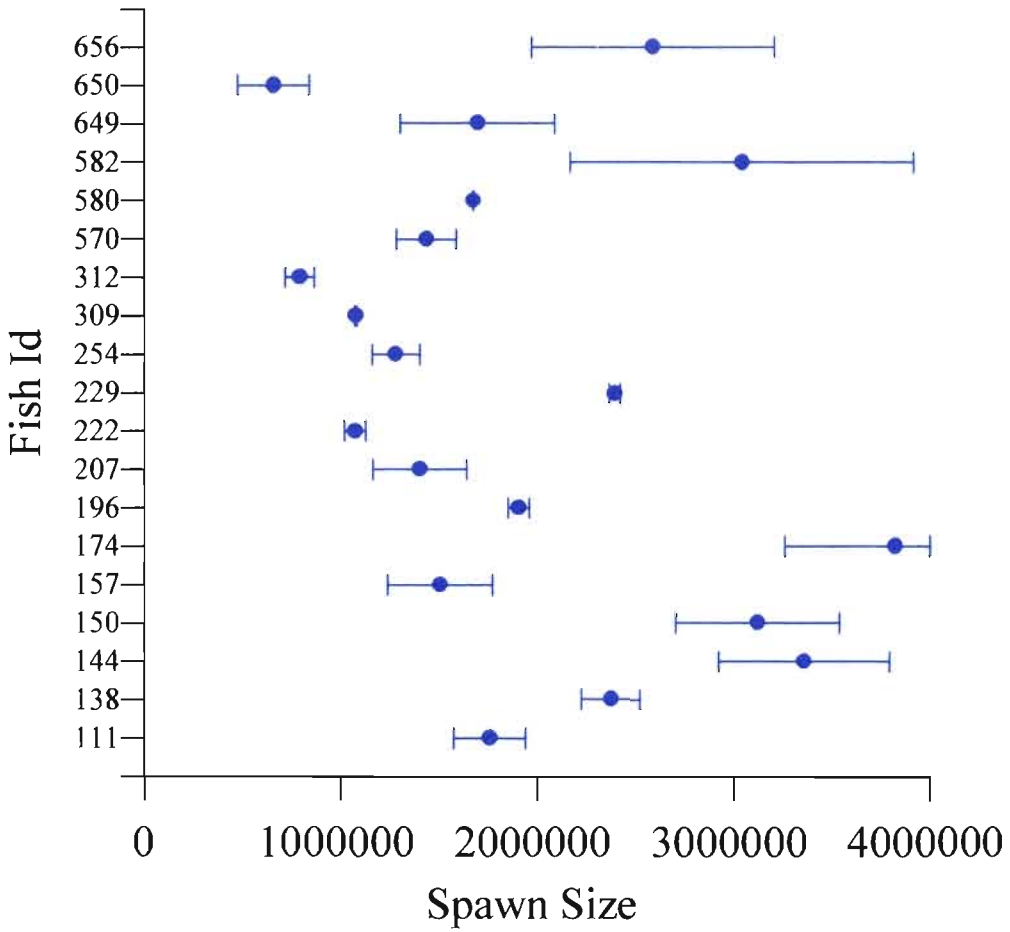



**Figure 45.** Spawn size estimations for 19 cobia whose ovaries contain FOM's.

Monthly spawning frequency estimates were relatively consistent for both the FOM and POF method in the north-central Gulf of Mexico (**Table 25**), although frequency estimates obtained from monthly samples sizes less than five may not be accurate. In contrast, there was greater variation in monthly spawning frequency estimates for cobia from the southeastern Atlantic Ocean (**Table 26**). However, if frequency estimates from March are eliminated (a reasonable assumption since less than half the fish examined during March were in the late developing stage, suggesting the spawning season was just starting), average spawning frequency for April through June increases to every 4.0 days for the POF method and every 4.3 days for the FOM method. In contrast, spawning frequency is much lower for cobia in the northwestern Gulf of Mexico (**Table 27**), averaging once every 12.5 days for the POF method and once every 9.0 days for the FOM method. These estimates are based on fish captured in July only; if fish from June were included, frequency estimates would decrease to 25 days for POF and 18 days for FOM.

**Table 25.** Spawning frequency estimates for cobia in the late development ovarian maturity stage from the north-central Gulf of Mexico (Destin, FL, to Chandelier Islands, LA). Data from 1996 and 1997 combined. Postovulatory follicles (POF) represent a combination of 12 and 24 hour POF. FOM-final oocyte maturation.

| Month | N | % POF | Spawning Frequency using POF | % FOM | Spawning Frequency using FOM |
|---|---|---|---|---|---|
| April | 18 | 28 | 3.6 days | 17 | 5.9 days |
| May | 99 | 24 | 4.2 days | 17 | 5.9 days |
| June | 1 | 100 | 1 day | 0 | --- |
| July | 16 | 25 | 4.0 days | 44 | 2.3 days |
| August | 3 | 33 | 3 days | 0 | -- |
| September | 4 | 0 | -- | 17 | 5.9 |
| **Mean Spawning Frequency** | 141 | 22 | 4.5 days | 19 | 5.3 days |

**Table 26.** Spawning frequency estimates for cobia in the late development ovarian maturity stage from the southeastern Atlantic Ocean (Morehead City, NC, to Cape Canaveral, FL). Data from 1996 and 1997 combined. Postovulatory follicles (POF) represent a combination of 12- and 24-hour POF. FOM-final oocyte maturation.

| Month | N | % POF | Spawning Frequency from POF | % FOM | Spawning Frequency from FOM |
|---|---|---|---|---|---|
| March | 13 | 7.6 | 13.5 days | 7.6 | 13.5 days |
| April | 7 | 42.8 | 2.3 days | 0 | --- |
| May | 10 | 30.0 | 3.0 days | 20 | 5.0 days |
| June | 6 | 0 | -- | 50 | 2.0 days |
| Average Spawning Frequency | 36 | 20.0 | 5.0 days | 19.4 | 5.1 days |

**Table 27.** Spawning frequency estimates for cobia in the late development ovarian maturity stage from the northwestern Gulf of Mexico (Port Aransas, TX) in 1996. Post ovulatory follicles (POF) represent a combination of 12- and 24-hour POF. FOM-final oocyte maturation.

| Month | N | % POF | Spawning Frequency from POF | % FOM | Spawning Frequency from FOM |
|---|---|---|---|---|---|
| June | 6 | 0 | – | 0 | --- |
| July | 37 | 8 | 12.5 days | 11 | 9 days |
| August | 2 | 50 | 2 days | 0 | --- |
| Average Spawning Frequency* | 37 | 8 | 12.5 days | 11 | 9 days |

* **July only**

## Discussion

This study suggests that the timing and duration of the cobia reproductive season along the southeastern Atlantic Ocean and the northern Gulf of Mexico are similar to previous reports of cobia reproduction in the region (Richards 1976; Thompson *et al.* 1992; Beisiot *et al.* 1994; Lotz *et al.* 1996) and that there are no major differences in the reproductive season among the areas studied. Cobia have been reported to migrate to the Florida Keys during the winter (Lotz *et al.* 1996), and there has been some speculation regarding spawning of an overwintering stock of cobia in the Florida Keys. However, the limited data collected from the Florida Keys in this study suggests spawning does not occur during the winter, since females in the late developing ovarian stage were not found until March and 47% of the males captured in February in the Florida Keys did not yet have ripe testis. Additional samples from the Keys are necessary to thoroughly understand the reproductive dynamics of cobia from that area.

Male cobia appear to be capable of spawning for ten months of the year, whereas the female spawning season appears to be confined to a six-month period from April through September. The longer duration of the male reproductive season is not uncommon in marine, subtropical, multiple-spawning species (Brown-Peterson *et al.* 1988; Cuellar *et al.* 1996). Energetic investment in spermatogenesis is less than that for oocyte development and maturation, which may contribute to the ability of male fish to be reproductively ready longer than females. Dividing ripe males into three stages based on spermatogenic activity shows that although males remain ripe through late fall, most spermatogenic activity ceases by late summer, similar to the maturity pattern seen in female cobia.

While the female reproductive season appears to extend for six months, there is a significant number of female fish that were spent by July throughout the northern Gulf of Mexico. Lotz *et al.* (1996) found similar results in cobia from the same area, suggesting this is not an unusual occurrence. The reason that a portion of the female cobia appear to end their reproductive season in July while other females continue spawning through September is unclear, but suggests there may be two distinct groups of cobia in the northern Gulf of Mexico. Alternatively, younger, smaller females may cease spawning sooner than older females; a future investigation of otolith morphology genetics and age & growth patterns of northern Gulf cobia might reveal the presence of distinct groups.

This study presents the first detailed look at atresia, final oocyte maturation (FOM), and postovulatory follicles (POF) in cobia. Although atresia in cobia ovaries has been previously illustrated (Lotz *et al.* 1996), the various stages of atresia were not defined for cobia. Hunter and Macewicz (1985a) found that rates of atresia in northern anchovy (*Engraulis mordax)* could be useful in classifying the spawning condition of multiple spawning species. Cobia in the late developing maturity stage were never found with $>50\%$ of the yolked oocytes undergoing alpha or beta stage atresia (Hunter and Macewicz's (1985a) atresia state 2), although this was a common occurrence in spent fish in July, August, and September. Many cobia along the southeastern Atlantic Ocean during the early portion of the spawning season had alpha or beta stage atresia (**Table 22**). The low levels of atresia within each fish did not appear to reduce spawning

frequency (**Table 26**), although it may have influenced batch fecundity, as suggested by Hunter and Macewicz (1985a). In general, the high percentages of atresia observed in northern anchovy (Hunter and Macewicz 1985a) were uncommon in cobia except at the very end of the reproductive season when spawning had ceased.

Final oocyte maturation appears to be a synchronous process in individual cobia. However, the percentage of yolked oocytes undergoing final oocyte maturation was quite variable, suggesting cobia batch fecundities may also be very variable. Although the amount of time necessary between initiation of FOM and hydration and spawning in cobia is currently unknown, FOM generally occurs within 24 hours of spawning and can begin as little as 12 hours prior to spawning in sciaenid fishes (Brown-Peterson *et al.* 1988). The time of day that cobia spawn is unclear. Ditty and Shaw (1992) suggested cobia spawn during the day, based on examination of wild-caught larval cobia. Cobia induced to spawn at the Gulf Coast Research Laboratory spawned during the early morning prior to dawn (J.S. Franks and J.M. Lotz, personal communication). However, the timing of hormone-initiated spawning may not reflect natural spawning in the wild. Nevertheless, these data suggest that FOM may require 18-24 hours in cobia, since fish undergoing the early stages of FOM were captured during the daytime. Further information on the timing and duration of final oocyte maturation could resolve the temporal question of when cobia spawn.

There has never been an estimate of spawning frequency for cobia. Although the percentage of fish captured containing 24-hour or younger POF has been shown to be an effective method of determining spawning frequency in multiple spawning fish (Hunter and Macewicz 1985b; Hunter *et al.* 1992), we have shown that the percentage of fish undergoing FOM can also be used to estimate spawning frequency of cobia. Spawning frequency estimates using both the POF and FOM methods were similar for cobia from the southeastern Atlantic Ocean and the north-central Gulf of Mexico (**Tables 25 and 26**), and averaged once every four days. This is similar to the once every three-day spawning frequency reported for bigeye scad (*Selar crumenophthalmus;* Clarke and Privitera 1995), a subtropical carangid species, somewhat related to cobia. A spawning frequency of once every four days seems a reasonable estimate for cobia, and is supported by the fact that fish undergoing FOM were never found with POF of any age in the ovaries, suggesting a minimum of a three-day interval between spawning events. There appears to be a major difference in spawning frequency between cobia from the northwestern Gulf of Mexico and those captured in more eastern locations. Spawning occurs much less frequently in the northwestern Gulf of Mexico (once every nine to 12.5 days) than in locations further east. Additionally, the agreement between spawning frequency estimates using POF and FOM is not as close as for areas further east. However, these data are based on fish captured during July only; perhaps additional samples from other months would show spawning frequencies more similar to those estimated for cobia from the north-central Gulf of Mexico and the southeastern Atlantic Ocean. An additional explanation could be that cobia utilize the northwestern Gulf of Mexico primarily as a feeding ground and make extensive (1-2 day) migrations to the spawning grounds.

The location of spawning of cobia is still unclear. Joseph *et al.*, (1964) and Richards (1967) indicated that spawning occurs in nearshore waters, in the lower Chesapeake Bay and in inshore waters of the Atlantic Ocean. Burns collected cobia eggs and larvae (described in Ditty and Shaw 1992) inshore in Crystal Bay, Florida and has been told by numerous fishers that they have witnessed small groups of cobia spawning in Tampa Bay, Florida. There have been suggestions that cobia along the southeastern Atlantic Ocean spawn offshore (Hassler and Rainville 1975; Shaffer and Nakamura 1989). These speculations are supported by the histological data from this study. The lack of fish with oocytes in the final stages of FOM or hydrated oocytes suggests that the cobia collected for this study did not spawning in the nearshore areas where our samples were taken. Additionally, the relatively low percentage of ovaries containing POF's less than 12-hours-old indicates fish collected in this study did not spawn in the nearshore areas, but may have returned from offshore spawning grounds within 24 hours of spawning. Perhaps the reasons for this disparity of identification of spawning grounds is due to the fact that cobia may spawn both inshore and offshore.

Assuming females spawn 1,000,000 - 2,000,000 eggs every 2-6 days during the 91 days of May, June, and July, total fecundity may range from 15,000,000 - 90,000,000 eggs during that period. These estimates for total fecundity are similar to estimates obtained by Lotz et al. 1995 for batch spawn size. Lotz et al. 1995 did not observe fish with oocytes larger that 700$\mu$m and did not prescreen animals for presence of ovaries in final stages of oocyte maturation. It is likely that their estimates are of total fecundity rather than batch spawn size.

## VII. RECOMMENDATIONS FOR FUTURE RESEARCH

Recommendations for needed research on cobia from the Gulf of Mexico and the South Atlantic:

- Further investigate the reproductive biology of Florida Keys cobia to determine spawning season duration and spawning frequency.

- Collect additional cobia samples off Texas to resolve the difference in spawning frequency between Texas cobia and cobia from the northern and eastern Gulf and the South Atlantic.

- Procure additional fish from the north central Gulf to fill in the gaps in collections in order to better estimate spawning frequency.

- Conduct a population genetics study to determine whether cobia from the northwestern gulf are a different population with differing reproductive patterns, than cobia from more eastern lcoations within the Gulf of Mexico.

- Collect additional fish from the later part of the spawning season from the South Atlantic for comparison with northern Gulf and Texas fish.

- Obtain gonad and otolith samples from the Chesapeake Bay for stock identification, since cobia migrate into the Bay ready to spawn. Compare these data with growth rates and spawning frequencies of fish from the South Atlantic and Gulf of Mexico fish.

- Obtain much needed samples from cobia which overwintering in deep waters (150-300+ feet) of the northern Gulf of Mexico and off the Carolinas.

- Collect additional samples from southeastern Atlantic Ocean during the latter part of the reproductive season (June - September) to confirm the duration of the season and verify spawning frequency estimates.

- Collect additional samples from the northeastern Gulf of Mexico to determine spawning frequencies and to ascertain if spawning frequencies from the northeastern Gulf are similar to those of the north central Gulf of Mexico and the southeastern Atlantic Ocean.

- Determine the reproductive status of cobia overwintering in the north central Gulf of Mexico and the Florida Keys, as well as cobia that are resident in the Keys during the summer.

- Collect smaller (immature) males to determine age/length of males at first maturity.

- Conduct an analysis of trade-off among egg production, yield-per-recruit and size regulations to determine which size regulations are optimal in order to protect the spawning biomass.

- Develop a reliable index of recruitment.

- Spawn cobia in captivity to obtain sequential ovarian samples before and after spawning to document the timing of final oocyte maturation as well as the appearance of 12 and 24 hour post ovulatory follicles (POF).

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# APPENDICES

Not included

## Appendix A

Examples of Publicity Campaign

# Appendix B

Age/Length Keys

Tables 1-6

**Appendix Table 4(a).** Age length key, fork length (cm) composition in percent, of cobia females from the Florida Keys, by age group.

| Length (cm) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Keys Females | | | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | | | |
| 65 | | | | | | | | | | | | | | |
| 70 | | 66.7 | 33.3 | | | | | | | | | | | |
| 75 | | | 100.0 | | | | | | | | | | | |
| 80 | | 20.0 | 60.0 | 20.0 | | | | | | | | | | |
| 85 | | | 50.0 | 50.0 | | | | | | | | | | |
| 90 | | | 80.0 | 20.0 | | | | | | | | | | |
| 95 | | 33.3 | 66.7 | | | | | | | | | | | |
| 100 | | | | | | | | | | | | | | |
| 105 | | | | 50.0 | 50.0 | | | | | | | | | |
| 110 | | | | | | | | | | | | | | |
| 115 | | | | | | | | | | | | | | |
| 120 | | | | | | | | | | | | | | |
| 125 | | | | | | | | | | | | | | |
| 130 | | | | | | | | | | | | | | |
| 135 | | | | | | | | | | | | | | |
| 140 | | | | | | | | | | | | | | |
| 145 | | | | | | | | | | | | | | |
| 150 | | | | | | | | | | | | | | |
| 155 | | | | | | | | | | | | | | |
| 160 | | | | | | | | | | | | | | |

**Appendix Table 4(b).** Age length key, fork length (cm) composition in percent, of cobia males from the Florida Keys, by age group.

| Length (cm) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Keys Males | | | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | | | |
| 65 | | | | | | | | | | | | | | |
| 70 | | 100.0 | | | | | | | | | | | | |
| 75 | | | 100.0 | | | | | | | | | | | |
| 80 | | 25.0 | 75.0 | | | | | | | | | | | |
| 85 | | 14.3 | 42.9 | 42.9 | | | | | | | | | | |
| 90 | | | 33.3 | 66.7 | | | | | | | | | | |
| 95 | | | | | | | | | | | | | | |
| 100 | | | | | 100.0 | | | | | | | | | |
| 105 | | | | | | | | | | | | | | |
| 110 | | | | | | | | | | | | | | |
| 115 | | | | | | | | | | | | | | |
| 120 | | | | | | | | | | | | | | |
| 125 | | | | | | | | | | | | | | |
| 130 | | | | | | | | | | | | | | |
| 135 | | | | | | | | | | | | | | |
| 140 | | | | | | | | | | | | | | |
| 145 | | | | | | | | | | | | | | |
| 150 | | | | | | | | | | | | | | |
| 155 | | | | | | | | | | | | | | |
| 160 | | | | | | | | | | | | | | |

**Appendix Table 5(a).** Age length key, fork length (cm) composition in percent, of cobia females from the northern Gulf of Mexico, by age group.

| Length (cm) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N Gulf Females | | | | | | | | | | | | | | |
| 35 | 100.0 | | | | | | | | | | | | | |
| 40 | 100.0 | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | | | |
| 65 | | 100.0 | | | | | | | | | | | | |
| 70 | | | | | | | | | | | | | | |
| 75 | | | 100.0 | | | | | | | | | | | |
| 80 | | | 100.0 | | | | | | | | | | | |
| 85 | | | 80.0 | 20.0 | | | | | | | | | | |
| 90 | | 6.7 | 73.3 | 13.3 | | 6.7 | | | | | | | | |
| 95 | | | 73.3 | 23.3 | 3.3 | | | | | | | | | |
| 100 | | 4.2 | 12.5 | 75.0 | 4.2 | 4.2 | | | | | | | | |
| 105 | | | 37.5 | 45.8 | 12.5 | 4.2 | | | | | | | | |
| 110 | | | 9.1 | 63.6 | 27.3 | | | | | | | | | |
| 115 | | | 10.5 | 26.3 | 42.1 | 15.8 | 5.3 | | | | | | | |
| 120 | | | 3.8 | 23.1 | 42.3 | 19.2 | 11.5 | | | | | | | |
| 125 | | | 12.5 | 25.0 | 12.5 | 25.0 | 25.0 | | | | | | | |
| 130 | | | | | 25.0 | 25.0 | 50.0 | | | | | | | |
| 135 | | | | | | 33.3 | 66.7 | | | | | | | |
| 140 | | | | | | | 100.0 | | | | | | | |
| 145 | | | | | | | | | | | | | | |
| 150 | | | | | | | | | | | | | | |
| 155 | | | | | | 100.0 | | | | | | | | |
| 160 | | | | | | | 100.0 | | | | | | | |

**Appendix Table 5(b).** Age length key, fork length (cm) composition in percent, of cobia males from the northern Gulf of Mexico, by age group.

| Length (cm) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N. Gulf Males | | | | | | | | | | | | | | |
| 35 | 50.0 | 50.0 | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | | | |
| 65 | | | | | | | | | | | | | | |
| 70 | | | | | | | | | | | | | | |
| 75 | | | 100.0 | | | | | | | | | | | |
| 80 | | | 50.0 | 50.0 | | | | | | | | | | |
| 85 | | | 11.1 | 77.8 | 11.1 | | | | | | | | | |
| 90 | | 10.0 | 50.0 | 40.0 | | | | | | | | | | |
| 95 | | | | 70.0 | 20.0 | | 10.0 | | | | | | | |
| 100 | | | 8.3 | 50.0 | 33.3 | | | | 8.3 | | | | | |
| 105 | | | 11.1 | 33.3 | 22.2 | 22.2 | 11.1 | | | | | | | |
| 110 | | | | 50.0 | 25.0 | | | 25.0 | | | | | | |
| 115 | | | | | | | 100.0 | | | | | | | |
| 120 | | | | | | | 100.0 | | | | | | | |
| 125 | | | | | | | | | | | | | | |
| 130 | | | | | | | 100.0 | | | | | | | |
| 135 | | | | 100.0 | | | | | | | | | | |
| 140 | | | | | | | | | | | | | | |
| 145 | | | | | | | | | | | | | | |
| 150 | | | | | | | | | | | | | | |
| 155 | | | | | | | | | | | | | | |
| 160 | | | | | | | | | | | | | | |

**Appendix Table 6(a).** Age length key, fork length (cm) composition in percent, of cobia females from Texas, by age group.

| Length (cm) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Texas Females | | | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | | | |
| 65 | | | | | | | | | | | | | | |
| 70 | | | | | | | | | | | | | | |
| 75 | | | 100.0 | | | | | | | | | | | |
| 80 | | | 100.0 | | | | | | | | | | | |
| 85 | | | 100.0 | | | | | | | | | | | |
| 90 | | | 100.0 | | | | | | | | | | | |
| 95 | | | 50.0 | 50.0 | | | | | | | | | | |
| 100 | | 10.0 | 10.0 | 60.0 | 20.0 | | | | | | | | | |
| 105 | | | | 100.0 | | | | | | | | | | |
| 110 | | | | | | | | | | | | | | |
| 115 | | | | 25.0 | 50.0 | 25.0 | | | | | | | | |
| 120 | | | | 40.0 | 40.0 | | 20.0 | | | | | | | |
| 125 | | | | | | | | | | | | | | |
| 130 | | | | | | | | | | | | | | |
| 135 | | | | | | | | | | | | | | |
| 140 | | | | | | | | | | | | | | |
| 145 | | | | | | | | | | | | | | |
| 150 | | | | | | | | | | | | | | |
| 155 | | | | | | | | | | | | | | |
| 160 | | | | | | | | | | | | | | |

**Appendix Table 6(b).** Age length key, fork length (cm) composition in percent, of cobia males from Texas, by age group.

| Length (cm) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Texas Males | | | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | | | |
| 40 | 100.0 | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | | | |
| 65 | | | | | | | | | | | | | | |
| 70 | | | | | | | | | | | | | | |
| 75 | | | | | | | | | | | | | | |
| 80 | | | 50.0 | 25.0 | 25.0 | | | | | | | | | |
| 85 | | | 12.5 | 87.5 | | | | | | | | | | |
| 90 | | | 44.4 | 33.3 | | 22.2 | | | | | | | | |
| 95 | | | 25.0 | 75.0 | | | | | | | | | | |
| 100 | | | | 50.0 | | 50.0 | | | | | | | | |
| 105 | | | | 100.0 | | | | | | | | | | |
| 110 | | | | | | | | | | | | | | |
| 115 | | | | | | | | | | | | | | |
| 120 | | | | | | | | | | | | | | |
| 125 | | | | | | | | | | | | | | |
| 130 | | | | | | | | | | | | | | |
| 135 | | | | | | | | | | | | | | |
| 140 | | | | | | | | | | | | | | |
| 145 | | | | | | | | | | | | | | |
| 150 | | | | | | | | | | | | | | |
| 155 | | | | | | | | | | | | | | |
| 160 | | | | | | | | | | | | | | |

**Appendix Table 1(a).** Age/length key, fork length (cm) composition in percent, of cobia females from North and South Carolina, by age group.

| Length (cm) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carolina Females | | | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | | | |
| 65 | | | | | | | | | | | | | | |
| 70 | | | | | | | | | | | | | | |
| 75 | | | | | | | | | | | | | | |
| 80 | | | | | | | | | | | | | | |
| 85 | | | | | | | | | | | | | | |
| 90 | | | 100.0 | | | | | | | | | | | |
| 95 | | | 50.0 | | | | 50.0 | | | | | | | |
| 100 | | | | | 66.7 | 33.3 | | | | | | | | |
| 105 | | | | | 25.0 | 50.0 | 25.0 | | | | | | | |
| 110 | | | | 25.0 | | 25.0 | 25.0 | | | 25.0 | | | | |
| 115 | | | | | | 20.0 | 30.0 | 10.0 | 20.0 | 20.0 | | | | |
| 120 | | | | | | | | 50.0 | | 50.0 | | | | |
| 125 | | | | | | | | 66.7 | 33.3 | | | | | |
| 130 | | | | | | | | | 50.0 | 16.7 | | 16.7 | | 16.7 |
| 135 | | | | | | | | | | | | 100.0 | | |
| 140 | | | | | | | | | | | | | | |
| 145 | | | | | | | | | | | | | | |
| 150 | | | | | | | | | | | | | | |
| 155 | | | | | | | | | | | | | | |
| 160 | | | | | | | | | | | | | | |

**Appendix Table 1(b).** Age length key, fork length (cm) composition in percent, of cobia males from North and South Carolina, by age group.

| Length (cm) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carolina Males | | | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | | | |
| 65 | | | | | | | | | | | | | | |
| 70 | | | | | | | | | | | | | | |
| 75 | | | | | | | | | | | | | | |
| 80 | | | 100.0 | | | | | | | | | | | |
| 85 | | | 50.0 | 50.0 | | | | | | | | | | |
| 90 | | | | 66.7 | | | 33.3 | | | | | | | |
| 95 | | | | 40.0 | | 20.0 | 20.0 | | 20.0 | | | | | |
| 100 | | | | 20.0 | | 20.0 | 40.0 | 20.0 | | | | | | |
| 105 | | | | | | | | 50.0 | | 50.0 | | | | |
| 110 | | | | | | | 100.0 | | | | | | | |
| 115 | | | | | | | | | | | | | | |
| 120 | | | | | | | | | | | | | | |
| 125 | | | | | | | | | | | | | | |
| 130 | | | | | | | | | | | | | | |
| 135 | | | | | | | | | | | | | | |
| 140 | | | | | | | | | | | | | | |
| 145 | | | | | | | | | | | | | | |
| 150 | | | | | | | | | | | | | | |
| 155 | | | | | | | | | | | | | | |
| 160 | | | | | | | | | | | | | | |

**Appendix Table 2(a).** Age length key, fork length (cm) composition in percent, of cobia females from the Florida east coast, by age group.

| Length (cm) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FL Atlantic Females | | | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | | | |
| 65 | | | | | | | | | | | | | | |
| 70 | | | | | | | | | | | | | | |
| 75 | | | | | | | | | | | | | | |
| 80 | | | 100.0 | | | | | | | | | | | |
| 85 | | | 33.3 | 33.3 | 33.3 | | | | | | | | | |
| 90 | | | 81.8 | 18.2 | | | | | | | | | | |
| 95 | | | 70.0 | 30.0 | | | | | | | | | | |
| 100 | | | 16.7 | 33.3 | 33.3 | 16.7 | | | | | | | | |
| 105 | | | 40.0 | 20.0 | 20.0 | 20.0 | | | | | | | | |
| 110 | | | | 16.7 | 16.7 | 50.0 | | 16.7 | | | | | | |
| 115 | | | | 100.0 | | | | | | | | | | |
| 120 | | | | | | 50.0 | 50.0 | | | | | | | |
| 125 | | | | | | | | 100.0 | | | | | | |
| 130 | | | | | | | | | | | | | | |
| 135 | | | | | | | | | | | | | | |
| 140 | | | | | | | | | | | | | | |
| 145 | | | | | | | | | | | | | | |
| 150 | | | | | | | | | | | | | | |
| 155 | | | | | | | | | | | | | | |
| 160 | | | | | | | | | | | | | | |

**Appendix Table 2(b).** Age length key, fork length (cm) composition in percent, of cobia males from the Florida east coast, by age group.

| Length (cm) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FL Atlantic Males | | | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | | | |
| 65 | | | | | | | | | | | | | | |
| 70 | | | | | | | | | | | | | | |
| 75 | | | | | | | | | | | | | | |
| 80 | | 33.3 | 33.3 | | 33.3 | | | | | | | | | |
| 85 | | | 75.0 | 25.0 | | | | | | | | | | |
| 90 | | | 25.0 | 37.5 | 12.5 | | 25.0 | | | | | | | |
| 95 | | | | | 50.0 | 50.0 | | | | | | | | |
| 100 | | | | 50.0 | | 50.0 | | | | | | | | |
| 105 | | | | 33.3 | | | 33.3 | | 33.3 | | | | | |
| 110 | | | | | | | 50.0 | 50.0 | | | | | | |
| 115 | | | | | | | | | | | | | | |
| 120 | | | | | | | | | | | | | | |
| 125 | | | | | | | | | | | | | | |
| 130 | | | | | | | | | | | | | | |
| 135 | | | | | | | | | | | | | | |
| 140 | | | | | | | | | | | | | | |
| 145 | | | | | | | | | | | | | | |
| 150 | | | | | | | | | | | | | | |
| 155 | | | | | | | | | | | | | | |
| 160 | | | | | | | | | | | | | | |

**Appendix Table 3(a).** Age length key, fork length (cm) composition in percent, of cobia females from the Florida west coast, by age group.

| Length (cm) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FL Gulf Females | | | | | | | | | | | | | | |
| 35 | 33.3 | | 66.7 | | | | | | | | | | | |
| 40 | 100.0 | | | | | | | | | | | | | |
| 45 | 100.0 | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | |
| 55 | | 100.0 | | | | | | | | | | | | |
| 60 | | 100.0 | | | | | | | | | | | | |
| 65 | | 50.0 | 50.0 | | | | | | | | | | | |
| 70 | | 20.0 | 80.0 | | | | | | | | | | | |
| 75 | | 66.7 | 33.3 | | | | | | | | | | | |
| 80 | | 42.9 | 28.6 | 28.6 | | | | | | | | | | |
| 85 | | 5.3 | 94.7 | | | | | | | | | | | |
| 90 | | | 42.9 | 57.1 | | | | | | | | | | |
| 95 | | | 60.0 | 40.0 | | | | | | | | | | |
| 100 | | | 57.1 | 42.9 | | | | | | | | | | |
| 105 | | | 50.0 | 50.0 | | | | | | | | | | |
| 110 | | | | 100.0 | | | | | | | | | | |
| 115 | | | | | 50.0 | 50.0 | | | | | | | | |
| 120 | | | | | | 100.0 | | | | | | | | |
| 125 | | | | | | | | | | | | | | |
| 130 | | | | | | | | | | | | | | |
| 135 | | | | | | | | | | | | | | |
| 140 | | | | | | | | | | | | | | |
| 145 | | | | | | | | | | | | | | |
| 150 | | | | | | | | | | | | | | |
| 155 | | | | | | | | | | | | | | |
| 160 | | | | | | | | | | | | | | |

**Appendix Table 3(b).** Age length key, fork length (cm) composition in percent, of cobia males from the Florida west coast, by age group.

| Length (cm) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FL Gulf Males** | | | | | | | | | | | | | | |
| 35 | 50.0 | 50.0 | | | | | | | | | | | | |
| 40 | 100.0 | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 50 | | 100.0 | | | | | | | | | | | | |
| 55 | | 100.0 | | | | | | | | | | | | |
| 60 | | 100.0 | | | | | | | | | | | | |
| 65 | | 25.0 | 75.0 | | | | | | | | | | | |
| 70 | | | 100.0 | | | | | | | | | | | |
| 75 | | | | | | | | | | | | | | |
| 80 | | | 80.0 | 10.0 | 10.0 | | | | | | | | | |
| 85 | | | 36.4 | 45.5 | 9.1 | 9.1 | | | | | | | | |
| 90 | | | | 50.0 | 50.0 | | | | | | | | | |
| 95 | | | | | | | | | | | | | | |
| 100 | | | | | | | | | | | | | | |
| 105 | | | | | | | | | | | | | | |
| 110 | | | | | | 100.0 | | | | | | | | |
| 115 | | | | | | | | | | | | | | |
| 120 | | | | | | | | | | | | | | |
| 125 | | | | | | | | | | 100.0 | | | | |
| 130 | | | | | | | | | | | | | | |
| 135 | | | | | | | | | | | | | | |
| 140 | | | | | | | | | | | | | | |
| 145 | | | | | | | | | | | | | | |
| 150 | | | | | | | | | | | | | | |
| 155 | | | | | | | | | | | | | | |
| 160 | | | | | | | | | | | | | | |