

Report to Virginia Marine Resources Commission

Grant F-132-R-1 The Population Dynamics of Blueline and Golden Tilefish, Snowy and Warsaw Grouper and Wreckfish.

Performance Period 05/01/2010-11/30/2011

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The objective of this project are: 1) examine the age composition of the various grouper, wreckfish and tilefish species found off the coast of Virginia, 2) estimate their annual growth rates, 3) estimate annual fishing and natural mortality rates, and 4) evaluate their reproductive characteristics. To accomplish these objectives we have performed the following tasks:

Collections:

Because these species are difficult to obtain we undertook both fishery-dependent and fishery-independent collections. For fishery-dependent collections we notified the public that we sought specimens obtained from recreational fishing that could be donated to VMRC through their Marine Sportfish Collection Program. Summary of donated specimens is listed in Table 1.

| Fish Caught via Fishery Dependent and Independent Sampling | | |
|--|--------------|------------|
| Species | Donated Fish | ODU Caught |
| Blueline Tilefish | 821 | 245 |
| Golden Tilefish | 30 | 6 |
| Snowy Grouper | 15 | 0 |
| Wreckfish | 11 | 22 |

Table 1. Number by species of fish collected through fishery-dependent and fishery-independent sampling.

We also worked with agents at fishing cleaning stations to obtain carcasses. Because we are interested in the reproductive biology of these species, we also undertook 19 collection trips on private and charter vessels using hook and line gear. The summary of fishery independent trip collections is listed in Table 2.

| Year | Fishery Independent Sampling Trip Dates |
|-------------|---|
| 2010 | 6/14, 7/8, 7/29, 8/12, 8/26, 11/20 (Total:6) |
| 2011 | 1/25, 4/14, 6/4, 7/7, 7/10, 7/28, 7/30, 9/3, 10/9, 11/19, 11/26, 12/19 (Total:12) |
| 2012 | 1/16 |
| Total Trips | 19 |

Table 2. List of Fishery Independent Sampling Trips.

Otolith Processing:

For the processing of otoliths, CQFE staff was trained at the Ageing Laboratory at the South Carolina Department of Natural Resources, Marine Resources Research Institute, during the week of August 15th, 2011. The protocols for obtaining otolith thin sections were identical to those already being used at CQFE. Training included methods of obtaining otolith thin sections. CQFE personnel compared otolith thin sections made in the Norfolk laboratory using various techniques to enhance readability with those sample prepared by personnel from South Carolina.

Both sagittal otoliths were extracted from all collection specimens and processed following these protocols. The number of otoliths processed is listed in Table 3.

Table 3. List of Otolith Sample by Month of Capture

Blueline Tilefish Otoliths

| Month | # Otolith Samples |
|-----------|-------------------|
| January | 149 |
| February | 0 |
| March | 7 |
| April | 8 |
| May | 20 |
| June | 106 |
| July | 218 |
| August | 304 |
| September | 17 |
| October | 69 |
| November | 69 |
| December | 99 |
| Total | 1066 |

Golden Tilefish Otoliths

| Month | # Otolith Samples |
|-----------|-------------------|
| January | 4 |
| February | 0 |
| March | 0 |
| April | 2 |
| May | 4 |
| June | 10 |
| July | 3 |
| August | 9 |
| September | 0 |
| October | 3 |
| November | 1 |
| December | 0 |
| Total | 36 |

Snowy Grouper Otoliths

| Month | # Otolith Samples |
|-----------|-------------------|
| January | 0 |
| February | 0 |
| March | 1 |
| April | 2 |
| May | 3 |
| June | 0 |
| July | 6 |
| August | 2 |
| September | 0 |
| October | 1 |
| November | 0 |
| December | 0 |
| Total | 15 |

Wreckfish Otoliths

| Month | # Otolith Samples |
|-----------|-------------------|
| January | 0 |
| February | 0 |
| March | 0 |
| April | 4 |
| May | 1 |
| June | 7 |
| July | 1 |
| August | 1 |
| September | 6 |
| October | 13 |
| November | 0 |
| December | 0 |
| Total | 33 |

Gonad Processing:

Fresh gonads were obtained from fishery-independent sampling and processed on board. For all species collected, gonads will be preserved in 10% buffered formalin. The number of specimens processed is listed in Table 4. These gonads are being processed for staining and for sectioning. We anticipate that this task will be complete by June 2012. Sufficient samples have been obtained from blueline tilefish to obtain spawning season.

Table 4. List of Gonad Samples by month

Blueline Tilefish Gonads

| Month | # Gonad Samples |
|-----------|--------------------|
| January | 46 (34 M, 12 F) |
| February | 0 |
| March | 0 |
| April | 5 (2 M, 3 F) |
| May | 4 (4 F) |
| June | 12 (12 F) |
| July | 68 (21 M, 47 F) |
| August | 27 (27 F) |
| September | 7 (2 M, 5 F) |
| October | 3 (2 M, 1 F) |
| November | 27 (14 M, 13 F) |
| December | 46 (38 M, 8 F) |
| Total | 245 (113 M, 132 F) |

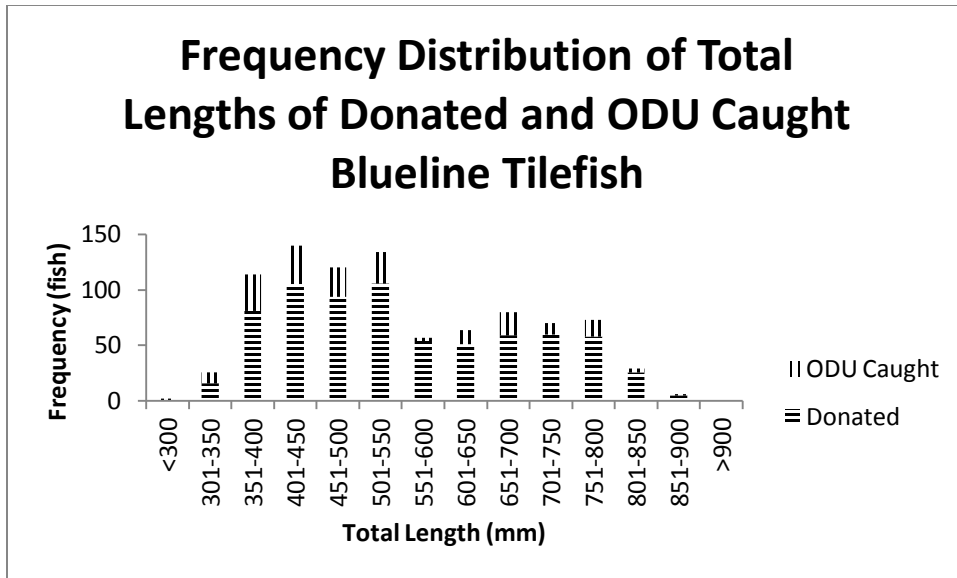
Otolith Ageing:

The Marine Resources Research Institute uses the protocols developed by the Southeast Fisheries Science Center Age and Growth Laboratory in Beaufort, NC (NMFS-Beaufort Ageing Lab) for ageing these species. Previously, all grouper, wreckfish and tilefish otolith specimens collected by the VMRC were sent to the NMFS-Beaufort Ageing Lab for the determination of ages. Hence, during our training session, CQFE staff were trained to age using the NMFS protocols. Moreover, CQFE staff were also given a reference sample of otolith sections that they aged subsequent to their return. Additionally, a sample of 100 otoliths that were aged by CQFE personnel were sent to the Marine Research Institute to verify our ageing.

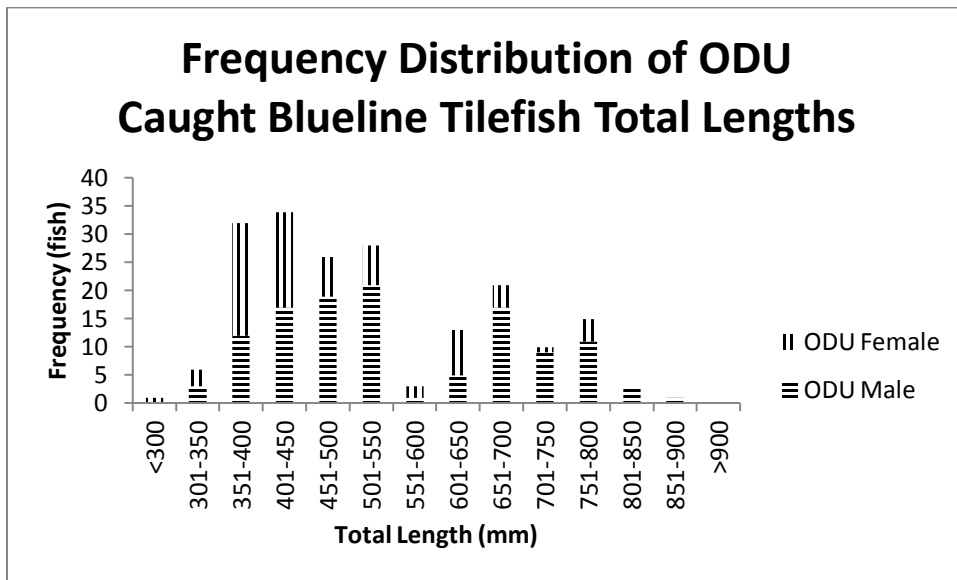
Blueline Tilefish Preliminary Results

As anticipated, we have obtained sufficient specimens of this species to proceed with preliminary analysis to including marginal increment analysis, ageing technique verification, age and size frequency distributions and growth analyses.

One of our concerns was that we would be able to obtain a broad distribution of sizes. The graph shown below indicates that our sampled sizes range from 289 to 884 mm with a mean of 549 mm total length.

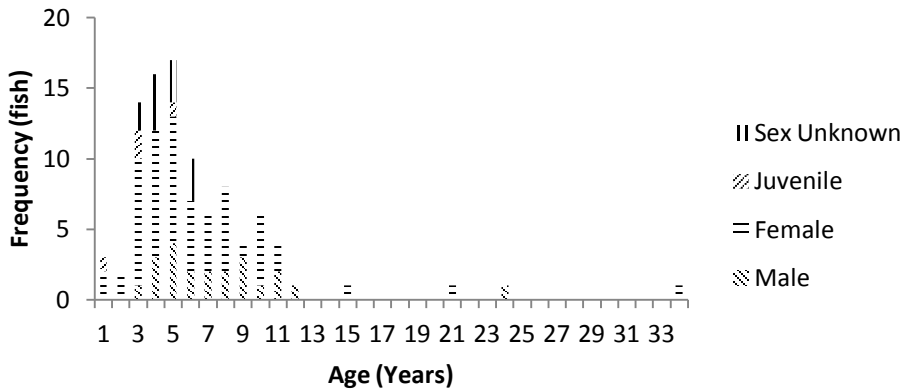


For those fish obtained by fishery-independent sampling, we were able to closely approximate the range of fish caught in the recreational fishery for both males and females, as shown in the figure below.



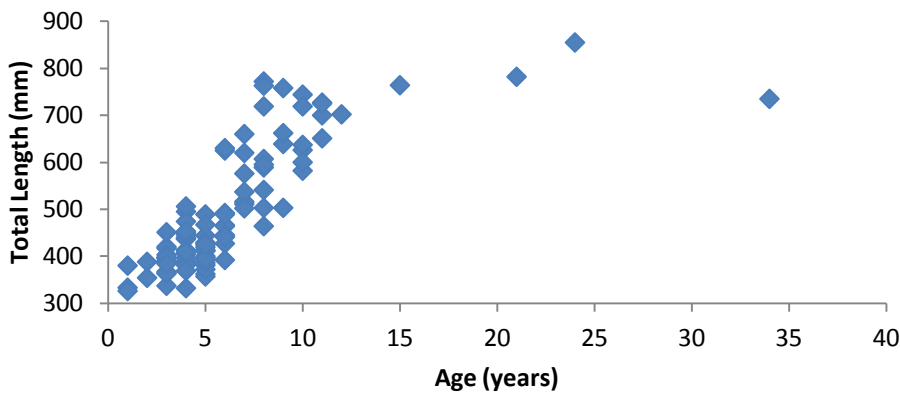
The age frequency ranges from 1 to 34 years old with a mean age of 6.38, shown in the graph below. Whereas the length frequencies show a slight bimodality, this is not observed in the age frequency distributions.

Blueline Tilefish Preliminary Age Frequency Distribution

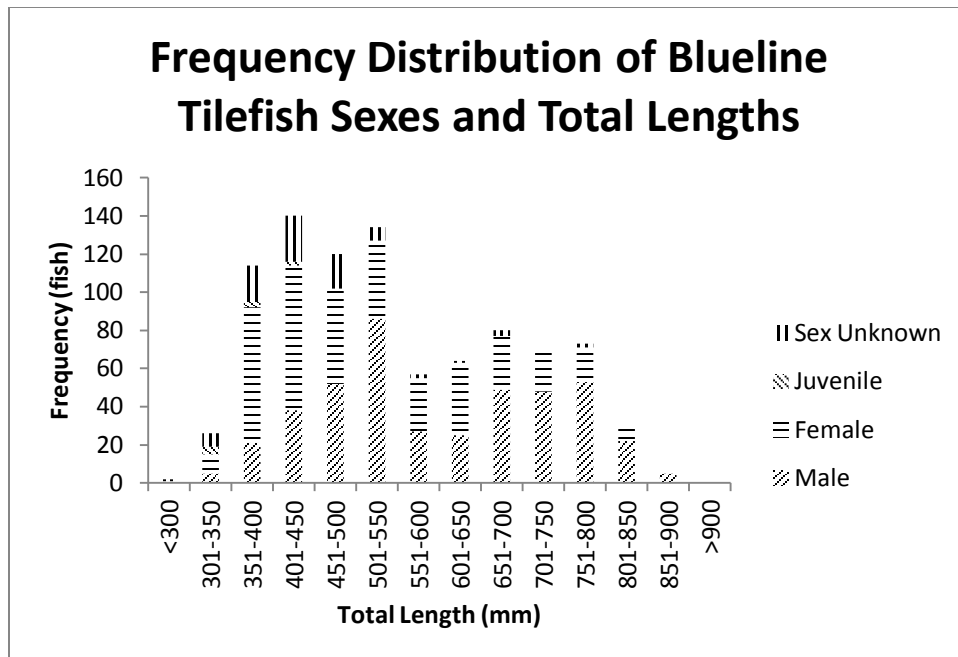


Preliminary size at age estimates indicates that growth may become asymptotic after age 15 at about 800 mm on the graph below. However, because of the paucity of data in ages >15 years, more old specimens will need to be obtained before a definitive growth curve can be fit. We will target larger fish in the next year of sampling to obtain this age and size data, if possible.

Blueline Tilefish Length at Preliminary Age



Reproductive staging was obtained by macroscopic examination of gonads. Microscopic examination will be done once tissue samples are processed. In the graph below we show the distribution of size by sex.



Communicating with the Angling Community

We use the CQFE website (www.odu.edu/fish) to make all our data available to anglers who donate fish carcasses and who are interested in this project. Additionally we are developing species reports especially designed for the public. See attached example for Golden Tilefish.

Priorities for next collection season

We have collected over 1,000 blueline tilefish specimens. Fishery-independent sampling provided 245 gonad samples. This is a sufficient sample size for analysis of reproductive season, spawning model, and fecundity. We also have sufficient samples to validate annulus formation with marginal increment analyses. Despite this intensive sampling, we saw few older, larger fish and will endeavor to collect these specimens through donations or the commercial fishery, if possible. We will complete ageing, age validation, growth curve analyses, and reproductive analysis this year.

Our next priority is to increase the collection of golden tilefish and wreckfish through specifically targeted private vessels equipped to sample further offshore in deeper waters where these fish reside. We will supplement collections with donations and from the commercial fishery, if available.

CQFE RESEARCH SPECIES

GOLDEN TILEFISH (*Lopholatilus chamaeleonticeps*) Goode & Bean, 1879

Class: Actinopterygii (ray-finned fishes)
Order: Perciformes (perch-like fishes)
Family: Malacanthidae (tilefishes) (“manythorns”)
Subfamily: Latilinae
Genus: *Lopholatilus*
Species: *chamaeleonticeps*

“The tilefish was unknown until May 1879, when Captain William H. Kerby of the schooner William V. Hutchins caught the first specimen south of Nantucket Lightship in 150 fathoms of water while working cod lines. When his crew found that the plentiful fishes made a tasty meal, some of the specimens were salted down and taken to Gloucester where a portion of the catch was smoked. This discovery started a new and productive tilefish commercial fishery for the surrounding area.

A specimen of this unknown fish was sent to the U.S. National Museum where it was declared a new species belonging to a tropical family inhabiting the Gulf of Mexico. It was given the name of *Lopholatilus chamaeleonticeps*, which means “the crested tilus with a head like a chameleon.” Fishermen understandably shortened its name to tilefish. Increased catches of this new fish prompted the U.S. Bureau of Fisheries to send research vessels and scientists to study the habits and habitat of the tilefish. What they discovered was that the tilefish occupied a very specific part of the ocean—a narrow band of real estate along the outer edge of the continental shelf where the sea floor is bathed by warm water from the Gulf Stream. The temperature of the water here ranges from 47 - 50 degrees F., with little variation from season to season. As far as is known, the tilefish never leaves this limited strip of the coast to venture into the cooler water of the landward shoals or the frigid depths of the Atlantic abyss.

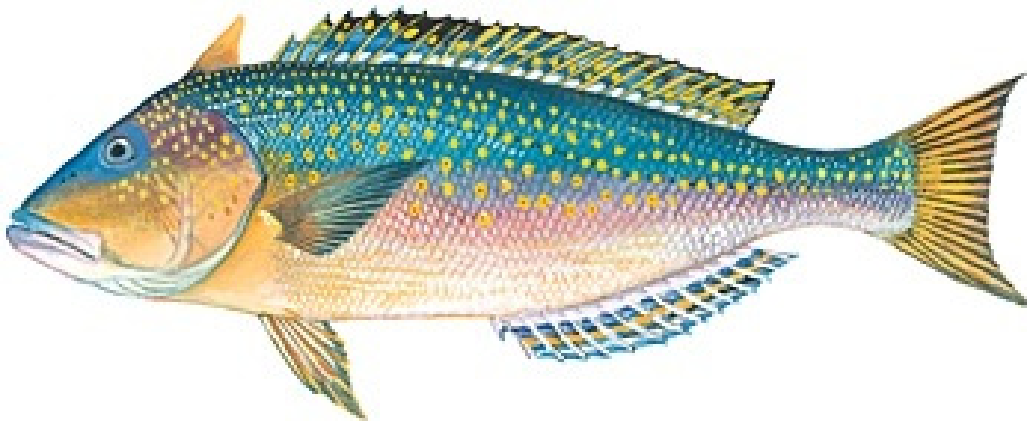
It appears that it was this inability to tolerate changes in its environment that brought near-annihilation to the tilefish just three years after its discovery due to an apparent Easterly shift in the flow of the Gulf Stream. On March 3, 1882, Captain Lawrence of the bark Plymouth sailing from Nova Scotia to New York reported sailing from six o'clock in the morning until five o'clock in the evening through 69 miles of dead and floating tilefish. One week later the brig Rachel Cooney sighted the dead fishes 75 miles south-southwest of the lightship on the south shoal of Nantucket, and sailed through dead

tilefish for 40 miles. Other ships in the area reported, “Dead and dying fish as far as the eye could see.

Tabulating all of the accounts, the Bureau of Fisheries found the range of destruction to extend over an area 170 miles long and 26 miles wide, covering at least 4000 square miles. It was estimated that almost 1.5 billion tilefish perished in the incident.

Scientists offered this explanation: tilefish are bottom dwellers in about 100 fathoms of water. In 1882, the Gulf Stream, near the edge of which the tilefish live, moved farther out to sea, leaving them in cold water. They could not follow the shifting stream, as the bottom of the ocean drops off abruptly near the 100-fathom line. Consequently, almost the entire population, unable to remain in Gulf Stream water, was killed.

For ten years tilefish were completely absent from the decks of New England fishing boats, and it was thought that the species had gone extinct. Then, in 1892 they were found again. Slowly the number of landings increased, and in the period from July 1915 to July 1918, 11.5 million pounds of tilefish were commercially landed. The tilefish has been doing relatively well in its delicately balanced, watery niche ever since; but no one can predict when a wandering Gulf Stream will wreak havoc upon the golden tilefish again.”



PHYSICAL DESCRIPTION

The golden tilefish is easily distinguishable from other members of the family Malacanthidae by the large adipose flap, or crest, on the head.

The species is blue-green and iridescent on the back, with numerous spots of bright yellow and gold. The belly is white and the head is rosy, with blue under the eyes. The pectoral fins are sepia-colored, and the margin of the anal fin is purplish-blue.

“The tilefish has a fleshy, finlike flap on the nape of the neck in front of the dorsal fin, close behind the eye. The tilefish’s large head is strongly convex when viewed from above but nearly flat in profile from below. Both of its jaws are armed with an outer row of large conical teeth and inner rows of smaller teeth. The trunk (moderately flattened sidewise) is deepest close behind the head, tapering backward to the tail. The dorsal fin extends back from above the gill opening almost to the base of the tail fin, with the anal fin about half as long as the dorsal fin.

Tilefish average between 15 and 25 pounds and are generally found 2 to 4 ft. long. Larger individuals near 50 pounds have been reported. A New Jersey state record golden tilefish was recently caught at Tom’s Canyon on September 9, 2008 by Keith Karl, a recreational angler from Brick Township, NJ who caught a 55 pound, 4 ounce golden tilefish..”



RANGE

“Tilefish have been found from Nova Scotia down to the Gulf of Mexico. They are found in waters from 250-1,500 feet deep, where bottom temperatures range from 49° to 58° F., Due to their stringent ecological habitat requirements for water depth, fine or semi-consolidated sediment substrate for constructing and supporting their burrows, and narrow temperature range tolerances, their distribution throughout this range may be discontinuous and generally concentrated around the edges and slopes of submarine canyons adjacent to the outer continental shelf. They are absent from the Caribbean. A closely related species (*Lopholatilus villarii*), occurs in the South Atlantic from Brazil to Argentina; and their range does not overlap with their Northern cousin. Two distinct stocks of golden tilefish (*L. chamaeleonticeps*) are recognized from observed morphological differences. The Northern stock is distributed south to Cape Hatteras, and the southern stock, possessing smaller individuals, occurs from south of Cape Hatteras to at least the Yucatan peninsula.”

DIET

Tilefish feed during the day on the bottom, predominately upon bottom-dwelling invertebrates such as crabs, and lobsters. The list of possible prey items also includes: squid, shrimp, shelled mollusks, annelid worms, sea urchins, sea cucumbers, and sea anemones. They occasionally catch other fish.

ENVIRONMENT

“The depth range of the tilefish off the Atlantic coast is a very narrow one, with none ever being taken shallower than about 45 fathoms (270 feet) and very few ever being encountered much deeper than 100 fathoms.(600 feet) The deepest recorded tilefish was observed at a depth of 170 fathoms, (1020 feet) and with the best fishing reliably being found at 60-90 fathoms (360-540 feet).

The temperature range that tilefish will tolerate is very narrow also, with the temperature of the bottom water along the areas it inhabits varying between about 47°F and about 53°F in most years, summer or winter. The tilefish appears to be very vulnerable to chilling, this having been the probable cause of the mass destruction described above. It is not known whether the tilefish is equally sensitive to high temperatures. In any case it could escape such by descending to a greater depth.

Tilefish are shelter-seeking fish (presumably to avoid predators), and adults have been observed using rocks, ledges, and shipwrecks, along with horizontal and vertical burrows in the clay and silt substrates (with these colonial structures commonly referred to as “pueblo” dwellings) of the upper slopes and flanks of offshore submarine canyons such as Hudson Canyon. Fisheries biologist Churchill Grimes estimated in 1986 that tilefish burrow density near the Hudson Canyon was at about 2,500 burrows/km².

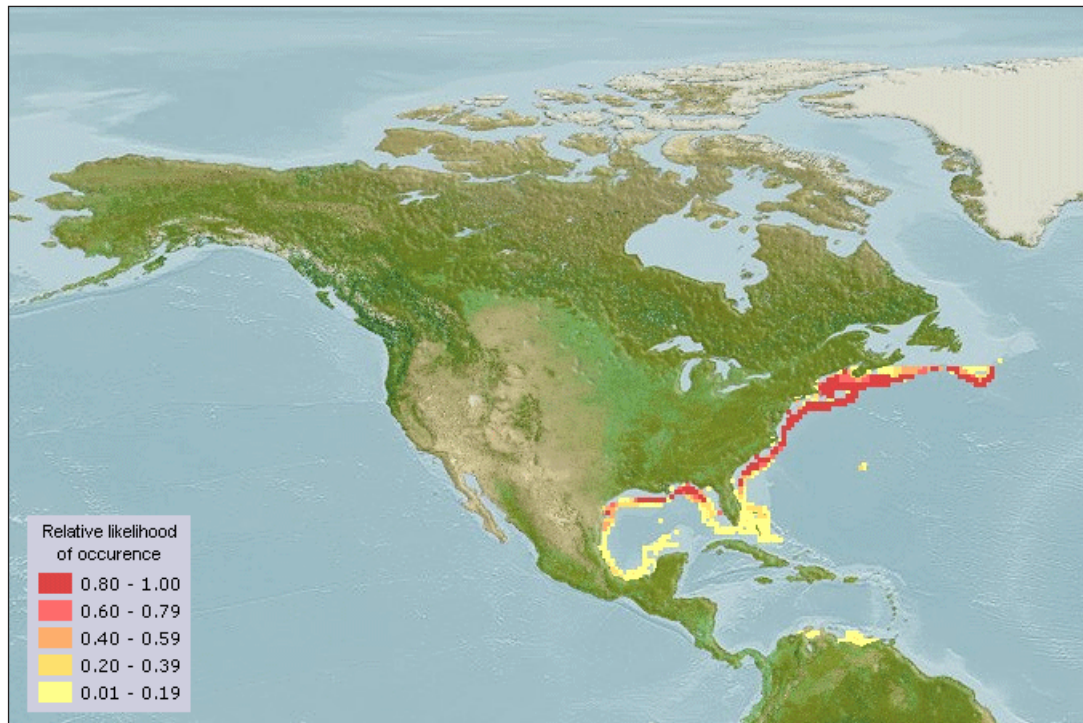
Ichthyologist Dr. Ken Able hypothesized that tilefish are important modifiers or creators of habitat on the outer continental shelf. The irregular hummocky topography, observed on deep-dive explorations that extending for miles on either side of the Hudson Canyon, is thought to be the product of tilefish burrowing activity and integral to the unique ecology of the area., thus classifying the tilefish as a keystone species within its ecological niche. Tilefish live in burrows which may be as large as 15 feet across, and may sometimes congregate in pods or small groups at depths ranging from 200 to more than 1,400 feet. As tilefish become larger they tend to live at greater depths. They do not school, but group in clusters near the heads and sides of submarine canyons along the outer continental shelf.”

REPRODUCTION

“Golden tilefish are relatively slow growing and long-lived with a maximum observed age and length for females of 46 years and 43.3 in., and 39 years and 44.1 in. for males. At lengths exceeding 27.6 inches, the predorsal adipose flap, characteristic of the species, is larger in males and can be used to distinguish the sexes. Golden tilefish of both sexes are mature at ages of 5 to 7 years. Females are smaller than males and sexual maturity is reached when fish are about 27 inches long and weigh about 9 pounds. Spawning occurs from March to September, and females lay from 2 to 8 million pelagic eggs.”

Based on mathematical model estimation, golden tilefish have a low to minimum population doubling time of 4.5 - 14 years ($K=0.09-0.13$; $t_m=5$; $t_{max}=35$; $Fec=195,000$). The Monter Bay Aquarium Sea Food Watch states that golden tilefish populations in the Mid-Atlantic are beginning to recover from being over fished while other populations remain in trouble

The Environmental Defense Fund has issued a health advisory for tilefish due to high levels of mercury found in tested specimens.



Golden tilefish Range

FISHERY MANAGEMENT

Tilefish are managed by the South Atlantic Fishery Management Council. The SAFMC South Atlantic Federal Regulations (For areas three-200 miles off the coasts of NC, SC, GA, and East Florida).

Commercial and Recreational:

- Vertical hook-and-line including hand-held hook-and-line and bandit gear.
- Spearfishing gear without rebreathers.
- Powerheads, except where expressly prohibited in Special.
- Management Zones (SMZs). In addition, the use of explosive charges, including powerheads, are prohibited in the Exclusive Economic Zone (EEZ) off South Carolina.

Commercial:

- Limited access permit required.
- Gear restrictions apply.
- Annual commercial quota - 295,000 pounds gutted weight (gw).
- Effective January 31, 2011, the commercial Annual Catch Limit (quota) for golden tilefish is 282,819 pounds (gw) as approved in Amendment 17B.
- Commercial trip limit - 4,000 pounds gw. The trip limit will decrease to 300 lbs. gw if 75% of the quota is taken on or before September 1.
- Bottom longline, only in depths 50 fathoms or more and only north of St. Lucie Inlet, Florida. Vessels with longline gear onboard may only possess snowy grouper, one warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, blue-line tilefish and sand tilefish. No other snapper grouper species may be possessed or harvested.
- Black sea bass pots except in SMZs and only north of Cape Canaveral, Florida Vehicle Assembly Building-28° , 35.1° N. latitude.
- Sink net fishermen (North Carolina only) can make multi-gear trips and all legal snapper and grouper harvested with black sea bass pots and/or vertical hook-and-line gear may be retained.
- Experimental gear on limited basis, provided that a process is implemented.

Recreational:

- Included in the 3-grouper per person bag limit. A limit of one per person within the 3-grouper per person aggregate bag limit.
- Effective January 31, 2011, the recreational Annual Catch Limit (quota) for golden tilefish is 1,578 fish based on an allocation of 97% commercial and 3% recreational as approved in Amendment 17B.
- Gear restrictions apply.
- Recreational Sector Temporarily Closed to Fishing Golden Tilefish, effective October 6, 2011.

REFERENCES

- “Species Spotlight: Golden tilefish (*Lopholatilus chamaeleonticeps*)”, American Littoral Society.
- “Fishes of the Gulf of Maine”, Fishery Bulletin 74, Vol. 53 1953, Henry Bigelow and William Schroeder.
- “The Secret Lives Of Fishes” , 1977 Grosset and Dunlap publishers, New York, NY, Bernard Ludwig Gordon.
- “Essential Fish Habitat Document: Tilefish, *Lopholatilus chamaeleonticeps*, Life History and Habitat Characteristics”. Sept 1999 NOAA U.S. Dept. of Commerce, Steimle, F., et.al.
- NOAA Technical Memorandum NMFS-NE-152.