Summary of the 2015 blueline tilefish cooperative-with-industry data collection project

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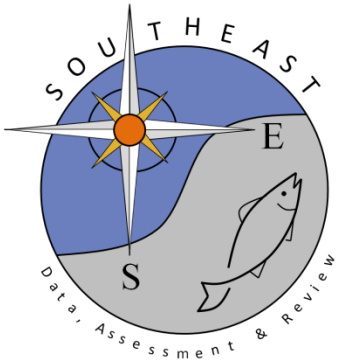

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Background

In 2015, NMFS-SEFSC received funds from the NMFS Office of Science and Technology to support survey-related efforts targeting the southeast U.S. Atlantic Ocean (SEUS) deepwater demersal species complex. Additionally, in April 2015, the SEFSC-Beaufort Laboratory coordinated and hosted a workshop, funded through the NMFS Cooperative Research Program, to determine optimal approaches for surveying the SEUS deepwater species complex. The workshop was attended by fishermen, stock assessment scientists and survey scientists with relevant experience and expertise. The resulting workshop report, published as a NOAA Technical Memorandum (Carmichael et al. 2016), included recommendations on gears that could be used to most effectively survey species within the deepwater species complex, including blueline (gray) tilefish (*Caulolatilus microps*).

Given the benchmark stock assessment planned for blueline tilefish in 2016, and related data needs, as well as the availability of sampling recommendations generated from the deepwater survey workshop, the SEFSC opted to focus use of the deepwater survey funds on blueline tilefish, with the following objectives:

1) Provision of blueline tilefish life-history data for use in the planned 2016 blueline tilefish stock assessment;
2) Provision of tissue samples for a planned blueline tilefish genetics study (J. McDowell, Virginia Institute of Marine Sciences, PI); and
3) Demonstrating a cooperative survey approach that could be utilized for subsequent deepwater survey efforts.

Methods

Survey approach

Given the advantages of working cooperatively with industry (e.g., availability of industry participants with expertise targeting blueline tilefish), and the challenges and costs of performing the sampling from scientific vessels (e.g., identifying and procuring a survey vessel

and identifying or hiring available scientific personnel), a cooperative-with-industry approach was utilized, in which cooperating fishermen conducted sampling by following (generally) standardized protocols (see below) and data and biological samples were collected by a trained NMFS-Southeast Fisheries Science Center (SEFSC) fishery observer. Cooperating fishermen were contracted by the Atlantic States Marine Fisheries Commission (ASMFC), using funds transferred to ASMFC from NMFS-SEFSC.

Survey design, gears utilized and sampling effort:
Given that one of the project objectives was to provide tissue samples for the planned blueline tilefish genetics study, and given related questions about blueline tilefish population connectivity along the U.S. east coast, sampling was planned to occur at or near the northern (NY/NJ) and southern (FL Keys) ends of the blueline tilefish U.S. east coast range. Given funding limitations, it was not feasible for sampling to occur throughout the blueline tilefish range. Thus, in addition to the northern and southern ends of the range, sampling was directed to occur in areas off VA, NC and SC (Table 1) characterized by relatively high recent blueline tilefish landings.

Table 1: Planned sampling effort (number of sampling days) by latitudinal and depth zone. * = see "variation of Standardized Protocols" section.

	Depth zone (feet)		
Latitudinal zone	**250-500**	**500-750**	**> 750**
Hudson Canyon	*	*	*
~ Norfolk Canyon to NC-VA line	4	3	2
NC-VA line to Cape Hatteras	4	3	2
Cape Hatteras to Cape Lookout (Raleigh Bay)	4	3	2
Cape Lookout to Cape Fear (Onslow Bay)	3	2	1
SC	4	3	2
FL Keys	4	3	2

Sampling within each latitudinal zone was stratified into three depth zones [250-500 feet (~ 75-150m), 500-750 feet (~ 150 – 225m), and > 750 feet (> ~ 225m); Table 1]. The greatest proportions of blueline tilefish were expected to occur in the shallower two depth zones. The deepest depth zone was included as an exploratory zone (depths at which blueline tilefish are not typically targeted) to assess the potential occurrence of a cryptic blueline tilefish biomass in those depths.

Blueline tilefish utilize both unstructured habitats (mud / sand / shell) and mixed hardbottom / softbottom sites, the latter of which may be characterized by moderate to high hardbottom

relief (Carmichael et al. 2016). Fishermen recommended sampling the unstructured habitat with long-bottom longline gear, and the mixed habitat with short-bottom longline or vertical hook and line gear (Carmichael et al. 2016). Given that the distribution of unstructured versus mixed habitats varies spatially (including with depth) in waters along the U.S. east coast, and given the limited knowledge of habitat distributions in those waters, it was not possible to predetermine gear-specific sampling effort in each of the latitudinal zone x depth strata cells. Instead, cooperating fishermen were directed to deploy gears based on the availability of both habitat types within each cell.

Site selection

A single cooperating fisherman (with supporting crew and a NMFS-SEFSC observer or SEFSC-Beaufort personnel) sampled within each latitudinal zone x depth cell (Table 2). The location and distribution of sampling sites within each cell was determined by the fisherman, with objectives of (1) maximizing the likelihood of catching blueline tilefish and (2) distributing sampling effort over a relatively broad area (i.e., sampling locations should not be clustered in space). Thus, it is likely that sampling generally did not target "marginal" habitats assumed by the fishermen to be less likely to result in blueline tilefish catch. Fishermen were advised not to "clump" sampling sites, with a general rule of maintaining a distance of at least 200 meters between sampling locations.

Table 2: Distribution of sampling effort by commercial fishermen, with each number representing a different fisherman. * = see "variation of Standardized Protocols" section.

	Depth zone (feet)		
Latitudinal zone	**250-500**	**500-750**	**> 750**
Hudson Canyon	1*	1*	1*
~ Norfolk Canyon to NC-VA line	2	3	4
NC-VA line to Cape Hatteras	3	4	2
Cape Hatteras to Cape Lookout (Raleigh Bay)	4	2	3
Cape Lookout to Cape Fear (Onslow Bay)	5	5	5
SC	6	6	6
FL Keys	7	7	7

Gear specifications and use

Three gears were utilized: long-bottom longline (LBLL), short-bottom longline (SBLL), and vertical hook and line (VHL).

- The LBLL gear consisted of a one-mile monofilament or cable mainline (500-700 lb test) equipped with 100 evenly spaced gangions. Gangion length was allowed to be determined by each cooperating fisherman; a two-foot length was recommended.

Weights were attached to both ends of the mainline to anchor the gear, and the mainline was attached to a surface buoy to mark the location of the gear.
- The SBLL gear consisted of a 90-foot monofilament mainline (800-lb test) with two-foot gangions (200 lb test) spaced every three feet. Multiple SBLL deployments were allowed to be set sequentially.
- The VHL gear was used at the discretion of each cooperating fisherman, and was not standardized.

With exceptions described in the following section, the following protocols were followed:
- All long-bottom longline (LBLL) and short-bottom longline (SBLL) sampling occurred during daylight hours.
- For LBLL and SBLL deployments:
  - Premium cut squid bait was used. Each hook was baited with a single piece of squid measuring approximately 1" x 1".
  - 12/0 hooks were used
- Soak duration (first hook deployed to first hook retrieved) was 30 minutes.

Variation on standardized protocols

For the 'Hudson Canyon' latitudinal zone, Captain 1 initially agreed to serve as a cooperative fisherman on the project, but soon before the project's initiation Captain 1 indicated he would not be able to participate until later in the year, with a need to focus initially on commercial harvest of another species. Due to the limited sampling window specified in our Scientific Research Permit, it was not possible to wait for Captain 1's subsequent availability, or to identify another cooperating fisher for that area. Instead, Captain 1 agreed to keep blueline tilefish he caught as bycatch on his commercial trips, and to provide those fish for workup by NMFS samplers when he returned to the docks from those trips. Captain 1 provided blueline tilefish for sampling at the docks following two trips. Those blueline tilefish were sampled by a NMFS-SEFSC observer (first trip) and a NMFS-NEFSC commercial port sampler (second trip). Because Captain 1's trips were multiple days in duration, it was not possible to acquire useful reproductive tissue samples from blueline tilefish collected by Captain 1 as bycatch, given related reproductive tissue degradation. No data were collected for non-blueline tilefish species caught by Captain 1.

For the 'Cape Lookout to Cape Fear (Onslow Bay)' latitudinal zone, no fishers with experience targeting deepwater species with longline were identified. Thus, Captain 5, a charter (VHL) fisherman who participated in the 2015 deepwater survey workshop (Carmichael 2016), was selected as a cooperator, and all sampling in that latitudinal zone occurred by VHL. Data

collection (including collection of biological samples) for those trips was performed by personnel from the SEFSC-Beaufort Laboratory, and focused on "priority" deepwater species including tilefish species and groupers. Data were not collected for other species for which considerable fishery-independent and –dependent data are available (e.g., vermilion snapper, red porgy and black sea bass). Additionally, Captain 5's survey efforts in the > 750' depth zone occurred slightly north of Cape Lookout – thus that effort (n = 4 sampling sites) is included in the 'NC-VA line to Cape Hatteras' row in Table 3.

For the 'FL Keys' latitudinal zone, to avoid gear loss due to consistent relatively strong currents, Captain 7 altered LBLL and SBLL deployment protocols such that the gears were never separated from the fishing vessel. Instead, the LBLL or SBLL was paid out until the mainline was resting on the bottom, but with a line attaching the mainline to the fishing vessel. After soaking, the gear was retrieved in opposite order of deployment, so that the last hook deployed was the first hook recovered, and the first hook deployed was the last hook recovered. Under this protocol, Captain 7 attempted to make the average soak time for each LBLL hook equal to 30 minutes.

Data collection

The following data were collected for each site-specific sampling event:

<u>Sampling and environmental data</u>

- Date
- Depth
- Sampling location (latitude and longitude)
- Gear (LBLL, SBLL or VHL)

<u>Biological data</u>

- Species identification
- Fork length (in cm) for all fish collected
- Otoliths (sagittal; both right and left otoliths when possible)
- Reproductive tissue samples, stored in formalin for subsequent processing
- Tissue sample (pectoral fin clip) for genetic analysis

For sampling for which data collection was performed at sea by a NMFS-SEFSC fishery observer (i.e., all sampling except for the 'Hudson Canyon' and 'Cape Lookout to Cape Fear (Onslow Bay)' latitudinal zones), observers had the option of not collecting all biological samples from all fish, if catches were sufficiently high that full data collection could not occur in a timely manner.

Thus, in some cases otoliths, reproductive tissue and fin clips were not collected for all fish caught.

Tissue samples for genetic analyses were sent to J. McDowell, Virginia Institute of Marine Sciences, for analysis.

Reproductive tissue samples were sent to SCDNR / MARMAP for processing and analysis.

Otoliths were provided to J. Potts (SEFSC-Beaufort) for processing and analysis.

Results

A total of 1,026 blueline tilefish were collected during the study. The spatial distribution of collections is shown in Figure 1.

Gear-specific sampling efforts, catch, and CPUE, respectively, by latitude zone and depth, are presented in Tables 3-5.

Appendix 1 contains a list of all taxa, and the number of individuals of each taxon, collected during the project.

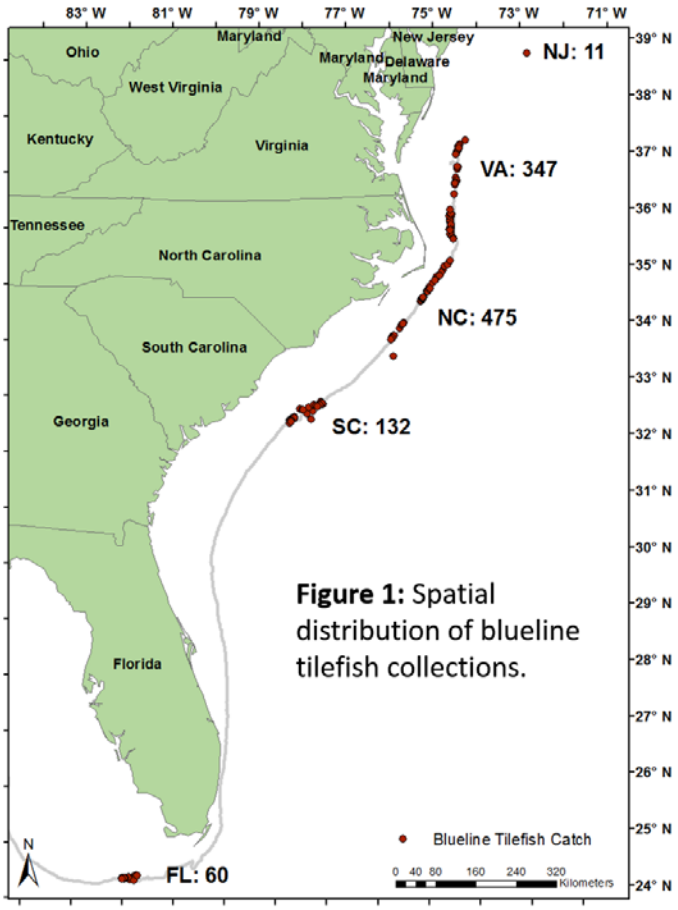

Figure 1: Spatial distribution of blueline tilefish collections.

Table 3. Effort (number of deployments or, for VHL, number of sites at which vertical hook and line was utilized) by gear and depth zone. "-" denotes cells for which there was no fishing effort. * = see "variation of Standardized Protocols" section.

	LBLL			SBLL			VHL		
Effort	**Depth zone**			**Depth zone**			**Depth zone**		
Latitude zone	**250-500**	**500-750**	**> 750**	**250-500**	**500-750**	**> 750**	**250-500**	**500-750**	**> 750**
Hudson Canyon	*	*	*	*	*	*	*	*	*
~ Norfolk Canyon to NC-VA line	19	0	6	1	17	4	19	27	0
NC-VA line to Cape Hatteras	22	9	1	0	2	2	17	7	1
Cape Hatteras to Cape Lookout (Raleigh Bay)	0	0	0	0	0	0	27	29	37
Cape Lookout to Cape Fear (Onslow Bay)	0	0	0	0	0	0	38	5	0
SC	5	33	9	0	0	0	0	40	7
FL Keys	6	7	0	13	14	2	8	17	5

Table 4. Blueline tilefish catch by gear and depth zone. "-" denotes cells for which there was no fishing effort. * = see "variation of Standardized Protocols" section.

	LBLL			SBLL			VHL		
Catch	**Depth zone**			**Depth zone**			**Depth zone**		
Latitude zone	**250-500**	**500-750**	**> 750**	**250-500**	**500-750**	**> 750**	**250-500**	**500-750**	**> 750**
Hudson Canyon	*	*	*	*	*	*	73	*	*
~ Norfolk Canyon to NC-VA line	318	-	0	0	0	0	40	0	-
NC-VA line to Cape Hatteras	274	0	0	-	0	0	25	6	0
Cape Hatteras to Cape Lookout (Raleigh Bay)	-	-	-	-	-	-	25	43	41
Cape Lookout to Cape Fear (Onslow Bay)	-	-	-	-	-	-	59	3	-
SC	2	92	2	-	-	-	-	36	0
FL Keys	2	12	NA	3	31	0	1	11	0

Table 5. Blueline tilefish CPUE per deployment or, for VHL, per site at which VHL was utilized. "-" denotes cells for which there was no fishing effort. * = see "variation of Standardized Protocols" section.

	LBLL			SBLL			VHL		
CPUE	**Depth zone**			**Depth zone**			**Depth zone**		
Latitude zone	**250-500**	**500-750**	**> 750**	**250-500**	**500-750**	**> 750**	**250-500**	**500-750**	**> 750**
Hudson Canyon	*	*	*	*	*	*	*	*	*
~ Norfolk Canyon to NC-VA line	16.74	-	0	0	0	0	2.11	0	-
NC-VA line to Cape Hatteras	12.45	0	0	-	0	0	1.47	0.86	0
Cape Hatteras to Cape Lookout (Raleigh Bay)	-	-	-	-	-	-	0.93	1.48	1.11
Cape Lookout to Cape Fear (Onslow Bay)	-	-	-	-	-	-	1.55	0.60	-
SC	0.40	2.79	0.22	-	-	-	-	0.90	0
FL Keys	0.33	1.71	-	0.23	2.21	0	0.13	0.65	0

References

Carmichael, J, M Duval, M Reichert, N Bacheler and GT Kellison. 2016. Workshop to determine optimal approaches for surveying the deep-water species complex off the southeastern U.S. Atlantic coast. NOAA Technical Memorandum NMFS-SEFSC-685. http://docs.lib.noaa.gov/noaa_documents/NMFS/SEFSC/TM_NMFS_SEFSC/NMFS_SEFSC_TM_685.pdf

Appendix 1. Taxa, and number of individuals of each taxon, collected during the project.

Scientific Name	Common Name	Number collected
Caulolatilus microps	Blueline (gray) tilefish	1026
Helicolenus dactylopterus	Blackbelly rosefish	545
Epinephelus niveatus	Snowy grouper	176
Carcharhinus plumbeus	Sandbar shark	50
Mustelus canis	Smooth dogfish shark	49
Lopholatilus chamaeleonticeps	Golden tilefish	48
Pagrus pagrus	Red porgy	36
Rhizoprionodon terraenovae	Atlantic sharpnose shark	29
Centropristis striata	Black sea bass	24
Sphyrna lewini	Scalloped hammerhead shark	13
Epinephelus flavolimbatus	Yellowedge grouper	8
Coryphaena hippurus	Dolphin fish	7
Rhomboplites aurorubens	Vermilion snapper	5
Seriola dumerili	Greater amberjack	4
Carcharhinus falciformis	Silky shark	3
Ophichthus ocellatus	Pale-spotted eel	3
Anguilliformes	Eels	2
Caulolatilus chrysops	Goldface tilefish	2
Centropristis ocyurus	Bank sea bass	2
Cirrhigaleus asper	Roughskin dogfish shark	2
Dasyatis centroura	Roughtail stingray	2
Epinephelus nigritus	Warsaw grouper	2
Isurus oxyrinchus	Shortfin mako shark	2
Lutjanus analis	Mutton snapper	2
Molidae	Ocean sunfishes	2
Mycteroperca phenax	Scamp grouper	2
Phycidae	Hake family	2
Scomber scombrus	Atlantic mackerel	2
Scyliorhinus retifer	Chain catshark	2
Seriola rivoliana	Almaco jack	2
Thunnus albacares	Yellowfin tuna	2
Thunnus atlanticus	Blackfin tuna	2
Urophycis floridana	Southern hake	2
Balistes capriscus	Gray triggerfish	1
Calamus leucosteus	Whitebone porgy	1
Caranx crysos	Blue runner	1
Carcharhinidae	Requiem shark family	1
Congridae	Conger eel	1
Gymnothorax kolpos	Blacktail moray eel	1

Gymnothorax moring	Spotted moray eel	1
Merluccius sp.	Merlucciid hake family	1
Muraenidae	Moray eel family	1
Seriola zonata	Banded rudderfish	1
Squalus cubensis	Cuban dogfish shark	1