



## **SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL**

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### **POLICY CONSIDERATIONS FOR SOUTH ATLANTIC FOOD WEBS AND CONNECTIVITY AND ESSENTIAL FISH HABITATS (December 2016)**

#### **Introduction**

This document provides guidance from the South Atlantic Fishery Management Council (SAFMC) regarding South Atlantic Food Webs and Connectivity and the protection of Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (EFH-HAPCs) supporting the Council move to Ecosystem Based Fishery Management. The guidance is consistent with the overall habitat protection policies of the SAFMC as formulated and adopted in the Habitat Plan (SAFMC 1998a), the Comprehensive EFH Amendment (SAFMC 1998b), the Fishery Ecosystem Plan of the South Atlantic Region (SAFMC 2009a), Comprehensive Ecosystem-Based Amendment 1 (SAFMC 2009b), Comprehensive Ecosystem-Based Amendment 2 (SAFMC 2011), and the various Fishery Management Plans (FMPs) of the Council.

For the purposes of policy, the findings assess potential threats and impacts to managed species EFH and EFH-HAPCs and the South Atlantic ecosystem associated with changes in food webs and connectivity and processes that could improve those resources or place them at risk. The policies and recommendations established in this document are designed to address such impacts in accordance with the habitat policies of the SAFMC as mandated by law. The SAMFC may revise this guidance in response to 1) changes in conditions in the South Atlantic region, 2) applicable laws and regulatory guidelines, 3) new knowledge about the impacts or 4) as deemed as appropriate by the Council.

#### **Policy Considerations**

A key tenet of ecosystem-based fisheries management (EBFM) is the consideration of potential indirect effects of fisheries on food web linkages when developing harvest strategies and management plans. Examples of unintended consequences include the over exploitation of predators, an increase in abundance of their prey, and a decline of organisms two trophic levels below them, a phenomenon known as a trophic cascade (Carpenter et al. 1985). Alternatively, fishing on lower trophic level species, planktivorous “forage” fishes for example, may ultimately lead to predator population declines due to food limitation (e.g. Okey et al. 2014; Walters and Martell 2004). Food web linkages connect different components of the larger ecosystem, such as pelagic forage fishes and their piscivorous predators or demersal carnivores. This connectivity between food webs over space, time, and depth creates multiple energy pathways that



## **Threats to EFH and EFH-HAPCs from Changes in South Atlantic Food Web and Connectivity**

The SAFMC finds that negative impacts to EFH and EFH-HAPCs can change South Atlantic food webs and connectivity for managed species. Table 1 following food webs and connectivity policy and research recommendations, presents a summary of South Atlantic fisheries and their designated EFH and EFH-HAPCs as presented in the SAFMC EFH User Guide (<http://safmc.net/download/SAFMCEFHUsersGuideFinalNov16.pdf>).

## **SAFMC Policies Addressing South Atlantic Food Webs and Connectivity**

The SAFMC establishes the following policies to address South Atlantic food webs and connectivity, and to clarify and augment the general policies already adopted in the Habitat Plan and Comprehensive Habitat Amendment and Fishery Ecosystem Plan (SAFMC 1998a; SAFMC 1998b; SAFMC 2009a).

### ***General Policies:***

1. **Forage Fisheries** – Managers should consider forage fish stock abundances and dynamics, and their impacts on predator productivity, when setting catch limits to promote ecosystem sustainability. To do so, more science and monitoring information are needed to improve our understanding of the role of forage fish in the ecosystem. This information should be included in stock assessments, ecosystem models, and other fishery management tools and processes in order to support the development of sustainable harvest strategies that incorporate ecosystem considerations and trade-offs.  
Note: Initial preliminary definition and potential list of forage fish species presented in Appendix A.
2. **Food Web Connectivity** – Separate food webs exist in the South Atlantic, for example inshore-offshore, north-south, and benthic-pelagic, but they are connected by species that migrate between them such that loss of connectivity could have impacts on other components of the ecosystem that would otherwise appear unrelated and must be accounted for.
3. **Trophic Pathways** – Managers should aim to understand how fisheries production is driven either by bottom-up or top-down forcing and attempt to maintain diverse energy pathways to promote overall food web stability.
4. **Food Web Models** – Food web models can provide useful information to inform stock assessments, screen policy options for unintended consequences, examine ecological and economic trade-offs, and evaluate performance of management actions under alternative ecosystem states.

5. **Food Web Indicators** – Food web indicators have been employed to summarize the state of knowledge of an ecosystem or food web and could serve as ecological benchmarks to inform future actions.
6. **Invasive Species** – Invasive species, most notably lionfish, are known to have negative effects on ecologically and economically important reef fish species through predation and competition and those effects should be accounted for in management actions.
7. **Contaminants** – Bioaccumulation of contaminants in food webs can have sub-lethal effects on marine fish, mammals, and birds and is also a concern for human seafood consumption.

### **Research and Information Needs Addressing South Atlantic Food Webs and Connectivity**

1. Scientific research and collection of data to further understand the impacts of climate variability on the South Atlantic ecosystem and fish productivity must be prioritized. This includes research on species distribution, habitat, reproduction, recruitment, growth, survival, predator-prey interactions and vulnerability.
2. Characterization of offshore ocean habitats used by estuarine dependent species, which can be useful in developing ecosystem models.
3. Scientific research and monitoring to improve our understanding of the role of forage fish in the ecosystem, in particular abundance dynamics and habitat use.
4. Basic data are the foundation of ecosystem-based fisheries management thus, fixing existing data gaps in the South Atlantic must be addressed first in order to build a successful framework for this approach in the South Atlantic.
5. NOAA in cooperation with regional partners develop and evaluate an initial suite of products at an ecosystem level to help prioritize the management and scientific needs in the South Atlantic region taking a systemic approach to identify overarching, common risks across all habitats, taxa, ecosystem functions, fishery participants and dependent coastal communities.
6. NOAA in cooperation with regional partners develop risk assessments to evaluate the vulnerability of South Atlantic species with respect to their exposure and sensitivity to ecological and environmental factors affecting their populations.
7. NOAA coordinate with ongoing regional modeling and management tool development efforts to ensure that ecosystem management strategy evaluations (MSEs) link to multispecies and single species MSEs, inclusive of economic, socio-cultural, and habitat conservation measures.

8. NOAA develop ecosystem-level reference points (ELRPs) and thresholds as an important step to informing statutorily required reference points and identifying key dynamics, emergent ecosystem properties, or major ecosystem-wide issues that impact multiple species, stocks, and fisheries. Addressing basic data collection gaps is critical to successful development of ELRPs.
9. Continued support of South Atlantic efforts to refine EFH and HAPCs is essential to protect important ecological functions for multiple species and species groups in the face of climate change.

Habitats designated as EFH and EFH-HAPCs by the SAFMC (Table 1), if negatively impacted, can change South Atlantic food webs and connectivity for managed species.

**Table 1.** Habitats designated as Essential Fish Habitat (EFH), their associated managed fisheries/species, and EFH-HAPCs (Source: SAFMC EFH Users Guide 2016).

Essential Fish Habitat	Fisheries/Species	EFH- Habitat Areas of Particular Concern
<b>Wetlands</b>		
Estuarine and marine emergent wetlands	Shrimp, Snapper Grouper	Shrimp: State designated nursery habitats Mangrove wetlands
Tidal palustrine forested wetlands	Shrimp	
<b>Submerged Aquatic Vegetation</b>		
Estuarine and marine submerged aquatic vegetation	Shrimp, Snapper Grouper, Spiny lobster	Snapper Grouper, Shrimp
<b>Shell bottom</b>		
Oyster reefs and shell banks	Snapper Grouper	Snapper Grouper
<b>Coral and Hardbottom</b>		
Coral reefs, live/hardbottom, medium to high rock outcroppings from shore to at least 600 ft where the annual water temperature range is sufficient.	Snapper Grouper, Spiny lobster, Coral, Coral Reefs and Live Hard/bottom Habitat	The Point, Ten Fathom Ledge, Big Rock, MPAs; The <i>Phragmatopoma</i> (worm reefs) off central east coast of Florida and nearshore hardbottom; coral and hardbottom habitat from Jupiter through the Dry Tortugas, FL; Deepwater CHAPCs
rock overhangs, rock outcrops, manganese-phosphorite rock slab formations, and rocky reefs		Snapper-grouper [blueline tilefish]
Artificial reefs	Snapper Grouper	Special Management Zones
<b>Soft bottom</b>		
Subtidal, intertidal non-vegetated flats	Shrimp	
Offshore marine habitats used for spawning and growth to maturity	Shrimp	
Sandy shoals of capes and offshore bars	Coastal Migratory Pelagics	Sandy shoals; Capes Lookout, Fear, Hatteras, NC; Hurl Rocks, SC;
troughs and terraces intermingled with sand, mud, or shell hash at depths of 150 to 300 meters		Snapper-grouper [golden tilefish]
<b>Water column</b>		
Ocean-side waters, from the surf to the shelf break zone, including Sargassum	Coastal Migratory Pelagics	
All coastal inlets	Coastal Migratory Pelagics	Shrimp, Snapper-grouper
All state-designated nursery habitats of particular importance (e.g., PNA, SNA)	Coastal Migratory Pelagics	Shrimp, Snapper-grouper
High salinity bays, estuaries	Cobia in Coastal Migratory Pelagics	Spanish mackerel: Bogue Sound, New River, NC; Broad River, SC
Pelagic Sargassum	Dolphin	
Gulf Stream	Shrimp, Snapper-grouper, Coastal Migratory Pelagics, Spiny lobster, Dolphin-wahoo	
Spawning area in the water column above the adult habitat and the additional pelagic environment	Snapper-grouper	

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## Appendix A. Potential list of potential forage species and definition.

Note: Species highlighted constitute a preliminary list of non-managed forage fish species.

Final Report SEAMAP-SA		Period 05/01/2006 - 04/30/2011,									
Table 2.5											
Abundance, biomass, and occurrence by species. Values are for 2006-2010 calendar years. Ranking is by total number of individuals. Top 50 species of 215											
CommonName	Species	Number Rank	Total Number	% of Total Abundance	Biomass (kg)	%of Total BioMass	Number of Occurrences	% of Occurrences	CumPct Number	Rank Biomass	CumPct Biomass
Atl bumper	<i>Chloroscombrus chrysurus</i>	1	1368597	35.34	18645.26	6.76	979	61.57	35.34	5	46.21
Atl croaker	<i>Micropogonias undulatus</i>	2	467821	12.08	24544	8.89	871	54.78	47.42	2	25.33
spot	<i>Leiostomus xanthurus</i>	3	342689	8.85	19807.84	7.18	1121	70.5	56.27	3	32.51
white shrimp	<i>Litopenaeus setiferus</i>	4	141041	3.64	3779.69	1.37	809	50.88	59.91	14	64.34
striped anchovy	<i>Anchoa hepsetus</i>	5	140732	3.63	1244.2	0.45	961	60.44	63.54	27	73.97
moonfish	<i>Selene setapinnis</i>	6	128782	3.33	2173.18	0.79	1001	62.96	66.87	20	69.92
cannonball jellyfish	<i>Stomolophus meleagris</i>	7	127957	3.3	45368.66	16.44	723	45.47	70.17	1	16.44
scup/porgy	<i>Stenotomus sp.</i>	8	120165	3.1	4249.36	1.54	505	31.76	73.27	11	59.99
pinfish	<i>Lagodon rhomboides</i>	9	87700	2.26	4134.76	1.5	623	39.18	75.53	12	61.49
banded drum	<i>Rivulus fasciatus</i>	10	68273	1.76	5041.15	1.83	775	48.74	77.29	9	56.81
butterfish	<i>Peprilus triacanthus</i>	11	68083	1.76	1801.7	0.65	852	53.58	79.05	22	71.34
star drum	<i>Stellifer lanceolatus</i>	12	67465	1.74	1279.21	0.46	462	29.06	80.79	26	73.52
Southern kingfish	<i>Menticirrhus americanus</i>	13	63683	1.64	6310.79	2.29	1181	74.28	82.43	7	52.86
harvestfish	<i>Peprilus paru</i>	14	61621	1.59	2706.34	0.98	986	62.01	84.02	16	66.41
Atl thread herring	<i>Opisthonema oglinum</i>	15	56675	1.46	1427.48	0.52	977	61.45	85.48	25	73.06
brown shrimp	<i>Farfantepenaeus aztecus</i>	16	49209	1.27	759.13	0.28	548	34.47	86.75	32	75.62
breif squid	<i>Lolliguncula brevis</i>	17	48151	1.24	555.35	0.2	1263	79.43	87.99	33	75.82
Atl cutlassfish	<i>Trichiurus lepturus</i>	18	46126	1.19	2442.13	0.88	599	37.67	89.18	19	69.13
silver seatrout	<i>Cynoscion nothus</i>	19	43987	1.14	2448.59	0.89	659	41.45	90.32	18	68.25
northern searobin	<i>Prionotus carolinus</i>	20	38652	1	430.23	0.16	712	44.78	91.32	34	75.98
weakfish	<i>Cynoscion regalis</i>	21	35781	0.92	3000.54	1.09	670	42.14	92.24	15	65.43
Atl menhaden	<i>Brevoortia tyrannus</i>	22	27118	0.7	842.86	0.31	206	12.96	92.94	30	75.04
spider crab	<i>Libinia dubia</i>	23	23998	0.62	74.19	0.03	496	31.19	93.56	44	76.6
squid sp	<i>Loligo spp.</i>	24	21515	0.56	316.24	0.11	485	30.5	94.12	36	76.22
bay anchovy	<i>Anchoa mitchilli</i>	25	20415	0.53	31.27	0.01	442	27.8	94.65	49	76.69
bluefish	<i>Pomatomus saltatrix</i>	26	20169	0.52	1763.96	0.64	531	33.4	95.17	23	71.98
silver perch	<i>Bairdiella chrysoura</i>	27	19695	0.51	826.85	0.3	292	18.36	95.68	31	75.34
inshore lizardfish	<i>Synodus foetens</i>	28	19482	0.5	1537	0.56	830	52.2	96.18	24	72.54
pigfish	<i>Orthopristis chrysoptera</i>	29	14141	0.37	1086.03	0.39	418	26.29	96.55	28	74.36
spadefish	<i>Chaetodipterus faber</i>	30	7942	0.21	369.7	0.13	416	26.16	96.76	35	76.11
Spanish mackerel	<i>Scomberomorus maculatus</i>	31	7906	0.2	1008.44	0.37	781	49.12	96.96	29	74.73
Atl sharpnose shark	<i>Rhizoprionodon terraenovae</i>	32	7778	0.2	4522.38	1.64	973	61.19	97.16	10	58.45
lady crab	<i>Ovalipes stephensoni</i>	33	5630	0.15	45.44	0.02	421	26.48	97.31	47	76.66
shortfin anchovy	<i>Anchoa lyolepis</i>	34	5515	0.14	19.94	0.01	225	14.15	97.45	50	76.7
irridescenct swimming crab	<i>Portunus gibbesii</i>	35	5165	0.13	47.12	0.02	462	29.06	97.58	46	76.64
Atl lookdown	<i>Selene vomer</i>	36	5078	0.13	183.14	0.07	408	25.66	97.71	38	76.37
hogchocker	<i>Trinectes maculatus</i>	37	4903	0.13	161.57	0.06	296	18.62	97.84	39	76.43
windowpane	<i>Scophthalmus aquosus</i>	38	4137	0.11	100.84	0.04	410	25.79	97.95	41	76.51
bullnose ray	<i>Myliobatis freminvillei</i>	39	3844	0.1	12041.15	4.36	330	20.75	98.05	6	50.57
lesser blue crab	<i>Callinectes similis</i>	40	3774	0.1	45.23	0.02	375	23.58	98.15	48	76.68
bonnethead shark	<i>Sphyrna tiburo</i>	41	3670	0.09	4091.41	1.48	561	35.28	98.24	13	62.97
butterfly ray	<i>Gymnura micrura</i>	42	3561	0.09	2626.05	0.95	470	29.56	98.33	17	67.36
fringed flounder	<i>Etropus crossotus</i>	43	3514	0.09	80.22	0.03	575	36.16	98.42	42	76.54
cownose ray	<i>Rhinoptera bonasus</i>	44	3437	0.09	19154.01	6.94	196	12.33	98.51	4	39.45
king mackerel	<i>Scomberomorus cavalla</i>	45	3216	0.08	218.23	0.08	280	17.61	98.59	37	76.3
bluntnose stingray	<i>Dasyatis sayi</i>	46	2896	0.07	5847.42	2.12	490	30.82	98.66	8	54.98
spotted hake	<i>Urophycis regius</i>	47	2827	0.07	76.87	0.03	189	11.89	98.73	43	76.57
ocellated flounder	<i>Ancylorsetta quadrocellata</i>	48	2599	0.07	102.39	0.04	414	26.04	98.8	40	76.47
leopard sea robin	<i>Prionotus scitulus</i>	49	2498	0.06	62.75	0.02	284	17.86	98.86	45	76.62
clearnose skate	<i>Raja eglanteria</i>	50	2410	0.06	2138.9	0.77	300	18.87	98.92	21	70.69

(Source: SEAMAP-SA Report Project: NA06NMF435002: September 2012)

Forage species: fish—small, short-lived and fast growing mid-trophic level species—are primary energy pathways in many marine food webs, and that they support other valuable fish stocks and many species of marine birds and mammals. Forage fish are presumed to be important in the SAB because they are food for valuable commercial and recreational species in this ecosystem, in addition to supporting other species in the broader biological community. SAB forage fish groups include Atlantic menhaden (*Brevoortia tyrannus*), halfbeaks (*Hemiramphus spp.*, *Hyporhamphus unifasciatus*), anchovies (*Anchoa spp.*, *A. mitchilli*, *A. hepsetus*, *Engraulis eurystole*), sardines (*Harengula jaguana*, *Sardinella aurita*), Atlantic silverside (*Menidia menidia*), scads (*Decapterus punctatus*, *Trachurus lathami*, *Selar crumenophthalmus*), shad (*Alosa spp.*), Atlantic thread herring (*Opisthonema oglinum*), mullets (*Mugil spp.*), and other pelagic oceanic planktivores such as lanternfish (*Diaphus spp.*), antenna codlet (*Bregmaceros atlanticus*), striated argentine (*Argentina striata*), chub mackerel (*Scomber japonicus*), and flyingfish (Exocoetidae).

Note: Squids (*Illex illecebrosus*, *Loligo pealei*) and shrimps (rock shrimps and penaeid shrimps) in this system also serve as forage (Pauly 1998, Anderson and Piatt 1999, Okey 2006), as do krill (Euphausiacea). These forage groups exhibit widely varying importance, e.g., interaction strengths, in the presently modelled context. (Source: Exploring the Trophodynamic Signatures of Forage Species in the U.S. South Atlantic Bight Ecosystem to Maximize System-Wide Values. Thomas A. Okey, Andrés M. Cisneros-Montemayor, Roger Pugliese, Ussif R. Sumaila)