

Discussion Document 10

Example Stock Complexes and Fishery Functional Groups

EBFM PDT

January 2019

While discussing concepts and approaches to be discussed in an example Fishery Ecosystem Plan (eFEP), many people have been confused by the terminology used to describe how reference points and catch limits could be set and allocated. Some presenters have used terms like trophic groups, stock complexes, and fishery functional groups interchangeably as the approaches and the worked example have evolved. Many have asked for more tangible examples in our discussion documents.

The tables below are copied or derived from tables that are included in a draft eFEP and prior discussion documents presented to the EBFM committee (such as <https://s3.amazonaws.com/nefmc.org/Stock-complex-table.pdf>). They include 76 managed and unmanaged species (81 including life stages in different life stages) that are caught in appreciable quantities in the Georges Bank Ecosystem Production Unit (EPU – see other eFEP documents for map).

As a tangible example, Table 1 classifies the species by stock complex, trophic group, and functional group. Table 2 lists important biological and life history characteristics, as well as management authority and management plan. Included in Table 2 is a 2015 estimate of total biomass, derived from applying a catchability coefficient estimate to the spring and fall NEFSC bottom trawl survey data for Georges Bank EPU survey strata. A rough estimate of total catch for stock complexes can be made by multiplying the catchability adjusted biomass by 0.2, and 0.1 for sharks and skates. The actual multiplier could be different for certain stock complexes depending on the species composition of the stock complex and the objectives that will be adopted for EBFM. Allocations of the stock complex catch limits to the fishery functional groups would depend on the FEP objectives and how the FEP defines Georges Bank fisheries and permitting.

To protect some species from persistent depletion or to rebuild biomass if and when a stock is depleted, it may be necessary to define and set catch limits for a stock and/or adopt measures (landings penalty, area closures, gear selectivity, etc.) to reduce the incentive to target such a stock or species. This approach to protect a stock from persistent depletion may be needed, for example, for species that are relatively more valuable or are easier (i.e. less costly) to catch.

The actual matrix of stock complex catch limits and allocations to fishery functional groups will of course depend on how the Council structures an FEP to achieve the objectives that it adopts. One tenant that the PDT stands behind is that the sum of the stock complex catch limits should not exceed the overall catch limit defined for the EPU, i.e. system outputs (i.e. catch) should not exceed average energy/biomass inputs.

Definitions (see also <https://s3.amazonaws.com/nefmc.org/Glossary.pdf>):

Trophic guild - A group of species that feed on similar items or have similar dietary requirements and therefore have a similar ecological function within the structure of an ecosystem.

Stock complex - A group of related species at a defined trophic level that have similar diets and life-history characteristics. Catch limits for stock complexes would be set, their total not to exceed the overall EPU catch limit.

Fishery functional group - A group of species that are typically caught together in a particular type of gear and feed on similar food items. In terms of EBFM, a functional group is the intersection of stock complexes (see definition below) with a fishery, i.e. they are caught together.

Table 1. Example matrix of stock complexes and fishery functional groups for species that are commonly caught by commercial and recreational fisheries in the Georges Bank EPU.

Species complex	Species	Trophic group	Fishery functional group (allocation of a stock complex catch)												
			Ecosys tem compo nent	Demer sal Trawl	Mid- water Trawl	Sink gillnet	Drift gillnet	Botto m longlin e	Drift longlin e	Pot	Seine	Dredg e	Demer sal recreat ional	Pelagic recreat ional	PS consu mption
Apex Predator	1. Yellowfin Tuna	Apex Predator								X					X
	2. Bluefin Tuna	Apex Predator								X					X
	3. Swordfish	Apex Predator					X			X					X
Bottom feeder	10. Black Sea Bass	Benthivore									X			X	
	12. Witch Flounder	Benthivore		X											
	13. American Plaice, > 20	Benthivore		X											
	16. Yellowtail Flounder	Benthivore		X								X			
	17. Golden Tilefish	Benthivore		X		X		X					X		
	18. Haddock	Benthivore		X		X						X		X	
	21. Northern Searobin	Benthivore	X										X		
	22. Striped Searobin	Benthivore	X										X		
	23. Winter Flounder	Benthivore		X								X		X	
	24. Scup	Benthivore		X							X			X	
	25. Tautog	Benthivore	X											X	
	26. Cunner	Benthivore	X											X	

Species complex	Species	Trophic group	Fishery functional group (allocation of a stock complex catch)												
			Ecosys tem compo nent	Demer sal Trawl	Mid- water Trawl	Sink gillnet	Drift gillnet	Botto m longlin e	Drift longlin e	Pot	Seine	Dredg e	Demer sal recreat ional	Pelagic recreat ional	PS consu mption
	27. Ocean Pout	Benthivore											X		
Bottom feeding skate	15. Rosette Skate	Benthivore		X											
	19. Smooth Dogfish	Benthivore		X									X		
Crustacean	7. Blue Crab	Benthivore									X				
	8. Jonah Crab	Benthivore									X				
	9. Cancer Crabs	Benthivore									X				
	11. Red Crab	Benthivore	X								X				
	14. American Lobster	Benthivore		X							X				
	20. Lady Crab	Benthivore	X								X				
	28. Spider Crab	Benthivore	X								X				
Fish eater	63. Weakfish	Piscivore													
	65. Atlantic Cod	Piscivore		X		X		X			X		X		
	66. Sea Raven	Piscivore	X										X		
	67. Fourspot Flounder	Piscivore	X												
	70. Goosefish	Piscivore		X		X					X	X	X		
	71. Offshore Hake, > 40	Piscivore		X											
	72. Silver Hake, > 40	Piscivore		X				X			X		X		
	73. Striped Bass	Piscivore											X		

Species complex	Species	Trophic group	Fishery functional group (allocation of a stock complex catch)													
			Ecosys tem compo nent	Demer sal Trawl	Mid- water Trawl	Sink gillnet	Drift gillnet	Botto m longlin e	Drift longlin e	Pot	Seine	Dredg e	Demer sal recreat ional	Pelagic recreat ional	PS consu mption	
	74. Summer Flounder	Piscivore		X		X								X		
	75. Bluefish	Piscivore		X											X	
	77. White Hake, > 40	Piscivore		X		X		X					X			
	80. John Dory	Planktivore	X													
Fish eating skate	48. Little Skate	Macrozoo- piscivore		X		X						X		X		
	49. Smooth Skate	Macrozoo- piscivore	X													
	51. Clearnose Skate	Macrozoo- piscivore		X												
	62. Thorny Skate	Piscivore	X													
	64. Barndoor Skate	Piscivore	X													
	69. Winter Skate	Piscivore		X		X							X			
Forage fish	39. Shortfin squid	Macroplanktivore														X
	40. Longfin Squid	Macroplanktivore		X												X
	57. Blueback Herring	Mesoplanktivore			X						X					X
	58. Alewife	Mesoplanktivore			X						X					X
	59. American Shad	Mesoplanktivore			X											
	60. Atlantic Menhaden	Mesoplanktivore			X						X					X
	61. Atlantic Herring	Mesoplanktivore			X						X					X

Species complex	Species	Trophic group	Fishery functional group (allocation of a stock complex catch)												
			Ecosys tem compo nent	Demer sal Trawl	Mid- water Trawl	Sink gillnet	Drift gillnet	Botto m longlin e	Drift longlin e	Pot	Seine	Dredg e	Demer sal recreat ional	Pelagic recreat ional	PS consu mption
	78. Butterfish	Planktivore			X										
	79. Atlantic Mackerel	Planktivore			X						X			X	
Halibut	68. Atlantic Halibut	Piscivore		X				X					X		
Large bottom feeder	5. Atlantic Wolffish	Benthivore											X		
	37. American plaice, < 20	Macroplanktivore	X												
	38. Lumpfish	Macroplanktivore	X												
	41. Longhorn Sculpin	Macroplanktivore	X										X		
	42. Red hake < 40	Macroplanktivore		X											
	44. White hake, 20 – 40	Macroplanktivore		X											
Mollusk	32. Ocean Quahog	Benthos										X			
	33. Mussels	Benthos										X			
	34. Sea Scallop (Live)	Benthos										X			
	35. Surf clam (Live)	Benthos										X			
	6. Channel Whelk	Benthivore								X		X			
Other benthos	36. Sea Cucumber	Benthos	X												
Other bottom feeder	29. Octopus	Benthivore	X												

Species complex	Species	Trophic group	Fishery functional group (allocation of a stock complex catch)												
			Ecosys tem compo nent	Demer sal Trawl	Mid- water Trawl	Sink gillnet	Drift gillnet	Botto m longlin e	Drift longlin e	Pot	Seine	Dredg e	Demer sal recreat ional	Pelagic recreat ional	PS consu mption
	30. Conchs	Benthivore								X		X			
	31. Sea Urchin	Benthivore	X												
Plankton and fish feeder	45. White hake, < 20	Macroplanktivore		X											
	46. Cusk	Macrozoo-piscivore	X					X					X		
	50. Pollock	Macrozoo-piscivore		X		X							X		
	52. Windowpane	Macrozoo-piscivore		X											
	53. Red Hake, < 40	Macrozoo-piscivore		X							X		X		
	54. Offshore hake, < 40	Macrozoo-piscivore													
	55. Silver hake, < 40	Macrozoo-piscivore													
Redfish	81. Acadian Redfish	Planktivore-Piscivore		X		X							X		
	47. Blackbelly Rosefish	Macrozoo-piscivore	X										X		
Shark	4. Other Skarks	Apex Predator	X											X	
	43. Spiny Dogfish < 60 cm	Piscivore		X		X		X					X		
	76. Spiny Dogfish > 60 cm	Piscivore		X		X		X					X		
	82. Chain Dogfish	Small Shark													

Table 2. Biological and trophic characteristics of Georges Bank EPU species.

Species	Scientific Name	Management authority	FMP	Total q-adjusted biomass	Trophic group	Trophic level	Adult body size	Primary Offshore Habitat	Preferred Depth Range (m)
1. Yellowfin Tuna	<i>Thunnus albacares</i>	NMFS-SFD	HMS	#N/A	Apex Predator			Pelagic	
2. Bluefin Tuna	<i>Thunnus thynnus</i>	NMFS-SFD	HMS	#N/A	Apex Predator			Pelagic	
3. Swordfish	<i>Xiphias gladius</i>	NMFS-SFD	HMS	#N/A	Apex Predator			Pelagic	
4. Other Skarks		ASMFC	Coastal Sharks	#N/A	Apex Predator			Pelagic	
5. Atlantic Wolffish	<i>Anarhicas lupus</i>	NEFMC	NE Multispecies	0.15	Benthivore	3.2	150	Sand and gravel, spawn in rocky habitats	70-184
6. Channel Whelk	<i>Busycon</i>	Unmanaged	NA	#N/A	Benthivore				
7. Blue Crab	<i>Callinectes sapidus</i>	Unmanaged	NA	#N/A	Benthivore				
8. Jonah Crab	<i>Cancer borealis</i>	ASMFC	Jonah Crab	0.32	Benthivore				
9. Cancer Crabs	<i>Cancer spp.</i>	Unmanaged	NA	#N/A	Benthivore				
10. Black Sea Bass	<i>Centropristis striata</i>	MAFMC/ASMFC	Summer Flounder, Scup, and Black Sea Bass	0.25	Benthivore	4	66		
11. Red Crab	<i>Geryon quinquidens</i>	NEFMC	Red crab	#N/A	Benthivore	2.5		Silt and clay	320-1300
12. Witch Flounder	<i>Glyptocephalus cynoglossus</i>	NEFMC	NE Multispecies	0.13	Benthivore	3.1	60	Mud and muddy sand	80-400
13. American Plaice	<i>Hippoglossoides platessoides</i>	NEFMC	NE Multispecies	0.45	Benthivore	3.7	> 20	Mud and sand	40-300
14. American Lobster	<i>Homarus americanus</i>	ASMFC	Lobster	16.68	Benthivore				
15. Rosette Skate	<i>Leucoraja garmani</i>	NEFMC	NE Skate Complex	0.07	Benthivore		26	Mud and sand	80-400
16. Yellowtail Flounder	<i>Limanda ferruginea</i>	NEFMC	NE Multispecies	1.61	Benthivore	3.2	64	Sand with and w/o shells, gravel, and rocks	30-90

Species	Scientific Name	Management authority	FMP	Total q-adjusted biomass	Trophic group	Trophic level	Adult body size	Primary Offshore Habitat	Preferred Depth Range (m)
17. Golden Tilefish	<i>Lopholatilus chamaeleonticeps</i>	MAFMC	Tilefish	#N/A	Benthivore	3.5	125	Semi-consolidated clay	100-300
18. Haddock	<i>Melanogrammus aeglefinus</i>	NEFMC	NE Multispecies	938.76	Benthivore	4.1	112	Sand, shells, gravel, along margins of rocky reefs	40-160
19. Smooth Dogfish	<i>Mustelus canis</i>	ASMFC	Coastal Sharks	6.61	Benthivore	4.2	150	Pelagic	
20. Lady Crab	<i>Ovalipes oscillatus</i>	Unmanaged	NA	1.67	Benthivore				
21. Northern Searobin	<i>Prionotus carolinus</i>	Unmanaged	NA	0.75	Benthivore	4.2	38		
22. Striped Searobin	<i>Prionotus evolans</i>	Unmanaged	NA	#N/A	Benthivore	4.2	45		
23. Winter Flounder	<i>Pseudopleuronectes americanus</i>	NEFMC	NE Multispecies	8.96	Benthivore	2.8	64	Mud, sand, and hard bottom	10 to 70
24. Scup	<i>Stenotomus chrysops</i>	MAFMC/ASMFC	Summer Flounder, Scup, and Black Sea Bass	18.97	Benthivore	3.9	46	Sand, mud, mussel beds, rock and other structures	10 to 50
25. Tautog	<i>Tautoga onitis</i>	ASMFC	Tautog	#N/A	Benthivore	3.3	91		
26. Cunner	<i>Tautoglabrus adspersus</i>	Unmanaged	NA	1.17	Benthivore		38		
27. Ocean Pout	<i>Zoarces americanus</i>	NEFMC	NE Multispecies	1.08	Benthivore	3.4	110	Wide variety of substrates, esp in association with structure	20-140
28. Spider Crab		Unmanaged	NA	#N/A	Benthivore				
29. Octopus		Unmanaged	NA	#N/A	Benthivore				
30. Conchs		Unmanaged	NA	#N/A	Benthivore				
31. Sea Urchin		Unmanaged	NA	#N/A	Benthivore				
32. Ocean Quahog	<i>Arctica islandica</i>	MAFMC	Surf Clam & Ocean Quohog	#N/A	Benthos			Mud, sand, gravel	40-100

Species	Scientific Name	Management authority	FMP	Total q-adjusted biomass	Trophic group	Trophic level	Adult body size	Primary Offshore Habitat	Preferred Depth Range (m)
33. Mussels	<i>Mytilus spp.</i>	Unmanaged	NA	#N/A	Benthos				
34. Sea Scallop (Live)	<i>Placopectin magellanicus</i>	NEFMC	Sea Scallop	37.44	Benthos	1.94		Sand and gravel	18-110
35. Surf clam (Live)	<i>Spisula solidissima</i>	MAFMC	Surf Clam & Ocean Quohog	0.03	Benthos	1.94		Sand and gravel	8 to 40
36. Sea Cucumber		Unmanaged	NA	#N/A	Benthos				
37. American Plaice	<i>Hippoglossoides platessoides</i>	NEFMC	NE Multispecies	0.45	Macroplanktivore	3.7	< 20	Mud and sand	40-300
38. Lumpfish	<i>Cyclopterus lumpus</i>	Unmanaged	NA	#N/A	Macroplanktivore	3.9	61		
39. Shortfin squid	<i>Illex illecebrosus</i>	MAFMC	Mackerel, Squid, and Butterfish	1.51	Macroplanktivore	3.33		Pelagic	70-400
40. Longfin Squid	<i>Loligo peleii</i>	MAFMC	Mackerel, Squid, and Butterfish	28.76	Macroplanktivore	3.4		Pelagic	30-200
41. Longhorn Sculpin	<i>Myoxocephalus octodecemspinosus</i>	NEFMC	NE Multispecies	5.21	Macroplanktivore	3.7	46		
42. Red Hake	<i>Urophycis chuss</i>	NEFMC	NE Small-mesh Multispecies	5.27	Macroplanktivore	3.6	< 40	Soft sediments and shells	50-300
43. Spiny Dogfish	<i>Squalus acanthias</i>	MAFMC/NE FMC	NE Skate Complex	192.42	Macroplanktivore	4.3	< 60		20-300
44. White Hake	<i>Urophycis tenuis</i>	NEFMC	NE Multispecies	0.15	Macroplanktivore	4.2	20 - 40	Fine sediments, mixed and rocky habitats	30-400
45. White Hake	<i>Urophycis tenuis</i>	NEFMC	NE Multispecies	0.15	Macroplanktivore	4.2	< 20	Fine sediments, mixed and rocky habitats	30-400
46. Cusk	<i>Brosme brosme</i>	Unmanaged	NA	#N/A	Macrozoopiscivore	4	120	Gravel and rocky ground, boulders	100-200
47. Blackbelly Rosefish	<i>Heliolenus dactylopterus</i>	Unmanaged	NA	3.22	Macrozoopiscivore		47		
48. Little Skate	<i>Leucoraja erinacea</i>	NEFMC	NE Skate Complex	68.01	Macrozoopiscivore	3.6	54	Sand and gravel	10-100

Species	Scientific Name	Management authority	FMP	Total q-adjusted biomass	Trophic group	Trophic level	Adult body size	Primary Offshore Habitat	Preferred Depth Range (m)
49. Smooth Skate	<i>Malacoraja senta</i>	NEFMC	NE Skate Complex	0.05	Macrozoopiscivore		61	Soft mud	100-400
50. Pollock	<i>Pollachius virens</i>	NEFMC	NE Multispecies	0.30	Macrozoopiscivore	4.4	130	Over rocky substrates	80-300
51. Clearnose Skate	<i>Raja eglanteria</i>	NEFMC	NE Skate Complex	#N/A	Macrozoopiscivore		84	Mud and sand	0-40
52. Windowpane	<i>Scophthalmus aquosus</i>	NEFMC	NE Multispecies	2.62	Macrozoopiscivore		46	Mud and sand	0-70
53. Red Hake	<i>Urophycis chuss</i>	NEFMC	NE Small-mesh Multispecies	10.54	Macrozoopiscivore	3.6	66	Soft sediments and shells	50-300
54. Offshore Hake	<i>Merluccius albidus</i>	NEFMC	NE Small-mesh Multispecies	0.04	Macrozoopiscivore	4.3	< 40	?	160-500
55. Silver Hake	<i>Merluccius bilinearis</i>	NEFMC	NE Small-mesh Multispecies	9.74	Macrozoopiscivore	4.3	< 40	Sand	40-400
56. Blueback Herring	<i>Alosa aestivalis</i>	ASMFC	Shad & River Herring	0.51	Mesoplanktivore		40	Pelagic	
57. Alewife	<i>Alosa pseudoharengus</i>	ASMFC	Shad & River Herring	1.03	Mesoplanktivore		40		
58. American Shad	<i>Alosa sapidissima</i>	ASMFC	Shad & River Herring	0.81	Mesoplanktivore		76		
59. Atlantic Menhaden	<i>Brevoortia tyrannus</i>	MAFMC	Atlantic Menhaden	#N/A	Mesoplanktivore		50	Pelagic	
60. Atlantic Herring	<i>Clupea harengus</i>	NEFMC/ASMFC	Herring	601.69	Mesoplanktivore	3.2	45	Pelagic	60-140
61. Thorny Skate	<i>Amblyraja radiata</i>	NEFMC	NE Skate Complex	0.06	Piscivore		105	Variety of habitats	70-400
62. Weakfish	<i>Cynoscion regalis</i>	ASMFC	Weakfish	#N/A	Piscivore	3.8	98	Pelagic	
63. Barndoor Skate	<i>Dipturus laevis</i>	NEFMC	NE Skate Complex	24.38	Piscivore		152	Mud, sand, and gravel	40-400
64. Atlantic Cod	<i>Gadus morhua</i>	NEFMC	NE Multispecies	15.59	Piscivore	4.4	200	Complex hard bottom habitats, sand and gravel	30-160
65. Sea Raven	<i>Hemitripterus americanus</i>	Unmanaged	NA	5.34	Piscivore		64		
66. Fourspot Flounder	<i>Hippoglossina oblonga</i>	Unmanaged	NA	4.69	Piscivore		41		

Species	Scientific Name	Management authority	FMP	Total q-adjusted biomass	Trophic group	Trophic level	Adult body size	Primary Offshore Habitat	Preferred Depth Range (m)
67. Atlantic Halibut	<i>Hippoglossus hippoglossus</i>	NEFMC	NE Multispecies	0.63	Piscivore	4.5	470	Sand, gravel, or clay	60-140, also on slope
68. Winter Skate	<i>Leucoraja ocellata</i>	NEFMC	NE Skate Complex	146.56	Piscivore		110	Sand and gravel	10 to 90
69. Goosefish	<i>Lophius americanus</i>	NEFMC/MAFMC	Monkfish	1.24	Piscivore	4.45	120	Variety of habitats, prefer soft sediments	50-400
70. Offshore Hake	<i>Merluccius albidus</i>	NEFMC	NE Small-mesh Multispecies	0.09	Piscivore	4.3	41	?	160-500
71. Silver Hake	<i>Merluccius bilinearis</i>	NEFMC	NE Small-mesh Multispecies	19.49	Piscivore	4.3	76	Sand	40-400
72. Striped Bass	<i>Morone saxatilis</i>	ASMFC	Striped Bass	0.33	Piscivore	4.5	200	Pelagic	
73. Summer Flounder	<i>Paralichthys dentatus</i>	MAFMC/ASMFC	Summer Flounder, Scup, and Black Sea Bass	4.69	Piscivore	4.5	94		
74. Bluefish	<i>Pomatomus saltatrix</i>	MAFMC	Bluefish	5.63	Piscivore	4.5	130	Pelagic	10 to 50
75. Spiny Dogfish	<i>Squalus acanthias</i>	MAFMC/NEFMC	NE Skate Complex	192.42	Piscivore	4.3	40-160		20-300
76. White Hake	<i>Urophycis tenuis</i>	NEFMC	NE Multispecies	0.46	Piscivore	4.2	133	Fine sediments, mixed and rocky habitats	30-400
77. Butterfish	<i>Peprilus triacanthus</i>	MAFMC	Mackerel, Squid, and Butterfish	11.47	Planktivore	4	30	Pelagic	
78. Atlantic Mackerel	<i>Scomber scombrus</i>	MAFMC	Mackerel, Squid, and Butterfish	50.75	Planktivore	3.7	60	Pelagic	
79. John Dory	<i>Zenopsis conchifer</i>	Unmanaged	NA	#N/A	Planktivore		80		
80. Acadian Redfish	<i>Sebastes fasciatus</i>	NEFMC	NE Multispecies	0.01	Planktivore-Piscivore	4	30	Soft sediments, gravel, and rocky habitats	100-300
81. Chain Dogfish	<i>Scyliorhinus retifer</i>	Unmanaged	NA	0.05	Small Shark		48		

