Black Sea Bass Fishery Information Document

June 2017

This document provides a brief overview of the biology, stock condition, management system, and fishery performance for black sea bass with an emphasis on 2016, the most recent complete fishing year.

1. Biology

Black sea bass (*Centropristis striata*) are distributed from the Gulf of Maine through the Gulf of Mexico, but fish north of Cape Hatteras, North Carolina are considered one unit stock. Adults and juveniles are mostly found on the continental shelf. Young of the year (i.e., fish less than one year old) can be found in estuaries. Adults prefer to be near structures such as rocky reefs, coral patches, cobble and rock fields, mussel beds, and shipwrecks. Adults in the Mid-Atlantic show strong site fidelity during the summer but migrate to offshore wintering areas south of New Jersey when water temperatures decrease in the fall. Adults in the South Atlantic and Gulf of Mexico do not migrate during the winter.[1]

Black sea bass are protogynous hermaphrodites, meaning the majority are born female and then later transition to males, usually around 2-5 years of age. Male black sea bass are either of the dominant or subordinate type. Dominant males are larger than subordinate males and develop a bright blue nuccal hump during the spawning season. About half of black sea bass are sexually mature by 2 or 3 years of age and about 20 cm (about 8 inches) in length. Most black sea bass greater than 19 cm (about 7.5 inches) are either in a transitional stage between female and male or have fully transitioned to the male stage. Results from a simulation model highlight the importance of subordinate males, and therefore less reliance on dominant males, in the spawning success of sea bass improving its resiliency to exploitation compared to other species with a typical protogynous life history. Black sea bass reach a maximum size of about 60 cm (about 24 inches) and a maximum age of about 12 years.[1,2]

Black sea bass in the Mid-Atlantic spawn in nearshore continental shelf areas at depths of 20-50 meters. Spawning usually takes place between April and October. During the summer, adult black sea bass share complex coastal habitats with tautog, hakes, conger eel, sea robins and other migratory fish species. Essential Fish Habitat (EFH) for black sea bass consists of pelagic waters, structured habitat, rough bottom, shellfish, sand, and shell, from the Gulf of Maine through Cape Hatteras, North Carolina. Juvenile and adult black sea bass mostly feed on crustaceans, small fish, and squid. The Northeast Fisheries Science Center (NEFSC) food habits database lists spiny dogfish, Atlantic angel shark, skates, spotted hake, summer flounder, windowpane, and monkfish as predators of black sea bass.[1]

2. Status of the Stock

A benchmark stock assessment for black sea bass was peer-reviewed and approved at the 62nd Stock Assessment Review Committee (SARC 62) in December 2016. The protogynous life history, structure-orienting behavior and potential spatial stock structure of black sea bass have

posed challenges for prior analytical assessments of this species. The benchmark stock assessment was successful at evaluating, addressing and incorporating many of the concerns and greatest sources of uncertainty that had plagued prior stock assessments. The 2016 benchmark stock assessment working group spent a great deal of time analyzing and simulating various datasets to gain a better understanding on how these life history characteristics impact the assessment and the black sea bass population. As the result of this new information and changes to the modelling approaches, new biological reference points were developed as part of the assessment.[3,4]

The 2016 benchmark assessment indicated that the black sea bass stock north of Cape Hatteras, North Carolina was not overfished and overfishing was not occurring in 2015, the terminal year of the assessment. Spawning stock biomass (SSB) averaged around 6 million pounds from the late 1980's and early 1990's and then steadily increased from 1997 to 2002 when it reached 18.7 million pounds. There was then a decline in SSB until 2007 (8.9 million pounds), followed by a steady increase through 2015 with SSB at its highest estimated level (Figure 1). The model-estimated SSB in 2015 was 48.89 million pounds (22,176 mt), 2.3 times SSB at maximum sustainable yield, SSB_{MSY} = 21.31 million pounds (9,667 mt).[4]

The fishing mortality rate (F) in 2015 was 0.27, below the fishing mortality threshold reference point ($F_{MSY\ PROXY}$ = F40%) of 0.36 (Figure 2). Fishing mortality was very high in the early 1990's, typically greater than 1.0, but declined and stabilized after 1997 once black sea bass was added to the summer flounder and scup management plan. Fishing mortality has been below the $F_{MSY\ PROXY}$ reference point for the last five years. Model estimated recruitment was relatively constant throughout the time series except for large peaks from the 1999 and 2011 year classes. Average recruitment of age 1 black sea bass from 1989 – 2015 equaled 24.3 million fish with the 1999 year class estimated at 37.3 fish and the 2011 year class estimated at 68.9 million fish. Since 2012, recruitment has been average with the latest cohort (2014 year class) estimated to be 24.9 million fish. There is some evidence there may be a strong 2015 year class but additional catch and survey information is needed to determine its status.[4]

A data update with information through 2016, including recent estimates of commercial and recreational fishery catch and fishery independent indices, will be provided by the NEFSC in July 2017.

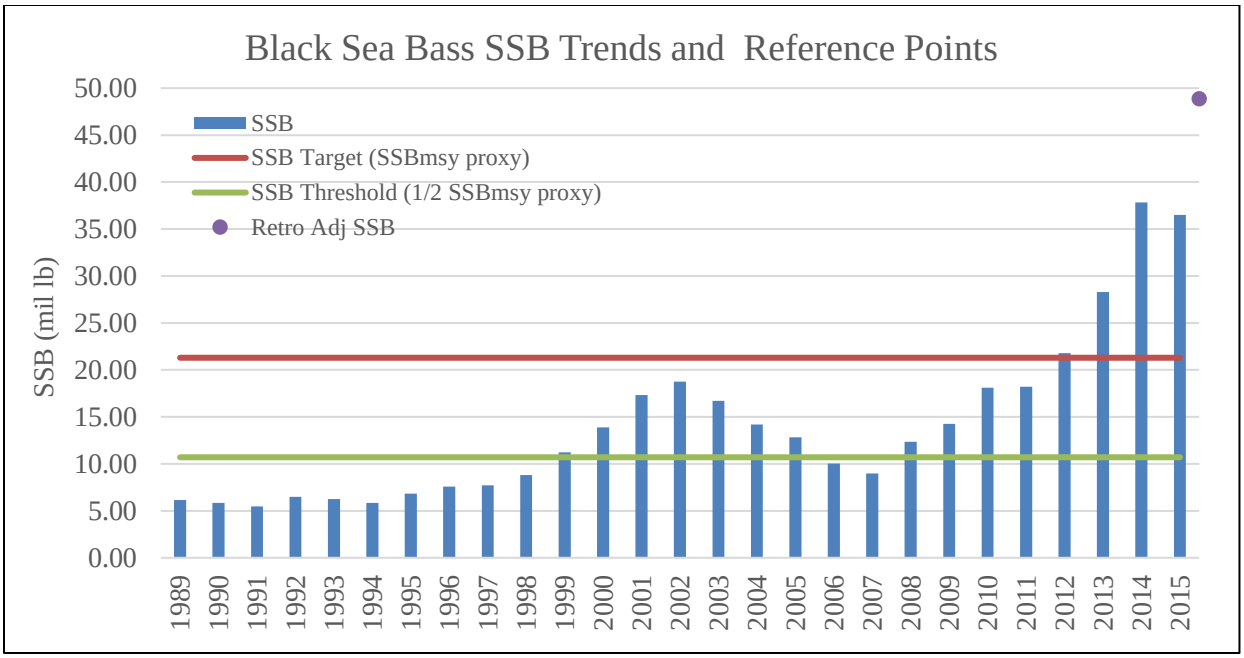

Figure 1: Spawning stock biomass, both mature male and female biomass, of black sea bass from 1989 to 2015 and biomass reference points from the 2016 benchmark stock assessment. The 2015 retro-adjusted spawning stock biomass value was generated to correct for the retrospective bias present in the assessment model and is used as the estimate to compare to the reference points.[4]

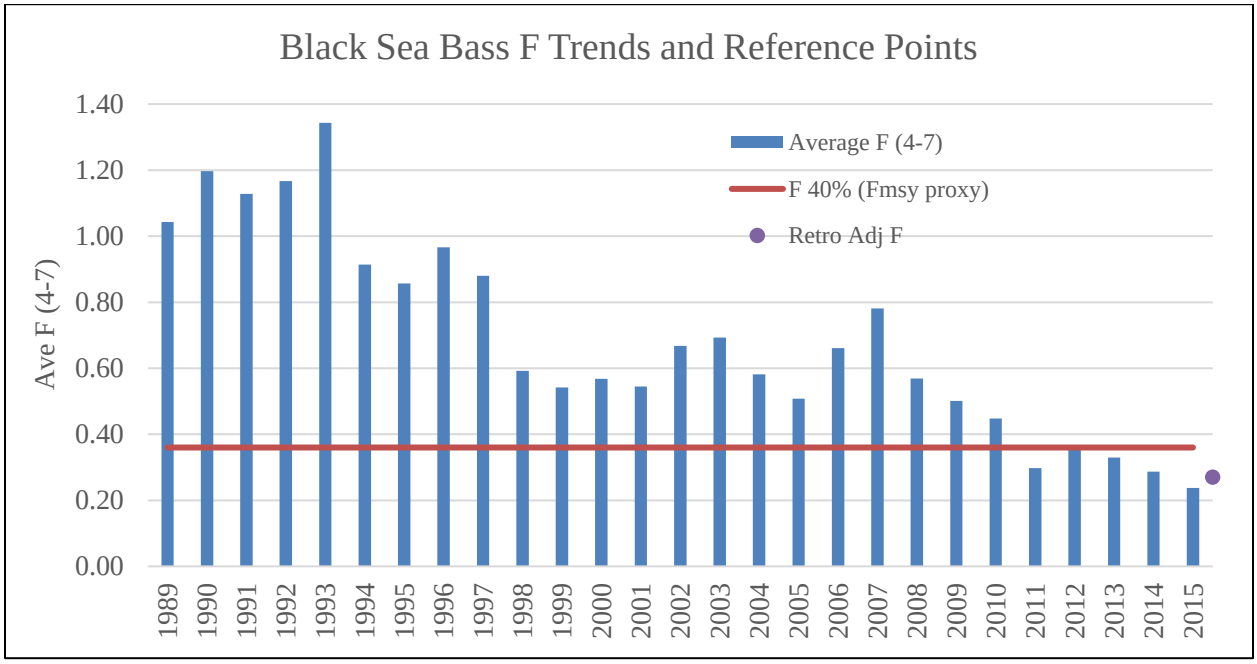

Figure 2: Fishing mortality rate on black sea bass ages 4-7 and the $F_{MSY\ PROXY}$ reference point from the 2016 benchmark stock assessment. The 2015 retro-adjusted fishing mortality rate value was generated to correct for the retrospective bias present in the assessment model and is used as the estimate to compare to the reference points.[4]

In January 2017, the Mid-Atlantic Fishery Management Council's (Council's) Scientific and Statistical Committee (SSC) reviewed the most recent black sea bass benchmark stock assessment and peer review results. The SSC recognized the substantial improvement in the black sea bass stock assessment and accepted the OFL estimates produced by the stock assessment for management use.

3. Management System and Overall Fishery Performance

The Council and the Atlantic States Marine Fisheries Commission (Commission) work cooperatively to develop fishery regulations for black sea bass from Maine through Cape Hatteras, North Carolina. The Council and Commission work in conjunction with the National Marine Fisheries Service (NMFS), which serves as the federal implementation and enforcement entity. This cooperative management endeavor was developed because a significant portion of the catch is taken from both state waters (0-3 miles offshore) and federal waters (3-200 miles offshore, also known as the Exclusive Economic Zone or EEZ). The management unit for black sea bass includes U.S. waters from Cape Hatteras, North Carolina to the U.S.-Canadian border.

The Council has managed back sea bass since 1997 when it amended the Summer Flounder and Scup Fishery Management Plan (FMP) to include black sea bass. The original FMP and subsequent amendments and frameworks are available at: www.mafmc.org/fisheries/fmp/sf-s-bsb.

Commercial and recreational black sea bass fisheries are managed using catch and landings limits, commercial quotas, recreational harvest limits, minimum fish sizes, gear regulations, permit requirements, and other provisions as prescribed by the FMP. The Council allocates 49% of the total allowable landings of black sea bass to the commercial fishery as a commercial quota and 51% of allowable landings to the recreational fishery as a recreational harvest limit.

The Council's SSC recommends annual Acceptable Biological Catch (ABC) levels for black sea bass, which are then approved by the Council and Commission and submitted to NMFS for final approval and implementation. The ABC is divided into commercial and recreational Annual Catch Limits (ACLs), based on the landings allocation prescribed in the FMP and the recent distribution of discards between the commercial and recreational fisheries. The Council first implemented recreational and commercial ACLs, with a system of overage accountability, in 2012. Both the ABC and the ACLs are catch limits (i.e., include both projected landings and discards), while the commercial quota and the recreational harvest limit are landing limits.

Table 1 shows black sea bass catch and landings limits from 2008 through 2018, as well as commercial and recreational landings through 2016. Total black sea bass landings (commercial and recreational) peaked in 1986, when approximately 15.8 million pounds of black sea bass were landed About 7.70 million pounds of black sea bass were landed by commercial and recreational fishermen from Maine through Cape Hatteras, North Carolina in 2016 (Figure 3).[5,6]

Table 1: Summary of catch limits, landings limits, and landings for commercial and recreational black sea bass fisheries and landings from Maine through Cape Hatteras, NC 2008 through 2018.

Management measures	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018 [d]
ABC (mil. lb) [a]	--	--	4.50	4.50	4.50	5.50	5.50	5.50	6.67	10.47	8.94
Commercial ACL (mil. lb)[a]	--	--	--	--	1.98	2.60	2.60	2.60	3.15	5.09	4.35
Commercial quota (mil. lb) [b]	2.03	1.09	1.76	1.71	1.71	2.17	2.17	2.21	2.71	4.12	3.52
Commercial landings (mil. lb)	1.93	1.18	1.68	1.69	1.72	2.26	2.18	2.29	2.59[c]	--	--
% of commercial quota landed	95%	108%	95%	99%	101%	104%	100%	104%	96%	--	--
Recreational ACL (mil. lb)[a]	--	--	--	--	1.86	2.90	2.90	2.90	3.52	5.38	4.59
Recreational harvest limit (mil. lb) [b]	2.11	1.14	1.83	1.78	1.32	2.26	2.26	2.33	2.82	4.29	3.66
Recreational landings (mil. lb)	2.03	2.56	3.19	1.17	3.19	2.46	3.60	3.79	5.19	--	--
% of recreational limit harvested	96%	225%	174%	66%	242%	109%	159%	163%	184%	--	--

[a] The ABC is the annual Acceptable Biological Catch for the entire black sea bass fishery, and is divided into sector-specific Annual Catch Limits (ACLs) for the commercial and recreational fisheries. The ABC and ACLs include both landings and discards.

[b] Commercial quotas and recreational harvest limits reflect the removal of projected discards from the sector-specific ACLs. For 2006-2014, these limits are also adjusted for Research Set Aside (RSA). Quotas and harvest limits for 2015-2018 do not reflect an adjustment for RSA due to the suspension of the program in 2014.

[c] Preliminary.

[d] Currently implemented; subject to change based on SSC review and subsequent Council and Commission review in July/August 2017.

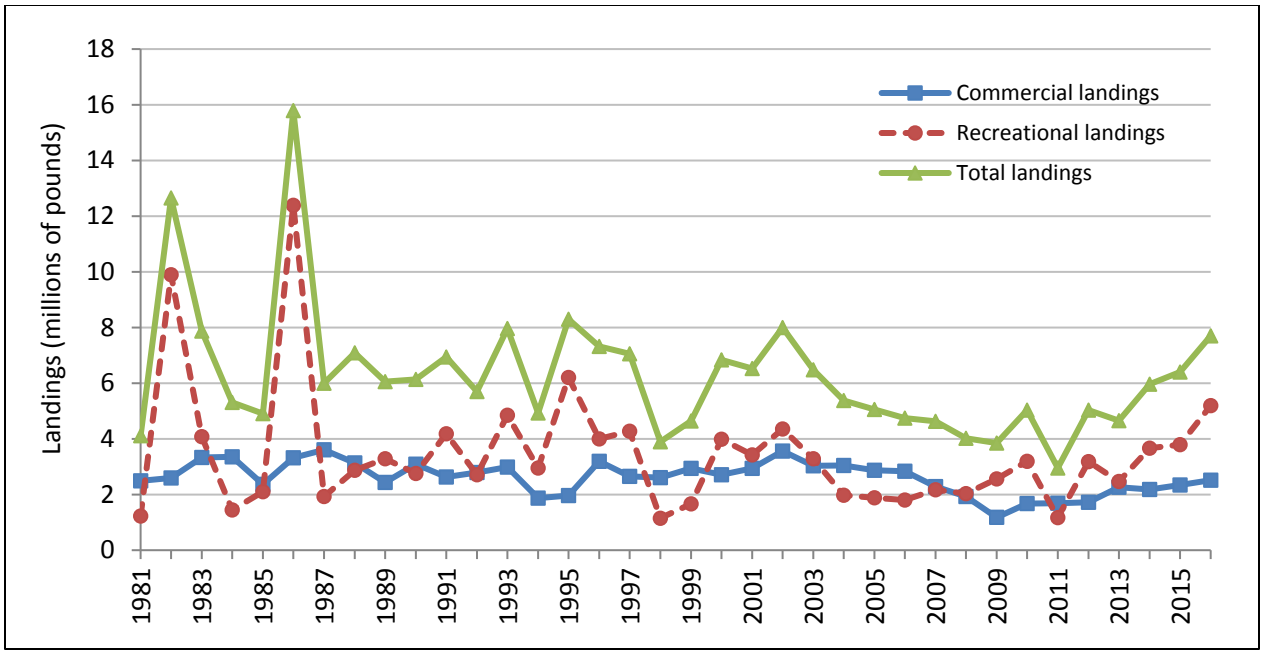

Figure 3: Commercial and recreational black sea bass landings in millions of pounds from Maine through Cape Hatteras, North Carolina, 1981-2016.[5,6]

4. Commercial Black Sea Bass Measures and Fishery Performance

Commercial landings of black sea bass peaked in 1987 at 3.61 million pounds, and reached a low of 1.18 million pounds in 2009 (Figure 3). In 2016, commercial fishermen landed approximately 2.59 million pounds of black sea bass (corresponding to 96% of the commercial quota), an increase from 2.29 million lb in 2015 which corresponds to an increase in the 2016 quota.[6]

A moratorium permit is required to fish commercially for black sea bass in federal waters. In 2016, 673 vessels held federal commercial black sea bass permits.[7]

The minimum commercial size limit for black sea bass of 11 inches total length has been in place since 2002. The Commission divides the black sea bass commercial quota among the states based on the allocation percentages given in Table 2, and states set measures to achieve their state-specific commercial quotas.

Table 2: Allocation of commercial black sea bass quota among states established in the Commission's FMP.

State	Allocation (percent)
Maine	0.5
New Hampshire	0.5
Massachusetts	13.0
Rhode Island	11.0
Connecticut	1.0
New York	7.0
New Jersey	20.0
Delaware	5.0
Maryland	11.0
Virginia	20.0
North Carolina	11.0
Total	100

Vessel Trip Report (VTR) data for 2016 indicate that 65% of the commercial black sea bass caught by federal permit holders from Maine to North Carolina was caught with bottom otter trawl gear. About 22% were caught with fish pots and traps, 5% in offshore lobster traps, 4% with hand lines and 2% assigned to beam otter trawls. Other gear types accounted for just over 1% each of total commercial landings.[8]

Any federally-permitted vessel which uses otter trawl gear and catches more than 500 pounds of black sea bass from January through March, or more than 100 pounds from April through December, must use nets with a minimum mesh size of 4.5-inch diamond mesh applied throughout the codend for at least 75 continuous meshes forward of the end of the net. Pots and traps used to target black sea bass commercially must have two escape vents with degradable hinges in the section known as the parlor. The escape vents must measure 1.375 inches by 5.75 inches if rectangular, 2 inches by 2 inches if square, or have a diameter of 2.5 inches if circular.

A review of the VTR data suggest that statistical area 616 was responsible for the largest percentage of commercial black sea bass catch in 2016 (Table 3, Figure 4). While statistical area 539 accounted for only 4.6% of 2016 black sea bass catch, this area had the highest number of trips that caught black sea bass (1,378 trips), accounting for 16.3% of all trips.[8] It should be noted that discards on VTR's are self-reported.

Table 3: Statistical areas that accounted for at least 5% of the total commercial black sea bass catch in 2016, with associated number of trips.[8]

Statistical Area	Percent of 2016 Commercial Black Sea Bass Catch	Number of Trips
616	34%	492
621	11%	318
613	11%	933
537	9%	921
615	8%	158

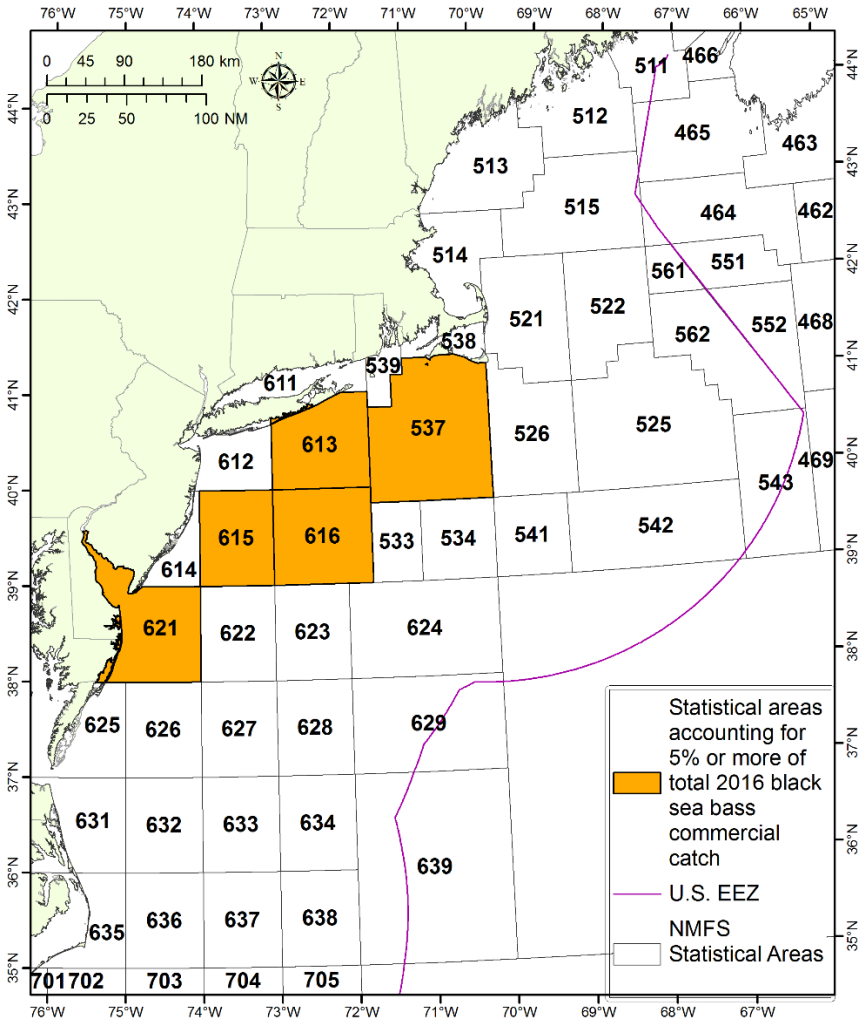

Figure 4: NMFS Statistical Areas, highlighting those that each accounted for more than 5% of the commercial black sea bass catch in 2016.[8]

Over the past two decades, total black sea bass ex-vessel value (adjusted to 2016 dollars to account for inflation) from Maine to North Carolina has ranged from a low of $3.33 million in 1994 and

reached a time series high in 2016 with an ex-vessel vlaue of of $9.26 million. Black sea bass reached its lowest adjusted average annual price per pound in 1996, at $1.65 ($1.14 in 1996 dollars), and its highest adjusted average annual price per pound in 2016, at $3.58 (Figure 5).[6]

In 2016, 2.59 million pounds of black sea bass were landed in the commercial fishery, generating $9.26 million in revenues at an average price of $3.58 per pound (Figure 5). Landings, ex-vessel value and price per pound are all increases from 2015.[6]

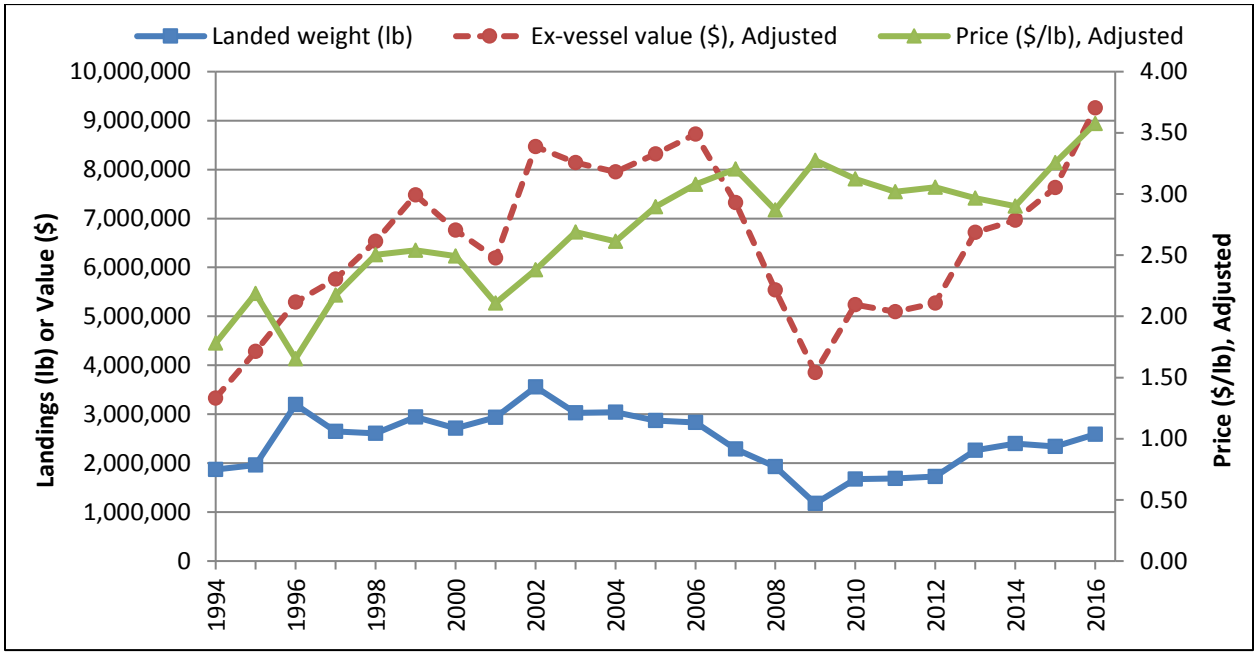

Figure 5: Landings, ex-vessel value, and price for black sea bass, from Maine through North Carolina, 1994-2016. Ex-vessel value and price are adjusted to real 2016 dollars.[6]

At least 100,000 pounds of black sea bass were landed in each of nine ports in seven east coast states in 2016. These nine ports accounted for nearly 61% of all commercial black sea bass landings in 2016 (Table 4).[6] Detailed community profiles developed by the NEFSC Social Science Branch can be found at www.mafmc.org/communities/.

Table 4: Ports reporting at least 100,000 lb of black sea bass landings in 2016, and corresponding percentage of total 2016 commercial black sea bass landings.[6]

Port name	Pounds of black sea bass landed	% of total commercial black sea bass landed	Number of vessels landing black sea bass
HAMPTON, VA	238,435	9.2	39
PT. PLEASANT, NJ	237,355	9.2	39
OCEAN CITY, MD	232,039	9.0	7
POINT JUDITH, RI	208,962	8.1	133
CAPE MAY, NJ	151,608	5.9	39
CHINCOTEAGUE, VA	141,663	5.5	10
NEW BEDFORD, MA	136,399	5.3	49
MONTAUK, NY	108,590	4.2	88
BEAUFORT, NC	104,916	4.1	47

207 federally-permitted dealers from Maine through North Carolina bought black sea bass in 2016, down slightly from 209 dealers purchasing black sea bass in 2015. More dealers bought black sea bass in New York than in any other state (Table 5). All dealers purchased approximately $9.26 million worth of black sea bass in 2016.[6]

Table 5: Dealers, by state, who reported buying black sea bass in 2016.[6]

State	MA	RI	CT	NY	NJ	DE	MD	VA	NC
Number of dealers	32	32	13	46	32	3	8	16	25

5. Recreational Black Sea Bass Measures and Fishery Performance

Black sea bass support a sizable recreational fishery in the Mid-Atlantic region. Most recreational black sea bass landings occur in state waters when the fish migrate inshore during the warm summer months.

The Council develops coast-wide regulations for the recreational black sea bass fishery in federal waters, including a minimum size, a possession limit, and open seasons (Table 6). The Commission and member states develop recreational black sea bass regulations in state waters (Table 7).

Table 6: Federal recreational measures for black sea bass, north of Cape Hatteras, NC, 2007 through 2017.

Measure	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Min. size (inches, total length)	12	12	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Possession limit	25	25	25	25	25	25	20	15	15	15	15
Open season	1/1-12/31	1/1-12/31	1/1-10/5	5/22-10/11 and 11/1-12/31	5/22-10/11 and 11/1-12/31	5/19-10/14 and 11/1-12/31	5/19-10/14 and 11/1-12/31	5/19-9/18 and 10/18-12/31	5/15-9/21 and 10/22-12/31	5/15-9/21 and 10/22-12/31	5/15-9/21 and 10/22-12/31

Table 7: State waters black sea bass recreational fishing measures in 2017.

State	Minimum Size (inches)	Possession Limit	Open Season
Maine	13	10 fish	May 19-September 21; October 18-December 31
New Hampshire	13	10 fish	January 1-December 31
Massachusetts	15	5 fish	May 20-August 29
Rhode Island**	15	3 fish	May 25-August 31
		7 fish	September 1-21; October 22-31
		5 fish	November 1-December 31
Connecticut** (Private & Shore)	15	5 fish	May 1-December 31
CT Authorized Party/Charter Monitoring Program Vessels		8 fish	May 1-October 31
		5 fish	November 1-December 31
New York**	15	3 fish	June 27-August 31
		8 fish	September 1-October 31
		5 fish	November 1-December 31
New Jersey**	12.5	10 fish	May 26-June 18
		2 fish	July 1-August 31
	TBD*	TBD*	TBD*
Delaware	12.5	15 fish	May 15-September 21; October 22-December 31
Maryland	12.5	15 fish	May 15-September 21; October 22-December 31
Virginia	12.5	15 fish	May 15-September 21; October 22-December 31
North Carolina, North of Cape Hatteras (N of 35° 15'N)	12.5	15 fish	May 15-September 21; October 22-December 31

***** New Jersey DFW has indicated the fall regulations are TBD

** On May 10, 2017, the possession limit was modified to 5 fish during Wave 6 (November/December) for the states of RI-NJ

Recreational data for 2004 and later are available from the Marine Recreational Information Program (MRIP). For years prior to 2004, recreational data were generated by the Marine Recreational Fishery Statistics Survey (MRFSS). Recreational black sea bass catch and landings peaked in 1986 when an estimated 28.95 million fish were caught and 21.74 million fish were landed by recreational fishermen from Maine to Cape Hatteras, North Carolina. Recreational catch reached a low of 3.43 million fish in 1984. Recreational landings were at their lowest in 2011, when 0.82 million fish were landed. In 2016, MRIP data indicate that an estimated 5.19 million pounds of black sea bass were landed recreationally from Maine through Cape Hatteras, North Carolina, corresponding to 184% of the 2016 recreational harvest limit (Tables 8 and 1, respectively).[5]

For-hire vessels carrying passengers in federal waters must obtain a federal party/charter permit. In 2016, 749 party and charter boats held federal recreational black sea bass permits. Many of these vessels also hold recreational permits for summer flounder and scup. The number of federal recreational black sea bass permits has steadily declined since a peak of 904 permits issued in 2009.[7]

Table 8: Estimated recreational black sea bass catch and landings from 1982 through 2016 from Maine through Cape Hatteras, North Carolina.[5]

Year	Catch ('000 of fish)	Landings ('000 of fish)	Landings ('000 of pounds)
1982	11,386	10,045	9,894
1983	7,561	4,537	4,079
1984	3,428	1,780	1,447
1985	6,047	3,388	2,097
1986	28,946	21,742	12,392
1987	5,052	2,883	1,924
1988	8,186	3,088	2,869
1989	6,427	4,239	3,289
1990	9,135	3,881	2,761
1991	10,829	5,269	4,186
1992	7,722	3,592	2,706
1993	9,023	6,007	4,842
1994	7,166	3,430	2,948
1995	14,059	6,747	6,207
1996	8,143	3,624	3,993
1997	10,646	4,739	4,268
1998	5,146	1,148	1,152
1999	7,400	1,378	1,664
2000	16,927	3,629	3,988
2001	13,869	2,841	3,421
2002	14,703	3,351	4,349
2003	12,128	3,251	3,289
2004	7,238	1,531	1,973
2005	7,041	1,263	1,883
2006	7,602	1,286	1,800
2007	8,727	1,528	2,175
2008	10,653	1,294	2,031
2009	9,224	1,806	2,558
2010	9,964	2,207	3,190
2011	4,737	817	1,171
2012	12,536	1,874	3,185
2013	9,807	1,282	2,464
2014	10,870	2,118	3,667
2015	9,429	2,215	3,790
2016	14,139	2,543	5,187

In 2016, about 65% of black sea bass landed by recreational fishermen were caught in state waters, and about 35% in federal waters (Table 9). The majority of black sea bass were landed in New York, Connecticut and Massachusetts. These three states accounted for about 73% of all recreational landings from Maine to Cape Hatteras, North Carolina in 2016 (Table 10).[5]

Table 9: Estimated percentage of black sea bass recreational landings (in numbers of fish) in state vs. federal waters, from Maine through North Carolina, 2007 through 2016.[5]

Year	State waters	Federal waters
2007	34.8%	65.2%
2008	60.3%	39.7%
2009	67.5%	32.5%
2010	72.1%	27.9%
2011	63.8%	36.2%
2012	72.6%	27.4%
2013	66.6%	33.4%
2014	62.5%	37.5%
2015	67.3%	32.7%
2016	64.6%	35.4%
2007-2016 average	**63.2%**	**36.8%**
2014-2016 average	**64.8%**	**35.2%**

Table 10: State-by-state contribution (as a percentage) to total recreational landings of black sea bass (in number of fish), Maine through Cape Hatteras, North Carolina, in 2015 and 2016.[5]

State	2015	2016
Maine	0.0%	0.0%
New Hampshire	0.0%	0.0%
Massachusetts	15.5%	15.4%
Rhode Island	10.5%	10.0%
Connecticut	14.9%	17.1%
New York	39.6%	40.6%
New Jersey	14.0%	11.6%
Delaware	1.0%	1.0%
Maryland	2.6%	3.1%
Virginia	1.8%	1.1%
North Carolina	0.1%	0.0%

MRIP data indicate that about 79% of recreational black sea bass landings in 2016 were caught by anglers fishing on private or rental boats, about 18% from anglers aboard party or charter boats, and less than 3% from shore (Table 11).[5]

Table 11: The number of black sea bass landed (in numbers of fish) by recreational fishing mode, Maine through North Carolina, 1981-2016.[5]

Year	Shore	Party/charter	Private/rental
1981	452,103	1,440,169	841,478
1982	81,445	8,104,204	2,063,334
1983	222,012	4,005,707	1,403,508
1984	98,227	1,128,294	1,264,897
1985	163,448	2,393,049	1,659,700
1986	1,021,525	16,695,387	4,187,084
1987	71,956	1,157,243	2,238,159
1988	140,754	1,691,300	2,227,901
1989	237,970	1,991,672	2,419,654
1990	289,378	2,268,915	1,710,455
1991	250,675	2,586,145	2,621,271
1992	45,369	2,043,190	1,780,224
1993	54,676	4,579,662	1,562,227
1994	243,347	2,005,883	1,321,629
1995	275,982	5,197,231	1,413,571
1996	70,523	2,631,733	1,062,027
1997	8,337	3,950,336	908,836
1998	7,073	777,874	474,069
1999	19,231	621,354	771,260
2000	177,489	1,797,702	1,780,240
2001	14,035	1,826,852	1,164,977
2002	16,618	2,066,232	1,338,448
2003	10,760	2,073,132	1,308,493
2004	9,462	698,453	1,217,160
2005	13,110	605,932	869,467
2006	49,080	730,749	612,618
2007	9,865	909,869	709,901
2008	9,447	479,682	852,619
2009	23,992	442,107	1,442,842
2010	6,096	519,529	1,809,046
2011	8,177	310,760	561,730
2012	6,443	701,777	1,237,668
2013	12,246	274,269	1,035,601
2014	20,065	785,730	1,386,149
2015	3,284	936,006	1,343,013
2016	71,255	475,712	2,053,370
% of Total, 1981-2015	3.1%	58.7%	38.2%
% of Total, 2014-2016	1.3%	31.1%	67.6%

References

[1] Drohan, A.F., J. P. Manderson, D. B. Packer. 2007. Essential fish habitat source document: black sea bass, *Centropristis striata*, life history and habitat characteristics, 2nd edition. NOAA Technical Memorandum NMFS NE 200; 68 p.

[2] Blaylock, J. and G.R. Shepherd. 2016. Evaluating the vulnerability of an atypical protogynous hermaphrodite to fishery exploitation: results from a population model for black sea bass (Centropristis striata). Fishery Bulletin 114(4): 476-489.

[3] 62nd Northeast Regional Stock Assessment Workshop (62nd SAW) Assessment Summary Report at http://www.nefsc.noaa.gov/publications/crd/crd1701/crd1701.pdf.

[4] NEFSC (Northeast Fisheries Science Center). 2017. 62nd Northeast Regional Stock Assessment Workshop (62nd SAW) Assessment Report. US Dept. Commer., Northeast Fish Sci Cent Ref Doc. 17-03; 822 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://nefsc.noaa.gov/publications/.

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[8] Unpublished NMFS Vessel Trip Report (VTR) data.