Technical Report

2000 Massachusetts Striped Bass Monitoring Report

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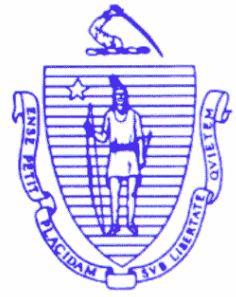Gary A. Nelson, Michael P. Armstrong, and Thomas Hoopes

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Massachusetts 2000 Striped Bass Fisheries Monitoring Report

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Executive Summary

During 2000, the commercial fishery for striped bass in Massachusetts harvested about 40,256 fish weighing 779,736 pounds. Total losses due to commercial harvesting (including release mortality) were 52,798 fish weighing 891,308 pounds. The recreational fishery harvested about 175,533 striped bass weighing over 2.5 million pounds. Total losses due to recreational fishing (including release mortality) were 747,019 fish weighing 5,638,423 pounds. Combined losses (includes losses due to scientific sampling) were 800,846 fish weighing 6,537,732 pounds, which reflects an increase (43% by number) in losses compared to 1999 (557,943 fish; 4,778,142 pounds). The majority of losses, 93% by number and 86% by weight, was attributed to the recreational fishery.

Introduction

This report summarizes the commercial and recreational striped bass fisheries conducted in Massachusetts during 2000. Data sources used to characterize the state fisheries come from monitoring programs of the Massachusetts Division of Marine Fisheries (DMF) and National Marine Fisheries Service (NMFS), which are considered to be essential elements of the long-term management approach described in Section 5 of the Atlantic States Marine Fisheries

Commission's (ASMFC) Fisheries Management Report No. 24 (Amendment #5 to the Interstate Fishery management Plan for Atlantic Striped Bass (IFMP))(Diodati, 1990).

Harvest and Losses

Commercial Fishery

Season: July 3-September 4. No landings were permitted on Thursday-Saturday.

Harvest: 779,736 pounds (against a harvest quota of 796,000 pounds).

Allowable Gear Type: Hook and line.

Minimum Size: 34 inches total length.

Licensing and Reporting: To purchase striped bass directly from fishermen, fish dealers are required to obtain special authorization from the DMF in addition to standard seafood dealer permits. Dealer reporting requirements include weekly telephone reports of all striped bass purchases; DMF administers a toll-free number and an interactive voice response system for this purpose. Following the close of the season, dealers are also required to provide a written transcript consisting of purchase dates, number of fish, pounds of fish, and names and permit numbers of fishermen from whom they purchased.

Fishermen must have a DMF commercial fishing permit (of some type)and a special striped bass fishing permit to sell their catch. They are also required to file catch reports at the end of the season, which include the name of the dealer(s) that they sell to and extensive information describing their catch composition and catch rates on a monthly basis. In addition, many fishermen voluntarily provide daily fishing logs.

Methods: The dealer telephone survey is used to gauge the distance to the harvest cap, while the dealer written transactions are used to estimate the final harvest. Information from catch reports and voluntary logs is used to characterize effort, disposition of the catch, catch weight, and size composition by catch category

Data from 1,424 fish sampled from the 2000 commercial harvest and the on-going DMF diet study was used to construct a length-to-weight conversion equation. The following geometric regression was derived:

$$\log 10\,(W) = -3.55763 + 3.077439 * \log 10\,(L), \quad RMS = 0.002272$$

where W equals weight in pounds, L equals total length in inches, and RMS is the residual mean square error. This equation was used to estimate the arithmetic average weight for given lengths by back-transforming the geometric weight as follows:

$$W = 10^{\wedge(-3.55763 + 3.077439 * \log 10(L) + RMS\,/\,2)}$$

Harvest Levels and Catch Composition

Due to problems with the new licensing system, dealer transactions were unavailable to determine landings for 2000. The estimate used here comes from dealer phone transactions. The estimate of commercial landings in 2000 was 779,736 pounds (40,256 fish) (Box 1). Size composition of the commercial catch by category of disposition is presented in Tables 1 (numbers of fish) and 1A (pounds of fish). Some commercial license holders, as in past years, reported releasing legal-size fish during the commercial season. This category represented 6.8% of the total catch. About 31% of the total catch was greater than the legal minimum of 34 inches.

Box 1. Attributes of the Massachusetts Striped Bass Commercial Fishery: 1990-2000

SEASON	SEASON LENGTH (D)	HARVEST (Pounds) 000s	HARVEST (Numbers) 000s	DEALER PERMITS	FISHING PERMITS
1990	93	160.6	6.3	95	1,498
1991	59	234.8	10.4	92	1,739
1992	39	239.2	11.3	135	1,861
1993	35	262.6	13.0	152	2,056
1994	24	199.6	10.4	150	2,367
1995	57	782.0	41.2	161	3,353
1996	42	696.8	38.3	179	3,801
1997	42	785.9	44.8	173	5,500
1998	28	822.0	45.3	180	5,540
1999	40	788.2	40.8	167	3,577
2000	36	779.7	40.2	137	3,280

Age and Sex Composition

Four-hundred and eighty-one striped bass sampled from the 2000 commercial harvest were used to estimate age and sex, respectively. Age was determined from scales and sex was determined by visual inspection of gonadal tissue (Sykes Method). Age ranged from 7 to 16 years, 98.4% were females. Approximately 96% of the sub-sample consisted of individuals from the 1987-1992 year classes (ages 8-13) (Box 2).

Estimation of Effort

Total hours fished from standard catch reports and average hours fished per trip from voluntary logs were used to estimate effort. Estimates were increased by 23%, the fraction of non-reporters who fished. Effort during the 63-day season amounted to 111,171 h fished and trip duration averaged 6.02 h. These figures imply that 18,467 trips were conducted. This reflects a decrease in effort from 1999 levels (Box 3). The commercial CPUE increased in 2000 to nearly 1997-1998 levels (Box 3; Fig. 1A).

Box 2. Age and size composition of striped bass sampled from the Massachusetts 2000 commercial harvest.

Age	Year Class	Number	%	Mean Length (in.)	Mean Weight (lbs)
7	1993	10	2.1	34	16.0
8	1992	59	12.3	35	15.5
9	1991	144	29.9	36	17.8
10	1990	133	27.7	37	19.2
11	1989	76	15.8	39	22.8
12	1988	35	7.3	39	24.9
13	1987	13	2.7	42	29.9
14	1986	8	1.7	44	33.9
15	1985	2	0.4	45	36.5
16	1984	1	0.2	46	32.0

Box 3. Commercial CPUE Index based on number of fish harvested and number of fishing trips.

Year	Harvest (Numbers)	Trips	CPUE
1991	10,400	17,827	0.58
1992	11,300	13,722	0.82
1993	13,000	10,593	1.23
1994	10,400	7,455	1.40
1995	41,200	28,455	1.45
1996	38,300	28,647	1.34
1997	44,800	20,621	2.17
1998	45,300	20,061	2.26
1999	40,838	25,929	1.57
2000	40,256	18,467	2.18

Characterization of Other Losses

Release mortality was estimated by using a hook-release mortality rate of 8% applied against the released sub-legal and legal-sized fish in Table 1A and 1B. Total losses due to release mortality were 12,542 fish weighing approximately 111,572 pounds.

Recreational Fishery

Season: None

Daily Bag Limit: One fish per person

Allowable Gear Type: Hook and Line

Minimum Size: 30 inches total length

Licensing and Reporting Requirements: None

Harvest levels

Preliminary harvest (A+B1) and total catch (A+B1+B2) estimates were provided by the NMFS MRFSS. Massachusetts paid for approximately 4,000 additional intercept interviews which began during wave 3. A similar "add-on" has been conducted since 1988, however, prior to 1995 it began in wave 2. Reference should be made to Osborn and Salz (1994) for a description of the new trip estimation procedure and its affect on catch.

The length distribution of harvested fish was estimated from biological sampling conducted by the MRFSS program in Massachusetts. Estimates of the length frequencies of the sub-legal and legal-size releases were obtained from the American Littoral Society's 2000 Massachusetts release data.

The preliminary estimate of total catch (including fish released alive) in 2000 is 7,319,123 striped bass, which is higher than the 1999 estimates (4,702,962 fish), but is lower than the 1998 estimates (7,392,310) (Table 2). The preliminary estimate of total harvest is 175,533 striped bass, which is also higher than the estimates in 1999 (126,755 fish), but is lower than the estimates in 1998 (207,952 fish). Total pounds of the catch exceeded 41 million pounds while harvest was over 2.5 million pounds (Table 2A).

To examine trends in recreational angler catches, standardized catch rates (total number of fish per trip) for striped bass were calculated for all fish caught using a general linear model (GLM) which adjusts trip catches for the effects of year, wave, county, area fished, mode fished, numbers of anglers in party, and time spent fishing. Trip catches were transformed using $\ln(x+1)$. Only data for those anglers who said they targeted striped bass were used in the analyses.

Standardized catch rates (back-transformed geometric median) declined from 0.72 fish per trip in 1986 to 0.33 fish per trip in 1991, the lowest value observed in the time series (Fig. 1B). Catch rates began increasing in 1992 and peaked at 1.35 fish per trip in 1998. Since 1999, catch rates have dropped relative to 1998.

<u>Estimation of Recreational Effort</u>

Standardized effort (no. trips) for each year was calculated by dividing the total number of fish caught (A+B1+B2) by the arithmetic mean total catch rate derived from the GLM. Effort has steadily increased from about 100,883 trips in 1987 to about 3.3 million trips in 1997-1998. Standardized effort dropped in 1999 to 2.3 million trips, but increased to 3.7 million in 2000.

<u>Characterization of Losses</u>

The same methods and rates previously described in the commercial fishery section were used to estimate recreational losses.   Release mortality was 487,042 fish (2,194,218 pounds) for sub-legal size fish and 84,444 fish (909,065 pounds) for the legal-sized stripers released.

Scientific Collections

About 1,030 striped bass, ranging is size from 12 to 42 inches, were sacrificed during 2000 as part of on-going diet studies conducted by DMF and the University of Massachusetts at Amherst.

Bycatch in Other Fisheries

During 1994, DMF sea-sampling efforts identified striped bass as bycatch in a Nantucket Sound springtime trawl fishery directed at long-finned squid (*Loligo pealei*). Those bycatch estimates were about 3,100 fish (17,600 pounds). Anecdotal information was also reported for this fishery which suggested that striped bass bycatch ranged from 8,000 pounds per day, with up to single tows landing 19,000 pounds. DMF personnel have sea-sampled this fishery during 1995-2000 and have observed only incidental catches of striped bass. Limited sampling and low catch rates make it unreasonable to extrapolate sample information. DMF will continue to monitor and investigate potential sources of striped bass bycatch during 2001.

Estimated Total Losses

Total estimated loss of striped bass during 2000 was 800,847 fish weighing 6,534,831 pounds (Box 4), which reflects an increase (43% by number) in losses compared to 1999 (557,943 fish; 4,778,142 pounds). The majority of losses, 93% by number and 86% by weight, was attributed to combined losses in the recreational fishery.

Box 4. Preliminary estimates of striped bass losses occurring in Massachusetts waters during 2000.

	NUMBER	POUNDS	MEAN WT.
Commercial			
Harvest	40,256	779,736	19.9
Release Mortality	12,542	111,572	10.0
Recreational			
Harvest	175,533	2,535,140	14.4
Release Mortality	571,486	3,103,283	4.5
Scientific	1,030	5,100	5.0
Total	800,847	6,534,831	

Required Fishery-Independent Monitoring Programs

Massachusetts Tagging Study

The Massachusetts Division of Marine Fisheries (DMF) joined the Striped Bass Cooperative State-Federal Coastwide Tagging Study in 1991. The study's primary objective has been to develop an integrated database of tag releases and recoveries that will provide current information related to striped bass mortality and migration rates. The majority of striped bass tagged prior to 1991 (the tagging study began in 1986) have ranged from 18 to 28 inches in length. Since Atlantic coastal fisheries had employed minimum sizes of 28-36 inches, resulting mortality estimates from these data may understate the effects fishing has on larger striped bass. The Massachusetts tagging effort has therefore focused on the tag and release of larger fish that reach coastwide legal sizes. To accomplish this job, the DMF contracts several select charter boat captains to take DMF personnel on board to tag and release their catch during regularly scheduled fishing trips. Fish are caught in spring and fall by trolling artificial baits in shoal areas around Nantucket Island. Tag summary statistics are presented in Box 5.

Box 5. Tag summary statistics.

Year	Trips	Boats	Number Tagged	Ave. Length	SE	Length Range Min	Length Range Max.
1991	17	4	388	817	5.4	534	1300
1992	29	3	899	798	4.2	524	1267
1993	15	2	678	784	4.8	515	1210
1994	13	2	377	735	4.8	548	1028
1995	11	2	449	767	5.2	470	1178
1996	8	2	203	748	4.5	541	1077
1997	10	2	321	773	6.4	485	1090
1998	12	2	382	797	4.8	597	1055
1999	16	2	471	777	4.4	594	1108
2000	25	4	1095	752	3.1	510	1204

Table 1A. Estimated size distribution of the 2000 Massachusetts *commercial* striped bass catch (numbers of fish).

TL (inches)	Sold	Released Legal	Released Sub-Legal	Total	Percent	Cumulative Percent
14	0	0	1,531	1,531	0.78	0.78
15	0	0	0	0	0.00	0.78
16	0	0	3,063	3,063	1.55	2.33
17	0	0	0	0	0.00	2.33
18	0	0	4,594	4,594	2.33	4.66
19	0	0	4,594	4,594	2.33	7.00
20	0	0	4,594	4,594	2.33	9.33
21	0	0	0	0	0.00	9.33
22	0	0	1,531	1,531	0.78	10.10
23	0	0	1,531	1,531	0.78	10.88
24	0	0	6,126	6,126	3.11	13.99
25	0	0	6,126	6,126	3.11	17.10
26	0	0	13,783	13,783	7.00	24.09
27	0	0	9,189	9,189	4.66	28.76
28	0	0	16,846	16,846	8.55	37.31
29	0	0	6,126	6,126	3.11	40.42
30	0	0	21,440	21,440	10.88	51.30
31	0	0	4,594	4,594	2.33	53.63
32	117	0	21,440	21,557	10.94	64.57
33	468	0	15,315	15,783	8.01	72.58
34	3,511	3,140	0	6,651	3.38	75.96
35	5,968	2,692	0	8,660	4.40	80.35
36	6,144	3,589	0	9,732	4.94	85.29
37	5,325	449	0	5,773	2.93	88.22
38	5,676	1,794	0	7,470	3.79	92.01
39	4,271	0	0	4,271	2.17	94.18
40	3,101	1,794	0	4,895	2.48	96.66
41	2,282	0	0	2,282	1.16	97.82
42	1,170	449	0	1,619	0.82	98.64
43	995	0	0	995	0.50	99.15
44	351	0	0	351	0.18	99.33
45	293	449	0	741	0.38	99.70
46	351	0	0	351	0.18	99.88
47	117	0	0	117	0.06	99.94
48	59	0	0	59	0.03	99.97
49	59	0	0	59	0.03	100.00
50	0	0	0	0	0.00	100.00
51	0	0	0	0	0.00	100.00
52	0	0	0	0	0.00	100.00
53	0	0	0	0	0.00	100.00
54	0	0	0	0	0.00	100.00
55	0	0	0	0	0.00	100.00
56	0	0	0	0	0.00	100.00
57	0	0	0	0	0.00	100.00
58	0	0	0	0	0.00	100.00
59	0	0	0	0	0.00	100.00
60	0	0	0	0	0.00	100.00
Total	40,256	14,355	142,425	197,036		
Ave. Size	37.6	36.6	27.6			

Table 1B. Estimated size distribution of the 2000 Massachusetts *commercial*
striped bass catch (pounds).

TL (inches)	Sold	Released Legal	Released Sub-Legal	Total	Percent	Cumulative Percent
14	0	0	1,395	1,395	0.06	0.06
15	0	0	0	0	0.00	0.06
16	0	0	4,208	4,208	0.19	0.26
17	0	0	0	0	0.00	0.26
18	0	0	9,070	9,070	0.42	0.67
19	0	0	10,712	10,712	0.49	1.17
20	0	0	12,544	12,544	0.58	1.74
21	0	0	0	0	0.00	1.74
22	0	0	5,606	5,606	0.26	2.00
23	0	0	6,428	6,428	0.30	2.30
24	0	0	29,311	29,311	1.35	3.65
25	0	0	33,235	33,235	1.53	5.17
26	0	0	84,371	84,371	3.88	9.05
27	0	0	63,175	63,175	2.91	11.96
28	0	0	129,536	129,536	5.96	17.92
29	0	0	52,476	52,476	2.41	20.33
30	0	0	203,863	203,863	9.38	29.71
31	0	0	48,323	48,323	2.22	31.93
32	1,357	0	248,653	250,010	11.50	43.43
33	5,968	0	195,251	201,219	9.25	52.68
34	49,066	43,887	0	92,954	4.27	56.96
35	91,195	41,128	0	132,323	6.09	63.04
36	102,380	59,803	0	162,183	7.46	70.50
37	96,535	8,133	0	104,668	4.81	75.31
38	111,701	35,315	0	147,016	6.76	82.08
39	91,059	0	0	91,059	4.19	86.26
40	71,469	41,353	0	112,822	5.19	91.45
41	56,742	0	0	56,742	2.61	94.06
42	31,339	12,013	0	43,352	1.99	96.05
43	28,638	0	0	28,638	1.32	97.37
44	10,849	0	0	10,849	0.50	97.87
45	9,688	14,855	0	24,543	1.13	99.00
46	12,439	0	0	12,439	0.57	99.57
47	4,430	0	0	4,430	0.20	99.78
48	2,363	0	0	2,363	0.11	99.88
49	2,518	0	0	2,518	0.12	100.00
50	0	0	0	0	0.00	100.00
51	0	0	0	0	0.00	100.00
52	0	0	0	0	0.00	100.00
53	0	0	0	0	0.00	100.00
54	0	0	0	0	0.00	100.00
55	0	0	0	0	0.00	100.00
56	0	0	0	0	0.00	100.00
57	0	0	0	0	0.00	100.00
58	0	0	0	0	0.00	100.00
59	0	0	0	0	0.00	100.00
60	0	0	0	0	0.00	100.00
Total	779,736	256,488	1,138,158	2,174,382		
Ave. Weigh	19.9	18.3	8.2			

Table 2. MRFSS estimates of striped bass harvested (A+B1; in numbers and pounds), released (B2), and total catch from 1986-2000. Standardized trips were estimated from total catch and catch rates (see text).

	Harvest (A+B1)		Released (B2)	Total (A+B1+B2)	Standardized
Year	Numbers	Weight (lbs)	Numbers	Numbers	Trips
1986	29,434	298,816	442,298	471,732	339,765
1987	10,807	269,459	93,660	104,467	94,811
1988	21,050	421,317	209,632	230,682	213,776
1989	13,044	295,227	193,067	206,111	212,186
1990	20,515	319,092	339,511	360,026	397,673
1991	20,799	440,605	448,735	469,534	529,057
1992	57,084	972,116	779,814	836,898	910,968
1993	58,511	1,113,446	833,566	892,077	866,146
1994	74,538	1,686,049	2,102,514	2,177,052	1,613,064
1995	73,806	1,504,390	3,280,882	3,354,688	2,053,165
1996	68,300	1,291,706	3,269,746	3,338,046	1,965,713
1997	199,373	2,891,970	5,417,751	5,617,124	3,230,102
1998	207,952	2,973,456	7,184,358	7,392,310	3,269,795
1999	126,755	1,822,818	4,576,208	4,702,963	2,255,835
2000	175,533	2,535,140	7,143,590	7,319,123	3,762,947

Table 3A. Estimated size distribution of the 2000 Massachusetts recreational striped bass catch (numbers).

TL (in.)	Kept	Released Sub-legal	Released Legal	Total	Percent	Cumulative Percent
13						
14		14,867		14,867	0.20	0.20
15		22,300		22,300	0.30	0.51
16		44,601		44,601	0.61	1.12
17		74,335		74,335	1.02	2.13
18		133,803		133,803	1.83	3.96
19		304,773		304,773	4.16	8.13
20		498,044		498,044	6.80	14.93
21		505,478		505,478	6.91	21.84
22		535,212		535,212	7.31	29.15
23		683,882		683,882	9.34	38.49
24		616,980		616,980	8.43	46.92
25		557,512		557,512	7.62	54.54
26		594,680		594,680	8.13	62.66
27		460,877		460,877	6.30	68.96
28	967	468,310		469,277	6.41	75.37
29	7,690	572,379		580,069	7.93	83.30
30	7,944		483,177	491,121	6.71	90.01
31	9,382		170,970	180,353	2.46	92.47
32	27,959		163,537	191,495	2.62	95.09
33	34,907		81,768	116,675	1.59	96.68
34	6,261		29,734	35,995	0.49	97.17
35	18,145		14,867	33,012	0.45	97.63
36	9,267		29,734	39,001	0.53	98.16
37	11,647		7,433	19,080	0.26	98.42
38	2,285		22,300	24,586	0.34	98.76
39	14,618		22,300	36,919	0.50	99.26
40	7,690		7,433	15,123	0.21	99.47
41	5,206		0	5,206	0.07	99.54
42	0		7,433	7,433	0.10	99.64
43	6,572		0	6,572	0.09	99.73
44	0		0	0	0.00	99.73
45	4,993		0	4,993	0.07	99.80
46			7,433	7,433	0.10	99.90
47			0	0	0.00	99.90
48			7,433	7,433	0.10	100.00
Total	175,533	6,088,034	1,055,556	7,319,123		
Ave. Size	34.9	23.8	31.8			

Table 3B. Estimated size distribution of the 2000 Massachusetts recreational striped bass catch (pounds).

TL (in.)	Kept	Released Sub-legal	Released Legal	Total	Percent	Cumulative Percent
13		0				
14		12,373		12,373	0.03	0.03
15		22,950		22,950	0.06	0.09
16		55,984		55,984	0.14	0.22
17		112,445		112,445	0.27	0.49
18		238,366		238,366	0.58	1.07
19		641,653		641,653	1.55	2.62
20		1,228,571		1,228,571	2.97	5.60
21		1,449,683		1,449,683	3.51	9.10
22		1,772,069		1,772,069	4.29	13.39
23		2,597,391		2,597,391	6.29	19.68
24		2,672,294		2,672,294	6.47	26.14
25		2,738,972		2,738,972	6.63	32.77
26		3,297,494		3,297,494	7.98	40.75
27		2,871,203		2,871,203	6.95	47.70
28	6,737	3,263,971		3,270,708	7.91	55.61
29	59,817	4,452,306		4,512,123	10.92	66.53
30	68,705		4,178,813	4,247,518	10.28	76.81
31	89,901		1,638,246	1,728,147	4.18	80.99
32	295,835		1,730,418	2,026,253	4.90	85.89
33	406,610		952,473	1,359,083	3.29	89.18
34	80,054		380,179	460,233	1.11	90.30
35	253,968		208,083	462,051	1.12	91.41
36	141,619		454,385	596,004	1.44	92.86
37	193,852		123,726	317,578	0.77	93.62
38	41,337		403,347	444,684	1.08	94.70
39	286,684		437,347	724,031	1.75	96.45
40	163,186		157,743	320,929	0.78	97.23
41	119,311		0	119,311	0.29	97.52
42	0		183,619	183,619	0.44	97.96
43	174,673		0	174,673	0.42	98.38
44	0		0	0	0.00	98.38
45	152,852		0	152,852	0.37	98.75
46	0		240,628	240,628	0.58	99.34
47	0		0	0	0.00	99.34
48	0		274,301	274,301	0.66	100.00
Total	2,535,140	27,427,727	11,363,309	41,326,176		
Ave. Weight	14.4	4.5	10.8			

Massachusetts Commercial CPUE
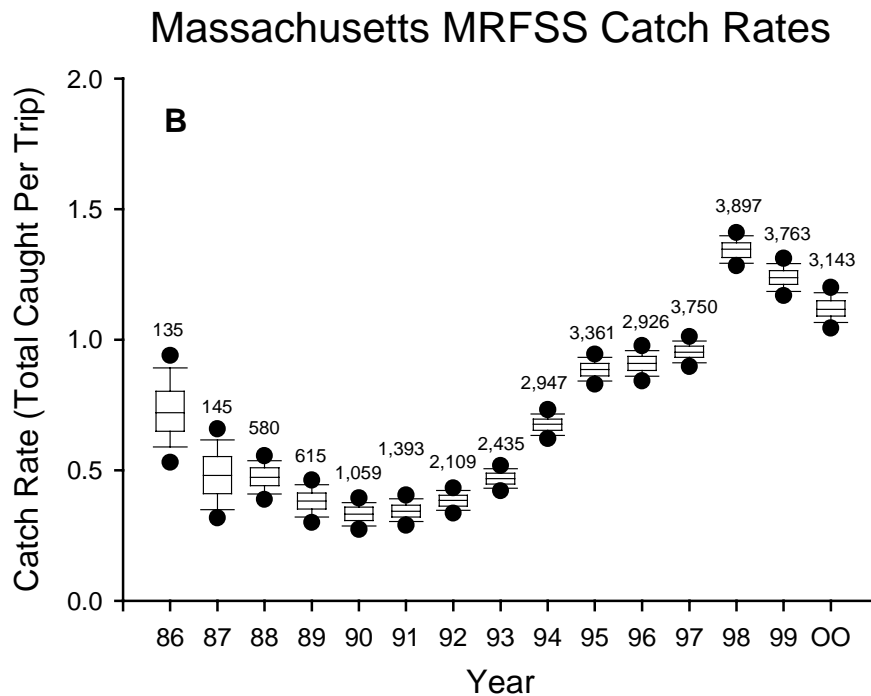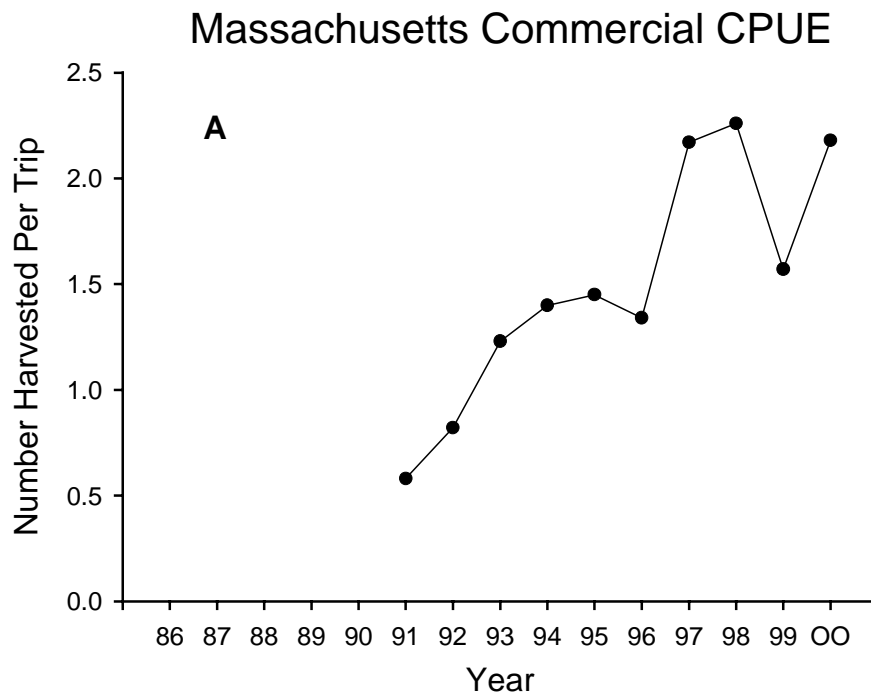

Massachusetts MRFSS Catch Rates

Figure 1. Estimates of A) harvest rates (numbers per trip) of the commercial fishery and B) total catch rates (total numbers caught per trip) of the recreational fishery for striped bass in Massachusetts waters, 1986-2000. For the MRFSS plot, dots represent the 5th and 95th percentiles, whiskers represent the 10th and 90th percentiles, horizontal edges of the box represent the 25th and 75th percentiles, and the horizontal bar represents the geometric median. The number of intercepts are shown above each box.