Technical Report

Massachusetts Division of Marine Fisheries
Technical Report TR-24

2004 Massachusetts Striped Bass Monitoring Report

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Massachusetts Division of Marine Fisheries
Department of Fish and Game
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Commonwealth of Massachusetts

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Summary

During 2004, the commercial fishery for striped bass in Massachusetts harvested about 60,632 fish weighing 1,206,305 pounds. Total losses due to commercial harvesting (including release mortality) were 70,544 fish weighing 1,304,752 pounds. The recreational fishery harvested about 403,547 striped bass weighing over 5.4 million pounds. Total losses due to recreational fishing (including release mortality) were 868,413 fish weighing over 7.7 million pounds. Combined losses (including scientific losses) were 939,078 fish weighing over 9.0 million pounds, which reflects a 16% increase in numbers lost and an 11% increase in weight lost compared to 2003 (810,381 fish; 8.1million pounds). The majority of losses, 92% by number and 86% by weight, was attributed to the recreational fishery.

Acknowledgements

The collection and quality of striped bass data would suffer greatly without the efforts of many DMF employees. Tom Hoopes, Micah Dean, and Kim Lundy assisted with the Oracle database of commercial landings and wrote SQL code to summarize the landings data. Kristen Ferry developed and coordinated the volunteer recreational angler data collection program. John Boardman aged all scale samples. John Boardman, Paul Caruso, and John Shepherd conducted the commercial sampling of stripers. Paul Caruso coordinated the tagging study. Mary Ann Fletcher and Beth Shanks entered the data from catch reports and recreational scale envelopes, respectively.

Funding for this effort was provided by the Massachusetts Division of Marine Fisheries and Sportfish Restoration Funds Grants F-57-R and F-48-R.

Introduction

This report summarizes the commercial and recreational striped bass fisheries conducted in Massachusetts during 2004. 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 3 of the Atlantic States Marine Fisheries Commission's (ASMFC) Fisheries Management Report No. 41 (Amendment #6 to the Interstate Fishery management Plan for Atlantic Striped Bass (IFMP)).

Commercial Fishery

Season: July 11-August 10. No landings were permitted on Thursday-Saturday.

Harvest: 1,206,305 pounds (against a harvest quota of 1,141,517 pounds).

Allowable Gear Type: Hook and line.
Minimum Size: 34 inches total length.
Trip Limit: 30 fish per day.

Licensing, Reporting, and Estimation of Landings

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 any type) and a special striped bass fishing endorsement to sell their catch. They are 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. Many fishermen voluntarily provide daily fishing logs.

2004 Landings

The estimate of landings used here comes from dealer phone transactions. Commercial landings in 2004 were 1,206,305 pounds (60,632 fish) (Table 1). Most striped bass were sold in Barnstable, Bristol and Suffolk counties of Massachusetts (Figure 1).

Table 1. *Attributes of the Massachusetts Striped Bass Commercial Fishery: 1990-2004.*

	SEASON	HARVEST			
SEASON	LENGTH (Days)	(Pounds) 000s	(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
2001	29	815.0	40.2	164	4,241
2002	21	924.9	44.9	132	4,587
2003	21	1055.4	55.7	151	4,858
2004	19	1206.3	60.6	130	4,409

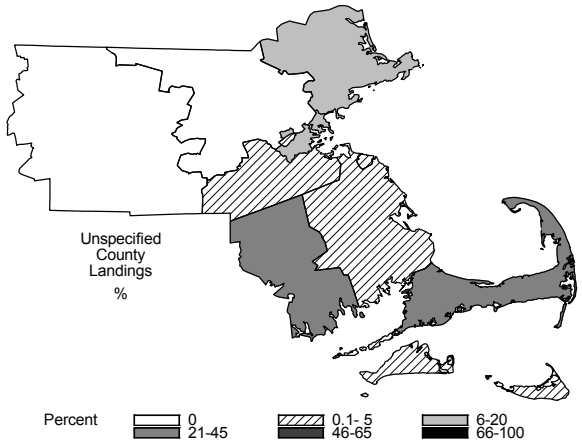


Figure 1. Percentage of total numbers of striped bass sold by commercial fishermen in Massachusetts counties during 2004.

Size Composition

Information from biological sampling, catch reports and voluntary logs is used to characterize disposition of the catch, catch weight, and size composition by catch category. Data from 2,921 fish sampled from the 2004 commercial harvest and 2000 DMF diet study were used to construct a length-to-weight equation that was used to estimate weight-at-size for individual bass. The following geometric regression was derived:

$$\log_{10}(W) = -3.4403 + 2.933 * \log_{10}(L),$$
$$RMS = 0.00358$$

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:

$$W = 10^{\wedge(-3.4403+2.993*\log 10(L)+RMS/2)}$$

Size composition of the commercial catch by category of disposition is presented in Appendix Tables 1A (numbers of fish) and 1B (pounds of fish). About 36% of the fish from the total catch had lengths ≥34 inches.

Age and Sex Composition

Eight hundred and fifty-five striped bass sampled from the 2004 commercial harvest were used to sex and age the harvested fish. The proportion that each age comprised the total samples was estimated from a sub-sample of 249 fish which guaranteed a precision of ±10% at α= 0.05. Weighted proportions at age were generated by weighting the age proportions sampled in each county by county landings. Age was determined from scales and sex was determined by visual inspection of gonadal tissue (Sykes Method). Age ranged from 6 to 17 years, and 99.1% were females. Approximately 85% of the sub-sample consisted of individuals from the 1992-1996 year classes (ages 8-12) (Table 2).

Table 2. Age composition of 2004commercial harvest.

Age	Year Class	Number	Weighted %	Mean Length (in.)	Mean Weight (lbs)
6	1998	1	0.4	34.4	13.4
7	1997	10	3.9	34.4	14.1
8	1996	52	20.5	35.5	16.1
9	1995	54	21.7	36.7	17.7
10	1994	53	21.2	37.4	18.6
11	1993	33	13.6	39.3	22.9
12	1992	21	8.5	40.5	24.1
13	1991	16	6.5	42.3	27.4
14	1990	4	1.7	42.7	29.8
15	1989	3	1.4	41.6	29.8
16	1988	1	0.5	44.1	40.0
17	1987	1	0.4	45.8	38.5

Estimates of Total Catch Rates

Estimates of total catch rates (total number of fish caught per hour) for the commercial fishery were developed in order to provide an index that is more indicative of fluctuations in population abundance. On their mandatory catch reports, all fishermen are asked to record the total hours fished, number and pounds of fish caught by disposition category (i.e., released sub-legal, released legal, sold, and consumed), area fished and the fishing method (Surf, Boat, Both) by month. This information was used under a generalized linear model (GLM) framework to generate a standardized catch rate index (Hilborn and Walter, 1992). Each record represented the summarization of a permit's monthly number and pounds of fish caught and hours fished by year, month , area fished reduced to 4 regions (Cape Cod Canal, Southern MA, Cape Cod Bay, North MA) and fishing mode. The catch rate for each record was calculated by dividing the total numbers caught by the total number of hours fished. The catch rate was standardized using the GLM model

$$\ln(y+1) = a + \sum_{i=1}^{n} b_i X_i + e$$

where y is the observed catch rate, a is the intercept, b_i is the slope coefficient of the ith factor, X_i is the ith categorical variable, and e is the error term. Any variable not significant at $\alpha = 0.05$ with type-III (partial) sum of squares was dropped from the initial GLM model and the analysis was repeated. First-order interactions were considered in the analyses but not all were included because least-squares means could not be calculated for specific combinations (see Searle et al., 1980). The back-transformed geometric mean was estimated by

$$\hat{y}_i = \exp(LSM_i) - 1$$

where LSM is the least-squares natural log mean.

Standardized catch rates averaged 0.86 fish per hour during 1991-1994 and increased from 0.95 in 1995 to 1.19 in 1998 (Fig. 2). Catch rates fluctuated but declined through 2003, and increased in 2004 (Fig. 2).

Characterization of Other Losses

Release mortality was estimated by using a hook-release mortality rate of 8% applied against the released fish in Appendix Tables 1A and 1B. Total losses due to release mortality were 9,912 fish weighing approximately 98,447 pounds.

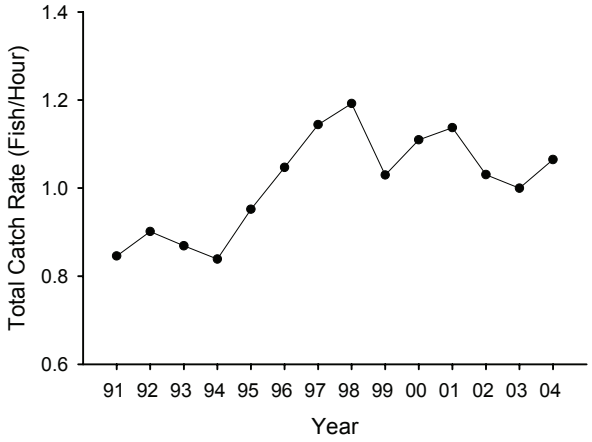


Figure 2. *Total catch rates (fish/hour) of striped bass for the Massachusetts commercial fishery.*

Recreational Fishery

Season: None
Daily Bag Limit: Two fish per person
Allowable Gear Type: Hook and Line
Minimum Size: 28 inches total length
Licensing and Reporting Requirements: None

Harvest levels: Harvest (A+B1) and total catch (A+B1+B2) estimates (Table 4) 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 effect on catch.

The estimate of total catch (including fish released alive) in 2004 was 6,124,378 striped bass, which is higher than the 2002 and 2003 estimates (Table 4). The estimate of total harvest was 403,547 striped bass, which is the highest observed in the time series. Total pounds harvested was over 5.4 million in 2004 (Table 4).

The MRFSS estimates were post-stratified by county to determine where harvested bass were being landed by recreational anglers. Most landings (85%) occurred in Barnstable, Essex, Bristol, and Plymouth counties (Figure 3). Only 15% of landings occurred in Dukes/Nantucket, Suffolk and Norfolk counties (Figure 3).

Size Composition

The length distribution of harvested fish was estimated from biological sampling conducted by the MRFSS program in Massachusetts. For released fish, volunteer recreational anglers were solicited to collect length and scale samples from striped bass that they captured each month (May-October). Each person was asked to collect a minimum of 5 scales from at least 10 fish per month and record the disposition of the each fish (released or harvested) and fishing mode. Over 2,800 samples were received from over 100 anglers. The size frequencies of measured fish are shown in Figure 4 by disposition and mode. The size frequency of released fishes was used to allocate MRFSS release numbers by mode among size classes. Numbers-at-length and weight-at-length data by disposition are summarized in Appendix Tables 2A and 2B.

Table 4. *MRFSS estimates of striped bass harvested (in number and pounds), released, and total catch. .*

	Harvest (A+B1)		Released (B2)	Total (A+B1+B2)
Year	Numbers	Weight (lbs)	Numbers	Numbers
1986	29,434	298,816	442,298	471,732
1987	10,807	269,459	93,660	104,467
1988	21,050	421,317	209,632	230,682
1989	13,044	295,227	193,067	206,111
1990	20,515	319,092	339,511	360,026
1991	20,799	440,605	448,735	469,534
1992	57,084	972,116	779,814	836,898
1993	58,511	1,113,446	833,566	892,077
1994	74,538	1,686,049	2,102,514	2,177,052
1995	73,806	1,504,390	3,280,882	3,354,688
1996	68,300	1,291,706	3,269,746	3,338,046
1997	199,373	2,891,970	5,417,751	5,617,124
1998	207,952	2,973,456	7,184,358	7,392,310
1999	126,755	1,822,818	4,576,208	4,702,963
2000	181,295	2,618,216	7,382,031	7,563,326
2001	288,032	3,644,561	5,410,899	5,698,930
2002	308,749	4,304,883	5,718,984	6,027,733
2003	402,201	5,120,554	4,306,965	4,709,166
2004	403,547	5,490,298	5,810,831	6,214,378

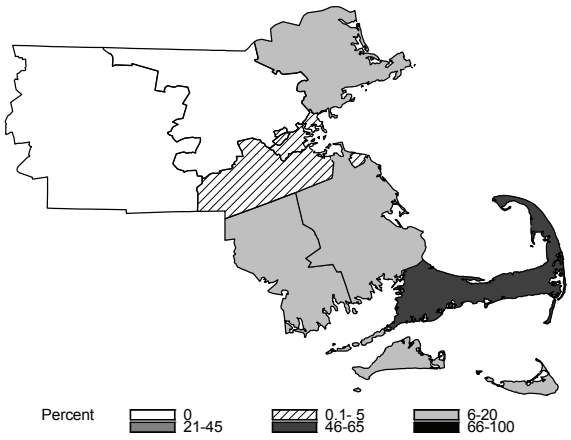


Figure 3. *Percentage of total numbers of striped bass landed by recreational anglers in each county of Massachusetts during 2004.*

Age Composition

A sub-sample of 390 fish was aged and combined with commercial and tagging samples to produce an age-length key used to convert the MRFSS size distribution into age classes. Recreational samples were selected using a weighted random design based on the total number of striped bass caught in each wave and mode stratum (as determined by MRFSS).

Trends in Catch Rates

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 delta-lognormal model (Lo et al., 1992) which adjusts trip catches for the effects of year, wave, county, area fished, mode fished, and time spent fishing. A delta-lognormal model was selected as the best approach to estimate year effects after examination of model dispersion (Terceiro, 2003) and standardized residual deviance plots (McCullagh and Nelder, 1989). In the delta-lognormal model, catch data is decomposed into catch success/failure and positive catch components. Each component is analyzed separately using appropriate statistical techniques and then the statistical models are recombined to obtain year estimates. The catch success/failure was modelled as a binary response to the categorical variables using multiple logistic regression:

$$\text{log}it(p) = \log(p/1-p) = a + \sum_{i=1}^{n} b_i X_i + e$$

where p is the probability of catching a fish, a is the intercept, b_i is the slope coefficient of the ith factor, X_i is the ith categorical variable, and e is the error term. PROC LOGISTIC (SAS, 2002) was used to estimate parameters, and goodness-of-fit was assessed using concordance measures and the Hosmer-Lemeshow test (SAS, 2002).

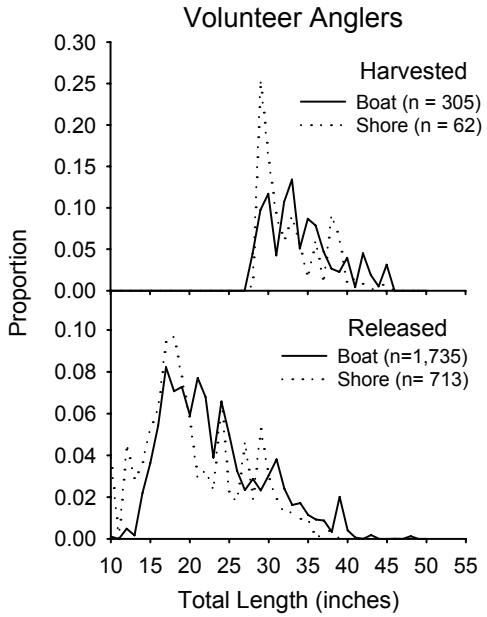


Figure 4. *Sizes of striped bass caught by volunteer recreational anglers in 2003 by disposition*

Positive catches, transformed using the natural logarithm, were modelled assuming a normal error distribution using PROC GLM

$$\log(y) = a + \sum_{i=1}^{n} b_i X_i + e$$

where y is the observed positive catch, b_i ,and X_i are the same symbols as defined earlier, and e is the normal error term. Any variable not significant at α=0.05 with type-III (partial) sum of squares was dropped from the initial GLM model and the analysis was repeated. First-order interactions were considered in the initial analyses but it was not always possible to generate annual means by the least-square methods with some interactions included (see Searle et al., 1980); therefore, only main effects were considered.

The annual index of striped bass total catch per trip was estimated by combining the two component models. The estimate in year i from the models is given by

$$\hat{I}_i = \hat{p}_i * \hat{y}_i$$

where p_i and y_i are the predicted annual responses from the logistic and GLM models. p_i is calculated by

$$\hat{p}_i = \frac{\exp(\hat{a} + \hat{b}_i)}{1 + \exp(\hat{a} + \hat{b}_i)}$$

and y_i is calculated by

$$\hat{y}_i = \exp(LSM_i + \sigma^2/2)$$

where LSM_i is the least squares mean for year i and σ^2 is the mean square error. Only data for those anglers who said they targeted striped bass were used in the analyses.

Standardized catch rates averaged 0.48 fish per trip during 1986-1992 and increased from 0.66 in 1993 to 2.48 in 1998 (Fig. 5). Catch rates declined through 2003, but increased in 2004 (Fig. 5).

Characterization of Losses

The same methods and rates previously described in the commercial fishery section were used to estimate recreational losses. Release mortality was 464,866 fish (2,264,917 pounds).

Scientific Collections

About 121 bass were taken or killed for scientific research in 2004.

By-catch in Other Fisheries

During 1994, DMF sea-sampling efforts identified striped bass as by-catch in a Nantucket Sound springtime trawl fishery directed at long-finned squid (*Loligo pealei*). Those by-catch estimates were about 3,100 fish (17,600 pounds). Anecdotal information was also reported for this fishery which suggested that striped bass by-catch ranged from 8,000 pounds per day, with up to single tows landing 19,000 pounds. DMF personnel sea-sampled this fishery during 1995-2000

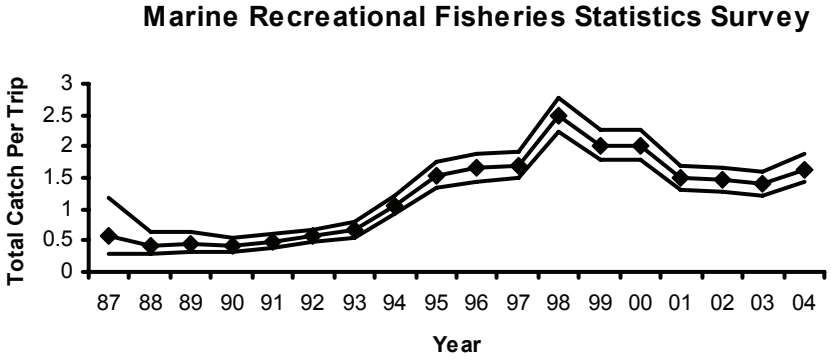


Figure 5. *Estimates of total catch rates (total number of fish caught per trip) of the recreational for striped bass in Massachusetts waters. 95% confidence intervals are shown.*

Table 5. Estimates of striped bass losses occurring in Massachusetts

FISHERY	NUMBER	POUNDS	MEAN WT.
Commercial			
Harvest	60,632	1,206,305	19.9
Release Mortality	9,912	98,447	9.9
Recreational			
Harvest	403,547	5,490,298	13.6
Release Mortality	464,866	2,264,917	4.9
Scientific	121	1,113	9.2
Total	939,078	9,061,080	

and 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 potential sources of striped bass by-catch during 2005.

Estimated Total Losses

Total estimated loss of striped bass during 2004 was 939,078 fish weighing 9,061,080 pounds (Table 5), which is a 16% increase in numbers lost and an 11% increase in weight compared to 2003 (810,381 fish; 8,150,093 pounds). The majority of losses, 92% by number and 86% by weight, was attributed to combined losses in the recreational fishery.

Removals-At-Age Matrix

The removals (numbers) due to release mortality and harvest by the recreational and commercial fisheries and scientific activities are apportioned by age and mortality source in Table 6.

Required Fishery-Independent Monitoring Programs

Massachusetts Tagging Study

The Massachusetts Division of Marine Fisheries (DMF) joined the Striped Bass Cooperative State-Federal Coast-wide Tagging Study

Table 6. Massachusetts Removal-At-Age Matrix for 2004 by source.

		Recreational		Commercial	
Age	Scientific	Release Mortality	Harvest	Release Mortality	Harvest
2	1	3680	0	1	
3	29	170793	0	230	
4	6	98151	1839	677	
5	6	55107	16882	1248	
6	15	50068	50772	1972	242
7	21	30145	84030	2429	2368
8	25	31578	103252	2431	12414
9	10	10968	51711	650	13139
10	6	6965	36794	146	12824
11	2	3770	27566	60	8224
12	0	1388	10486	26	5131
13	0	1329	10581	28	3917
14	0	545	3639	11	1008
15	0	306	4579	3	830
16	0	38	1076	0	294
17	0	36	339	0	242

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 coast-wide 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 fall by trolling artificial baits in shoal areas around Nantucket Island. In 2004, spring tagging of small bass in Plum Island Sound also occurred. Floy internal anchor tags provided by the USFWS are used. Total length of each fish is recorded. Scales are removed from each fish for aging. The release data are made available to the Annapolis, Maryland office of the USFWS, which coordinates regional tagging programs of state-federal participants.

For the analyses of survival, the ASMFC Tagging Subcommittee began using the MARK implementation of the Brownie et al. (1985) tagging models (White and Burnham 1997). The program MARK calculates maximum likelihood estimates of the multinomial parameters of survival and recovery based on an observed matrix of recaptures. The following passages were taken from ASMFC (2003) to describe the analyses of tagging data: "The analysis protocol involves the following series of steps. First, a full set of biologically-reasonable candidate models are identified prior to analysis. Various patterns of survival and recovery are used to parameterize the candidate models. These include models that allow parameters to be constant, time specific, or allow time to be modeled as a continuous variable. Other models allow time periods to coincide with changes in regulatory regimes established coastwide. These models are then fit to the tag recovery data and are arranged in order of fit by Akaike's Information Criteria (AIC). Annual survival is then calculated as a weighted average across all models, where the weight is a function of model fit. The lower the AICc (i.e., the better the fit), the higher the weight assigned to a specific model in the model averaging. Model averaging eliminates the need to select a single, best model, allowing the uncertainty of model selection to be incorporated into the variance of parameter estimates".

Summary statistics compiled since the start of this study are shown in Table 7. The recapture matrix used in the MARK modeling is shown in Table 8. Estimates from the MARK modeling showed that striped bass survival was relatively stable prior to 1994, but it dropped after the ASMFC closures were lifted in 1995. Survival was relatively stable from 1995-2003 (Figure 6).

Planned Management Programs in 2004

Regulations

Massachusetts' recreational bag and minimum size limits will remain at 2 fish per day and 28-inches total length, respectively. For the commercial fishery, minimum size limit and quota will remain 34-inches and 1,159,750 pounds allowed under Amendment 6, respectively. However, the quota in 2004 will be reduced by 64,788 pounds to account for the overage in 2004. The commercial fishery quota will be monitored using the IVR system. In addition, the commercial season will not open until July 12 and harvesting will be allowed only on Sunday with a daily bag limit of 5 fish, and Tuesday-Thursday with a daily bag limit of 30 fish.

Monitoring Programs

All monitoring programs will continue in 2005.

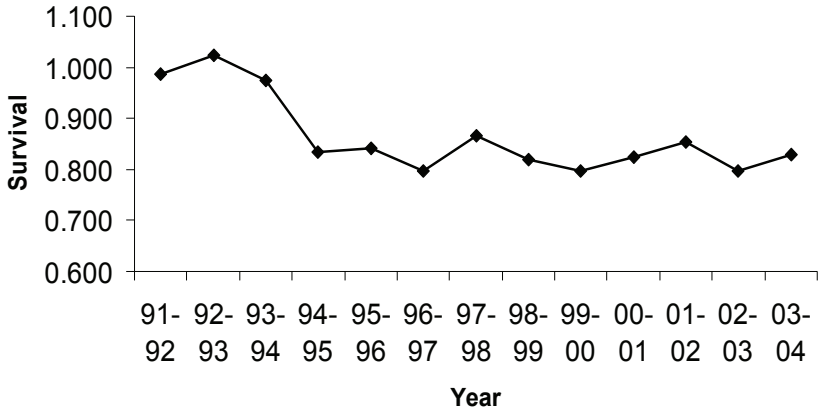
Table 7. Massachusetts tag summary statistics.

Year	Trips	Boats	Number Tagged	Ave. Length	SD	Length Range Min	Length Range Max.
1991	17	4	388	817	106.4	534	1300
1992	29	3	899	798	125.9	524	1267
1993	15	2	678	784	125.0	515	1210
1994	13	2	377	735	93.2	548	1028
1995	11	2	449	767	110.2	470	1178
1996	8	2	203	748	64.1	541	1077
1997	10	2	321	773	114.7	485	1090
1998	12	2	382	797	93.8	597	1055
1999	16	2	471	777	95.5	594	1108
2000	25	4	1095	752	102.6	510	1204
2001	14	3	456	786	102.5	503	1110
2002	12	3	239	764	103.6	487	1060
2003	15	3	655	825	92.1	602	1204
2004	25	7	784	707	193.1	316	1164

Table 8. Recapture matrix of striped bass ≥28 inches from 1991-2004 (Fall Tagging Only). A recapture year was defined as the beginning of tagging in year t to beginning of tagging in year t+1.

Year Tagged	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
1991	16	25	11	14	8	3	1	3	3	1	1	0	0
1992		33	34	27	26	19	16	11	4	1	3	2	1
1993			20	23	29	20	17	7	2	3	2	1	1
1994				15	11	9	5	4	4	1	0	2	0
1995					21	12	16	9	10	2	2	2	0
1996						11	6	3	3	1	2	0	1
1997							14	20	8	6	4	5	0
1998								4	4	1	2	0	0
1999									10	4	8	3	4
2000										19	23	16	11
2001											25	14	15
2002												9	4
2003													30

Figure 6. Estimated annual survival for striped bass released off coastal waters of Massachusetts.



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Appendix Table 1A. Estimated size distribution of the Massachusetts commercial striped bass catch (numbers of fish) in 2004.

TL (in.)	Kept	Released	Total	Percent	Cumulative Percent
11	0	0	0	0.00	0.00
12	0	0	0	0.00	0.00
13	0	0	0	0.00	0.00
14	0	89	89	0.05	0.05
15	0	40	40	0.02	0.07
16	0	265	265	0.14	0.21
17	0	241	241	0.13	0.34
18	0	290	290	0.16	0.50
19	0	527	527	0.29	0.79
20	0	1,623	1,623	0.88	1.67
21	0	1,001	1,001	0.54	2.21
22	0	2,856	2,856	1.55	3.76
23	0	2,187	2,187	1.19	4.94
24	0	4,698	4,698	2.55	7.49
25	0	6,649	6,649	3.60	11.09
26	0	7,321	7,321	3.97	15.06
27	0	4,760	4,760	2.58	17.64
28	0	7,802	7,802	4.23	21.87
29	0	6,742	6,742	3.65	25.52
30	0	16,415	16,415	8.90	34.41
31	0	12,707	12,707	6.89	41.30
32	86	19,004	19,090	10.34	51.64
33	1258	22,282	23,540	12.76	64.40
34	7483	1,087	8,570	4.64	69.05
35	8855	1,941	10,796	5.85	74.90
36	7762	991	8,753	4.74	79.64
37	6969	613	7,582	4.11	83.75
38	6322	254	6,576	3.56	87.31
39	5880	309	6,189	3.35	90.67
40	4815	70	4,885	2.65	93.31
41	4139	818	4,957	2.69	96.00
42	2148	0	2,148	1.16	97.16
43	1600	319	1,919	1.04	98.20
44	1390	0	1,390	0.75	98.96
45	807	0	807	0.44	99.39
46	656	0	656	0.36	99.75
47	182	0	182	0.10	99.85
48	109	0	109	0.06	99.91
49	171	0	171	0.09	100.00
50	0	0	0	0.00	100.00
51	0	0	0	0.00	100.00
52	0	0	0	0.00	100.00
Total	60,632	123,902	184,534		
Avg. Size	37.7	29.6	32.3		

Appendix Table 1B. Estimated size distribution of the Massachusetts commercial striped bass catch (pounds) in 2004.

TL (in.)	Kept	Released	Total	Percent	Cumulative Percent
11	0	0	0	0.00	0.00
12	0	0	0	0.00	0.00
13	0	0	0	0.00	0.00
14	0	90	90	0.00	0.00
15	0	49	49	0.00	0.01
16	0	397	397	0.02	0.02
17	0	432	432	0.02	0.04
18	0	618	618	0.03	0.07
19	0	1,319	1319	0.05	0.12
20	0	4,741	4741	0.19	0.31
21	0	3,381	3381	0.14	0.45
22	0	11,093	11093	0.46	0.91
23	0	9,703	9703	0.40	1.31
24	0	23,675	23675	0.97	2.28
25	0	37,862	37862	1.55	3.83
26	0	46,886	46886	1.92	5.76
27	0	34,131	34131	1.40	7.16
28	0	62,375	62375	2.56	9.72
29	0	59,865	59865	2.46	12.17
30	0	161,339	161339	6.62	18.79
31	0	137,776	137776	5.65	24.45
32	1,025	226,581	227606	9.34	33.79
33	16,446	291,303	307749	12.63	46.42
34	106,973	15,545	122518	5.03	51.44
35	138,061	30,267	168329	6.91	58.35
36	131,668	16,815	148482	6.09	64.44
37	128,320	11,287	139607	5.73	70.17
38	126,080	5,071	131151	5.38	75.55
39	126,747	6,665	133412	5.47	81.03
40	111,962	1,630	113591	4.66	85.69
41	103,626	20,477	124103	5.09	90.78
42	57,801	0	57801	2.37	93.15
43	46,197	9,220	55417	2.27	95.43
44	42,992	0	42992	1.76	97.19
45	26,697	0	26697	1.10	98.29
46	23,177	0	23177	0.95	99.24
47	6,858	0	6858	0.28	99.52
48	4,374	0	4374	0.18	99.70
49	7,299	0	7299	0.30	100.00
50	0	0	0	0.00	100.00
51	0	0	0	0.00	100.00
52	0	0	0	0.00	100.00
Total	1,206,305	1,230,592	2,436,897		
Avg. Weight	19.9	9.9	13.2		

Appendix Table 2A. Estimated size distribution of the Massachusetts recreational striped bass catch (numbers of fish) in 2004.

TL (in.)	Harvested	Released	Total	Percent	Cumulative Percent
10	0	46,711	46,711	0.75	0.75
11	0	0	0	0.00	0.75
12	0	71,868	71,868	1.16	1.91
13	0	38,103	38,103	0.61	2.52
14	0	143,765	143,765	2.31	4.83
15	0	229,044	229,044	3.69	8.52
16	0	324,445	324,445	5.22	13.74
17	0	491,832	491,832	7.91	21.66
18	0	438,508	438,508	7.06	28.71
19	0	427,341	427,341	6.88	35.59
20	0	341,578	341,578	5.50	41.09
21	0	396,023	396,023	6.37	47.46
22	0	357,514	357,514	5.75	53.21
23	0	209,560	209,560	3.37	56.58
24	3,148	384,417	387,565	6.24	62.82
25	0	258,162	258,162	4.15	66.97
26	0	174,304	174,304	2.80	69.78
27	0	160,793	160,793	2.59	72.37
28	12,671	156,433	169,104	2.72	75.09
29	19,370	166,335	185,705	2.99	78.08
30	55,730	175,962	231,692	3.73	81.80
31	73,244	200,923	274,167	4.41	86.22
32	27,280	126,876	154,156	2.48	88.70
33	31,961	90,655	122,616	1.97	90.67
34	29,338	91,480	120,818	1.94	92.61
35	30,589	64,572	95,161	1.53	94.15
36	8,676	44,128	52,804	0.85	94.99
37	22,235	45,457	67,692	1.09	96.08
38	21,186	20,377	41,563	0.67	96.75
39	20,460	95,361	115,821	1.86	98.62
40	19,451	19,387	38,838	0.62	99.24
41	13,680	2,998	16,678	0.27	99.51
42	5,044	479	5,523	0.09	99.60
43	0	8,764	8,764	0.14	99.74
44	4,399	0	4,399	0.07	99.81
45	0	0	0	0.00	99.81
46	0	479	479	0.01	99.82
47	686	0	686	0.01	99.83
48	0	6,196	6,196	0.10	99.93
49	0	0	0	0.00	99.93
50	4,399	0	4,399	0.07	100.00
51	0	0	0	0.00	100.00
52	0	0	0	0.00	100.00
53	0	0	0	0.00	100.00
Total	403,547	5,810,830	6,214,377		
Avg. Size	33.9	22.6	23.3		

Appendix Table 2B. Estimated size distribution of the Massachusetts recreational striped bass catch (pounds) in 2004.

TL (in.)	Kept	Released	Total	Percent	Cumulative Percent
10	0	15,655	15,655	0.05	0.05
11	0	0	0	0.00	0.05
12	0	41,570	41,570	0.12	0.17
13	0	28,006	28,006	0.08	0.25
14	0	131,913	131,913	0.39	0.64
15	0	258,372	258,372	0.76	1.41
16	0	443,984	443,984	1.31	2.72
17	0	806,964	806,964	2.39	5.11
18	0	853,731	853,731	2.53	7.63
19	0	978,148	978,148	2.89	10.53
20	0	911,592	911,592	2.70	13.22
21	0	1,223,089	1,223,089	3.62	16.84
22	0	1,269,130	1,269,130	3.75	20.60
23	0	849,782	849,782	2.51	23.11
24	14,560	1,770,637	1,785,197	5.28	28.39
25	0	1,343,653	1,343,653	3.98	32.37
26	0	1,020,207	1,020,207	3.02	35.39
27	0	1,053,689	1,053,689	3.12	38.50
28	92,966	1,143,014	1,235,979	3.66	42.16
29	157,855	1,349,971	1,507,827	4.46	46.62
30	502,679	1,580,629	2,083,308	6.16	52.78
31	728,787	1,990,986	2,719,773	8.05	60.83
32	298,501	1,382,583	1,681,084	4.97	65.80
33	383,464	1,083,189	1,466,653	4.34	70.14
34	384,896	1,195,225	1,580,121	4.67	74.82
35	437,685	920,138	1,357,823	4.02	78.83
36	135,063	684,134	819,197	2.42	81.26
37	375,728	764,968	1,140,696	3.37	84.63
38	387,752	371,415	759,167	2.25	86.88
39	404,742	1,878,680	2,283,423	6.76	93.63
40	415,076	412,011	827,087	2.45	96.08
41	314,320	68,604	382,924	1.13	97.21
42	124,563	11,782	136,345	0.40	97.62
43	0	231,275	231,275	0.68	98.30
44	124,865	0	124,865	0.37	98.67
45	0	0	0	0.00	98.67
46	0	15,470	15,470	0.05	98.72
47	23,722	0	23,722	0.07	98.79
48	0	227,265	227,265	0.67	99.46
49	0	0	0	0.00	99.46
50	183,073	0	183,073	0.54	100.00
51	0	0	0	0.00	100.00
52	0	0	0	0.00	100.00
53	0	0	0	0.00	100.00
Total	5,490,298	28,311,461	33,801,759		
Avg. Weight	13.6	4.9	5.4		