

Connecticut River American Shad Sustainable Fishing Plan Update

Submitted to the Atlantic States Marine Fisheries Commission

Prepared by

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Introduction

Annual spawning migrations of American Shad (*Alosa sapidissima*) in the Connecticut River have supported both recreational and commercial fisheries in the State of Connecticut, as well as recreational fisheries in upriver states, for generations. While American Shad once supported one of the largest commercial and recreational fisheries in the state, Connecticut shad fisheries are now mostly artisanal, although they still hold cultural and historical value. The Connecticut River now supports the state's only commercial shad fishery. There is currently a commercial drift gill net fishery that occurs south of River Kilometer (Rkm) 64, in the lower CT River. Landings in this gill net fishery have steadily declined in recent decades (Figure 1). The Connecticut River is also the only river in the state in which recreational harvest (via hook and line only) is currently permitted. The recreational fishery largely occurs in the range north of Hartford, Connecticut (Rkm 84) and south of the Holyoke Dam in Massachusetts (Rkm 139), with limited localized efforts occurring to the north and south of these areas.

The Connecticut Department of Energy and Environmental Protection (CT DEEP) has conducted annual research studies on American Shad in the Connecticut River since 1974 to monitor annual changes in stock composition. American Shad fishery data is collected from mandatory annual reporting of commercial landings while recreational fisheries are monitored periodically by a roving creel survey. The Massachusetts Division of Fish and Wildlife monitors fish passage which includes adult American Shad passage at the first mainstem dam (Rkm 139) on the Connecticut River in Holyoke, Massachusetts. Juvenile shad are monitored by CT DEEP through an annual seine survey conducted since 1978.

The number of commercial shad fishing licenses and associated effort has been steadily declining since peak levels during and after World War II. Recent commercial license sales continued to remain at low levels, typically 6 to 8 licenses have been sold annually since 2018. Commercial Shad license sales are expected to stay low or further decrease as fishermen retire and are not replaced. A high proportion of license holders exceed age 55 as few new participants have entered the fishery in the last decade.

The Connecticut River was once one of the most popular places to fish recreationally for American Shad and some think this was the birthplace of the sport. Numbers of fishermen, effort, catch, and harvest have all varied greatly over time, but similar to commercial fishing trends, recreational fishing for American Shad has exhibited a general decline in recent decades. Anecdotal and creel information gathered in the last ten years or so shows that fewer fishermen are targeting American Shad in the traditional shad fishing areas from Hartford to the CT/MA

state line, and there is little reason to believe this trend will reverse. Anglers that traditionally fished for shad in this area have switched to pursue striped bass, which provides a quality fishery from Hartford up into Massachusetts. Access to traditional shad fishing sites along the Connecticut River has changed over the years with infrastructure changes, restricted shore access due to development, and the natural breaching of a low-head dam in Enfield. The overall decrease in fishing effort and harvest for shad is also a reflection of a decreasing demand for consumption with fewer people knowing how to debone American Shad.

The Connecticut River American Shad Sustainable Fishing Management Plan (SFMP) was developed by CT DEEP to fulfill the requirements of Amendment 3 to the Interstate Fishery Management Plan for American Shad and River Herring. This update provides information collected since the last SFMP update in 2017. CT DEEP proposes the continuation of both recreational and commercial shad fisheries in the Connecticut River, and continued monitoring of the three metrics currently used to gauge fishery sustainability: adult lift passage, juvenile abundance, and adult escapement. Commercial shad fishing will remain prohibited in all other rivers in the state. All river systems with recreational fisheries, other than the Connecticut River, will continue to remain “catch-and-release only” for American Shad.

Current regulations

Commercial

To participate in the commercial fishery, Connecticut requires the purchase of an annual commercial shad license for the Connecticut River. The shad fishery is managed through area, gear, and season restrictions as well as rest days. The American Shad gill net season runs from April 1 through June 15. In the inland district (north of the Interstate 95 bridge), American Shad may be taken only in the main body of the Connecticut River from the I-95 Bridge to the William H. Putnam Memorial Bridge on Route 3 in Glastonbury/Wethersfield (Rkm 75) (Figure 2). In marine waters, American shad “shall not be netted between lines drawn south in Long Island Sound to the New York state line from Menunketesuck Point, Westbrook and Hatchetts Point, Old Lyme except with seines, pounds, and gill nets”. This regulation effectively prohibits trawl-caught shad from being harvested near the mouth of the Connecticut River. The commercial shad license fee was doubled in 2009 to \$200 and is the most expensive open-access commercial fishing license available in Connecticut.

Under the commercial shad fishing license, the following are prohibited: use of gill nets constructed of single or multiple-strand monofilament from sunrise to sunset, monofilament twine thickness greater than 0.28 mm (#69), commercial fishing for shad from sundown Friday to sundown Sunday except by the use of a scoop net, the use of nets with mesh size less than five inches stretched mesh, fishing in other than the main body of the Connecticut River (no coves), and the use of pound nets or other fixed or staked nets to take shad. A daily record detailing catch, effort, and landings is required in a report that must be submitted by July 15th of the fishing year.

The 2023 commercial landings data used in this report to generate the number of fish commercially landed and the total river population estimate are preliminary and may be adjusted before being finalized.

Recreational

Angling for American Shad is the only legal method of recreational take and may occur during the open season from April 1 through June 30. Fishing licenses are required for anyone 16 years of age or older fishing in either the Inland or Marine Districts. Recreational licenses are issued on a calendar basis and expire on December 31st. The daily possession limit is 6 American and hickory shad in the aggregate, per person, in both the inland and marine districts.

Fisheries Dependent Indices

Commercial Fishery

The commercial shad fishery in the Connecticut River is a spring (April-June) drift gillnet fishery that extends from the river mouth to Glastonbury, CT (river km 62). Monitoring of shad abundance (numbers and pounds) has been conducted annually from 1974 to 2023. The fishery has changed little since the adoption of outboard-powered vessels other than the change to drift gill nets from all other gear types (haul seine, fixed gill nets, and traps/pound nets).

Commercial shad fishermen are required to submit a complete catch report detailing the catch, effort, and landing activities associated with all landings made in Connecticut regardless of where the fishing takes place, as well as all fishing in Connecticut waters regardless of where the landings take place.

Recreational Fishery

Recreational shad landings in numbers have been estimated annually from 1980-1997 and periodically thereafter (2000, 2005, 2010) by a roving creel census (Figure 3). Before 1993, there was a thriving recreational fishery for American Shad in the Connecticut River from Enfield, CT (river km 99) to the Holyoke Dam, MA (river km 139). Before 1990, recreational landings often comprised as much as 60% of total landings. Recreational shad landings began to fall dramatically after 1995 to a point where harvest estimates from creel surveys were unreliable and imprecise as reflected by high (> 80%) proportional standard errors about the mean harvest estimates. Because of the low incidence of positive intercepts of anglers targeting shad in the creel survey in the late 1990s, annual Connecticut River surveys were discontinued in favor of surveys conducted on five-year intervals. Shad recreational harvest estimates between 1999, 2005, and 2010 did not differ significantly ($P < 0.05$) from zero (Figure 4). Most anglers that traditionally fished for shad have switched their efforts to pursue striped bass, which provides a quality fishery from Hartford up into Massachusetts. After 2010, the shad creel survey was not conducted due to budgetary and staffing shortfalls.

Fisheries Independent Indices

Holyoke Lift Passage Counts

Historically, there were no shad passed above Holyoke from the completion of the Holyoke Dam in 1849 until 1955 when a fish passage facility was completed, and small numbers of shad were lifted above the dam. Since opening, staff at the fish passage facility have maintained daily counts of American shad lifted each year (Watson 1970; Moffit et al 1982; Leggett et al 2004). Major technological improvements in the lift occurred in 1975, 1976, and 2005 (Henry 1976, Slater 2016). Information on the number of fish lifted daily, the number of lift days (days the lift is in operation), and the daily sex ratio at Holyoke are currently obtained from the Massachusetts Division of Fisheries.

Multiple tagging studies have been conducted to assess what portion of the total American Shad run to the Connecticut River passes above the Holyoke dam. One tagging study conducted in the 1970s estimated that 40-60% of the total shad run to the river passed above Holyoke (Leggett 1976). This study also documented that shad tagged during the latter portions of the spring migration season did not migrate upriver to Holyoke, but instead presumably spawned in the “lower river” (meaning the river stretch downstream of Holyoke, MA). The documentation of shad larvae in the lower river further corroborated that some level of shad spawning activity occurred below Holyoke. CT DEEP estimated the Connecticut River shad population from 1966-2004 using Holyoke lift data (Crecco and Savoy 1985). Information from the CT DEEP 1970s shad tagging study was subsequently used through the 1980-2000s to derive estimates of total shad run size from annual Holyoke passage numbers. This method to estimate the population was discontinued after 2005 when improvements were made to the Holyoke fish lift. In 2011-2012, a cooperative Connecticut River shad tagging study was initiated by the USFWS and the USGS Conte Anadromous Fish Research Center. Shad were collected in the lower river, radio- and PIT-tagged, and then subsequently detected if they passed at Holyoke. The estimated percentage of the run that passed beyond the Holyoke Dam in 2011 was 63% (Ken Sprankle USFWS personal communication).

For this sustainability plan, for years before 2005, we estimated the total shad run size to the Connecticut River from the annual Holyoke passage, using estimated proportions of the total run passing above Holyoke derived from earlier tagging studies (Crecco and Savoy 1985; Leggett 1976). For 2005 and later years, we estimated the total run size from Holyoke passage, assuming that 63% of the total run passed above Holyoke (based on 2011 results from the cooperative USFWS-USGS tagging study).

Juvenile Abundance Indices (JAI)

Annual American Shad reproductive success has been monitored in the Connecticut River since 1978 by collecting juvenile American Shad in a beach seine survey and calculating an annual index of relative abundance, or “JAI” (geometric mean catch/seine haul) (Table 1; Figure 5). Seining is conducted weekly from mid-July through mid-October at up to seven fixed stations located from Holyoke, MA to Essex, CT. The JAI is reported to ASMFC on an annual basis. The sampling protocol (including site locations, sampling intensity, and gear type) has remained consistent throughout

the survey. This metric provides an early warning of a population decline due to inadequate stock reproduction. Due to the COVID-19 pandemic, JAI was not assessed in 2020.

SUSTAINABLE FISHERY DEFINITION: Amendment 3 (ASMFC 2010) defines a sustainable fishery as “those that demonstrate their stock could support a commercial and/or recreational fishery that will not diminish the future stock reproduction and recruitment.”

Methods for Monitoring the Fishery and the Stock

A stop light style approach will be used to express the level of perceived risk to maintaining a Sustainable Fishery in the Connecticut River system. Risk will be assessed via a combination of two stock status (response) indicators and a fishing rate (stressor) indicator recognizing that factors other than in-river fishing (ocean environment, stream flow, temperature, dam & fish passage operations, etc.) significantly influence adult run size and recruitment.

The first response metric is PASSAGE, or the number of adult fish lifted at the first main stem dam in Holyoke MA (Figure 6). PASSAGE will be used as a proxy for total run size (i.e. adult stock). The threshold or trigger for PASSAGE is 140,000 fish. Recruitment (JAI) at this value has varied independent of adult stock size, indicating sufficient reproductive capacity to support future stock reproduction and recruitment. ***PASSAGE has not fallen below the threshold since Amendment 3 was adopted and the Sustainable Fisheries Management Plan was implemented. (Figure 6).***

The second metric is Recruitment Failure (hereafter abbreviated as RECRUITMENT), defined in Amendment 3 as three consecutive years of recruitment in the lower quartile of the time series. The time series of American shad JAI provided by the previously discussed CT DEEP seine survey will be used as the basis for the RECRUITMENT metric (Figure 7). ***RECRUITMENT fell into the lower quartile in 2022 (Figure 7) but increased out of the lowest quartile in 2023 (Figure 8).***

The third metric, ESCAPEMENT, is a measure of fishing pressure on the stock expressed as the proportion of the total run “escaping” the fishery to spawn (Figure 8). A very conservative trigger of 90% escapement was chosen to facilitate a timely review of potential implications for future stock production in the event of increasing fishery removals. Recent escapement has been over 90%, but lower escapement rates were common throughout the time series with no evident diminishment in subsequent recruitment. Median ESCAPEMENT between 1990 and 2023 was 95% with a range of 83% - 99%. All commercial fishing and virtually all sport fishing takes place below this dam. ***ESCAPEMENT has not fallen below the threshold since Amendment 3 and the Sustainable Fisheries Management Plan was implemented (Figure 8).***

For purposes of characterizing overall risk, a stop-light style scale has been developed (Figure 9). Each Sustainable Fishery metric will be scored annually as positive (favorable stock condition) or negative (unfavorable stock condition) relative to the trigger. The risk to maintaining a Sustainable Fishery will be judged by combining the results of the three metrics.

A “GREEN” stock status reflects all three indicators are positive, suggesting low risk to future stock reproduction. Management concern level is LOW. Management action is to continue monitoring.

A “YELLOW” stock status is indicated when two indicators are positive, and one is negative. Management concern level is GUARDED. Management action is to consider the values of these metrics in comparison to other relevant biological and environmental information (e.g. river flows, fish passage issues) to assess the threat to future stock production and recruitment. Fishery management action is contingent upon finding that harvest rates are materially contributing to diminished adult stock or recruitment. For example: if the ESCAPEMENT trigger has been exceeded, but both PASSAGE and RECRUITMENT are well above average, then no management action may be necessary. Conversely, if both ESCAPEMENT and PASSAGE are marginally “positive”, but RECRUITMENT is strongly negative, then additional harvest restrictions may be warranted.

An “ORANGE” stock status is indicated when two of three metrics are negative. Management concern level is ELEVATED. Management action again includes a closer examination of actual metric values and other relevant biological and environmental factors contributing to the perceived stock condition. Fishery management action is contingent on a finding that harvest rates are materially contributing to diminished adult stock or recruitment. The likely need for fishery management action is greater than under the GUARDED concern level.

A “RED” stock status is indicated when all three metrics are negative. The management concern level is HIGH. Management action includes immediate steps to increase ESCAPEMENT above the threshold. Possible harvest restrictions could include but may not be limited to one or more of the following: decrease in length of season, increase in minimum gillnet mesh size, increase in number of rest days. The need for more aggressive fishery management measures including a harvest moratorium would be contingent on a full examination of the stock and its capacity to support harvest.

In addition to ASMFC, the Connecticut River Migratory Fish Restoration Cooperative (formerly known as the Connecticut River Atlantic Salmon Commission) –a compact of the states bordering the Connecticut River (CT, MA, VT, NH), NMFS, and USFWS –has an interest in the Connecticut River American Shad resource and will be party to any system-wide fishery management decisions.

We recommend continued use of the three metrics described here to determine the sustainability of the CT River American shad fishery, as previously approved under Connecticut’s initial Sustainable Fisheries Management Plan.

All metrics used for this plan since the last update to the CT SFMP (submitted in 2017) have consistently been above the threshold, or trigger values, indicating a GREEN stock status and a low level of management concern. Management action is to continue monitoring. The RECRUITMENT metric fell into the lower quartile for one year (2022) but increased out of the

lower quartile in 2023. A change in management concern is only justified if the RECRUITMENT value falls into the lower quartile for three consecutive years.

LITERATURE CITED

- ASMFC. 2010. Amendment 3 to the Interstate fishery management plan for shad and river herring. Atlantic States Marine Fisheries Commission, Washington, D.C. USA.
- Crecco, V.A., and T.F. Savoy 1985. Density-dependent catchability and its potential causes and consequences on Connecticut River shad, *Alosa sapidissima*. Canadian Journal of Fisheries and Aquatic Sciences 42: 1649-1658.
- Henry, S.M. 1976. Development of fish passage facilities for American shad at the Holyoke Dam on the Connecticut River. In: Proceedings of a Workshop on American Shad: December 14–16, 1976, Amherst, Massachusetts. pp. 289–304. University of Massachusetts, Amherst. 350 p.
- Leggett, W.C. 1976. The American shad *Alosa sapidissima*, with special reference to its migrations and population dynamics in the Connecticut River. American Fisheries Society Monograph 1: 169-225.
- Leggett, W. C., T. Savoy, and C. Tomichuk. 2004. The impact of enhancement initiatives on the Connecticut River population of American shad. Pages 391-405. in P. M. Jacobson, D. A. Dixon, W.C. Leggett, B.C. Marcy, Jr. R.R. Massengill, editors. The Connecticut River Ecological Study (1965-1973) revisited: ecology of the lower Connecticut River 1973-2003. Am. Fish. Soc. Mon. 9. 545 pages.
- Moffitt, C.M., B.Kynard, and S.G. Rideout. 1982. Fish passage facilities and anadromous fish restoration in the Connecticut River basin. Fisheries 7(6):2-11.
- Slater, C. 2016. Anadromous Fish Investigations. Annual Report F-45-R-28. Massachusetts Division of Fisheries and Wildlife. 10p.
- Watson, J.F. 1970. Distribution and population dynamics of American shad, *Alosa sapidissima* (Wilson), in the Connecticut River above Holyoke Dam, Massachusetts. Ph.D. Dissertation, University of Massachusetts, Amherst. 105 p.

Figure 1. Connecticut River American Shad Commercial Landings (N), 1990 – 2023.

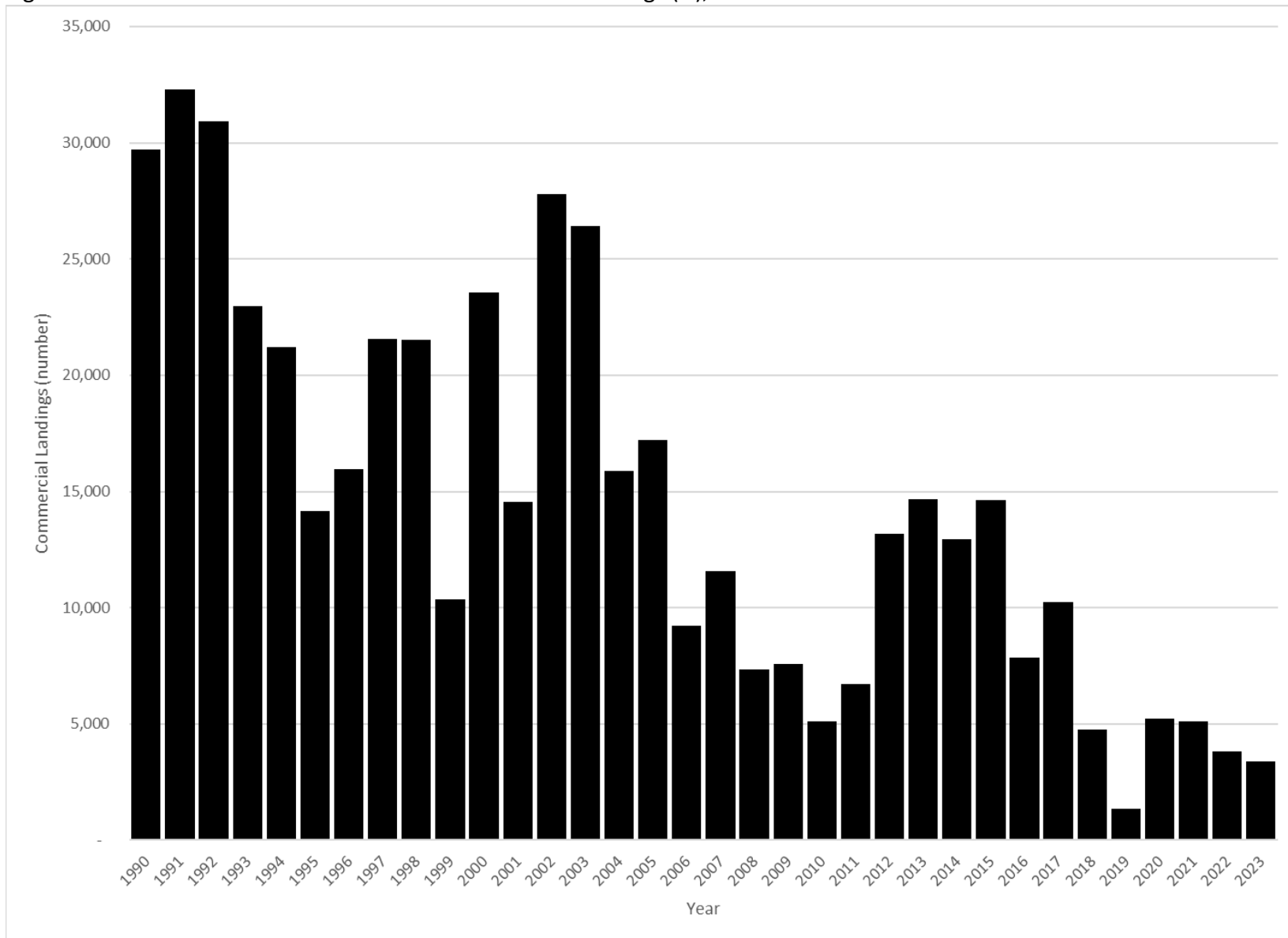


Figure 2. Connecticut River map showing range allowed for commercial shad gillnet fishery.

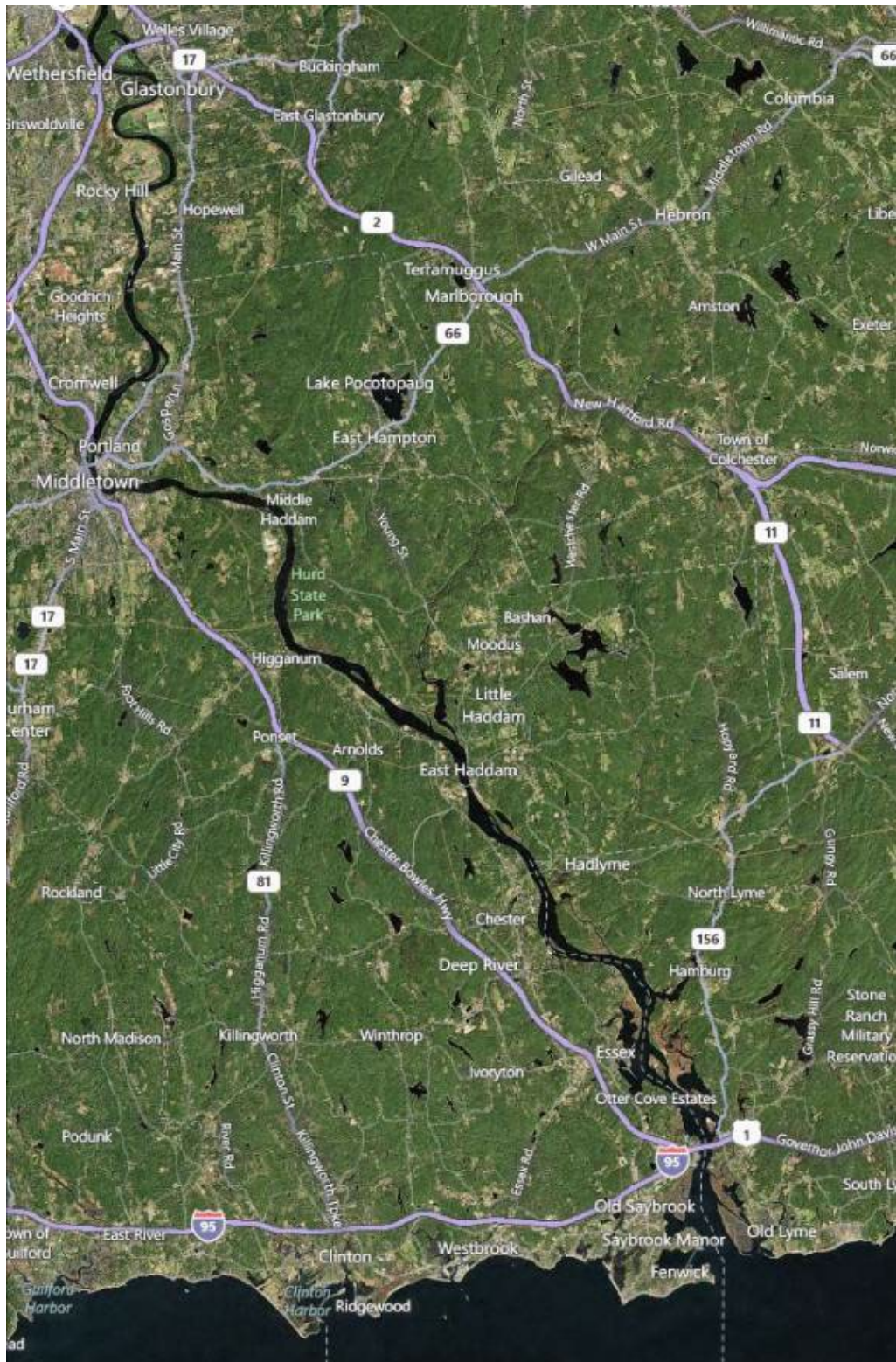


Figure 3. Map of the Connecticut River north of Hartford highlighting the creel survey sites for the American Shad recreational fishery. The sites marked in yellow indicate shad angler activity during the last creel survey conducted by CT DEEP in 2010.

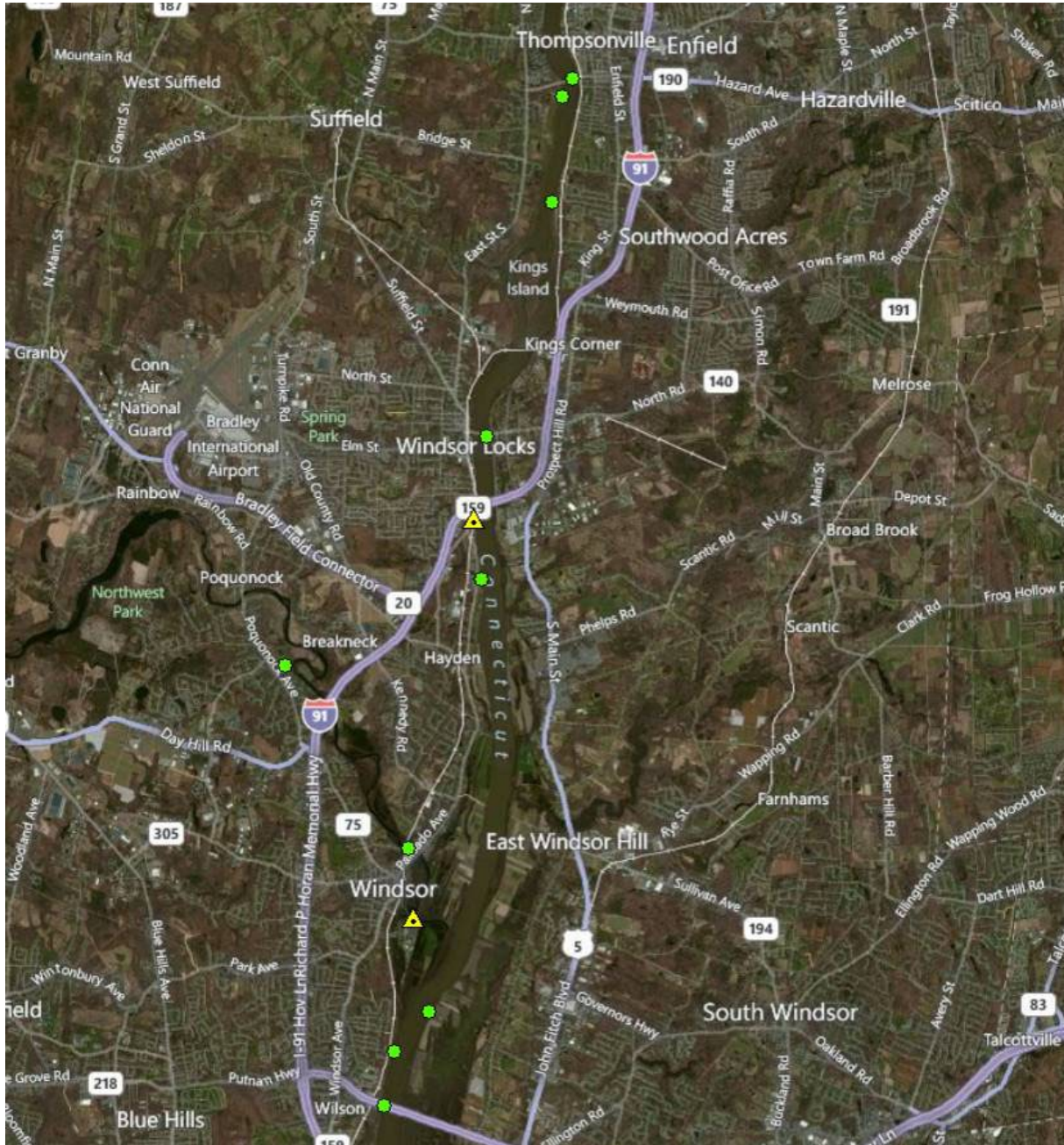


Figure 4. Annual Connecticut River American shad recreational landings (n), 1990-2023. Creel surveys have not been conducted by CT DEEP since 2010. For all years in which a creel survey was not conducted, recreational landings were estimated as 1% of the population estimate.

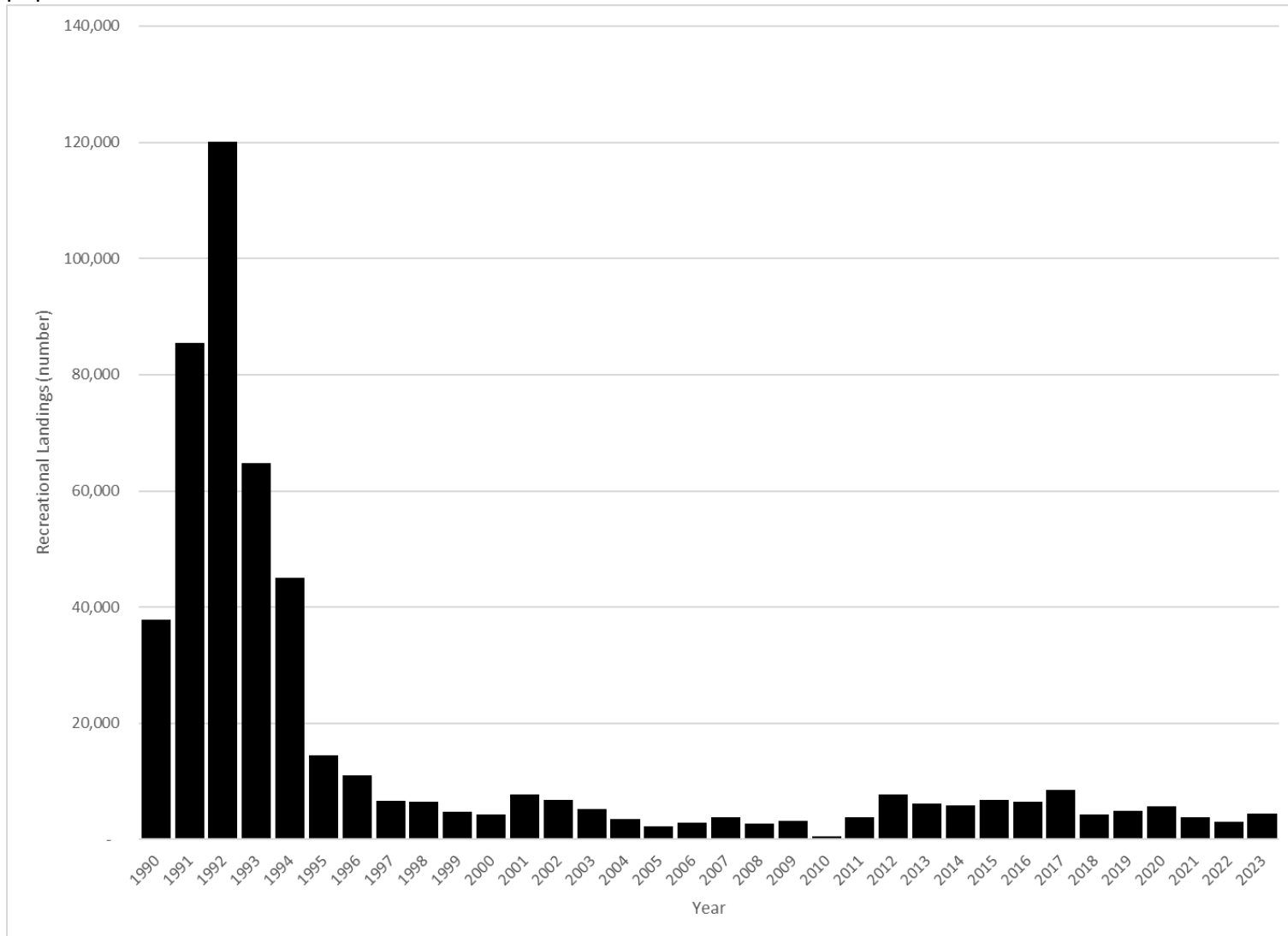


Figure 5. Map of the Connecticut River showing locations of juvenile seine survey sites.

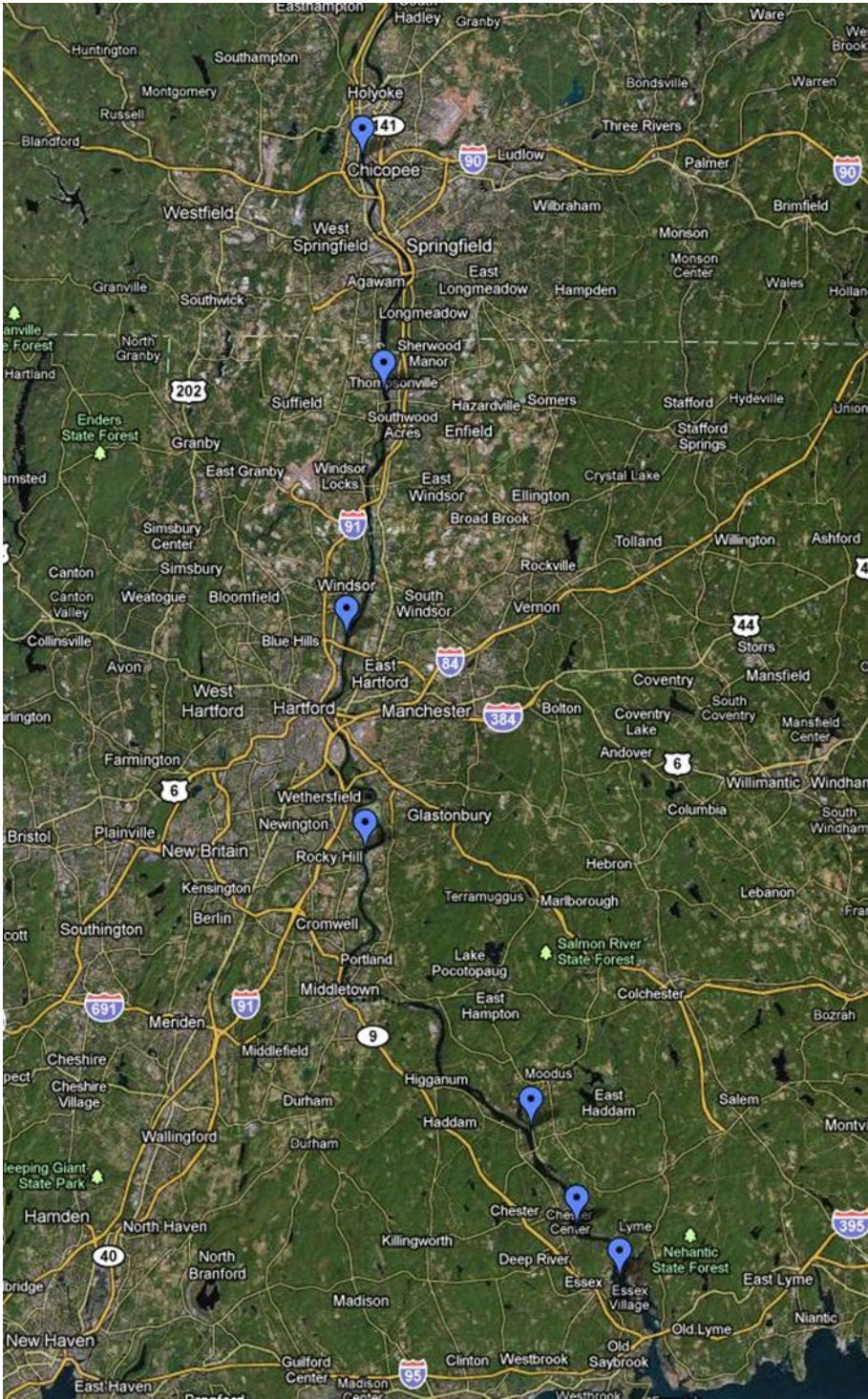


Figure 6. Number of American Shad lifted at the Holyoke Dam, 1990-2023. The orange line represents the minimum passage threshold of 140,000.

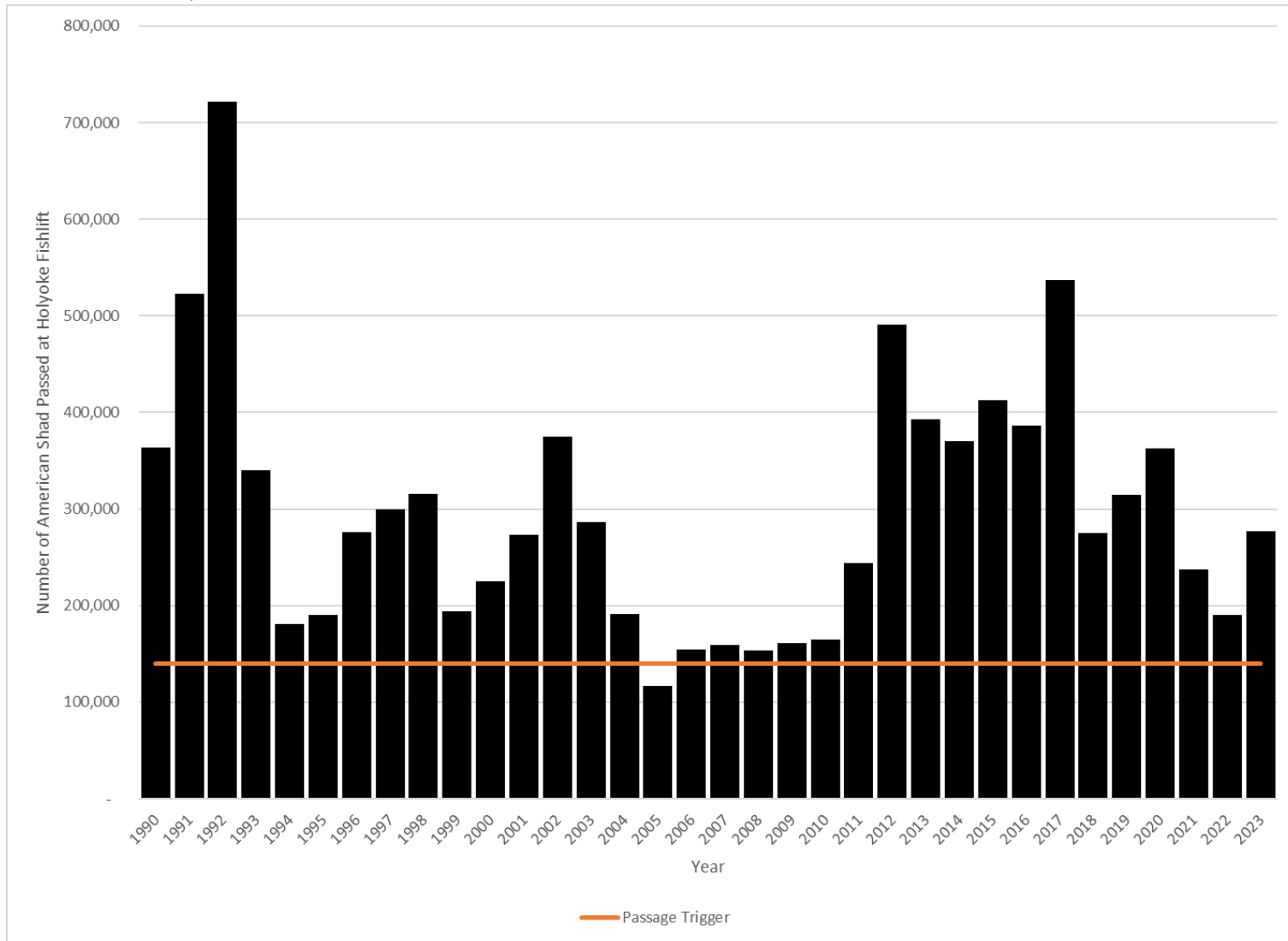


Figure 7. Connecticut River American shad juvenile geometric mean catch per unit effort, 1990-2023. The Orange line represents the low quartile value for the time series (1978-2023).

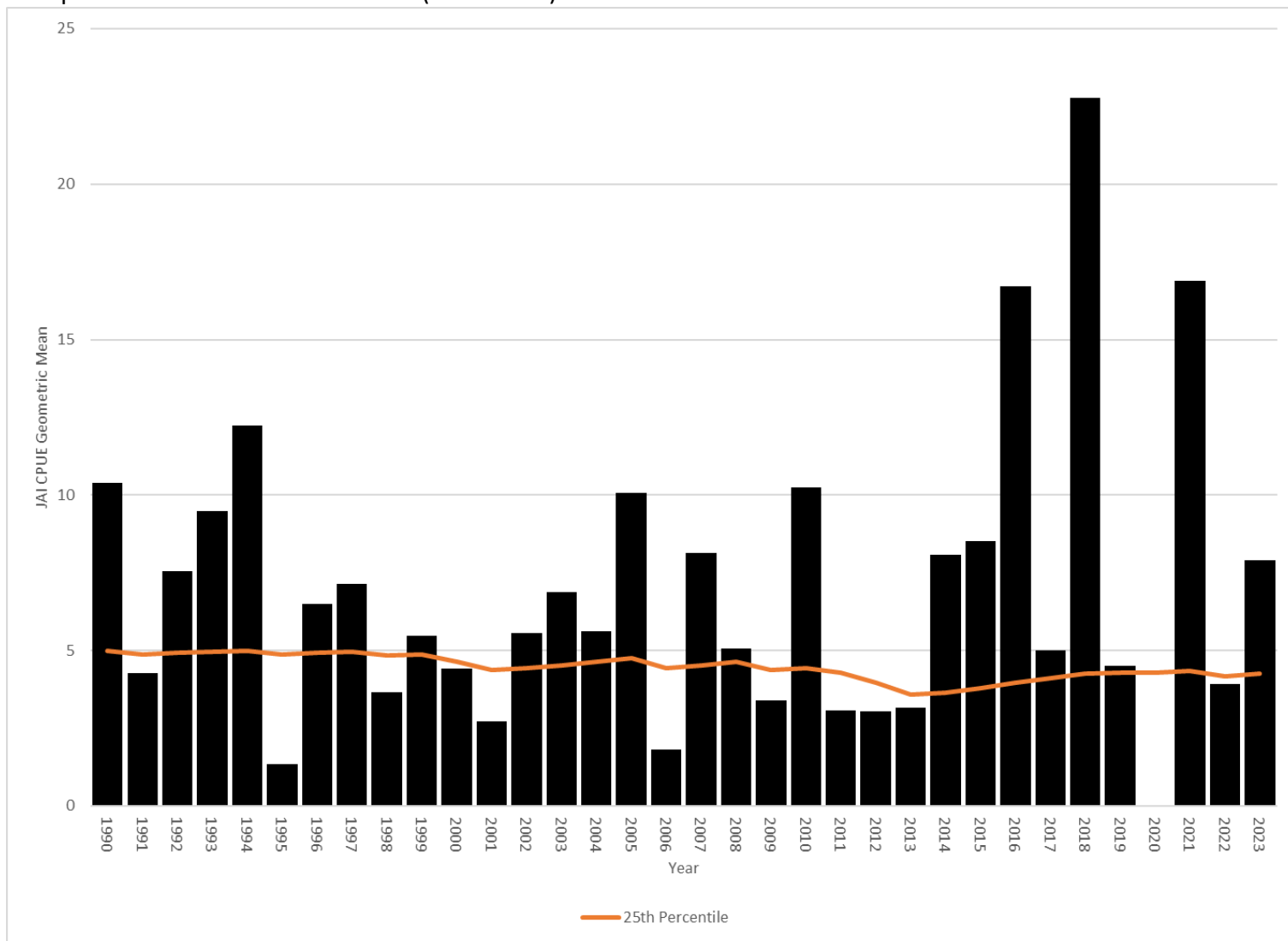


Figure 8. The annual percentage of escapement for Connecticut River American Shad; 1990-2023. The orange line indicates the threshold escapement value of 0.90.

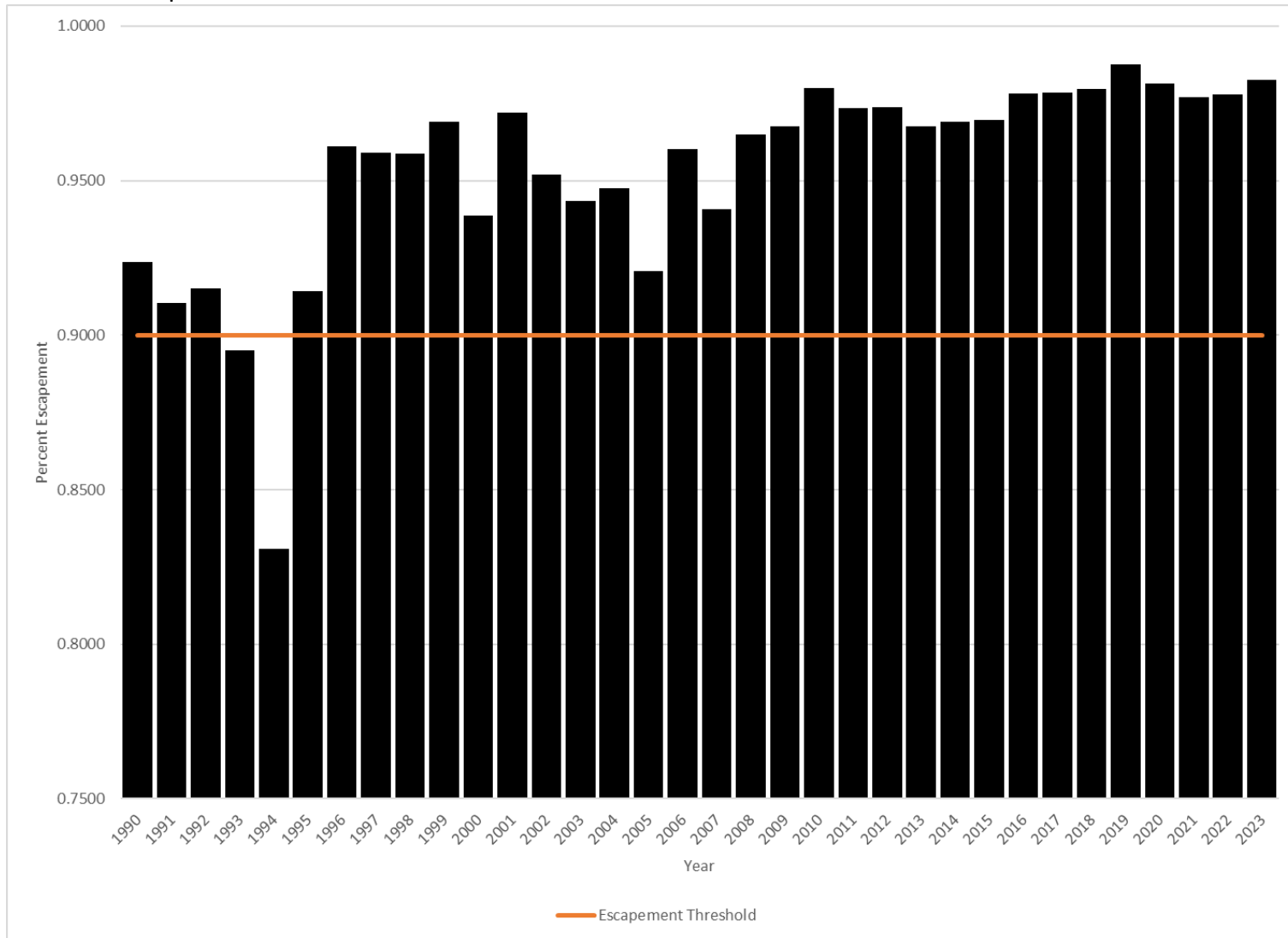


Figure 9. Sustainability Flow Chart for Connecticut River American shad stock monitoring.

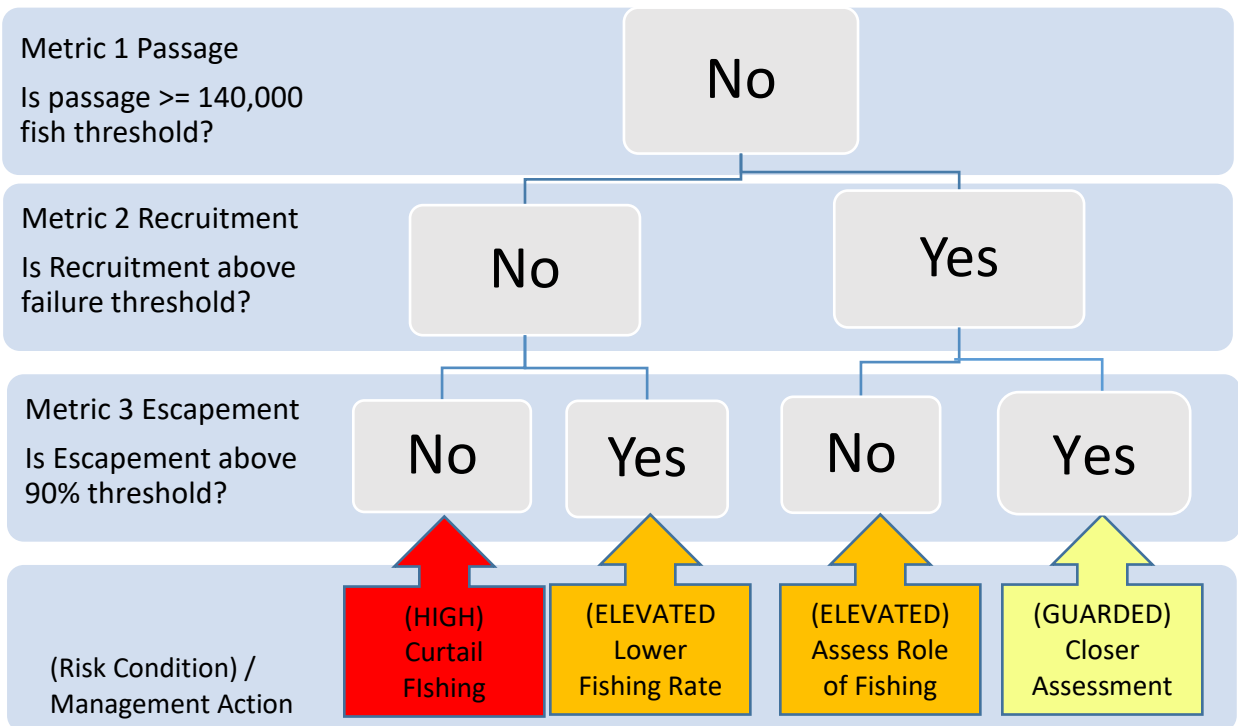
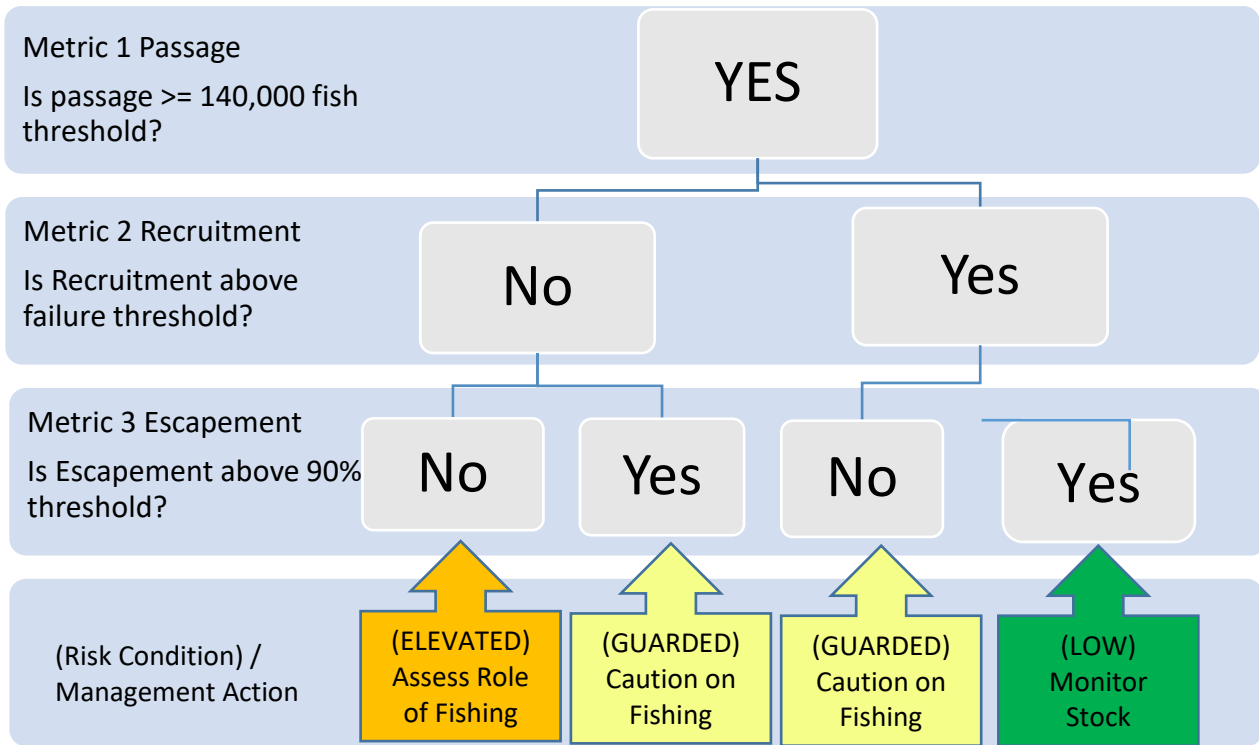


Table 1. Connecticut River American shad population estimates, commercial landings, recreational landings, and percent escapement, 1990 – 2023.

YEAR	CT POPULATION ESTIMATE (N)	CT COMMERCIAL LANDINGS (N)	CT RECREATIONAL LANDINGS (N) ¹	%ESCAPEMENT
1990	816,400	29,710	37,831	0.92
1991	1,195,900	32,286	85,494	0.90
1992	1,628,100	30,939	120,146	0.91
1993	749,200	22,963	64,855	0.88
1994	325,600	21,212	45,014	0.80
1995	304,500	14,161	14,425	0.91
1996	667,000	15,958	11,000	0.96
1997	659,000	21,555	6,590	0.96
1998	651,000	21,512	6,513	0.96
1999	475,000	10,378	4,751	0.97
2000	428,000	23,570	4,274	0.93
2001	773,000	14,543	7,731	0.97
2002	687,000	27,806	6,867	0.95
2003	527,000	26,420	5,273	0.94
2004	351,000	15,892	3,511	0.94
2005	226,000	17,209	2,260	0.91
2006	293,000	9,236	2,930	0.96
2007	244,000	11,576	3,820	0.94
2008	277,000	7,344	2,750	0.96
2009	321,000	7,593	3,210	0.97
2010	279,000	5,094	616	0.98
2011	387,000	6,725	3,870	0.97
2012	778,462	13,168	7,785	0.97
2013	623,757	14,661	6,236	0.97
2014	588,105	12,953	5,881	0.97
2015	687,760	14,637	6,878	0.97
2016	643,217	7,839	6,432	0.98
2017	852,776	10,260	8,528	0.98
2018	436,876	4,772	4,369	0.98
2019	498,986	1,341	4,990	0.99
2020	575,275	5,211	5,753	0.98
2021	376,676	5,119	3,767	0.98
2022	302,146	3,830	3,021	0.98
2023	440,265	3,397	4,403	0.98

¹ For years when a creel survey is not conducted, recreational landings are estimated as 1% of the population.

Table 2. Summary of SFMP values with triggers, 2013 – 2023.

YEAR	PASSAGE	PASSAGE TRIGGER	SUSTAINABILITY TARGET MET?
2013	392,967	140,000	YES
2014	370,506	140,000	YES
2015	412,656	140,000	YES
2016	385,930	140,000	YES
2017	536,670	140,000	YES
2018	273,979	140,000	YES
2019	314,361	140,000	YES
2020	262,244	140,000	YES
2021	237,306	140,000	YES
2022	190,074	140,000	YES
2023	277,367	140,000	YES

YEAR	JAI	JAI TRIGGER	SUSTAINABILITY TARGET MET?
2013	3.16	3.59	NO
2014	8.03	3.65	YES
2015	8.53	3.80	YES
2016	16.7	3.96	YES
2017	5.00	3.96	YES
2018	22.76	4.11	YES
2019	4.52	4.26	YES
2020	COVID 19		UNKNOWN
2021	16.88	4.34	YES
2022	3.93	4.18	NO
2023	7.89	4.26	YES

YEAR	% ESCAPEMENT	% ESCAPEMENT TRIGGER	SUSTAINABILITY TARGET MET?
2013	97	90	YES
2014	97	90	YES
2015	97	90	YES
2016	98	90	YES
2017	98	90	YES
2018	98	90	YES
2019	99	90	YES
2020	98	90	YES
2021	98	90	YES
2022	98	90	YES
2023	98	90	YES