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Review of the retained catch of Atlantic salmon as a result of the introduction of the River Classification System in the 1996 IFMP for insular Newfoundland (SFA's 3-14A)

Examen des prises conservées de saumon Atlantique après l'introduction du système de classification des rivières dans le PGIP de 1996 dans l'Île de Terre-Neuve (ZPS 3-14A)

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ABSTRACT

The implementation of the River Classification System in Newfoundland and Labrador Region in 1999 and its impact on the retained recreational Atlantic salmon catch are examined. The period from 1988 to 2009, which includes eleven years prior to implementation and the eleven years post implementation, was examined to document the observed changes. The number of licenses issued during the two time series declined but there was no significant change in effort, defined as rod days. The average number of retained small salmon in the recreational fishery declined post implementation of the River Classification System by 5,736 fish. The biggest decline in retained catch occurred in the smaller watersheds with lower River Classification designations and lower retention limits. While the overall average number of retained salmon declined under the River Classification System, retention increased on Class I rivers where a season retention limit of six fish is permitted.

RÉSUMÉ

On examine la mise en œuvre du système de classification des rivières dans la région de Terre-Neuve-et-Labrador en 1999 et son incidence sur les prises récréatives conservées de saumon Atlantique. L'examen a porté sur la période allant de 1988 à 2009, qui comprend onze ans avant la mise en œuvre et onze ans après celle-ci, afin de décrire les changements observés. Le nombre de permis délivrés pendant ces deux périodes a diminué, mais on n'a pas constaté de modification importante des efforts, définis en jours-pêcheurs. Le nombre moyen de petits saumons conservés dans le cadre de la pêche récréative a diminué de 5 736 poissons après la mise en œuvre du système de classification des rivières. La diminution la plus importante du nombre de prises conservées s'est produite dans les bassins hydrographiques plus petits ayant des désignations inférieures dans la classification des rivières et des limites plus basses de prises pouvant être conservées. Bien que le nombre moyen global de saumons conservés ait diminué avec l'application du système de classification des rivières, la conservation a augmenté dans les rivières de catégorie I, dans lesquelles la limite de conservation est de six poissons par saison.

INTRODUCTION

Atlantic salmon (*Salmo salar* L.) within the Newfoundland and Labrador region are managed through the application of Integrated Fisheries Management Plans, generally for a five year time frame. In 1984 a five year Atlantic Salmon Management Plan was introduced in an effort to rebuild depressed stocks in mainland Canada and southwestern Newfoundland. One measure was a prohibition on the retention of large salmon (≥ 63 cm FL) in insular Newfoundland which took effect in 1985. In an effort to reduce commercial catches, a quota management system was used in 1990 and 1991 (DFO 1990). In 1992 several major changes were introduced the most restrictive of which was the placement of a five-year moratorium on commercial salmon fishing in insular Newfoundland (DFO 1992). In 1997 further restrictions were implemented to manage the recreational Atlantic salmon fishery. As a result of this and uncertainties regarding levels of future salmon returns, the 1998 management plan was much more conservative than in previous years.

In 1999, a three year Atlantic salmon management plan introduced an Adaptive Management Strategy and a River Classification System. The River Classification System was used to set retention levels on a river by river basis. The classification, and therefore the allowed retention, assigned to a particular river was based on the size of the individual salmon stock in that river. This was a major departure from managing salmon on a more regional or Salmon Fishing Area (SFA) basis which set retention limits for larger areas. Details of the three year plan and a more detailed description of the River Classification System are provided in DFO (1999). Five year management plans were introduced in 2002 (DFO 2002) and 2007 (DFO 2007), wherein the River Classification System, though variously modified, was retained.

It is the intent of this manuscript to examine the impact of the introduction of the River Classification System on the recreational catch of Atlantic salmon in SFA's 3-14A (insular Newfoundland).

METHODS

Recreational fishery data from the period 1988-2009 were used in the analysis. These data cover an 11 year time period prior to the implementation of the River Classification System and 11 years when river classification was in effect as a management strategy. The data from 1994 to 2009 were derived from the License Stub Return System (angler logs) and the information prior to 1994 is a compilation of data collected by Fishery Officers and River Guardians. The number of recreational fishery licenses issued is derived from vendor data.

Recreational fishing effort are presented as rod days, defined as any day or part of a day on which an angler fishes. Since retention of salmon greater than 63 cm has not been permitted since 1985, it was decided to use retained small salmon as the metric for comparison between pre and post implementation of the River Classification System.

Two sample t-tests were used to test for differences between the number of salmon retained annually pre and post river classification as well as to test for changes in effort between the two time periods. T-tests were also used to compare the annual retention on rivers that were designated Class I rivers (season retention of 6 fish) under river

classification and those that were classed II, III (season retention of 4 or 2 fish respectively)

In 2008 and 2010 two rivers in the St. Georges Bay area (SFA 13) were re-classified mid season to allow additional retention on these rivers. The data from 2010 is still preliminary because processing of the information from the Licence Stub program had not been finalized when this manuscript was being prepared. Nevertheless a qualitative assessment was made to compare catch and effort between the years when the rivers were Class III (2003-07, 2008) and when the classification was changed to a Class II (2008, 2010) mid season.

RESULTS

CATCH AND EFFORT

For the five-year period immediately preceding the commercial salmon fishery moratorium (1987-91), the average number of recreational fishery licenses issued in Newfoundland and Labrador was 24,493. Maximum license sales were 26,508 recorded in 1993.

Licenses issued during the 11 years prior to and after the implementation River Classification System are detailed in Table 2. For the eleven year period prior to the implementation of the River Classification System (1988-98) there was a total of 258,987 (mean 23,544) licenses issued and for the eleven years post implementation (1999-2009) of the River Classification System there was a total of 185,031 (mean 16,821) licenses issued. Figure 1 displays the linear regression of licenses issued versus year, which displays a negative trend over time in the number of licenses issued. Since 2008 the number of licenses issued has increased over the mean for the period. However, despite the general decline in license sales since 1988 there was no significant change in annual effort pre and post river classification (t-test $p > 0.05$) For the eleven year period pre river classification there was a average annual effort of 117,285 rod days compared to a post river classification effort of 111,656 rod days (Table 1).

In the eleven years prior to the implementation of the River Classification System there was an average annual harvest of 27,025 small salmon in the recreational fishery. This is significantly higher (t-test $p < 0.05$) than the annual average harvest of 21,289 salmon in the eleven years after the introduction of the River Classification System. This decline in retained recreational catch (Fig. 2A) occurred even though effort remained the same and the abundance of salmon in freshwater was at least similar during both periods and indeed abundance of salmon in freshwater may have been greater during the 1999-2009 period (B. Dempson, Department of Fisheries and Oceans, pers. com.).

Although there was an overall decline in the number of retained fish and a decline in licenses sold, the maintenance of a constant effort in the fishery resulted in an increase in the proportion of available tags being filled. In 1988 a total of 396,675 tags were issued yet the total retained catch was only 39,641 or approximately 10 % of available tags. Since 1999 on average there has been 16,821 licenses issued annually with a potential harvest of 100,926 small salmon (6 tags per licence) for the Newfoundland and Labrador region of which on average 21,289 were retained in SFA's 3-14B or approximately 20 % of tags available. These seemingly contradictory trends suggest that the anglers that have remained in the fishery retain more fish.

Further, the trends in retention and effort were not consistent across all river classifications. For the pre and post implementation periods there was an average of 6,444 and 8,561 retained fish on Class I rivers respectively. This was a significant increase in retention (t-test $p < 0.05$) on rivers that were given a Class I designation. Since retention decreased overall during this period, the decline in retention on the Class II and Class III rivers is highly significant (t-test $p < 0.001$) (Fig. 2B)

IMPACT OF INCREASING ALLOWABLE RETENTION WITHIN A SEASON

Watersheds with individual management plans and an in-season review allow the possibility to examine the impact of varying the retention level within a season. Two such examples are Harry's River and Flat Bay Brook in SFA 13. Since 2003 Harry's River watershed has had an individual management plan as well as an individual stock assessment. Based on the returns to Harry's River and the management plan, Harry's River and Flat Bay Brook had allowable retention increases from 2 to 4 fish in 2008 and 2010. The change in the retention rate occurred on August 7 in 2008 and July 10 in 2010. The recreational season is from June 1 to September 7. Figures 3 and 4 reveal that for both rivers the two years where allowable retention increased were the two years with the highest harvest since a retention fishery was reintroduced in the early 1990's. Effort also increased to its highest levels during these two years. The small sample size ($n=2$) with respect to years with an increased allowable retention makes a statistical analyses of limited value. Nevertheless there appears to be a correlation between increasing allowable retention and increased effort and catch.

DISCUSSION

Prior to 1999 the Newfoundland and Labrador Atlantic salmon recreational fishery was managed using seasonal bag limits and a recreational fishing season. From 1999 onwards the fishery has been managed using a River Classification System with bag limits based on the specific river's classification and a recreational fishing season.

The purpose of the River Classification System was to allow DFO to manage the fishery on a river by river basis. Seasonal and daily bag limits could vary based on the size of a river's population and/or its status with respect to conservation limits. However, DFO does not set quotas in the Atlantic salmon recreational fishery. Therefore, although there is a daily bag limit there is no limit on the number of residents that can purchase a licence and no limit to the number of anglers that could fish a particular river.

In theory, irrespective of the number of licenses issued, retained catch of small salmon for SFA's 3-14B could be 6 tags per license. All (100 %) of this catch could be harvested on Class I rivers. Although this is unlikely to happen, the result of this study suggests that River Classification is resulting in additional retention on the Class I rivers (Fig. 2B). Further evidence that effort and harvest increase as retention limits increase can be seen on Harry's River and Flat Bay Brook. It is not as obvious in the Flat Bay Brook data but the change in effort and retention on Harry's River is quite dramatic in the two years when retention limits increased mid-season (Figs. 3 and 4).

Conversely the recreational catch that came from the Class II and III rivers declined quite significantly (Fig. 2B). This suggests that the River Classification approach limits the

harvest on smaller watersheds which have a lower class designation and this management approach protects these smaller watersheds through limiting the retained harvest on same.

Since the inception of the River Classification System the number of licenses issued and the overall number of small salmon retained has decreased. The number of rivers in the Class I and II categories is likely to have a greater impact on retained salmon catch than any other factor(s). Designating rivers as Class III or lower appears to be the biggest factor in reducing harvest on those watersheds. The overall reduction in retained catch since the inception of River Classification, as freshwater abundance since 1999 is equal to or greater than abundance in freshwater prior to 1998, has lead to an increase in the total number of spawners (i.e., reduction in the retained catch of small salmon) island wide. The recreational salmon fishery in SFA's 3-14B is the only legal way to harvest Atlantic salmon and hence any directed management measure designed to increase abundance of spawners must be directed at the recreational salmon fishery.

ACKNOWLEDGMENTS

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Table 1. Recreation catch statistics for SFA's 3-14A, 1988-2010.

Year	Small (<63 cm)			Large (≥63 cm)			Total (Small + Large)		
	Retained	Released	Total	Retained	Released	Total	Retained	Released	Total
1988	39841	*	39841	*	*	*	39841	*	40441
1989	18462	*	18462	*	*	*	18462	*	18645
1990	29967	*	29967	*	*	*	29967	*	30470
1991	20529	*	20529	*	*	*	20529	*	20865
1992	23118	5642	28760	*	1413	1413	23118	7055	30173
1993	24693	16403	41096	*	1640	1640	24693	18043	42736
1994	29225	20761	49986	*	4685	4685	29225	25446	54671
1995	30512	22971	53483	*	4658	4658	30512	27629	58141
1996	35440	30566	66006	*	5720	5720	35440	36286	71726
1997	22819	23129	45948	*	4154	4154	22819	27283	50102
1998	22668	27610	50278	*	3561	3561	22668	31171	53839
1988-98 Average	27025	21012	40396		3690	3690	27025	24702	42892
1999	22870	20160	43030	*	3222	3222	22870	23382	46252
2000	21808	22610	44418	*	5033	5033	21808	27643	49451
2001	20977	17708	38685	*	3716	3716	20977	21424	42401
2002	20913	18019	38932	*	3014	3014	20913	21033	41946
2003	21226	16455	37681	*	3639	3639	21226	20094	41320
2004	19946	17462	37408	*	3649	3649	19946	21111	41057
2005	21869	26009	47878	*	5308	5308	21869	31317	53186
2006	19394	24676	44070	*	4561	4561	19394	29237	48631
2007	14577	13088	27665	*	3385	3385	14577	16473	31050
2008	27497	26870	54367	*	5573	5573	27497	32443	59940
2009	23103	23285	46388	*	3053	3053	23103	26338	49441
1999-09 Average	21289	20577	41866		4014	4014	21289	24590	45880
2010p	24621	23175	47796	*	4438	4438	24621	27613	52234

Table 2. Number of Rod Days, Catch per Unit of Effort and number of licenses issued from 1988 to 2010, for SFA's 3-14B.

Year	Effort - Rod Days	Catch Per Unit Effort	Number of Licenses
1988	120497	0.34	26445
1989	91286	0.20	24488
1990	105736	0.29	22907
1991	89812	0.23	23390
1992	95931	0.31	25718
1993	125661	0.34	26508
1994	132935	0.41	22596
1995	128309	0.45	21489
1996	153759	0.47	25553
1997	123165	0.41	21403
1998	123041	0.44	18490
1988-98 Average	117285		23,544
1999	123840	0.37	17927
2000	127639	0.39	18316
2001	102768	0.41	17877
2002	95143	0.44	15937
2003	94862	0.44	17146
2004	91151	0.45	15657
2005	117114	0.45	15119
2006	106900	0.45	15596
2007	87655	0.35	14208
2008	143674	0.42	17842
2009	137465	0.36	19406
1999-09 Average	111656		16,821
2010p	122943	0.42	19,050

Table 3. Retained catch of small salmon 1988-2009, for SFA's 3-14B.

Year	Retained Fish		
	SAF's 3-14A	Class I Rivers	Class II-V Rivers
1988	39841	8459	31382
1989	18462	2967	15495
1990	29967	5093	24874
1991	20529	3656	16873
1992	23118	4910	18208
1993	24693	5132	19561
1994	29225	8682	20543
1995	30512	8405	22107
1996	35440	10036	25404
1997	22819	5828	16991
1998	22668	7721	14947
Mean	27025	6444	20580
1999	22870	9327	13543
2000	21808	6956	14852
2001	20977	8269	12708
2002	20913	8249	12664
2003	21226	8713	12513
2004	19946	8131	11815
2005	21869	10265	11604
2006	19394	7612	11782
2007	14577	5670	8907
2008	27497	11339	16158
2009	23103	9639	13464
Mean	21289	8561	12728

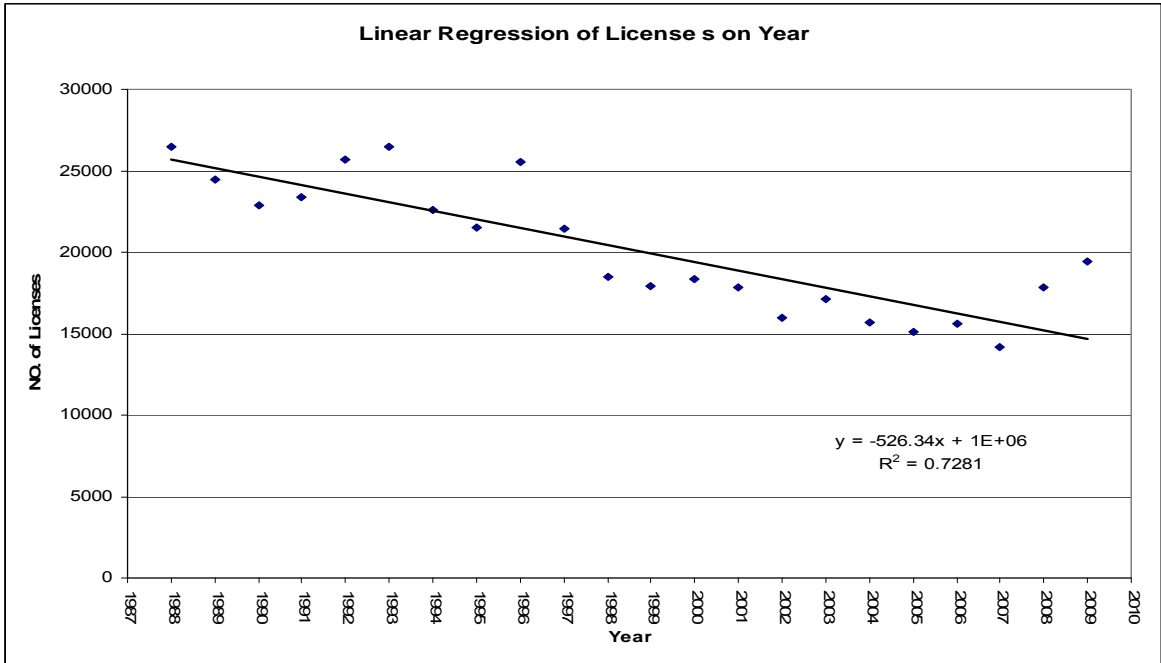


Figure 1. Linear regression of number of licenses issued on year.

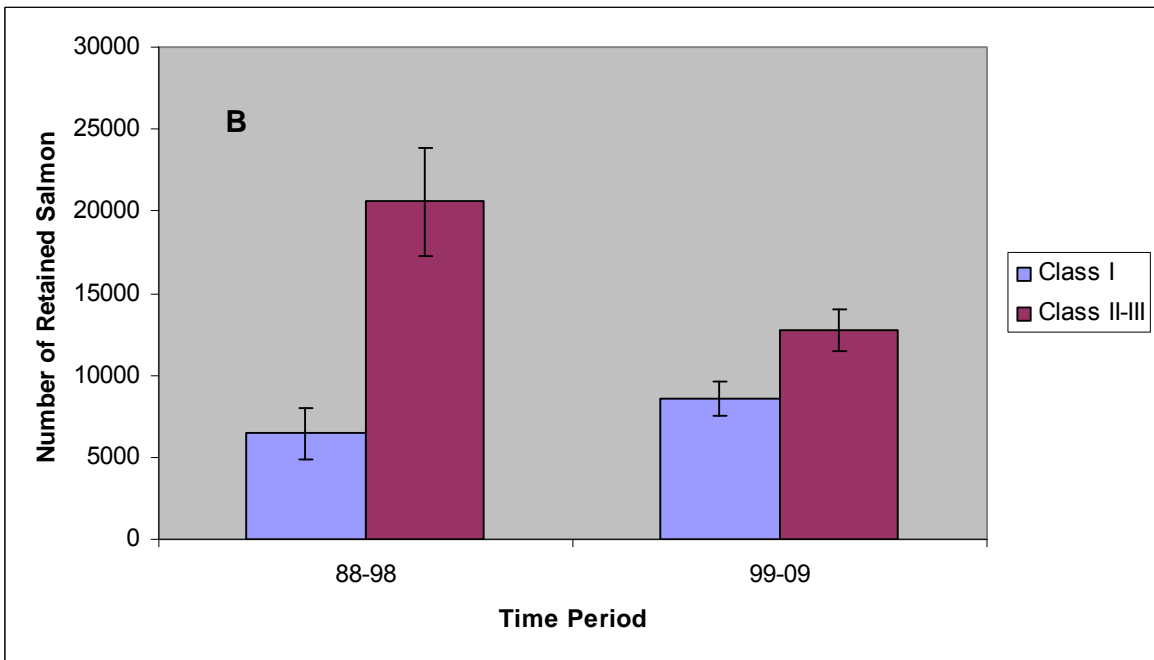
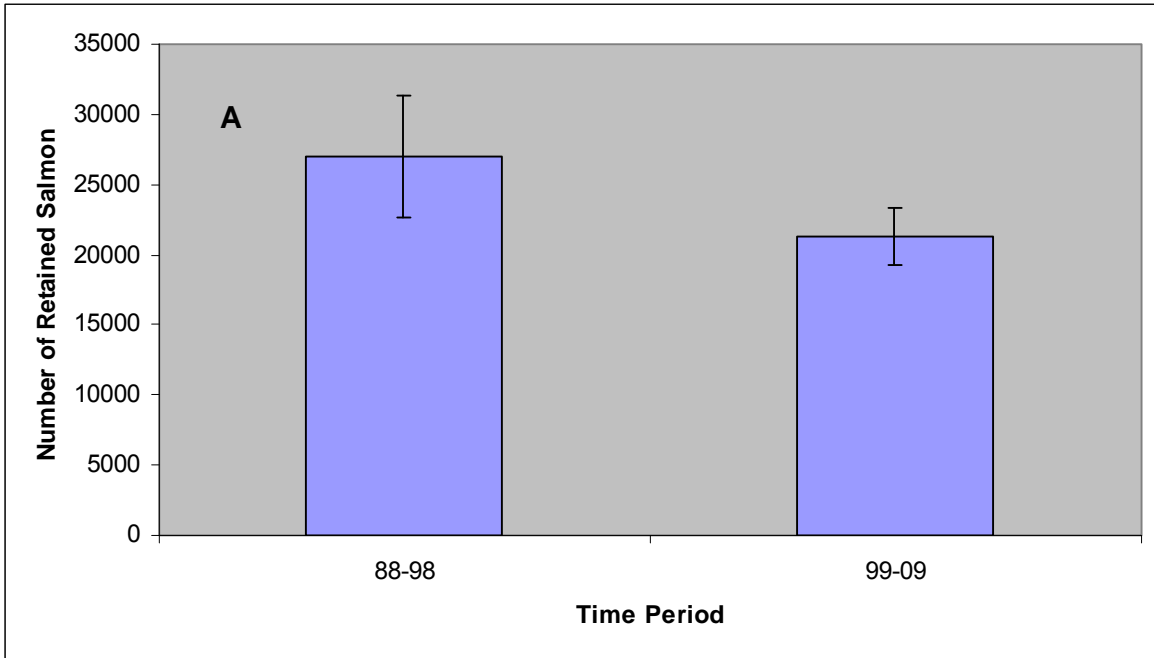


Figure 2. Bar graphs showing retained catch of small salmon for SFA's 3-14B for the two time periods representing pre and post implementation of the River Classification System. Error Bars are 95 % confidence intervals. A. All river classes; B. River classes separated into Class I and Class II-III.

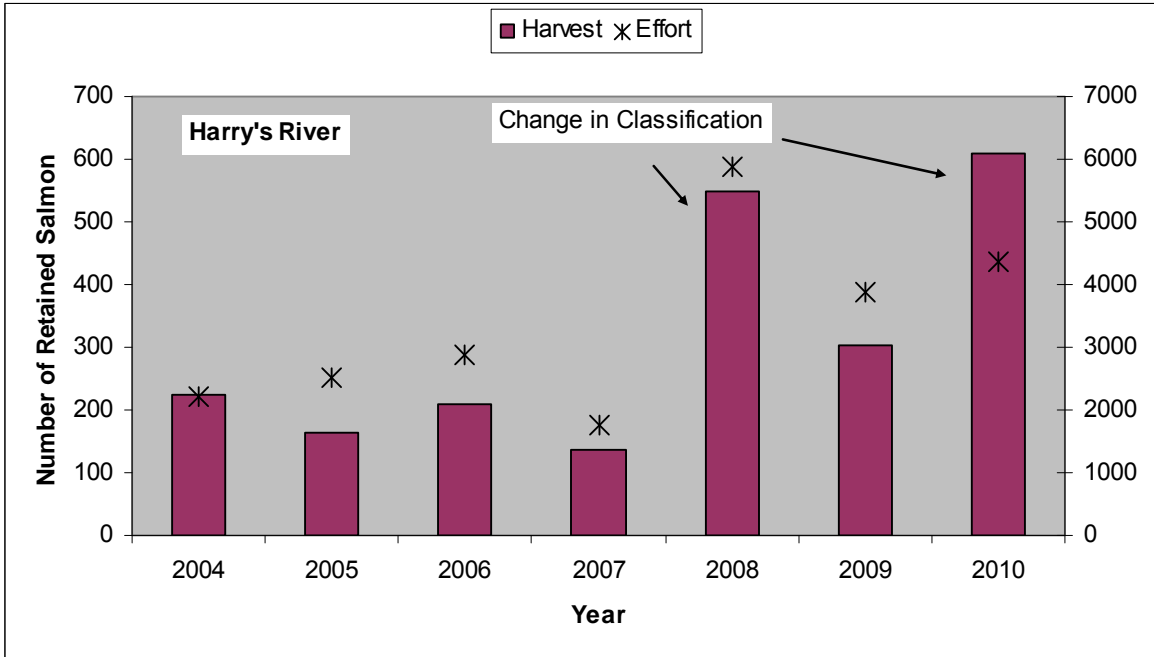


Figure 3. Plot of harvest (bars) and effort (stars) for Harry's River from 2004 to 2010.

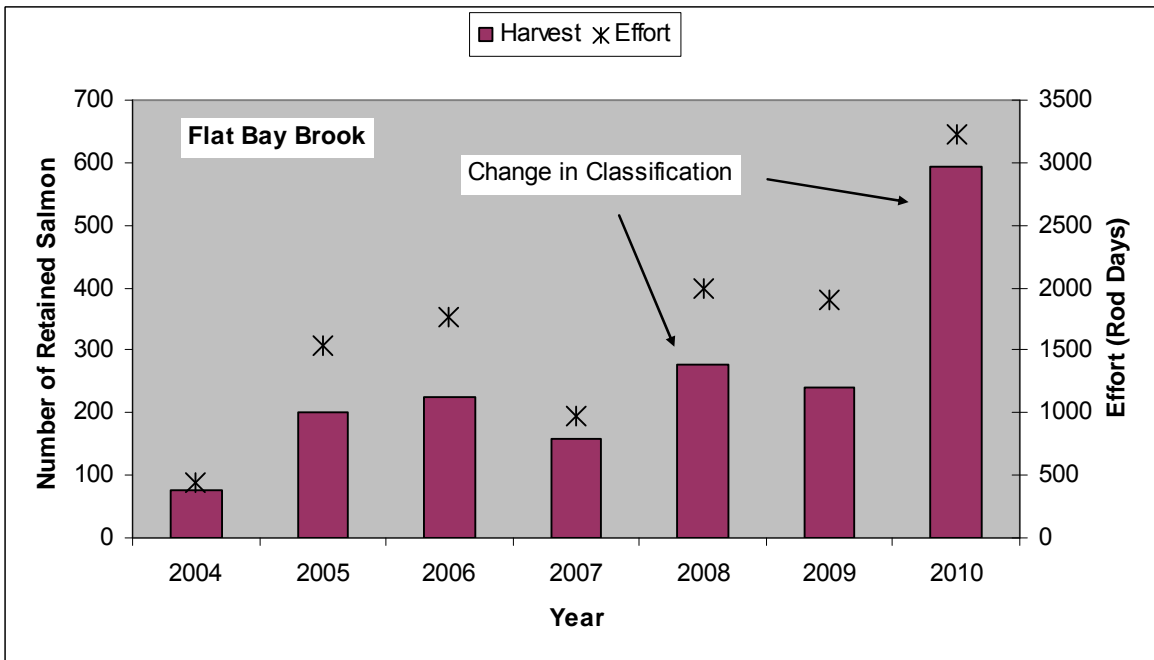


Figure 4. Plot of harvest (bars) and effort (stars) for Flat Bay Brook from 2004 to 2010.