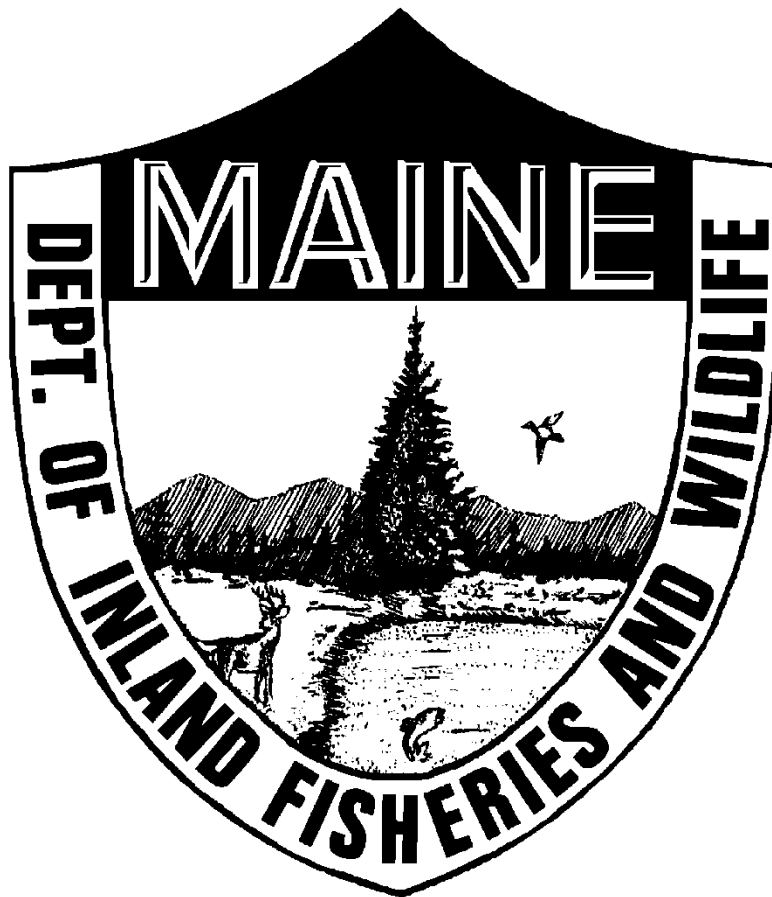


Fishery Progress Report Series No. 17-2

# Observations of Angler Use in Northern Maine Lakes, 1996-2016

By: Jeremiah R. Wood  
Fish River Lakes Region



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Maine Department of  
Inland Fisheries & Wildlife  
Fisheries and Hatcheries Division

**Job F-014**  
**Progress Report No. 17-2**  
**Observations of Angler Use in Northern Maine Lakes, 1996-2016**

**ABSTRACT**

Understanding angler use and associated fishing pressure is critical to the proper development of fisheries management strategies. We computed estimates of open-water angler use on major lakes and ponds in the Fish, Allagash and upper Aroostook watersheds using flight count data from the mid-1990s and 2010s. Results showed a striking decline in angler use on most waters over the study period, which mirrors demographic trends and is consistent with anecdotal observations. This lower level of angler use highlights the need to reconsider the effectiveness and necessity of current fishing regulations, and the potential to explore options that might better manage fisheries and encourage more angler use in northern Maine.

KEY WORDS: ANGLER USE, FISHING PRESSURE, USE ESTIMATES, ANGLER COUNTS

**Job F-014**  
**Progress Report No. 17-2**  
**Changes in Levels of Angler Use in Northern Maine Lakes, 1996-2016**

**SUMMARY**

We computed estimates of angler use during open water fishing seasons in the mid 1990's and 2010's. Estimates were calculated based on angler party counts conducted by Maine Warden Service pilots, combined with creel survey data describing timing of daily angler activity and average party sizes. Flight counts were conducted during the seasons of 1996-1998 and 2015-2016. Counts focused on the Fish River drainage in 1996, 1998 and 2015, and the Allagash and Aroostook river drainages in 1997 and 2016, with some overlap.

Angler use declined sharply in most waters during the study period. Because of the 20 year gap in flight count data over the course of the study, it is unclear whether these numbers represent a gradual decline in angler use, or one or more abrupt changes at specific times. Data from other sources, namely North Maine Woods, Inc., and the Allagash Wilderness Waterway, show a gradual decline in recreational use in their respective areas during the same time period.

Fishing regulations have remained the same in most study waters during the time period, while angler use has declined. Our results call to question the effectiveness and/or necessity for these regulations today, and highlight the opportunity to explore alternative options that may provide more effective management and increased angler opportunity.

## INTRODUCTION

A general understanding of the amount of fishing pressure a body of water receives is a critical component of fisheries management, and helps guide decision making related to the promulgation of fishing regulations. To better understand the levels of, and trends in, fishing pressure in northern Maine, we conducted aerial angler counts in two distinct regions during summer 2015 and summer 2016. These counts, combined with angler creel survey data, were used to estimate the total amount of use these waters received during the summer season. Use estimates were then compared with similar estimates from 1996-1998 to detect differences in angler use over time.

## METHODS

Angler counts were conducted by MDIFW Warden Service pilots and fixed wing aircraft during the open water fishing season in 1996-98 and 2015-16. The same core waters were counted on the Fish River chain of lakes from 1996-98 and in 2015, and in the Allagash/upper Aroostook area in 1997 and 2016. Some additional waters were counted during only one of these sampling events, and some waters were counted during 4 or 5 events.

Maine Warden Service pilots (primarily one individual with the occasional relief pilot) flew the directed routes and conducted instantaneous counts (number of parties fishing) on each water on specific dates. The flight schedule was predetermined, with allowance for adjustments based on personnel schedules, emergencies and weather conditions. Most flights took place during the mid-day hours (primarily 10 AM – 2 PM) to coincide with peak times of angler activity on these waters.

Instantaneous angler count data were combined with estimates of party size and timing of angler activity to estimate season-long use for each water (SAS 9.4). Party size and angler activity data were estimated using a combination of creel clerk and voluntary creel survey data. For the Fish River Chain waters, average party size, separated by weekday and weekend trips, as well as angler activity curves were generated from an intensive summer creel survey on Square Lake in 1996 (Tables 1 and 2). For the Allagash and upper Aroostook waters, these same data were generated from ten years of creel survey data from Big Eagle Lake in the Allagash River drainage, representing more than 500 angler trips collected primarily through the efforts of Allagash Wilderness Waterway rangers (Tables 1 and 2).

To compute the estimates, each aerial angler count (which represented number of parties fishing at a specific time) was expanded by the average party size from the creel survey data, specific to whether the count was conducted on a weekday or weekend day, to estimate number of anglers in the instantaneous count. Angler activity curves (which predict the proportion of total daily use likely to occur during each hour of the day) were used to expand this number to estimate total daily use. Estimates of total daily use were then expanded by the total number of days in the fishing season to estimate total summer angler use for each water. The open water season was considered to start around the time of ice-out in the spring (usually between April 25 – May 10) and end on September 30<sup>th</sup>, the last legal fishing day of the season in all study waters. 95% confidence intervals were generated for each estimate. In waters where the theoretical lower confidence limit was a negative number, this was adjusted to coincide with the minimum estimated number of anglers based on actual parties counted.

Considering the approximate twenty-year gap in summer angler use data during the study period, it was determined that running statistical tests comparing the two study periods was probably not appropriate due to the level of uncertainty around angler use during the intervening years. Instead, use estimates and confidence intervals were visually interpreted and combined with anecdotal information and supporting data from outside sources to determine the nature of changes in angler use.

## RESULTS

### *Fish River Chain*

Counts and use estimates were completed on 36 instances for Fish River Chain waters from 1996-2016 (Table 3). All Fish River Chain waters showed a decline in use between 1996 and 2015 (Figures 1-8). It appears that use declined substantially between 1996 and 1998 in most of these waters, and the decline continued up to 2015, though the lack of data between 1998 and 2015 make it difficult to determine the nature of the trend during those years.

### *Allagash/Upper Aroostook*

Based on flight count estimates, overall angler use in the Allagash and upper Aroostook waters declined substantially between 1997 and 2016 (Figures 9-13). Wide confidence intervals in some waters made it difficult to determine the significance of some declines, though they still appeared represent meaningful changes in use. Waters with the most marked declines included Second Musquacook, Haymock, Spider, Big Indian, Long, Round, Millinocket, Millimagassett and Chase lakes. Churchill and Big Pleasant lakes experienced lesser declines. While it is obvious that angler use is down substantially since 1997, the lack of data between 1997 and 2016 make it impossible to determine the nature of the overall trend during those years.

## DISCUSSION

### *Declining Use*

Summer use estimates from 2015 and 2016 appear to have confirmed what biologists and anglers in northern Maine have suspected for years – angler use in the area has declined considerably in the Fish, Allagash and Aroostook watersheds over the past two decades. No clear cut reason behind this decline in angler use is evident, but the overall pattern is the same in the majority of these waters, indicating that the cause is likely widespread rather than water-specific.

### *Supporting Data*

In addition to our data, information collected from other area sources showed similar trends in declining angler use. North Maine Woods, Inc. manages recreational access to more than 3.5 million acres of timberland in northern Maine, including angler access to all of the Allagash and upper Aroostook

drainage lakes covered in this study, as well as Fish River Lake and Carr Pond in the upper Fish River drainage. The organization records annual levels of users accessing these lands through managed access gates, categorized by recreation type. North Maine woods records showed a substantial decline in fishing use during the period of 1998-2016 (Figure 14).

The Allagash Wilderness Waterway is a state-managed recreation corridor along the Allagash River and its lakes, and includes the five Allagash waters covered in this study. Waterway rangers collect data on the number of users on the waterway, including canoe trippers, camping use and day-use by anglers. The trend in visitor days on the Allagash Wilderness Waterway has also showed an appreciable decline during the study period (Figure 15).

### *Reasons for Angler Use Declines*

Population demographics are likely a major driving force behind the overall declines in angler use in northern Maine. United States Census Bureau statistics show that the population of Aroostook County has declined approximately 21% from 1990-2015 (U.S. Census Bureau 2015). Much of this decline represents deaths of older, retired Mainers who made up a large part of the angling community, combined with outmigration of young people who would have replaced them. Maine has the highest median age in the United States, suggesting fewer young people recruiting into the angling population, and more elderly anglers ageing out over time.

Though these data show large declines in angler use in northern Maine, the level of angler participation on a statewide and national level has remained relatively steady. The 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation showed just a 7% decline in angling participation in the U.S., with an 8% increase in overall angling days (U.S. Department of the Interior 2013). Data from Maine showed only a 4% decrease in number of anglers from 1991 to 2011 (U.S. Department of the Interior 1993, 2013). Assuming the 2016 survey data are similar, it appears that the trend in declining angler use is probably not a statewide phenomenon.

Waters in northern Maine are unique in that they are far removed from major population centers. In addition to population declines in the area, another reason for plummeting angler use could be a shift away from angling remote destinations, and an increase in fishing activity closer to home. Such a pattern is consistent with a recent study on activities that compete with recreational fishing. In the study titled "Understanding Activities that Compete with Recreational Fishing", Responsive Management and Southwick Associates showed a trend of decreasing recreational time available to anglers, primarily due to increasing work obligations, family obligations and age/health (Responsive Management and Southwick Associates 2012). Having such a small amount of recreational time suggests that anglers are more likely to fish in places closer to where they live, and discontinue fishing waters that require long travel distances and overnight stays.

### *Specific Cases*

Some declines in angler use over the time period may have been explained by unique conditions in particular fisheries. In the Fish River Chain, most of the lakes appear to have experienced similar

declines in use over the 20 year study period, though a few have seen much greater declines, particularly Square Lake, Carr Pond and Fish River Lake. Angling use at Square Lake is often dependent on the quality of the landlocked salmon fishing and angler access to the lake. Landlocked salmon growth has been relatively poor at Square in recent years, potentially lessening the lake's draw as a destination fishery. Low water makes it difficult to launch a boat at Square, and low river flows prevent boats from navigating through the thoroughfares from Cross and Eagle lakes, which may have impacted use. Restrictive fishing regulations aimed at protecting brook trout in Fish River Lake and Carr Pond appear to have resulted in an under-harvested population of brook trout that exhibited poor growth. Fewer large trout may have drawn fewer anglers to these relatively remote lakes. Lower sporting camp activity at Fish River Lake may have resulted in less angler use as well.

A few Allagash and upper Aroostook waters experienced very drastic declines in use during the study period as well, which probably can't be explained by demographics alone. In the Allagash, Long Lake and Round Pond experienced sharp declines in use. These waters are often fished by canoeists paddling the Allagash Wilderness Waterway, and it is possible that AWW use declines, as well as fewer canoeists participating in angling may have driven this pattern.

Spider and Haymock lakes received just a small portion of the use they did in the 1990's. An active sporting camp operation exists on Haymock, with additional camps on Spider. Changes in use at this operation combined with fewer anglers fishing from public access sites on these waters may be causing these declines. Big Indian Pond and Second Musquacook Lake experienced drastic declines, with no obvious explanation.

In the upper Aroostook drainage, angler use dropped substantially at Munsungan and Millimagassett lakes. Both of these waters had popular togue fisheries that produced trophy-sized fish. Declines in these fisheries to current conditions (abundant, small togue in Munsungan, sparse togue numbers in Millimagassett) may have caused some of this change in use. Angler use in Millinocket Lake is virtually nonexistent compared to 1997. No angling was observed during 36 counts at Millinocket Lake in 2016. A now-defunct splake stocking program was in place during 1997, and apparently played a large part in supporting a fishery there. Chase Lake also saw very little angler activity in 2016. The fishery at Chase relies on a small population of wild brook trout that fluctuates in abundance over the years.

Some waters experienced minimal declines in angler use, in contrast with the overall trend. Use remained essentially the same at Big Pleasant Lake, likely due to an increase in angling by private camp owners. Several new camps have been built on the lake during the study period. Decline in use at Big Eagle and Churchill Lakes did not appear to be significant. Over the years, a popular early May and late September fishery for brook trout has developed in Big Eagle and Churchill, which has probably helped offset the declines.

### *Implications for Fisheries Management*

Lower angler use in northern Maine waters presents both management challenges and opportunities. Low use levels typically result in lower angler harvest, which makes fishing regulations less effective. Another factor that exacerbates this situation is the trend toward more voluntary catch and release

habits among anglers. Combined, these factors can make it very difficult to manage fish populations for increased fish growth and the resulting larger fish that anglers often desire. The majority of the waters in the region rely on natural reproduction to support sport fisheries, and recruitment of wild fish to these populations is typically far greater than that needed to sustain healthy populations. Low harvest may have resulted in high densities of slow growing fish in many of these waters. A considerable increase in harvest would be required to manage these waters for improved fish growth and size quality.

Having fewer anglers also presents a challenge to fisheries management in these waters. It can be more difficult to obtain information and opinions from the angling public, educate anglers and solicit support for fisheries management programs. Implementation of new stocking programs, continuation of current programs, and regulation changes can also be a challenge with low levels of angler use.

One great opportunity resulting from lower angler use is the ability to relax and simplify many fishing regulations that have likely become ineffective due to inadequate angler harvest. Many anglers in northern Maine still highly value the opportunity to harvest fish to eat, and regulation changes may provide them more ability to do so. This would improve the quality of the fishing experience for existing anglers, but it is uncertain whether relaxed fishing regulations will result in increased angler use. A recent liberalization of landlocked salmon regulations on Eagle Lake in the Fish River Chain appears to have increased angler use there. However, more remote Fish River Lake does not yet appear to have seen an increase in use from a regulation liberalization beginning in 2016.

It behooves state agencies to promote increased recreational use of fish and wildlife resources due to its tie to funding for conservation efforts. In the aforementioned study of activities that compete with recreational fishing (Responsive Management and Southwick Associates 2012), several recommendations were made to improve fishing participation. These included emphasizing the fun of fishing, increasing convenience, and encouraging anglers to invite their friends to fish with them. Locally, many anglers complain that fishing regulations are too complicated and difficult to understand, and they aren't able to take home enough fish to make it worth their trip. Though this is not a national pattern, making changes to fishing regulations and promoting fishing as a simpler, more enjoyable activity may help increase angling activity in northern Maine. Recently MDIFW has directed a focus toward simplifying fishing regulations and presenting the fishing law book in a more user friendly format. These efforts will continue in the coming years.

Understanding angler use and associated fishing pressure is critical to the proper development of fisheries management strategies. Regulations specific to fishing harvest require two key elements: knowing how many people are fishing, and how many fish each angler is harvesting. The vast majority of waters in this study were governed by the same fishing regulations throughout the 20-year period. The drastic reduction in angler use calls the current need and effectiveness of these regulations into question. The results of this study highlight a need to reconsider current fishing regulations in many northern Maine waters and determine whether alternative regulations would be more effective at both protecting and enhancing fisheries, while potentially encouraging more angler use.



## **RECOMMENDATIONS**

Based on the findings of this study, fisheries managers are encouraged to take a closer look at management strategies and the impacts that changes in angler use may be having on their effectiveness. Results similar to this study may suggest the need for simplified fishing regulations to encourage public participation in angling where regulations are not the driving force behind current fish population structure. Alternatively, changes to more drastic regulation strategies may be necessary in places where managers intend to make significant impacts to the current state of a fishery. The substantial changes in angler use over the study period also highlight the need to collect more regular data on angler use in Maine waters.

## **ACKNOWLEDGEMENTS**

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**TABLES AND FIGURES**

Table 1. Mean party size used to expand angler counts for Fish River Chain and Allagash/Aroostook lakes.

<b>Area</b>	<b># Anglers in sample</b>	<b>Mean weekday party size</b>	<b>Mean weekend party size</b>
Fish River Chain	647	1.86	2.05
Allagash/Aroostook	495	2.21	2.13

Table 2. Angler activity effective count curves for Fish River Chain and Allagash/Aroostook lakes generated from creel survey data.

Hour	<b>Fish River Chain (n=647)</b> proportion of anglers fishing	<b>Allagash/Aroostook (n=495)</b> proportion of anglers fishing
4	0.017	0.000
5	0.046	0.032
6	0.141	0.123
7	0.297	0.291
8	0.468	0.675
9	0.587	0.760
10	0.675	0.744
11	0.731	0.689
12	0.725	0.652
13	0.629	0.632
14	0.564	0.608
15	0.470	0.576
16	0.396	0.505
17	0.317	0.446
18	0.232	0.309
19	0.158	0.160
20	0.094	0.044
21	0.029	0.004
22	0.000	0.000

Table 3. Count effort and estimated angler use of Fish River Chain area waters, 1996-2016.

Year	Water	# counts	estimated angler days
1996	Square Lake	76	7348
1996	Eagle Lake	68	5425
1996	Cross Lake	68	1080
1996	Long Lake	68	5620
1996	Portage Lake	69	847
1996	St. Froid Lake	69	2642
1997	Eagle Lake	54	3621
1997	Portage Lake	54	464
1997	St Froid Lake	54	3045
1997	Fish River Lake	53	2690
1997	Carr Pond	53	738
1998	Square Lake	29	2166
1998	Eagle Lake	29	3265
1998	Cross Lake	29	479
1998	Long Lake	29	3686
1998	Portage Lake	29	482
1998	St. Froid Lake	29	1429
1998	Fish River Lake	29	1461
1998	Carr Pond	29	223
2015	Eagle Lake	52	2180
2015	Square Lake	52	1319
2015	Cross Lake	52	224
2015	Long Lake	52	2355
2015	St. Froid Lake	52	976
2015	Portage Lake	52	276
2015	Fish River Lake	52	371
2015	Carr Pond	52	146
2015	Mud Lake	52	53
2015	Madawaska Lake	52	196
2015	St. John River		
	<i>Hamlin - Van Buren</i>	52	53
	<i>Van Buren - Grand Isle</i>	52	392
	<i>Grand Isle - Frenchville</i>	52	305
	<i>Frenchville - Fort Kent</i>	52	105
	<i>Fort Kent - Allagash</i>	52	154
2016	Fish River Lake	36	301
2016	Carr Pond	36	78

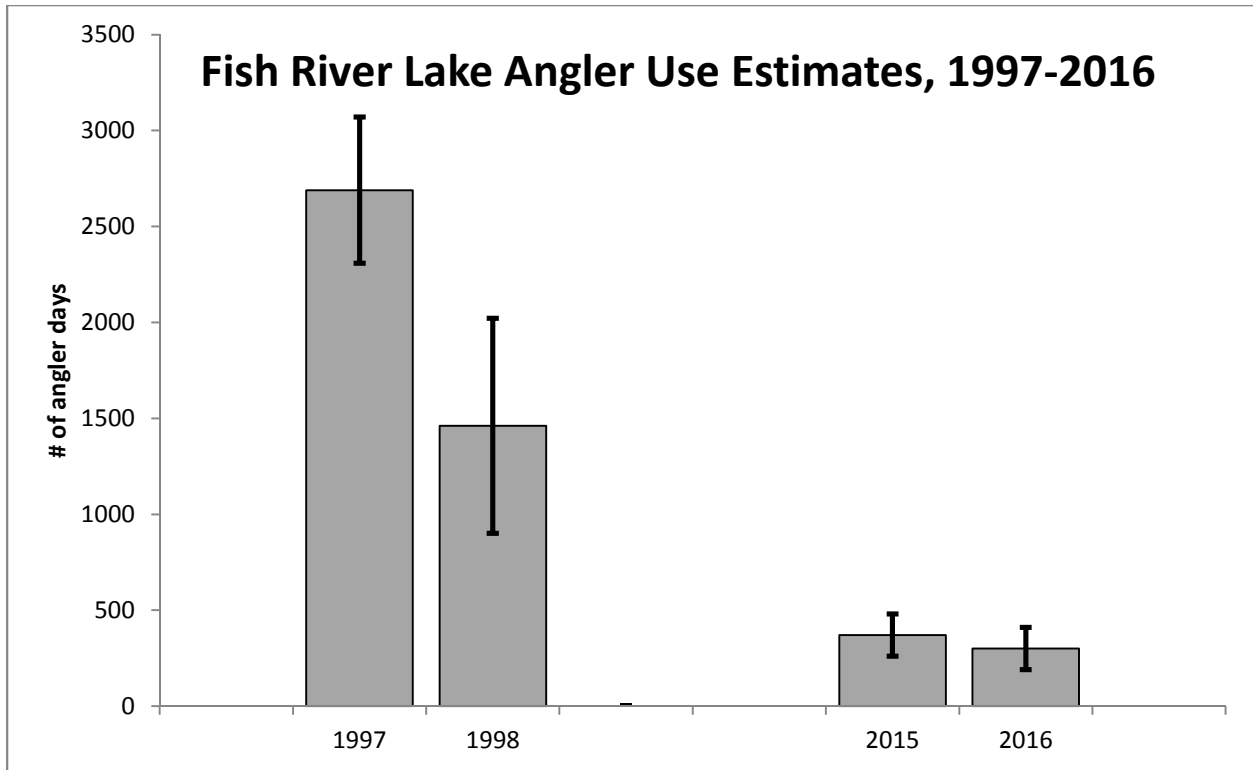


Figure 1. Angler use estimates for Fish River Lake, 1997-2016.

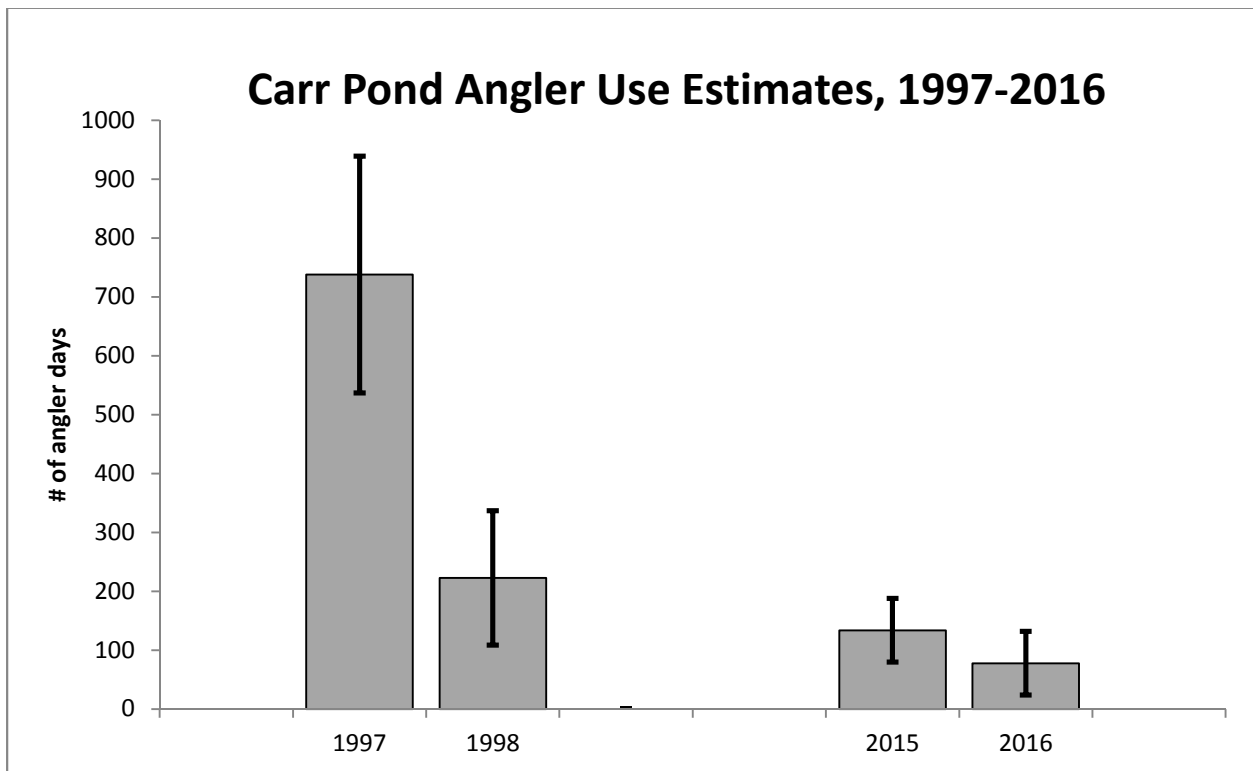


Figure 2. Angler use estimates for Carr Pond, 1997-2016.

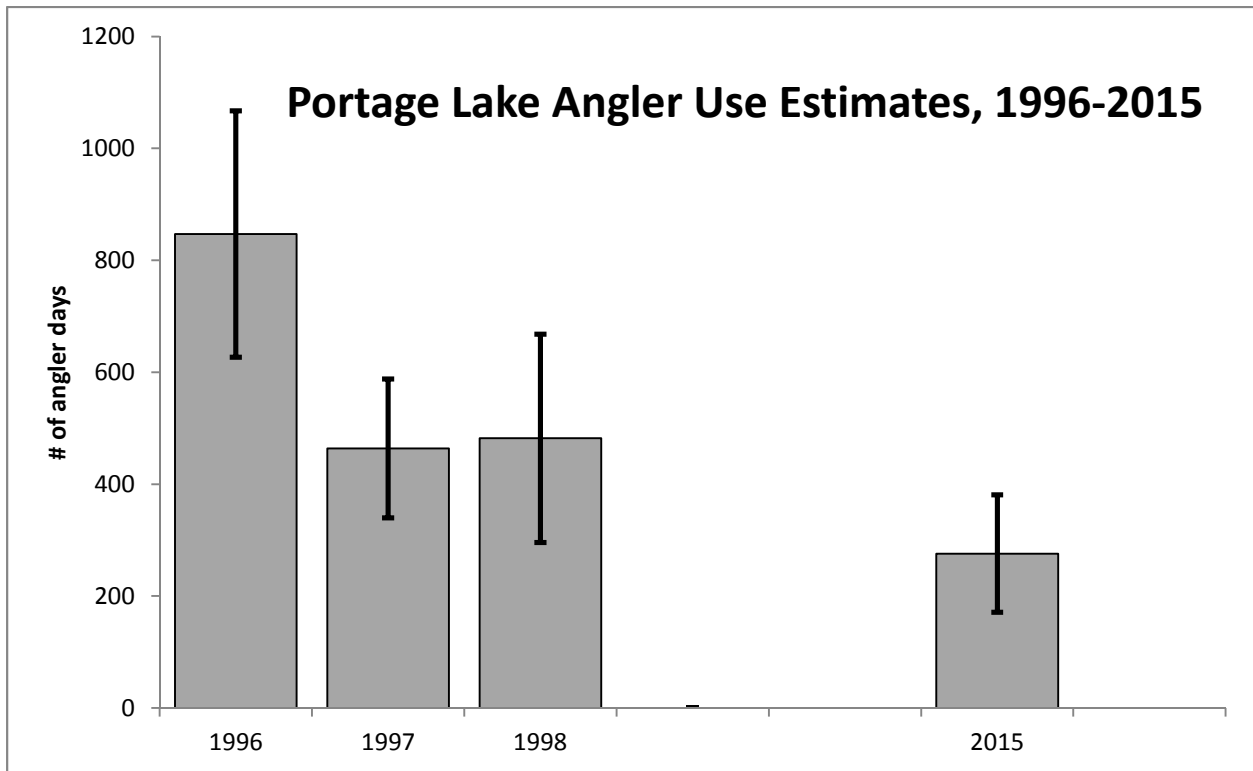


Figure 3. Angler use estimates for Portage Lake, 1996-2015.

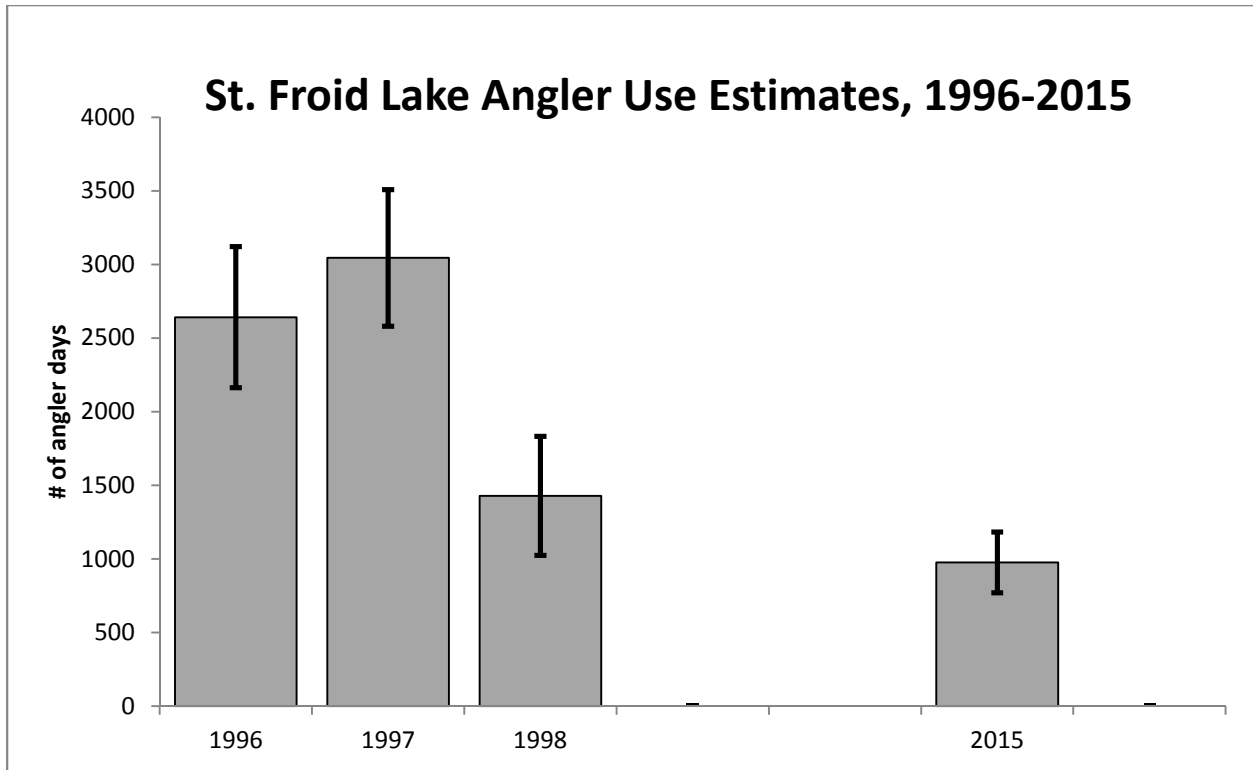


Figure 4. Angler use estimates for St. Froid Lake, 1996-2015.

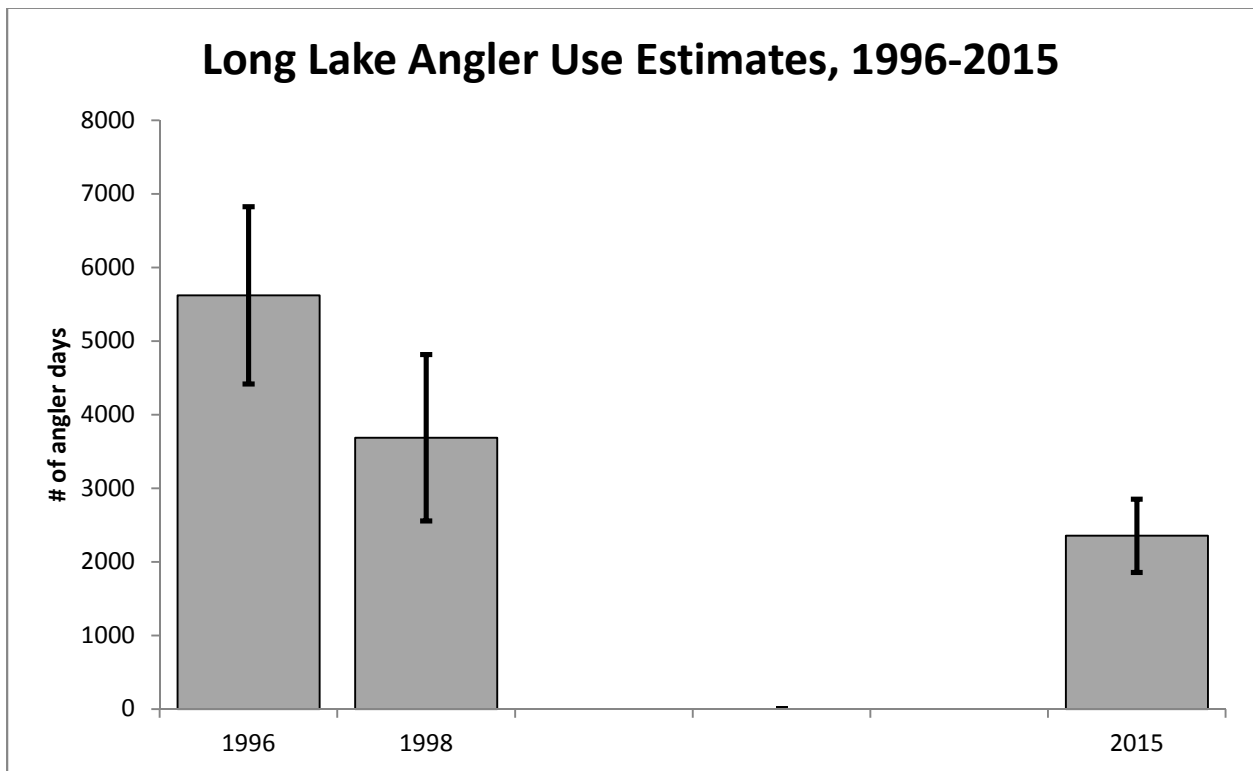


Figure 5. Angler use estimates for Long Lake, Fish River Chain, 1996-2015.

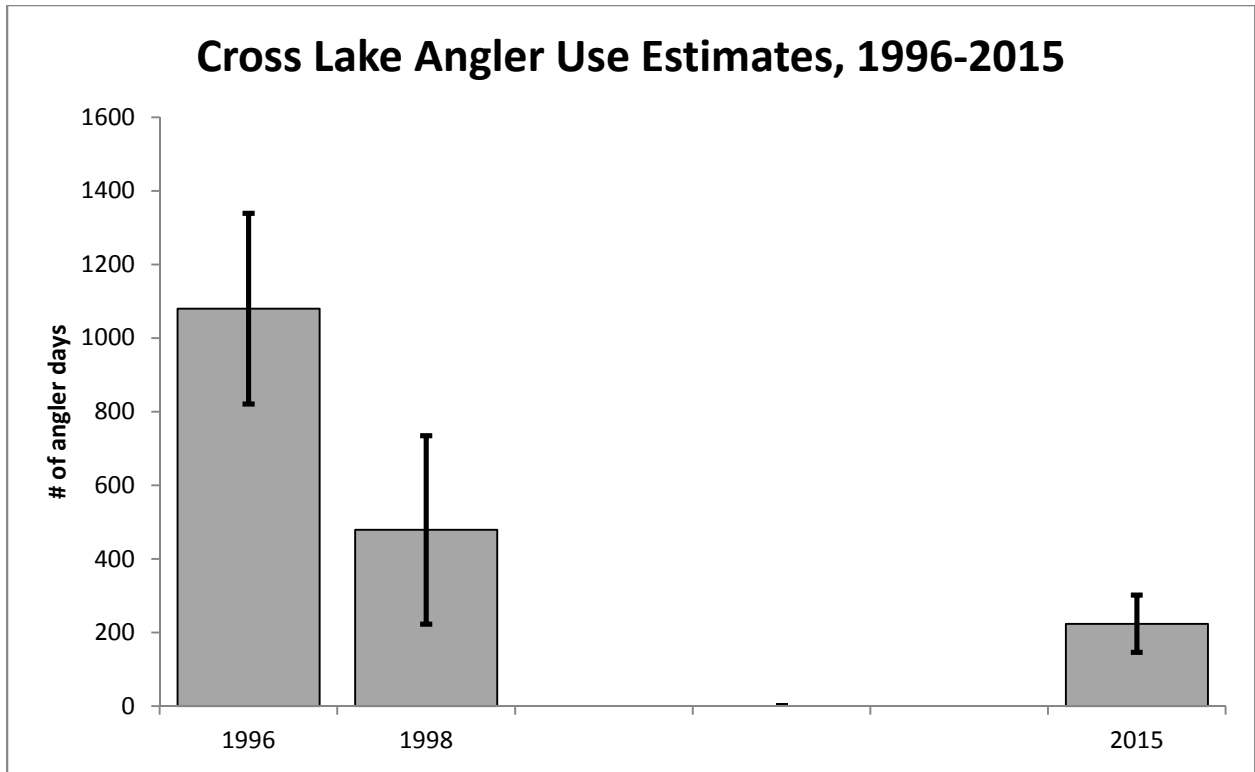


Figure 6. Angler use estimates for Cross Lake, 1996-2015.

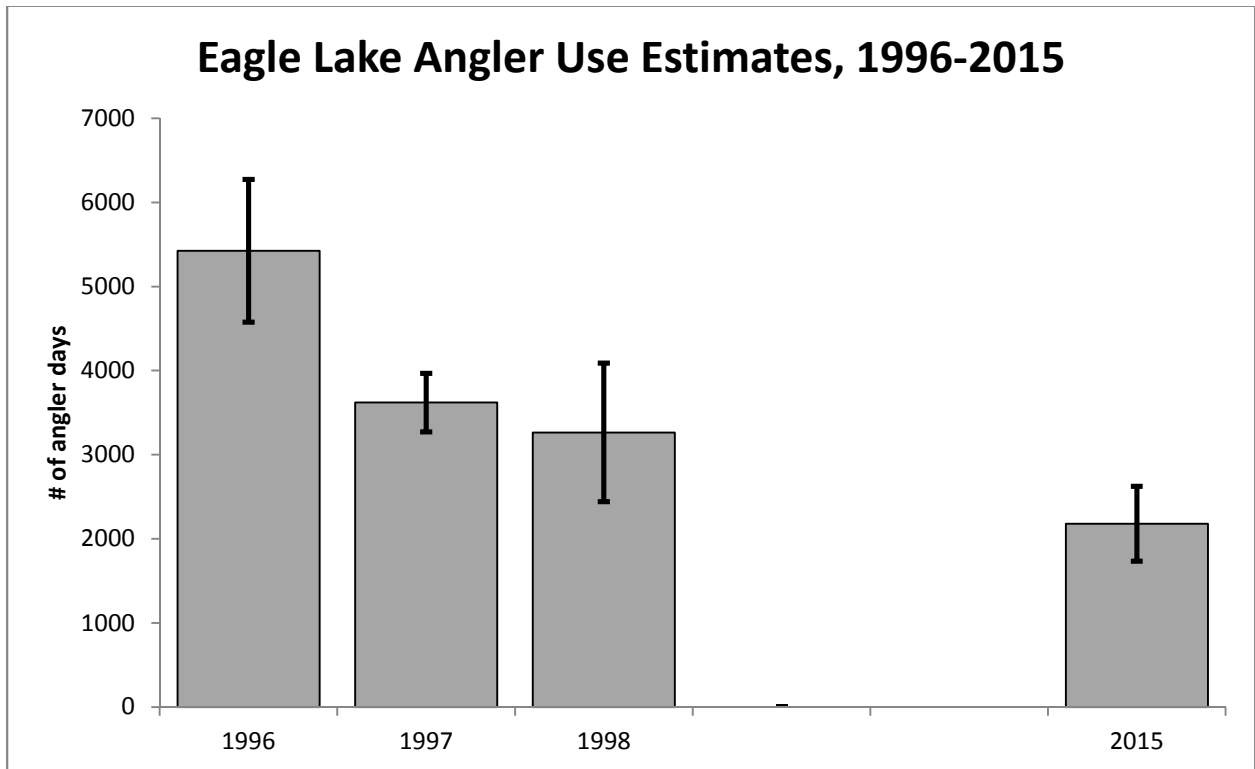


Figure 7. Angler use estimates for Eagle Lake, Fish River Chain, 1996-2015.



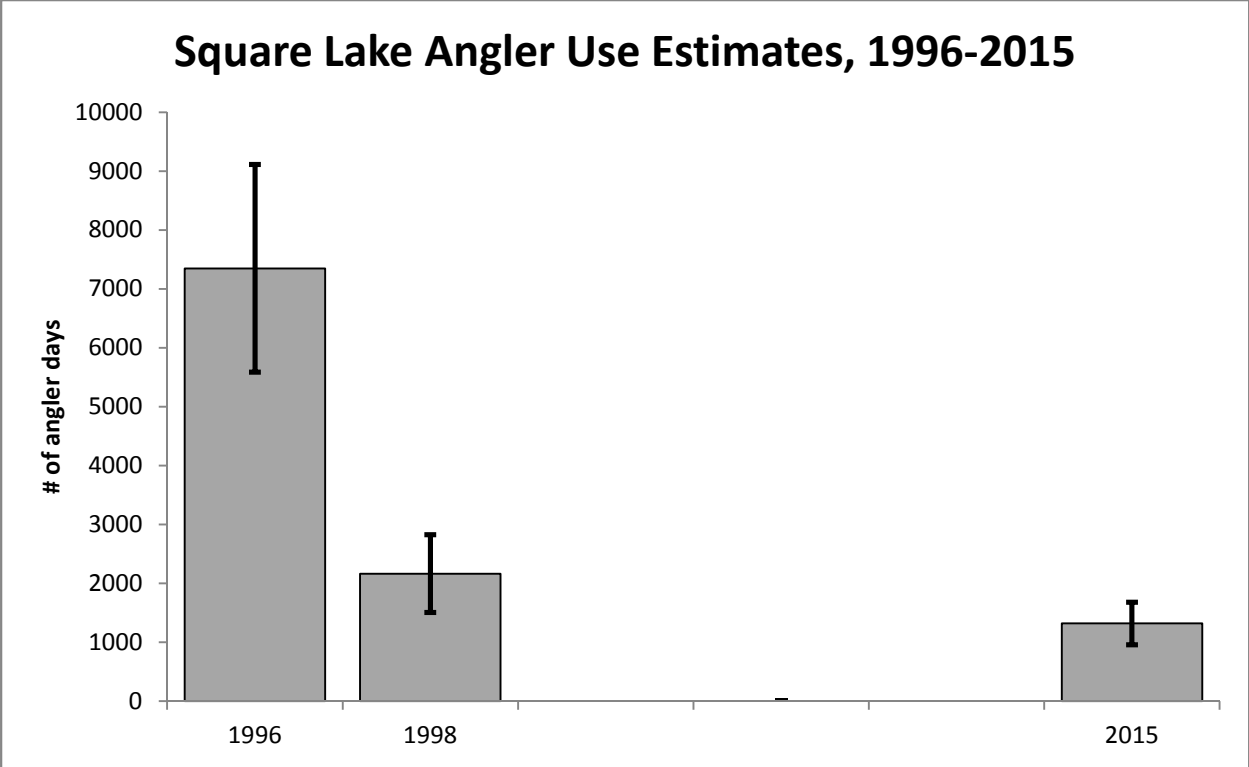


Figure 8. Angler use estimates for Square Lake, 1996-2015.

Table 4. Count effort and estimated angler use of Allagash and upper Aroostook area waters, 1997-2016.

Year	Drainage	Water	# Counts	Estimated angler days
1997	Allagash	1st Musquacook Lake	54	126
1997	Allagash	2nd Musquacook Lake	54	1093
1997	Allagash	3rd Musquacook Lake	54	63
1997	Allagash	4th Musquacook Lake	54	82
1997	Allagash	Clear Lake	54	147
1997	Allagash	Big Pleasant Lake	54	114
1997	Allagash	Spider Lake	54	546
1997	Aroostook	Chase Lake	54	402
1997	Aroostook	Munsungan Lake	54	1685
1997	Aroostook	Millimagassett Lake	54	669
1997	Aroostook	Millinocket Lake	54	326
1997	Allagash	Haymock Lake	54	1595
1997	Allagash	Big Indian Pond	54	766
1997	Allagash	Big Eagle Lake	54	1222
1997	Allagash	Churchill Lake	54	217
1997	Allagash	Umsaskis Lake	54	293
1997	Allagash	Long Lake	54	534
1997	Allagash	Round Pond	54	459
1997	Allagash	Priestly Lake	54	56
2016	Allagash	1st Musquacook Lake	36	91
2016	Allagash	2nd Musquacook Lake	36	119
2016	Allagash	3rd Musquacook Lake	36	19
2016	Allagash	4th Musquacook Lake	36	31
2016	Allagash	Clear Lake	36	56
2016	Allagash	Big Pleasant Lake	36	105
2016	Allagash	Spider Lake	36	125
2016	Aroostook	Chase Lake	36	17
2016	Aroostook	Munsungan Lake	36	749
2016	Aroostook	Millimagassett Lake	36	164
2016	Aroostook	Millinocket Lake	36	0
2016	Allagash	Haymock Lake	36	173
2016	Allagash	Big Indian Pond	36	23
2016	Allagash	Big Eagle Lake	36	752
2016	Allagash	Churchill Lake	36	212
2016	Allagash	Umsaskis Lake	36	104
2016	Allagash	Long Lake	36	53
2016	Allagash	Round Pond	36	55
2016	Allagash	Harrow Lake	36	50

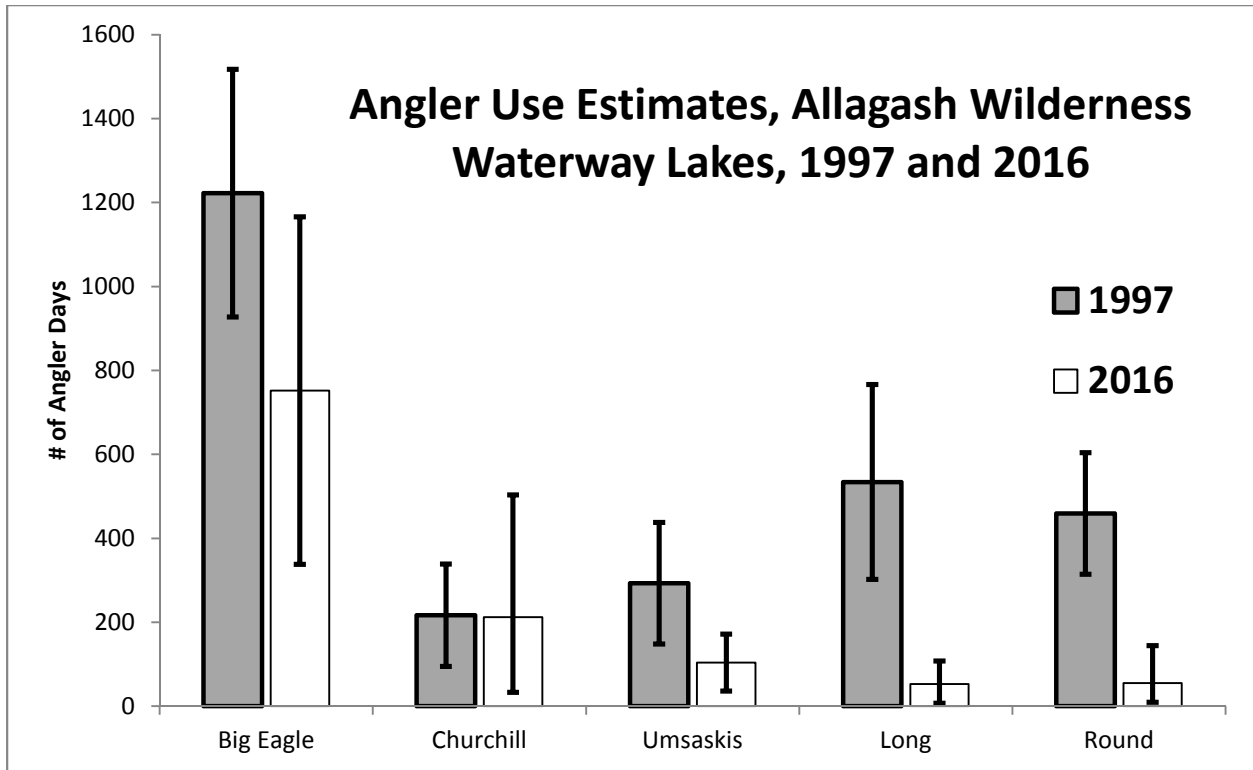


Figure 9. Angler use estimates for five lakes in the Allagash Wilderness Waterway, 1997 and 2016.

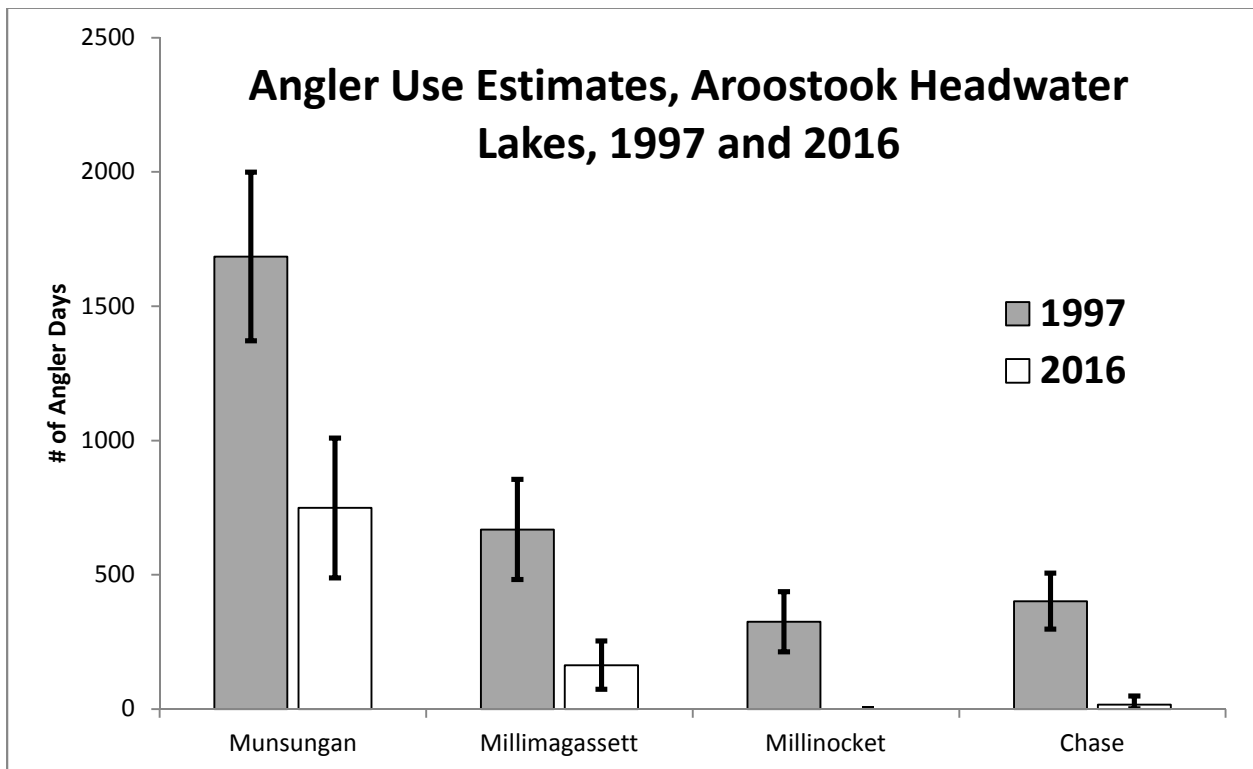


Figure 10. Angler use estimates for four lakes in the headwaters of the Aroostook River drainage, 1997 and 2016.

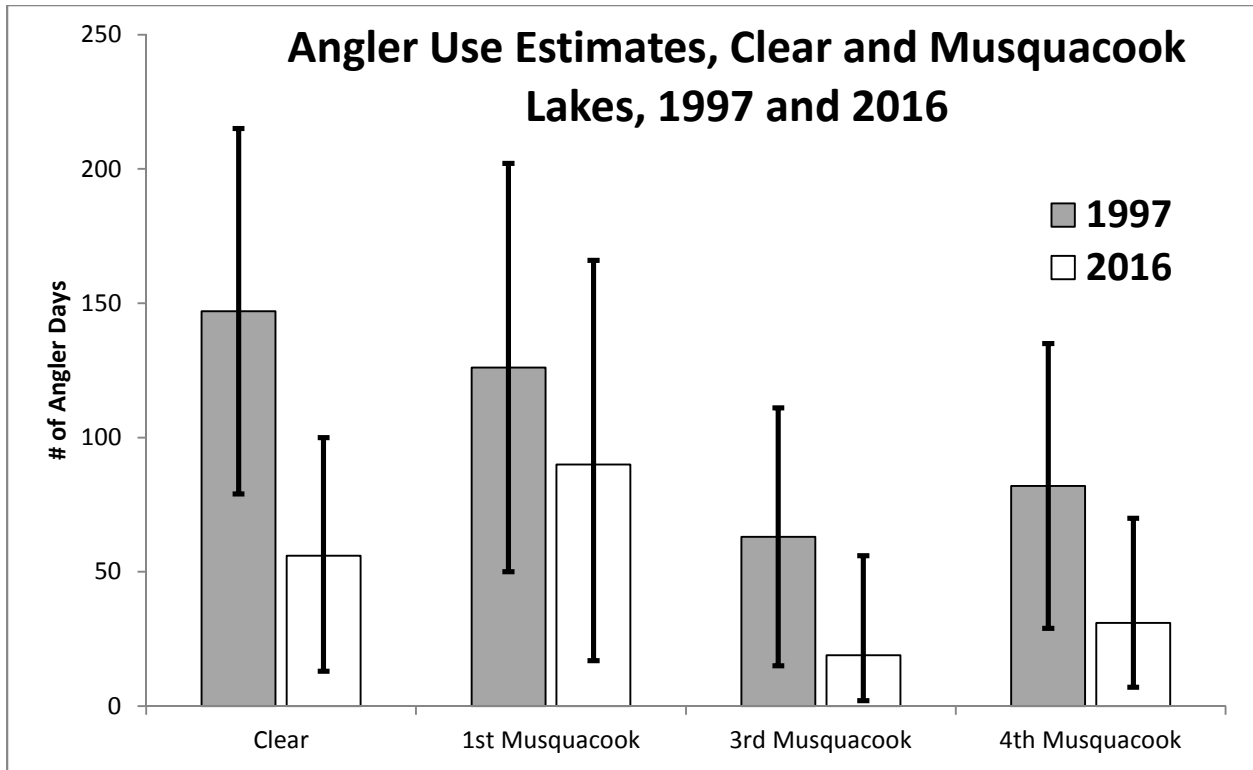


Figure 11. Angler use estimates for Clear Lake and three of the Musquacook lakes, 1997 and 2016.

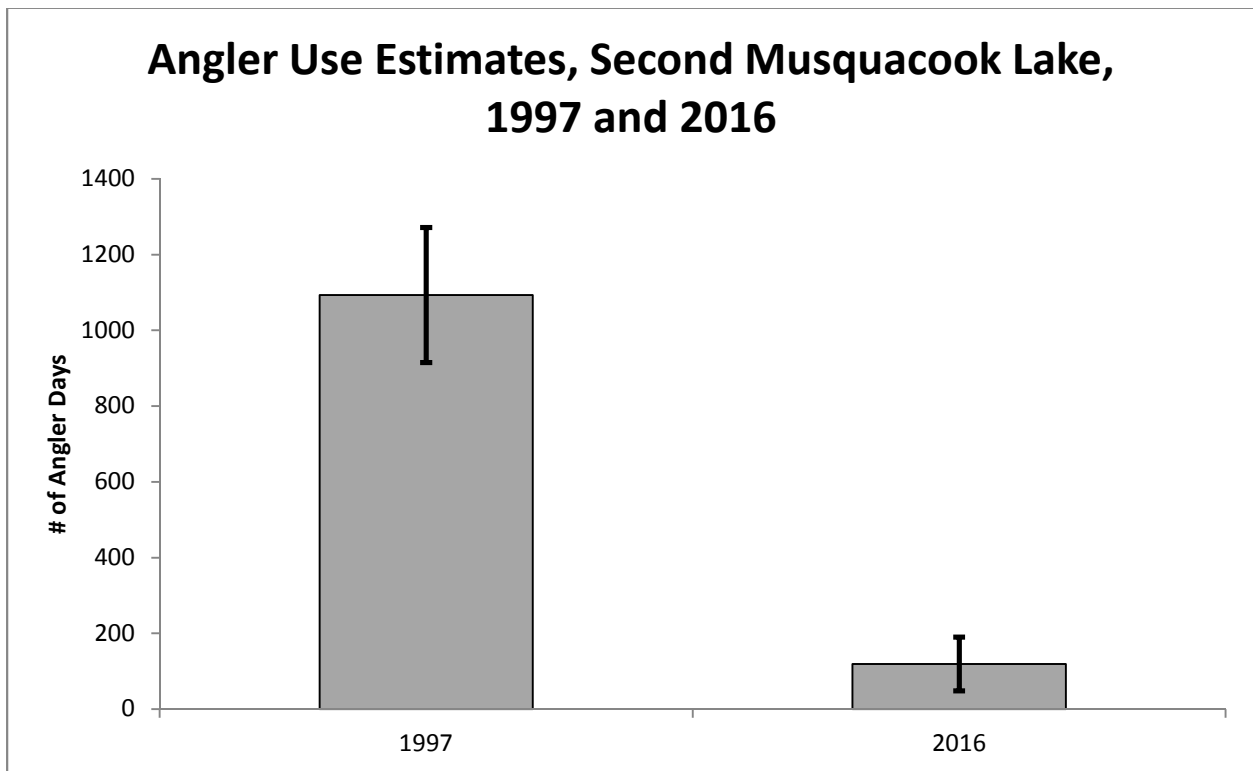


Figure 12. Angler use estimates for Second Musquacook Lake, 1997 and 2016.

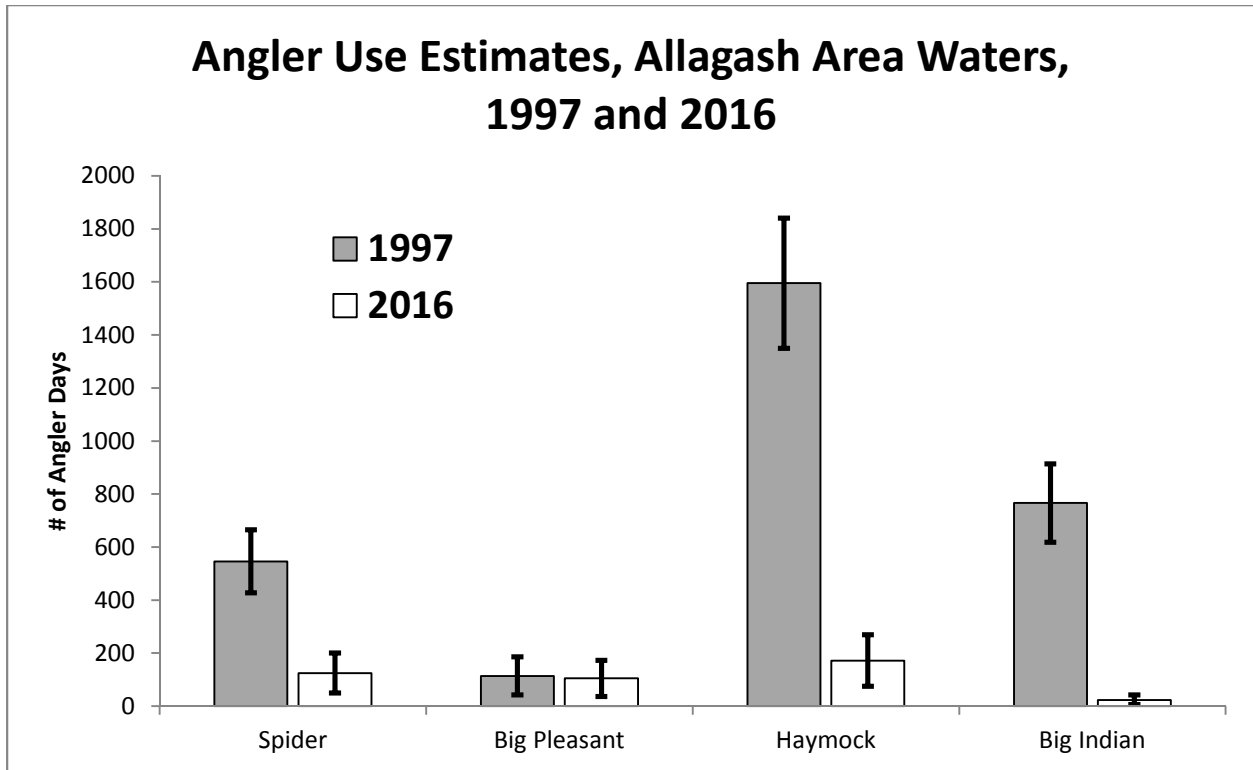


Figure 13. Angler use estimates for four Allagash River drainage waters, 1997 and 2016.

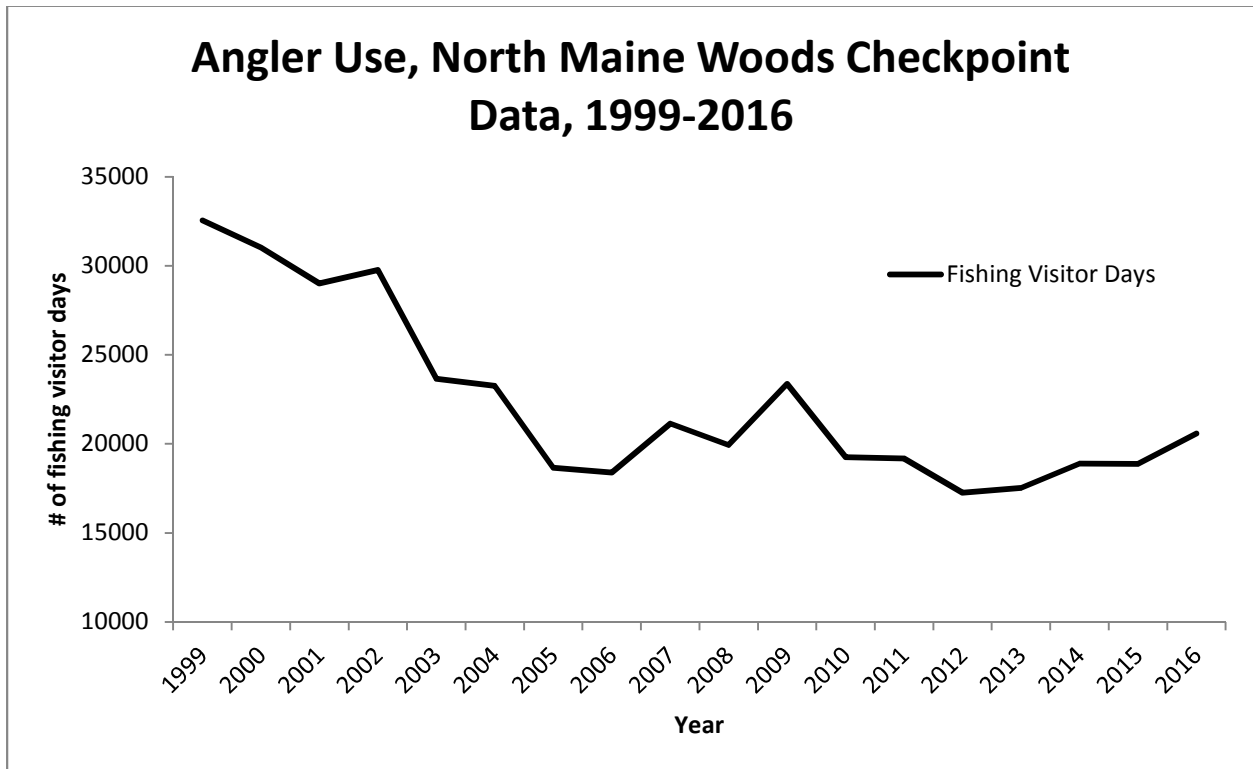


Figure 14. Total number of summer fishing visitor days tabulated from data collected at North Maine Woods Inc. checkpoints, 1999-2016.

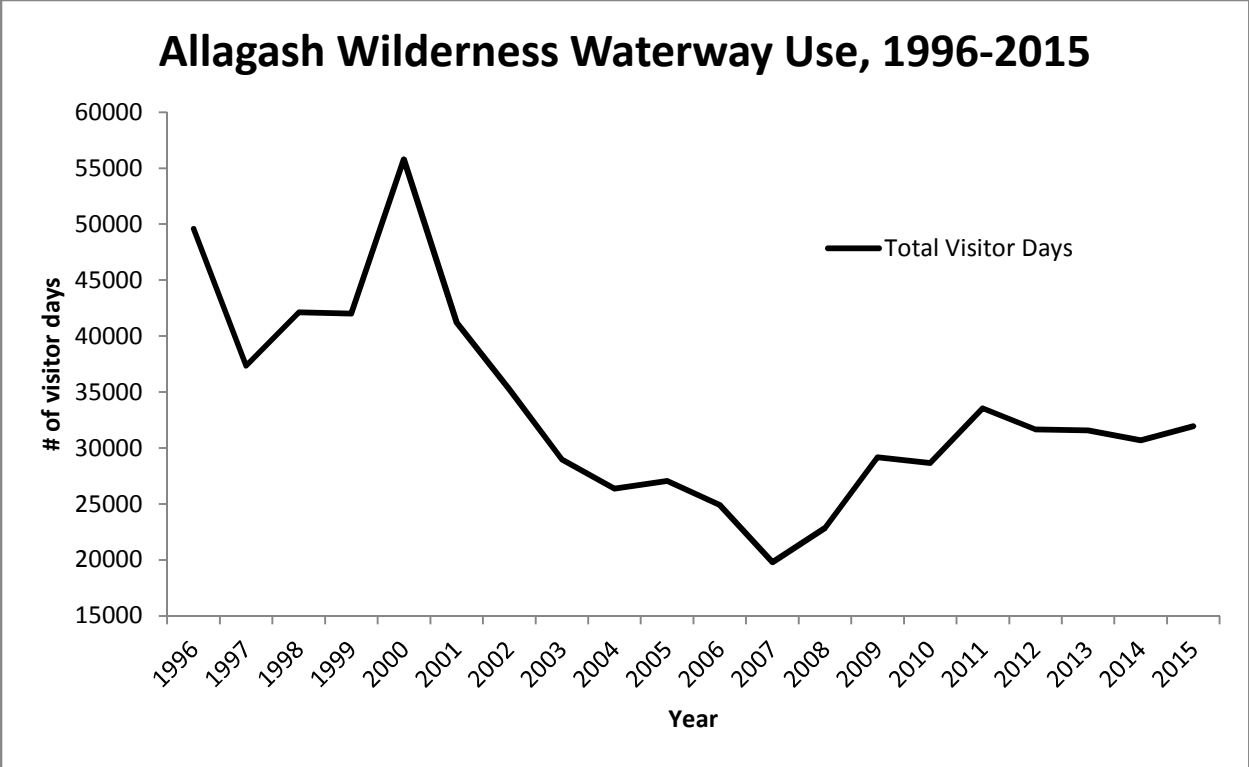


Figure 15. Total summer use visitor days on the Allagash Wilderness Waterway, tabulated from data collected by Waterway rangers, 1996-2015.

# COOPERATIVE

STATE



FEDERAL

# PROJECT

This report has been funded in part by the Federal Aid in Sport Fish Restoration Program. This is a cooperative effort involving federal and state government agencies. The program is designed to increase sport fishing and boating opportunities through the wise investment of angler's and boater's tax dollars in state sport fishery projects. This program which was founded in 1950 was named the Dingell-Johnson Act in recognition of the congressmen who spearheaded this effort. In 1984 this act was amended through the Wallop Breaux Amendment (also named for the congressional sponsors) and provided a threefold increase in Federal monies for sportfish restoration, aquatic education and motorboat access.

The program is an outstanding example of a "user pays-user benefits" or "user fee" program. In this case, anglers and boaters are the users. Briefly, anglers and boaters are responsible for payment of fishing tackle, excise taxes, motorboat fuel taxes, and import duties on tackle and boats. These monies are collected by the sport fishing industry, deposited in the Department of Treasury, and are allocated the year following collection to state fishery agencies for sport fisheries and boating access projects. Generally, each project must be evaluated and approved by the U.S. Fish and Wildlife Service (USFWS). The benefits provided by these projects to users complete the cycle between "user pays – user benefits."



**Maine Department of Inland Fisheries and Wildlife**  
284 State Street, 41 SHS, Augusta, ME 04333-0041