Tourism and Atlantic Salmon Stocks

Assessing the Impact of a Tourism Development Strategy For the Penobscot River

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Executive Summary

The collapse of the Atlantic salmon stock in the United States has had detrimental impacts on many ecosystems and rural economies north of the Hudson River. Remnant wild populations still hang on in eleven rivers feeding into the Gulf of Maine, but their future is very uncertain. Lately, a significant amount of attention and money has been invested in the restoration of these last wild populations.

One of the primary drivers behind the conservation effort is the promise of revenue generation from future angling tourism. The Atlantic salmon is considered the "King of Fish" within the fly fishing community and healthy fish runs generate hundreds of millions of dollars in economic activity by catering to anglers from around the world.

State and local agencies, as well as the private sector, are already beginning to develop a tourism strategy for angling and related activities on the Penobscot River, where recent conservation successes have led to the planned removal of several dams and spurred hopes for a salmon recovery. However, the relationship between increased tourism pressure and the recovering salmon stock has not been studied.

State and local and planners need to better understand the Atlantic salmon tourism business and its impact on local ecosystems and economies before moving forward. An analysis based on Stated Preference and Revealed Preference methodologies as well as Comparable Analysis modeling provides insight into the relationship. In comparable regions, like New Brunswick, there is a positive correlation between increased angling tourism and the health of the Atlantic salmon stock. The industry also contributes significantly to local economies and societies. Because the average salmon angler is known to be an educated, affluent male above 40, a targeted development strategy for tourism can be put in place.

However, there are significant differences between the New Brunswick and Penobscot salmon stocks. When taken into account, these differences call into question the positive correlation and uncover potential risks. These risks must be taken into account by state and local planners.

Objectives and Introduction

The objective of this report is to provide an analysis of the potential impacts, both positive and negative, that increased tourism development will have on the restoration of the Atlantic salmon stock in the United States with specific emphasis on the Penobscot River in Maine. For many years tourism has been considered a driver behind the economic justification to protect and restore the stock of Atlantic salmon returning to U.S. waters. Today, a large conservation project on the Penobscot River, called the Penobscot River Restoration Project, is using the promise of "increased tourism" as a measurable benefit from a restored fish stock. The Penobscot River Restoration trust is using the economic value of this *future use* to raise significant sums of money from private and public sources in order to purchase and remove several dams that block Atlantic salmon and several other anadromous fish species form accessing spawning habitat. However, despite its heavy reliance on the future benefits of tourism to raise funds, the Trust offers very little analysis on the actual impacts of increased tourism. Therefore, this report shall take a critical look at the impact of tourism on the Atlantic salmon in comparable regions in effort to determine the following:

- How do we define the Atlantic salmon tourism industry?
- What is the relationship between the tourism industry and the Atlantic salmon?
- Can the promise of sustainable tourism drive Atlantic salmon restoration?
- How can national and local policy makers mitigate potential risks to the fish stock?

The Atlantic Salmon (Salmo salar)

Atlantic salmon stocks in the United States are on the brink of collapse. Once a dominant ecological component of every major river north of the Hudson, by the mid 20th century wild Atlantic salmon runs remained in only a handful of rivers in eastern Maine. The Office of Protected Species at NOAA lists the Gulf of Maine Distinct Population Segment (DPS) of Atlantic salmon as Endangered under the Endangered Species Act of 1973. For over one hundred years, the United States government and environmental groups have supported restocking and habitat conservation efforts in recognition of the species decline. These efforts have proven inadequate. The key to restoring Atlantic salmon stocks in the U.S. is to restore access to spawning habitat, specifically, to remove dams.

As an anadromous fish, a family of fish that spend their adult lives in saltwater but spawn in freshwater, Atlantic salmon go through several life stages as they migrate from shallow freshwater streams to the North Atlantic and Arctic Oceans and then back again to their original river to spawn. How adult salmon return to their precise place of birth to lay their own eggs is still a mystery to science, but research suggests that the fish can "smell" their way. Atlantic salmon average 28-30 inches in length and weigh between 8-12 pounds, however adults can exceed 30 pounds and are extremely powerful and elegant fish. This has earned them the title of "King of Fish" among anglers who travel from around the world in hopes of catching one.

Historically, these fish spawned in all major rivers from the Hudson River in New York to northern Quebec and west to Greenland, and the Atlantic coast of Europe. However, the U.S. population of Atlantic salmon has been decimated and remnant wild populations only survive in 11 rivers in the U.S. all feeding into the Gulf of Maine. In Canada, Atlantic salmon are doing slightly better, in large part due to the sheer size and relative under development of coastal Labrador, Quebec and New Brunswick. However, in the Maritime Provinces high portions (greater than 30%) of the spawning capacity has been negatively impacted by the construction of dams and industrial land use activities like agriculture and timber harvest. There is a similar story to be told in the North Atlantic and Atlantic European ranges of the fish. In Europe agriculture and grazing and the construction of lochs have taken their toll on migratory Atlantic salmon. Because adult salmon can only spawn in their home river, those rivers impacted by human use tend to have far fewer returning salmon than do wild or free flowing rivers.

Despite a lack of reliable historical numbers it is estimated that the current population of Atlantic salmon in the United States represents less than one percent (1%) of the stock that existed prior to the arrival of Europeans in North America. On the Penobscot River, annual fish returns prior to 1830 were estimated at over 70,000. Today, less than two thousand fish return to the Penobscot to spawn. The collapse of the fish stock has had measurable environmental, social and economic impacts on local and regional communities.

Due to the sheer size of the historic migrations, the salmon played a significant role in shaping the ecosystems in which they functioned. While Atlantic salmon do not die after spawning like

their cousins in the Pacific, they do contribute a massive amount of nutrients in the form of eggs and gamete along with predation of adults in the rivers they inhabit. These nutrients feed entire ecosystems from small tributaries several hundred miles inland to the Gulf of Maine. It is now understood that the damming of the rivers and the resulting collapse of anadromous fish stocks throughout the eastern United States has led to the collapse of coastal ground fisheries in the Gulf of Maine – a multi billion-dollar industry that traditionally supported hundreds of communities.

While commercial fishing for Atlantic salmon in the U.S. has not been viable for years (and may never again be possible), recreational fishing remained for a long time a key link between humans and the fish stock. Salmon clubs dotted northern rivers like the Kennebec and Penobscot and helped fuel local economies with revenue from resident and non-resident anglers.

It is for this reason that the current conservation groups and state planners rely on a return of the Atlantic salmon *tourism industry* to help fuel the fight to save and restore remaining fish stocks. But what does this mean? How do we define the Atlantic salmon tourism industry? How can we measure its impacts? It is important for federal and state policy makers to understand the potential impacts of a revitalized tourism industry and the potential impact that it will have on the fish stock. Only then will federal and state officials, biologists, environmentalists and anglers be able to build a targeted tourism development plan and minimize economic waste and externalities.

Atlantic Salmon Tourism Industry

New Brunswick – A Model for Comparison

Because an industry for recreational salmon fishing no longer exists in the United States we must find a comparable model to form our analysis – upon which we can base our conclusions and make recommendations. The Atlantic salmon fishery of New Brunswick, Canada serves as a reminder of what the Maine salmon fishery once looked like and what policy makers and economic planners hope it will become again.

For various reasons, the stock of Atlantic salmon in New Brunswick has not been reduced to the same extent as that of Maine. A prosperous recreational fishing industry still exists and in many cases drives local economies. Looking at the moving parts of the recreational salmon fishing industry we can identify the angler as both the producer and the consumer of the product – the product being the experience of fishing. The value of the product is not only the price paid by the consumer but also the additional price he or she would be willing to pay for the same experience. Estimating this value is achieved through various valuation methodologies including contingent valuation and revealed preference methods. However, as a first step to analyzing the overall industry it is helpful to get a sense of the characteristics of the average angler.

The Atlantic Salmon Angler

The Atlantic Salmon Federation, an international non-profit organization dedicated to the conservation of wild Atlantic salmon conducted a survey of North American salmon anglers in 1997. The survey was mailed to nearly 7,000 readers of the Atlantic Salmon Journal in the United State and Canada. Table 1.1 shows the results of the survey.

The average angler for Atlantic salmon in North America is a male over the age of 50 with a university degree or higher and an income north of $50k per year. In fact over 54% of American respondents showed an income in excess of $100k. Roughly 70% of respondents claimed to be the only individual in the household that fished for salmon.

Table 1. Profile of an Atlantic Salmon Angler

	U.S. %	CDN. %	Total %
Gender:			
Male	97.4	97.0	97.2
Female	2.6	3.0	2.8
Age:			
19 or Under	0.0	0.2	0.1
20-29	0.6	3.5	2.1
30-39	7.2	10.3	8.8
40-49	13.1	22.4	17.8
50-59	22.5	26.8	24.7
60 and over	56.7	36.8	46.5
Education:			
High School	9.6	23.4	16.6
College or Tech.	16.6	22.4	19.3
University	32.8	30.2	31.2
Postgraduate	41.0	25.1	33.0
Income:			
$30 K or less	4.4	9.3	6.9
$30-$50 K	12.0	22.2	17.2
$50-$100 K	29.4	36.7	33.1
$100-$200 K	27.2	20.2	23.6
More than $200 K	27.0	11.6	19.1
Time Spent Fishing:			
3 days or less	6.7	15.1	11.0
4-7 days	10.3	19.0	14.7
8-14 days	20.0	22.2	21.2
15-21 days	17.5	15.2	16.3
More than 21 days	45.4	28.5	36.8
People In Household Who Fish:			
One	72.7	69.3	70.9
Two	22.5	23.2	22.8
Three	2.8	5.1	4.0
Four or more	2.0	2.4	2.2
% Of Fishing Time Spent Fishing Salmon			
25% or less	53.2	19.8	35.9
50%	18.8	11.9	15.2
75%	17.6	29.0	23.5
100%	10.3	39.3	25.3

MacIntosh: From the 1997 Atlantic Salmon Journal Survey

Many of the responses show a generally high degree of correlation between U.S. and Canadian anglers with exception of the "Time Spent Fishing" and "% Of Fishing Spent Fishing Salmon". In these cases 45% of U.S. respondents claim to fish more than 45 days of the year for Atlantic salmon versus only 28% of Canadian respondents. Also, only 10% of U.S. respondents claim to fish for Atlantic salmon 100% of the time as opposed to nearly 40% of Canadian respondents. This information is not surprising given that Atlantic salmon can not be readily fished in the United States and that increased travel time to fishing grounds may motivate U.S. anglers to spend more days fishing to make it worth the cost and time of travel. A conclusion that could potentially be drawn from this information is that if given the opportunity to fish in U.S. rivers for Atlantic salmon, U.S. anglers would spend a larger percentage of their overall fishing days in search of the "King of Fish" instead of other species. What is not shown in this table is the comparison of Atlantic salmon anglers in New Brunswick to overall sport fishing anglers in the same regions. Based on additional information provided by the Canadian Department of Fisheries and Oceans (DFO) we know that the average salmon angler is both older and more affluent than the typical sport fisherman.

Reasons Why Anglers Fish

Understanding the motivations of the Atlantic salmon angler also helps illustrate the relationship between tourism and the fish stock. Information collected from the DFO and compiled by Calvin MacIntosh of the University of New Brunswick is presented in a table below. Respondents to a survey were asked to rank their reason for fishing on a scale of 1 to 5 – 1 being the lowest priority and 5 being the highest. The results show that anglers value the ability to relax and enjoy nature above catching and eating fish. These statistics bode well for Atlantic salmon fishing and other distressed species whose harvest is not beneficial and in some cases illegal. This also suggests that demand for the product (the experience of salmon fishing) is not wholly dependent on the likelihood of successful fishing. It can be assumed however, that this assumption is limited in scope – that is to say that without any likelihood of catching a salmon, anglers would not partake in recreational fishing tourism.

Table 2. Reasons Why Anglers Fish

	1990			1995		
	Resident	Non Resident Canadian	Non Resident Non Canadian	Resident	Non Resident Canadian	Non Resident Non Canadian
To Catch Fish to Eat	3.5	2.4	2.0	2.9	2.6	2.2
For Relaxation	**4.4**	**4.4**	**4.6**	**4.4**	**4.3**	**4.4**
For Companionship	3.3	3.9	3.9	3.4	3.4	3.2
To Enjoy Nature	**4.5**	**4.2**	**4.3**	**4.3**	**4.3**	**4.4**
Challenge and Excitement	3.6	4.0	4.3	3.6	3.7	3.9
Improve Your Skills	2.7	2.9	2.9	2.7	2.7	2.7
To Get Away	4.0	3.7	3.9	4.2	4.0	3.9
Family Togetherness	3.2	2.4	2.5	3.7	3.3	3.1
To Catch a Trophy Fish	2.2	2.6	2.8	1.9	2.0	2.4

MacIntosh: Compiled from DFO Survey Data

Factors That Play a Role in Where Anglers Choose to Fish

The factors that determine where anglers choose to fish are also shown in another table compiled by MacIntosh and based on information from a DFO survey. Water Quality and Lack of Pollutants in Fish rank highest amongst anglers (based on scale of 1 to 5). Factors that rank lower in the priority chain that deserve mention include Access to Other Recreational Fishing, Tourist Facility Quality, Nearness to Bait and Tackle Shops. What do these data points suggest about anglers? It can be inferred from this data that a robust tourism model is not necessary to draw anglers. This limits the infrastructure investment needed to generate revenue from anglers (tourists) and potentially reduces the environmental impact of the development as well as costs and other barriers. Also, it should be noted that Presence of Favorite Species ranked very highly amongst Non Resident Non Canadian (*read American*) Anglers. This may point to the unmet demand in the U.S. market for local Atlantic salmon fishing.

Table 3. Factors That Play a Role in the Choice Where an Angler Fishes

	1990			1995		
	Resident	Non Resident Canadian	Non Resident Non Canadian	Resident	Non Resident Canadian	Non Resident Non Canadian
Water Quality	**4.4**	**4.5**	**4.6**	**4.5**	**4.4**	**4.7**
Natural Beauty of the Area	3.8	4.1	4.1	3.9	3.9	4.1
Presence of Wildlife	3.7	3.4	3.4	3.6	3.3	3.4
Places to Fish from Shore	3.5	3.4	3.2	3.3	3.3	3.0
Lack of Angler Crowding	3.6	4.0	4.2	3.7	4.0	4.3
Absence of Other Recreationists	3.0	3.4	3.5	3.1	3.3	3.6
Nearness to Food/Lodging	1.9	2.9	2.8	2.0	2.5	2.6
Tourist Facility Quality	1.9	2.8	2.5	2.0	2.6	2.5
Boat Launching/Marina	2.0	2.0	1.7	2.2	2.2	2.0
Access to Other Recreational Facilities	1.7	1.6	1.5	1.8	1.7	1.6
Nearness to Bait/Tackle Shops	1.7	1.9	1.7	1.7	1.8	1.9
Parking Availability	2.2	2.1	1.8	2.3	2.1	2.2
Availability of Handicapped Facilities	2.3	1.9	1.6	N/A	N/A	N/A
Cost	N/A	N/A	N/A	3.3	3.1	3.2
Lack of Pollutants in Fish	**4.3**	**4.4**	4.3	**4.5**	**4.3**	**4.3**
Size of Fish	3.5	3.3	3.6	3.7	3.4	3.5
Chance to Catch a Trophy Fish	2.7	3.3	3.4	2.8	2.9	3.3
Catch Rate of All Fish	3.0	3.2	3.4	2.6	2.7	2.7
Catch Rate of Fish You Can Keep	3.4	3.2	2.7	2.6	2.3	2.1
Presence of Favorite Species	3.7	4.2	**4.4**	3.7	3.8	4.1
Variety of Species Available	2.7	2.4	2.2	2.7	2.4	2.4
Distance/Travel Time	2.9	2.7	2.4	3.0	2.5	2.5
Information About the Area	3.0	2.8	2.7	3.1	2.8	2.7

Macintosh: Compiled from DFO Survey Data

License Trends and Revenue Generation

The distribution of salmon licenses vs. non salmon licenses and the resident vs. non resident licenses illustrated below suggest that Atlantic salmon fishing in New Brunswick is a significant aspect of overall recreational fishing. In 1999 Non Resident Salmon licenses accounted for over 60% of all Non Resident Licenses issued. This suggests that the pull of Atlantic salmon fishing, in particular, is a dominant driver of the tourism-fishing model in the region.

Table 4. License Trends and Revenue Generated from License Sales

	1995	1996	1997	1998	1999
Non Resident Salmon	6,030	6,366	6,345	5,420	5,213
Resident Salmon	21,949	22,350	21,166	16,890	17,654
Total Salmon	27,979	28,716	27,511	22,310	22,867
Non Resident Except Salmon	3,873	3,957	3,611	3,371	3,245
Resident Except Salmon	55,698	56,200	53,606	50,074	48,767
Total Except Salmon	59,571	60,157	57,217	53,445	52,012
Total Licenses	87,550	88,873	84,728	75,755	74,879
Total Revenue	1,122,688	1,201,536	1,144,765	929,284	918,636
Revenue Per License	12.82	13.52	13.51	12.27	12.27

MacIntosh: Department of Natural Resources and Energy, Province of New Brunswick

Taking the number of Resident and Non Resident Salmon licenses and multiplying them by the Average Spending Per Licensed Angler figure (DFO Data) the Direct Expenditures from Salmon Anglers can be determined for the 1999 salmon season in New Brunswick. It should be noted that Estimate of Increased Spending by 50% line refers to the fact that Atlantic salmon anglers, on average, spend up to 50% more than other sport fish anglers. This is due to the fact that salmon fishing often requires guiding services and lodging and that, as noted previously, salmon anglers tend to be more affluent than the average angler. This analysis finds that the Direct Expenditures for Salmon Anglers in New Brunswick was on the order of $20 million in 1999.

Table 5. Economic Impact of Salmon Fishery

		Resident	Non Resident	Total
Number of Licensed Salmon Anglers in 1999		17,654	5,213	22,867
Average Spending Per Licensed Angler		497.04	1,241.16	581.21
Estimate of Increased Spending by 50%		745.56	1,861.74	871.82
Direct Expenditures from Salmon Anglers		13,162,172	9,705,231	19,935,823
Economic Impact Multiplier	1.50	6,581,086	4,852,615	11,433,701
Direct Economic Impact of Salmon Fishery		**19,743,258**	**14,557,846**	**34,301,104**

MacIntosh: Calculated from Data in DFO Survey and DNRE License Statistics

The $20 million figure does not take into account other socio-economic benefits that could be factored in by an *economic impact multiplier* and therefore, may be a low estimate. It is also recognized that this analysis is dated. Based on work by the North Atlantic Salmon Conservation Organization (NASCO), Atlantic Salmon had an overall socio-economic impact of $28 million in New Brunswick in 2005. This was achieved through direct and indirect expenditures of roughly 16,000 salmon anglers across Canada during 2005. The difference in the

expenditures between 1999 and 2005 may be a function of different calculation methodologies between NASO and DFO. However, what stands out is the decrease in angler numbers. In fact, from 1996 there has been a steady decrease in the number of salmon anglers in New Brunswick. This is not surprising when we factor in the decline in the fish stock. What it may show is that there is a correlation between the number of anglers and expectation of catching a fish (note this conclusion was not supported by the *Reasons to Fish* survey). But, overall this is also no surprise. Anglers are less likely to go in pursuit of a fish if they don't believe there is a realistic chance of catching one – or at least a chance that the fish is there.

Do Salmon Stocks Drive Tourism or Does Tourism Drive Salmon Stocks?

The relationship between anglers (angling tourism revenue) and Atlantic salmon is not simply one sided. That is, anglers do not just go where the fish are. In fact, cases in New Brunswick show a reciprocal relationship exists, whereby the presence of angling tourism has led to an increase in salmon stocks.

The Miramichi River, New Brunswick

Mark Hambrook, President of the Miramichi Salmon Association in New Brunswick, suggests that without the development and support of the angling community, the Miramichi River would not have been able to sustain a population of wild Atlantic salmon. Briefly, the Miramichi is the best-known river in New Brunswick for salmon fishing. Roughly 20% of all returning salmon to North America return to the Miramichi. The region is known for its tourist friendly attitude and huge amounts of information on local lodging, dining and related activities can be found with a quick Internet search. However, this was not always the case. In 1953 the Miramichi Salmon Association was formed out of desperation by a group of sportsmen who had seen their native Atlantic salmon runs disappear. The collective social and economic influence of the tourists helped create policy and conservation efforts that have ensured the survival of the run. Today, salmon angling on the Miramichi generates over $25 million in revenue for the local economy.

The Restigouche River, New Brunswick

A similar situation occurred on the Restigouche River in New Brunswick. Demand for Atlantic salmon angling is the primary economic contributor to the region. In this case however, almost

all angling is non-resident high-end tourism. The Restigouche is home to several well-known and exclusive salmon clubs that lease the river from the Canadian government. Residents do not have permission to fish their local waters, but remarkably there is very little social tension between residents and tourists. Prior to the development of the tourism industry in this region the river was not fully valued for its ecological function and usual threats of dam construction, logging, and agriculture loomed. The beneficial impact of tourism on Atlantic salmon habitat and population is not exclusive to these two rivers. Many, if not all of the Atlantic salmon runs in New Brunswick owe their survival to support from dedicated anglers.

But how will the relationship between angling tourism and salmon restoration play out in the United States? It is important to note that the U.S. stocks of Atlantic salmon are in very severe decline. As mentioned previously, in recent years less than 2,000 fish returned to the Penobscot River to spawn. Therefore, the impact of tourism through recreational fishing may not match that of New Brunswick. In fact it could potentially have a disastrous affect on the already strained populations.

The Kennebec River, Maine

Paul Christman, a biologist at the Maine Department of Marine Resources feels that U.S. salmon stocks are just not ready for angling pressure from tourism. His department conducted a study several years ago (prior to the distinct population segments of Maine being listed as an endangered species) to better understand the potential impact of tourism on Atlantic salmon on the Kennebec River in Maine. The study developed a risk/reward analysis measuring the potential damage to the salmon stock by accidental angling kills against the benefits from tourism. The first difficulty the researches had to deal with was how to define and measure tourism benefits. They concluded that the only way to generate value through Atlantic salmon tourism is through fishing. Next, they listed potential benefits (to the salmon) as:

- Donations
- Support for conservation
- Likelihood of volunteering for work in habitat restoration
- Likelihood of encouraging others to become involved, etc.

Revenue from fishing licenses was not counted, nor were associated economic benefits such as money spent on local dining, lodging and retailers because those funds could not be directly channeled to benefit salmon stocks.

On the other side of the equation the researchers factored in the likely percentage of fish that would be killed or harmed during the catch & release process as well as the money that it would cost to hire two scientists to monitor the activity and record catch numbers. The biologist based their analysis on a 30 day spring season with a limited number of anglers.

The results found that the potential benefits from angling did not outweigh the potential risks to the fish stock and costs the State would have to incur. Based on this analysis tourism was regarded as a threat to Atlantic salmon conservation and plans to open temporary angling seasons on the Kennebec were abandoned.

Today, the Department of Protected Species at NOAA classifies the Maine populations of Atlantic salmon as endangered, under the Endangered Species Act of 1973. There is no recreational fishing for Atlantic salmon on the Penobscot River. Despite this, conservation groups, state planners and biologists all site tourism (angling) as a primary reason to restore the fish stock. If a detailed plan for the build up of angling tourism for Atlantic salmon on Penobscot does not exist, then it must be developed soon.

The Penobscot River Restoration Project

The Penobscot River Restoration Project, a decade long effort to restore Atlantic salmon stocks, has recently gained all necessary approval to remove two dams on the Penobscot and redesign a third. This will allow Atlantic salmon and 10 other species of anadromous fish to access over 1,000 miles of traditional spawning ground previously blocked by dams. The Project is thought to be one of the best battles won in the fight to conserve US wild Atlantic salmon stocks. The benefits from the project (and restored stocks and ecosystem function) include but are certainly not limited to:

Fisheries:

- Reestablish the river's historic connection to the ocean

- Striped bass, both species of Sturgeon and rainbow smelt will regain their entire historical habitat
- Improve access to hundreds of miles of river and dozens of lakes and ponds for shad, alewife, blueback herring and American eel.
- Alewife runs could increase from a few thousand to several million, and American shad from near zero to 1.5 million annually
- Atlantic salmon will regain half of their historical habitat in the river with just one dam passage (Milford Dam), which will have a new fish lift installed.
- Atlantic salmon runs could increase from less than 1,000 today to the 10,000-12,000 range.

Community & Economic

- Revitalization of social, recreational, and business opportunities along the Penobscot benefiting local citizens, local businesses, guides, outfitters, and recreational and commercial fisherman
- Many new and improved recreational opportunities – including canoeing, kayaking, fishing, river festivals, and wildlife watching – could become possible on the Penobscot bringing an influx of recreational enthusiasts and their dollars[1]

The Maine Department of Economic and Community Development has recently secured $3-5 million to fund river-related economic development activities (tourism infrastructure). However, to date there is no definitive impact analysis or tourism development plan. What follows are recommendations for the future tourism build-out based on site specific factors as well the information garnered from the New Brunswick comparable model.

Conclusions

Based on the data collected through the New Brunswick analysis and discussions with Canadian and U.S. fish biologists we can make several conclusions about the nature of the Atlantic salmon tourism industry and its impact on salmon stocks.

First, the consumer of the tourism experience is highly educated and relatively affluent male that is willing to travel considerable distances for the chance to fish salmon and spend significantly more than other sport-fishing anglers for the experience. This consumer is most concerned with the quality of the riparian environment and cares less about related services and additional recreational activities. Additionally, the economic impacts from salmon tourism (assuming the stocks are adequate to support fishing) are significant components to local communities.

[1] For more information see: http://www.penobscotriver.org/content/4033/Widerange_Benefits/

In New Brunswick the support of anglers helped conserve the salmon runs. In this case, tourism drove conservation in the region. The tourism model has become an interwoven piece of the community and is widely supported by the local society.

However, in Maine we can conclude that the runs are not ready to support increased pressure from angling tourism. The risks to the fish stock currently outweigh the potential gains. We can also conclude that the current methodology for measuring these gains is too limited. Creative thinking needs to be applied to the way people use and experience Atlantic salmon. If tourism benefits can be generated from alternative uses to angling via viewing or cultural activities, then the economic benefits from tourism may be able to encourage a faster fish recovery.

In the case of the Penobscot River, environmentalists and state planners may have gotten ahead of themselves when they suggested that tourism will provide significant economic benefits in the near term. Opening the fishery in the near term may not be possible. Instead planners should develop a long-term tourism development plan for the river based on a multiple uses (other than salmon fishing) and stage in salmon fishing eventually. The near term build out however, cannot in anyway slow the progress of the salmon recovery or the plan will result in economic waste and negative externalities.

Recommendations

Because the removal of the dams on the Penobscot is not scheduled to begin summer 2011 and will take between 18 and 24 months to complete there is ample to time to build a tourism development strategy for the new functions and benefits of the free flowing river. A 6-step process can be employed for build out.

Step 1 – Define the goals and objectives

Step 2 – Identify major issues of concern

Step 3 – Data collection and assessment

Step 4 – Decision-making

Step 5 – Implementation

Step 6 – Data collection, assessment and monitoring

Figure 1. 6-Step Strategy

Step 1 – Define the Goals and Objectives

State and local officials as well as other stakeholders need to identify what they hope to achieve by way of tourism as a result of the dam removals on the Penobscot. Is the objective to generate significant revenue from recreational fishing? Would the state prefer local tour operators develop river-related business or are they trying to attract non-resident businesses to the area? Is the objective to use the new river flow as an attraction for international whitewater paddling tournaments or for wildlife viewing and low impact eco-tourism? These are some of the questions that the stakeholders will need to answer.

For the purpose of illustration let's say the stakeholders collectively agree that their objectives are to develop a sustainable local tourism industry based on a multi-use understanding of the

river and its fish stocks. Furthermore, some of the goals may be to support an active recreational fishery for multiple species of anadromous fish, become a venue for festivals and paddling competitions, and attract wildlife viewers from the region. Salmon specific goals may be to identify ways in which tourists can contribute to conservation efforts and to prepare for a recreational season of salmon fishing (supposing numbers return as expected).

One issue uncovered in risk/reward analysis conducted by the Maine Department of Marine Resources is that Atlantic salmon tourism is currently only defined by angling use. This limits the potential benefit pool and should be reconsidered. Are there other ways salmon can attract tourism and generate revenue? Salmon are elusive creatures unlike eagles and moose so wildlife-viewing opportunities are rare. However, in some situations they do collect in certain pools or portions of a river, or occasionally jump waterfalls on their migration. Potentially, viewing stations could be constructed to entice wildlife lovers and future anglers to see the fish during their recovery stage. Additionally, fly fishing enthusiasts may be interested in Atlantic salmon museums or festivals or presentations by industry participants. Broadening the way we think about salmon tourism may uncover new revenue sources.

Step 2 – Identify Major Issues of Concern

There will be a range of potential impacts from designing (or not designing) a tourism strategy for the Penobscot River. To identify major issues of concern, decision makers need to create an open forum for stakeholders to ask question and to voice potential worries. A series of town or regional meetings is simple way to create this forum. The Maine Department of Economic and Community Development is considering funding a regional economic development collaborative. This is a good measure and should be supported. Issues and concerns raised can then be categorized into the following groups:

- Safety and Security Issues
- Environmental Issues
- Legal and Administrative Issues
- Social Issues
- Economic Issues

Environmental issues and economic issues (and their relationship with one another) will probably be of significant importance to the stakeholders and communities. Some might wonder if and how the economic benefits of the complete tourism experience (recreation, lodging, food, etc.) will be reinvested into the continuing efforts of the conservation movement. The decision makers might consider sourcing a percentage of new income associated with fishing and river tourism to ongoing conservation efforts. Perhaps a public matching program can be adopted.

Step 3 - Data Collection and Assessment

The key to making any informed decision is solid data collection and interpretation. To properly design and implement a tourism strategy for the Penobscot River the decision makers should follow two paths for data collection and assessment. First, information should be collected that pertains specifically to the Penobscot and the plans to drive tourism growth. Decision makers need to survey existing and future users of the resource. This will help them assign economic values and future use rates. This method is referred to by economists as the Stated Preference Method and will be useful since it determines future use and perceived value, by asking respondents to answer questions such as:

- How would you use the Penobscot for recreation?
- Would you like to fish for Atlantic salmon on the Penobscot?
- How much would you pay for the opportunity to fish?
- Do you rank fishing above sightseeing or kayaking, etc?

The second general method that should be employed is the Revealed Preference Method. This method uses other markets or services to assign value to the one in question – in our case, tourism and angling on the Penobscot River. Most often employed is a Travel Cost Method that assigns value and importance to future uses based on the amount of money people are willing to spend in order to take part in an activity. There are other hedonic pricing models that can be helpful as well. In the case of angling, it is important to take advantage of a comparable analysis, such as the information provided above with regards to New Brunswick.

This information provides decision-makers and planners with a large amount of pertinent information. For example, we know that the average salmon anger is an affluent educated male

generally over the age of 40. We also know how much revenue is generated in rivers that will one day be comparable to Penobscot. With this we can estimate the number of users, amount each is likely to pay, and other services that are important to the experience.

The fact that the average salmon angler does not choose his location based on other recreational activities tells planners that they can target a specific consumer group. There is little need to build go-cart racing courses or golf courses. It may also mean that the angler would prefer to stay amongst other anglers, in lodges, like they do in New Brunswick. Their preference for water quality and lack of pollutants can be used to further support the conservation of the riparian habitat and should urge responsible development practices along the river's edge.

Step 4 – Decision-Making

Once the necessary economic and scientific assessments have been made and input from all levels of stakeholders has been considered the planners should have enough information to decide how best to implement a tourism development strategy.

Step 5 – Implementation

The development strategy and the various action items should be implemented over a period of time that limits large single order financial burdens. It would unwise to roll out a full plan in the first 12 months only to suffer a significant return lag from tourism revenue. A measured pace of development that matches the expected growth of use will help generate continued support for the overall mission and limit financial and political risk. The following information may be useful as a guide.

- Phase 1
    - Develop infrastructure needed for multi-use river access (roads, boat ramps, walking paths, viewing stations, etc.)
    - Develop marketing capacity through Maine Office of Tourism
    - Develop tourism product (experiences) for dam removal phase (viewing, conferences, volunteer opportunities)
    - Support local recreational fishing museums and groups
- Phase 2

  - Develop capacity to host river related contests (kayaking, canoeing, fishing)
  - Build out increased lodging dining capacity (if needed)
  - Encourage local river-related economic projects (new businesses)
  - Open and encourage recreational fishing (when stocks are ready) for species other than Atlantic salmon
- Phase 3
  - Open Atlantic salmon fishery (when stocks are ready)
  - Host Festivals (Shad Festival) and other events that celebrate productivity of fishery

There are obviously many other steps necessary to ensure the success of a future plan. The above is intended to serve as an illustration of a stepped implementation strategy.

Step 6 - Data Collection, Assessment and Monitoring

Because many of the action items in the future development strategy are dependent on ecosystem recovery, it is crucial to monitor the ecological functions of the river (post dam removal) to fully understand the real time impacts on fish stocks. Over time it will also be just as important to monitor the impacts of the growing tourism industry on the local and regional communities. One approach for both of these processes is active management. Essentially this strategy can be reduced to *learning by doing* and adjusting management practices based on observable, measurable responses from previous activities.

This process helps create an ongoing stream of information and formal feedback loops that measure differences in predetermined indicators. There range of indicators for both ecological function and tourism impact is extensive, but they can generally be broken down into the following three categories:

- Leading Indicators
- Coincident Indicators
- Lagging Indicators

The International Organization for Standardization publishes extensive reports on environmental management, environmental quality and organizational management and leadership strategies

with a focus on the application of indicators for ongoing monitoring. For the purposes of illustration, some of the following indicators may be helpful.

Table 6. Outcomes and Indicators

Potential Outcome Issue	Indicator(s)
Aquatic ecosystems	Diversity of species Primary, secondary and tertiary production
Riparian ecosystems	Number of native & introduced species Vegetation growth Diversity of species Size of habitats and migrations
Economic (related to tourism)	Number of jobs created New businesses Average income per resident Property values
Tourism impact on environment	Revenue directed towards conservation Volunteer rates Donations

Closing Thoughts

The removal of these specific dams on the Penobscot and the potential for a healthy Atlantic salmon run presents the state of Maine with another great opportunity to support local communities through tourism. In order to make sure that the impacts of tourism further the recent environmental strides the state should conduct further research into the relationship between tourism development and fish stocks. Given the potential risks, it seems clear that in the early phases (after dam removal) the state should focus their efforts on supporting alternative recreation tourism opportunities. An important component of a successful development strategy will be to allow the economic benefits to directly support continued conservation and restoration.

Bibliography

Ames, Ted. (2010) *Interview with Ted Ames of the Stonington Fishermen's Alliance and Penobscot East Resource Center.* Retrieved on November 11, 2010 from http://www.penobscotriver.org/content/4104/Interviews/

Baum, E. (1997) *Maine Atlantic Salmon: A National Treasure.* Atlantic Salmon Unlimited, Hermon, Maine

Craig Brook National Fish Hatchery Site. US Fish and Wildlife Service. 2010. Web. 25 Oct. 2010. http://www.fws.gov/northeast/craigbrook/index.html

Chistman, Paul. Maine Department of Marine Resources. Telephone Interview. 14 Dec. 2010

David, Sheila. (2002) The H. John Heinz III Center for Science, Economics and the Environment: *Dam Removal Science and Decision Making.* Retrieved on November 4, 2010 from http://www.heinzctr.org/publications/index.shtml

Fay, et al. (2006) *Status Review for Anadromous Atlantic Salmon (Salmo salar) in the United States.* Retrieved on November 13, 2010 from http://www.nmfs.noaa.gov/pr/species/fish/atlanticsalmon.htm#habitat

Friends of Craig Brook Fish Hatchery (No Site). Craig Brook National Fish Hatchery. *2010. Web. 25 Oct. 2010. http://www.fws.gov/northeast/craigbrook/friends.html*

Graf, L William. (2002) The H. John Heinz III Center for Science, Economics and the Environment: *Dam Removal Status and Prospects.* Retrieved on November 4, 2010 from http://www.heinzctr.org/publications/index.shtml

Hambrook, Mark. Miramichi Salmon Association. Telephone Interview. 14 Dec. 2010
MacIntosh, D Calvin. (2001) *Socio Economic Value of New Brunswick Sport Fishery.* University of New Brunswick, Canada.

NOAA. (2010) NOAA Fisheries Offices of Protected Resources. *Atlantic salmon.* Retrieved on October 25, 2010 from http://www.nmfs.noaa.gov/pr/species/fish/atlanticsalmon.htm

North Atlantic Salmon Conservation Organization (NASCO) Site. NASCO. 2010. Web. 25 Oct. 2010. http://www.nasco.int/

Penobscot River Restoration Trust Site. Penobscot River Restoration Trust. 2010. Web. 25 Oct. 2010. http://www.penobscotriver.org/content/4009/About_Us/