West Branch Penobscot River:

Angler Survey and Economic Assessment 2025

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TROUT UNLIMITED
MAINE COUNCIL

I. EXECUTIVE SUMMARY

The 2025 angler survey and economic assessment of the West Branch Penobscot River documents a **high-value cold-water fishery** directly influenced by hydropower operations at Ripogenus Dam and McKay Station. The fishery is dominated by **landlocked Atlantic salmon**, with important contributions from **brook trout**, and attracts a majority of **out-of-state visitors (55%)**, reflecting its stature as a regional destination. Total angler effort was **15,169 angler-hours**, representing **4,396 angler-days**, with peak activity occurring from **mid-May through early July** during smelt drift and holiday periods. This is a statistically significant decline in effort compared to the reported results of earlier angler census and survey data (range 5,900-8,000 angler-days).

Angler catch rates were exceptionally strong: the river-wide **CPUE for Atlantic salmon was 0.884 fish/hour**, more than double the historical reference CPUE of 0.41 and far exceeding the state management goal of 0.2. However, only **~7%** of caught salmon met legal-size criteria, and **harvest was nearly nonexistent (0.23%)**, indicating the river now functions as a **de facto catch-and-release fishery**, even in zones where limited harvest is technically allowed. Brook trout were lightly harvested (3% of catch), further emphasizing the conservation-oriented nature of the fishery.

Environmental data reveal that **water temperature and flow variability**, particularly those associated with **peaking hydropower operations**, have measurable effects on angler catch rates and likely on the salmon population. Salmon catch declined at water temperatures above **20°C**, and temperature spikes in the Ripogenus Gorge (up to **4.5°C warmer** than McKay discharge) highlight potential concerns about surface-draw releases during warm periods. These conditions may influence fish distribution, angler success, and long-term population health.

Economically, the West Branch fishery produces **substantial regional impact**. Anglers spend an estimated **$284.25/day**, with variable costs (lodging, food, travel, guiding) comprising the majority. Total economic impact for 2025 is estimated at **$1.87 million**, and the projected **50-year cumulative impact $163,575,899 (2025 dollars, + annual 2% inflation rate/year)**. Consumer surplus modeling shows that anglers value the fishery significantly above their actual expenditures, contributing an additional **$307,413 per year** in non-market value.

Overall, the analysis indicates that the West Branch Penobscot River is a **highly productive, economically significant recreational fishery** at risk from **temperature increases, inconsistent flows, and declining numbers of larger salmon** compared to 1990s baselines. These findings underscore the importance of **refining hydropower operations**, improving access and safety in key zones, and implementing **adaptive management strategies** to sustain this iconic fishery during the upcoming hydropower licensing period. **Operational adjustments** that should be considered include minimizing surface-draw releases during warm periods, providing more flows to the gorge, year-round, ramping flows to prevent abrupt flow changes, and providing more stable minimum flows. All these actions could help maintain or improve cold-water habitat conditions.

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III. INTRODUCTION

A. PURPOSE AND OBJECTIVES

The study was done to provide information key to informing relicensing decisions that have not been adequately addressed by prior studies. A fisheries survey was conducted on a section of the West Branch Penobscot River directly influenced by the hydropower generation of McKay and the releases at the Ripogenus Dam. This river reach supports a high-quality landlocked Atlantic salmon population that completes its entire life cycle within the riverine area (Baum 1983, GNP 1996). Goals included: Quantify angler use and effort both spatial and temporal, by terminal gear method (flyfishing and single-hook lure), and mode (boat and wading); determining fish catch and harvest and fish population indicators; evaluate water temperature as a covariate affecting fish and angler behavior; determining the economic value of the fishery; and determine the economic impacts of flow disruptions on guides.

While there is published information on the economic value of fishing in Maine (Southwick Associates, 2014), the report is at a regional and state level. The USFWS 2011 has defined the cost of an average day-of-fishing in Maine, but it was generalized to the entire population of anglers on all fisheries. It does not apply to the value of a day-of-fishing at the West Branch Penobscot. There are limited fisheries-specific evaluations of resources available.

IV. METHODOLOGY

A. Study Area

This angler survey was conducted on the reach of the West Branch Penobscot River between Ripogenus Dam and Abol Bridge during the legal 2025 fishing season.

The study area was divided into five survey zones, listed in Table 1 and shown in Figure 1. The fishing regulations change at Telos Bridge from fly fishing only to single hook artificials.

The upper gorge (**Zone 1**) has extremely restricted flows, with only leakage flows for most of the year. There are 100 CFS releases from July 1st to September 30th that are drawn through a surface sluiceway, unless there is a generator fault. In that case, minimum release flows can be released from Ripogenus Dam. The gorge is steep sided with large boulders. Access points are limited. Some are challenging. There are few parking spots.

The generators at McKay station (top of **Zone 2**) provide most of the system's flow. Annually, flows range from 1,100 to 3,600 CFS depending on the time of year and generation needs. Currently, flows are managed as a pool-and-dump peaking operation. This results in precipitous rises and falls of the surface water elevation due to instantaneous flow changes. Most changes are approximately ±1,000 CFS increments and can result in approximately 1ft changes in water height in a little as 10-15 minutes. During periods of planned turbine maintenance, under current FERC set rules, the licensee is permitted to drop flows to as little as 400 CFS for up to 72 hours. The river is wider and flatter than in the Gorge, but still fast moving with large boulders and bedrock ledges. While this section is primarily a shore-based fishery, there are a couple of deeper pools that offer limited boat fishing for canoes or rafts. There is access at the power plant for whitewater rafters, who launch just above the plant and utilize the midday high flows for their trips during the summer months. There are several pull-offs on the west side of the river that offer easy access and a trail that runs along the east side of the river above Telos Bridge to the Little Eddy Pool.

Zone 3 is a heavily used section of river. Immediately below Telos Bridge is a twisting section of fast, bedrock runs the level into moderate gradient pools. The river settles into a long pool known as the Big Eddy. There is a popular campground on both banks of 500m long Big Eddy. Many of the campsites and cabins have streamside access to the river. There is a boat launch located on the west bank within the campground, where many anglers and guides will launch their drift boats or rafts. Anglers will regularly launch in the pool and spend their entire time fishing anchored in the pool. Some guides will run trips downstream from Big Eddy, fishing several miles of river and taking out below the Big Ambejackmockamus Falls.

Downstream of the campground is a carry-in launch used by rafters and canoeists, which also offers fishing access at the tail out of the Big Eddy pool. Below this point, are scattered undeveloped locations along the Golden Road where anglers pull off to access the river. The parking for cars is on the road's edge and of questionable safety at times. The trails to the water are unmarked and often difficult to find for many of these sites. The gradient decreases with fewer bedrock formations as the river approaches Big Eddy. Pool development is more pronounced with wider and deeper pools. Below Big Eddy there are a series of long, deep runs, punctuated by bedrock cataracts, but no true falls. They run several miles through Little and Big Ambejackmockamus Falls.

The area below the falls opens into **Zone 4** that consists of a 1.5-mile-long set of more gradual riffles and runs to the top of the Nesowadnehunk Deadwater. The two-mile long Deadwater is a deep pool where the river's current is greatly reduced. There is a state operated primitive campground (Horse race) at the upper end of the Deadwater that is very popular with general vacationers and some anglers. There is a boat launch in the campground. Some campsites are located on the water. It is an easy place to park trailers and RVs. This location has had a historic gathering (endured 45+years) that occurs each opening day of fishing season, but the amount of angling involved has been declining over time. In the past, this was a popular early season place for anglers to drift down through the Deadwater, trolling for salmonids. There are several other scattered access points throughout this Zone, including whitewater rafting luncheon areas/take outs, and another primitive campground (Salmon Point). This long natural impoundment ends at the above Nesowadnehunk Falls.

The Nesowadnehunk Falls marks the beginning of **Zone 5**. This is a wide, 250+ft, true fall with a vertical 4-6 ft drop, depending on where you are along the Falls and on water levels. It is a very popular spot where anglers vie to get the spot right at the base of the Falls. Fish can be seen actively jumping up the Falls in May-June. Some guides and anglers carry in rafts or canoes. They anchor in the pool directly below the middle of the Falls to fish the deeper, faster waters. The flow through this section is faster than the Deadwater, but water temperatures are warmer than Zone 3. There are similar length riffles and pools, which eventually transition to a series of longer deeper pools that flow a couple of miles to Abol Bridge. There are unmarked dirt roads leading to unmarked access points, an accessible section of the Old Golden Road that follows close to the river, and several locations where the river parallels the current Golden Road. Parking sites are not developed and there is no signage except for mile parks. This section is popular with tubers during late summer.

Table 1. Description of survey zones, length and applicable fishing regulations

River Section	Length KM (Miles)	Regulations
Zone 1- Ripogenus Gorge to McKay Station	1.17 (0.73)	April1- September 30 Fly Fishing only, Salmon 1 fish over 26 inches.
Zone 2- From McKay Station to Telos Road	1.81 (1.13)	April1- September 30 Fly Fishing only, Salmon 1 fish over 26 inches.
Zone 3-Telos Road to Big Ambejackmockamus Falls	4.49 (2.81)	April 1- August 15. Only Artificials with one hook (a single point hook or single treble hook. Single Salmon per day, 18 inch minimum.
Zone 4- Big A Falls to Nesowadnehunk Falls	5.73 (3.58)	April 1- August 15. Only Artificials with one hook (a single point hook or single treble hook. Single Salmon per day, 18 inch minimum.
Zone 5- Nesowadnehunk Falls to Abol Bridge	5.38 (3.63)	April 1- August 15. Only Artificials with one hook (a single point hook or single treble hook. Single Salmon per day, 18 inch minimum.

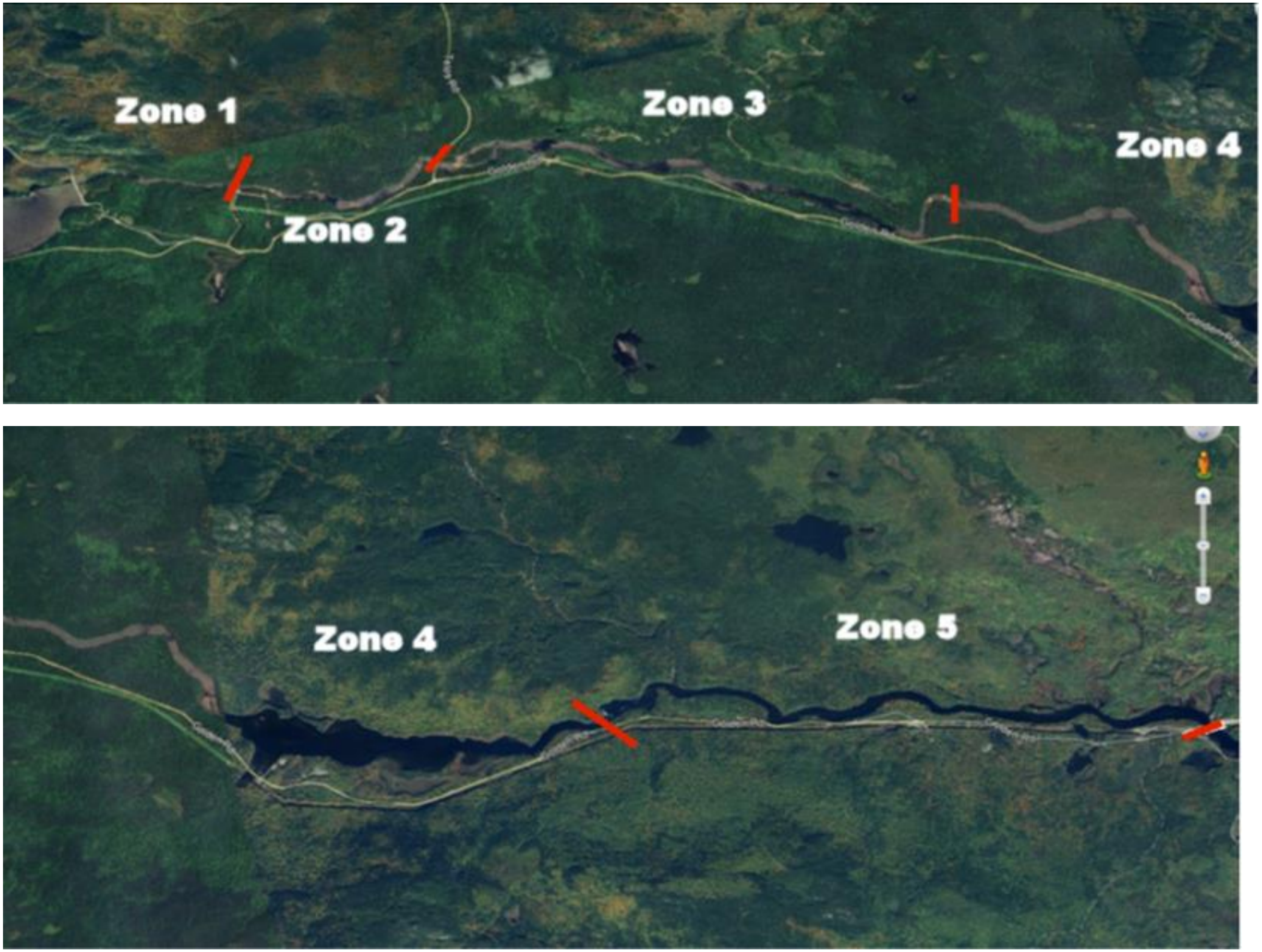

Figure 1. Zones used to create survey routes which had a maximum 1-hour long count time during angler surveys summer 2025.

B. Angler Survey Design

A random stratified angler survey design (Malvestuto et al. 1978) was developed for sampling the fishery on the W. Br. Penobscot River. Guides, MIFW Biologists, Game Wardens and local anglers were queried on timing and location of fishing activity. MIFW provided detailed time and biweekly reported usage data from their passive angler usage card surveys conducted in 2021 and 2022. The information from these sources was used to develop the a priori stratification (Table 1) and seasonal hourly probabilities of use for the river. Initially, sampling periods were defined based on descriptions of seasonal angler activity. Four seasonal periods and four strata (Table 2) were identified. A total of 90 samples were allocated across the combination of periods and strata, with sampling concentrated during the periods of highest usage. Every season, strata combinations were allocated a minimum of three samples.

Table 2. Strata sample periods and hours

SEASON STRATA		Date	Key Reason for Season Break Point
1	Early Spring	4/1-5-14	Cold, weather and road condition/accessibility issues
2	Late Spring	5/15-7/7	Prime fishing conditions, smelt drift, Dobson fly hatch and two major holidays
3	Summer	7/7-8/15	Warmer water conditions, evening caddis hatches
4	Early Fall	8/15-9/30	Start of Regulation changes to fly only, water temperatures starting to drop, effort lower, and Labor Day weekend
DAILY STRATA		Times-Military time	
WE/H	Weekend/Holidays	5.0 -20.0	
WDE	Weekday Early	5.0-15.0	
WDL	Weekday Late	16.0-20.0	
WD	Weekday	5.0-20.0*	

* Used as combined stratum when WDE and WDL stratum effort were not statistically different

Sampling dates within a sample period were assigned based on random number tables. Specific surveying times within a stratum were assigned based on values from random number tables and corresponding hourly probabilities, by season, generated from DIFW's angler survey cards (personnel communication T. Obrey). To decrease sampling costs, two surveys were scheduled on each sampling date. Since MIFW angler card data indicated an average trip length of 3.25-3.5 hours, a three-hour gap was scheduled between sample start times to minimize overlapping interviews. This survey is a dual survey instrument, collecting both effort and catch. The stratification was developed to optimize the accuracy of effort data. Survey count zones within the study area were defined which allowed survey agents to count all anglers within the zone within a one-hour period. This satisfies the "instantaneous" count requirement for this type of survey. While paired effort counts and catch interviews are the best data, it is not always possible to obtain angler's permission for an interviewer or to physically reach some anglers (boaters). A secondary volunteer survey clerk opportunistically interviewed anglers along the river, specifically targeting evening contacts. This allowed collection of additional catch data from completed trips. These data were used to fill in missing catch data cells. Data cells were filled by substituting 1st) catch data directly corresponding to a specific sample date, time, zone and fishing method, 2nd) catch data for corresponding times, zone and methodology for 3 days before and after the sample date where averaged, 3rd) catch data for the entire strata/period averaged together and substituted for the empty catch cell. This increased statistical power and provided more robust catch estimates.

Table 3. Post sample breakdown of possible sample blocks N(h) and completed samples n(h) for each season and daily strata. As well as Total sample hours (N) and completed samples (n). Number corresponds to season of stratum.

	N(h)		n(h)	
Season/strata	possible sample blocks per strata (N(h)) and proportion of total possible sample units*		completed samples per strata and percentage of strata sample units	
1WE/H	4.3%	110	4.5%	5
1WD	15.7%	397	2.0%	8
2WE/H	10.6%	270	4.4%	12
2WDE	14.2%	360	4.2%	15
2WDL	6.9%	175	2.8%	5
3WE/H	9.7%	244	4.5%	11
3WD	22.4%	565	1.8%	10
4WE/H	4.4%	112	5.4%	6
4WD	11.6%	294	3.4%	10
* unfishable days removed				
	N=	2,527		n= 82

1. Count and Interview Protocols

Direction of surveys (top to bottom or bottom to top) were randomly assigned prior to the survey. Clerks tallied all visible anglers (sample survey forms in Appendix Q & R). Noting angler method (fly, lure, bait), tallying number of boats and how many anglers were in each boat. Anglers were interviewed by clerks as encountered, but when there were large numbers of anglers present, a subset of anglers were randomly selected to be interviewed. Clerks identified themselves as TU volunteers conducting an angler survey. Anglers were asked for permission to conduct an interview. If permission was granted, anglers were asked about their fishing trip (start time, specific about that day's catch), where they came from, the primary reason for their trip to the river, whether they were staying overnight and how long. While conducting the interview, clerks did a visual inventory of angler's equipment and noted the name of the location where the angler was fishing. Anglers were also queried about where they were staying (campground, hotel, trail, cabin etc.). If Anglers volunteered information about previous fishing trips, it was recorded and attempts made to get complete data for the prior trip (time, location, catch). If anglers did not volunteer data, they would be prompted about trout, fallfish (chub/dace) or other fish they caught.

Expanded angler effort was calculated by sample Zone for the entire fishing season by angling method (fly and lure) and by mode (Shore or Boat) following the method of Malvestuto et al 1971.

Hours-of-fishing and catch from angler interviews were the primary source of catch data for each hour sample. In situations where there were counts of anglers and no corresponding angler interviews during the sample, then the supplemental interview data was searched for usable interviews as described above. Catch-per-river-hour was computed using the same stratification as used for effort. This was done for each zone, angler method, mode and fish species. Catch-per-unit-of-effort was calculated by dividing expanded angler effort by the expanded catch of each zone, angler method, mode and species.

C. Environmental Covariate Data Collection

Daily weather for the study area was compiled from the NOAA weather site each day. https://forecast.weather.gov/MapClick.php?lat=45.8759&lon=-69.1503. Days with significant snow, more than ½ inch of constant rain, or sustained winds over 25 mph were treated as unfishable and removed from the total number of possible sample hours (N).

During each survey, clerks recorded the flow (CFS) displayed at McKay Station. Water and air temperatures were determined with thermometers at a convenient point during the survey. Subjective notes were collected on wind, cloud cover, precipitation, and river height for each survey.

Continuous water temperature loggers (Onset-Tidbits) were deployed at three locations in the river to better inform our understanding of changes in water quality conditions, fishing success and fish activity. All loggers were checked with ice immersion baths, both before and after deployment to ensure that data recorded was within acceptable accuracy ($\pm$0.2C). Loggers were attached to anchor plates and tethered to a stream bank structure (boulder, roots or trunks). The plate was placed in a waist deep location in the current with several stream rocks placed over them to prevent direct solar heating of the logger.

D. Economics Methodology

The fixed costs of a fishing trip are required expenses needed to fish that day and include licenses fees, mandatory equipment and the daily prorated cost of equipment needed to participate in the fishery. An average license cost was calculated by proportionally allocating the expense of in-state and out-of-state licenses based on numbers of in-state and out-of-state anglers interviewed.

As part of the study, the daily pro-rate cost of angler's gear was determined. This required an estimate of the usable life of various pieces of fishing gear and current average cost of the fishing gear. A gear replacement survey was conducted using 30 random anglers. The angler listed the frequency of their replacement for various categories of fishing gear, their years of angling, and typical number of fishing trips per year. The average number-of-days-of-use were determined for each gear category.

To obtain current equipment values, a gear-cost survey was conducted using two major sport stores, two major online fishing gear suppliers and two fly fishing shops. Median costs for various gear categories were determined for each source and an average of all sources used to estimate the current typical replacement value for a category of equipment. For boat costs, individual boat manufacture websites were visited to determine average cost for specific boat types (drift, raft, canoes and kayak), and the necessary accessories to operate for fishing (oars, the anchors, life vest etc.). Several guides and individual anglers were surveyed for their typical annual usage of their boats and replacement timeframes. The average cost of each gear category was divided by the average number-of-days-of use to get a daily depreciation cost or daily use cost.

An angler's equipment was visually inventoried during interviews using a check off list. The fixed value of gear costs for an angler was calculated by multiplying each inventory component they had, by the daily use cost of that category and summing across categories. Combined with license costs it generated an angler's total fixed cost for the day. Fixed costs were calculated separately for boat and shore anglers because of the large difference in their cost basis. These fixed costs were expanded by the estimated numbers of shore and boat angler-days to generate the total fixed costs of the fishery.

Variable costs were estimated by developing estimates of lodging, food, travel, and guide costs. Campgrounds, lodgings, and guides were surveyed for current, pro-rated daily costs. The Federal daily meals reimbursement rates were used as a substitute for food costs only for those anglers staying overnight. Federal mileage reimbursement rates were used as an estimate of vehicle operation costs. The per capita hourly income from the town of origin was used to estimate the value of travel time to the river. In the case where air travel was involved, the median air fare for travel to the closest airport at the time of the survey was used. All travel related variable costs were combined and doubled to account for travel in both directions. The median trip length (nights of lodging) was estimated from angler interviews and multiplied by the appropriate per diem lodging cost for the interview. Guiding service costs for 2025 were determined by visiting the websites of 10 guides who list the West Branch as a location they guide at and using the median of their listed prices.

To determine the consumer surplus value of a fishing day at the West Branch Penobscot River a Distance Travel Model was used. The selected Distance Travel Model methodology follows the procedures outlined at https://ecosystemvaluation.org/travel_costs.html developed by King, D.M., M. J. Mazzotta and K.J Markowitz. 2000.

E. Age and Growth

To evaluate the effect of current flow management on river populations, scale samples were collected by angling from as many sizes of LLS as could be caught from the W. B. Penobscot River. Two sample periods were used to allow quantification of over-summer LLS growth. The first period was June and Second Period was the last week of August through late September.

All scales were given to MDIFW staff experienced in LLS scale reading. Back calculated length-at-age data allows a review of age specific growth for multiple year classes and comparison with LLS growth information from earlier studies. The length-at-age back calculation formula presented below uses a 25mm intercept which is the length of the fish at the start of scale formation.

Back Calculated Length-at-age formula:

Length-at-age(mm)= 25+[{(body length(mm)-25}*{Annulus Radius (mm)/Scale Radius (mm)}]

V. RESULTS

A. Angler Survey

The anglers surveyed were very cooperative and forthcoming with information. A total of 82 angler counts were completed. A total of 352 interviews were granted during the counts. The supplemental interviewer was able to obtain an additional 323 catch and effort interviews of mostly completed trips. Information from the supplemental interviews was used to fill in missing catch interview data for 25 samples (usually for one specific fishing method or fishing mode within a sample- not the entire sample's catch).

A total of 8 samples (angler counts and interviews) were lost due to weather and vehicle issues. Effort values for each stratum within a season were tested by T-test for statistically significant differences. For three of the four seasons the Weekday-Early and Weekday-Late strata defined in the *a priori* design were not significantly different in means or variability. For the *a posteriori* analysis of angler effort the Weekday-Early and Weekday-Late strata were combined for the Early Spring, Summer, and Early Fall Seasons.

1. Angler Effort

Visitor trends. The results of this survey documented that out-of-state anglers comprised 55% of participants in the W.B. Penobscot fishery. Anglers staying overnight to fish comprised 79.9% of angler-days. This fishery attracts a far higher proportion of resident tourists than do typical Maine Tourist Attractions (MOD, 2024 Table 4). The composition of out-of-state participants shows higher New England state participation and lower South Region participation than general tourism in Maine.

Table 4. Origin of W.B. Penobscot anglers and comparison with statewide tourist origins and estimated average per person travel costs to the river (does not include lodging at the river)

Regional of Angler's origin	Count	Angler Composition	Statewide Tourism Composition*	Average Travel Costs per Angler
Maine	85	45%	13%	249
other New England States	73	39%	29%	637
Mid-Atlantic	12	6%	22%	1,604
South	1	1%	12%	1,875
Canada	4	2%	7%	469
Mid-West	10	5%	7%	2,249
South-West**	1	1%	4%	1,280
West**	1	1%	4%	1,500
Usable responses	187			

*2024 Maine Tourism- Summer Tracking Summary- Origins map
** Flew in- reduced travel times and overall costs. - No vehicle was rented.

Figure 2 provides a general overview of the timing and levels fishing activity for the entire surveyed river reach by time-of-day and date. Only counts with anglers present show up on the graph. There were numerous zero counts in the early spring season. Weather and road conditions made accessing the river difficult prior to early May. Angler activity peaked in late-June and the highest densities of anglers were seen in the evenings, often using drift boats at the Big Eddy Pool. Total angler effort was estimated at 15,169 angler-hours (±1,165 se) or 4,396 angler-days for the reach from Ripogenus Dam to Abol Bridge. The accuracy of the data was excellent, total river effort had an RSE=7.7%. Total angler trips for this reach of river were 1,465 angler-trips with anglers spending an average of 3 nights on the river during a trip (Figure 3). Angler effort consisted of 89% fly anglers and 11% lure anglers. Anglers on shore fished for 11,279 angler-hours, or 3,269 angler-days. Anglers fished from boats for 4,643 angler-hours, or 1,346 angler-day, about 30% of the total angler effort. The dominance of fly fishing was expected because the upper two zones were under fly-fishing-only regulations.

Detailed breakdowns of the 2025 Angler effort statistics are presented in Appendix A-C, Tables A1-A3. Angler effort was concentrated in Zone 2, 3, and at one location in Zone 5 (Nesowadnehunk Falls). Peak angler effort occurred between May 16th and July 6th (late spring stratum) by anglers who were focused on fishing. This is the stratum with smelt drift and has two holiday weekends.

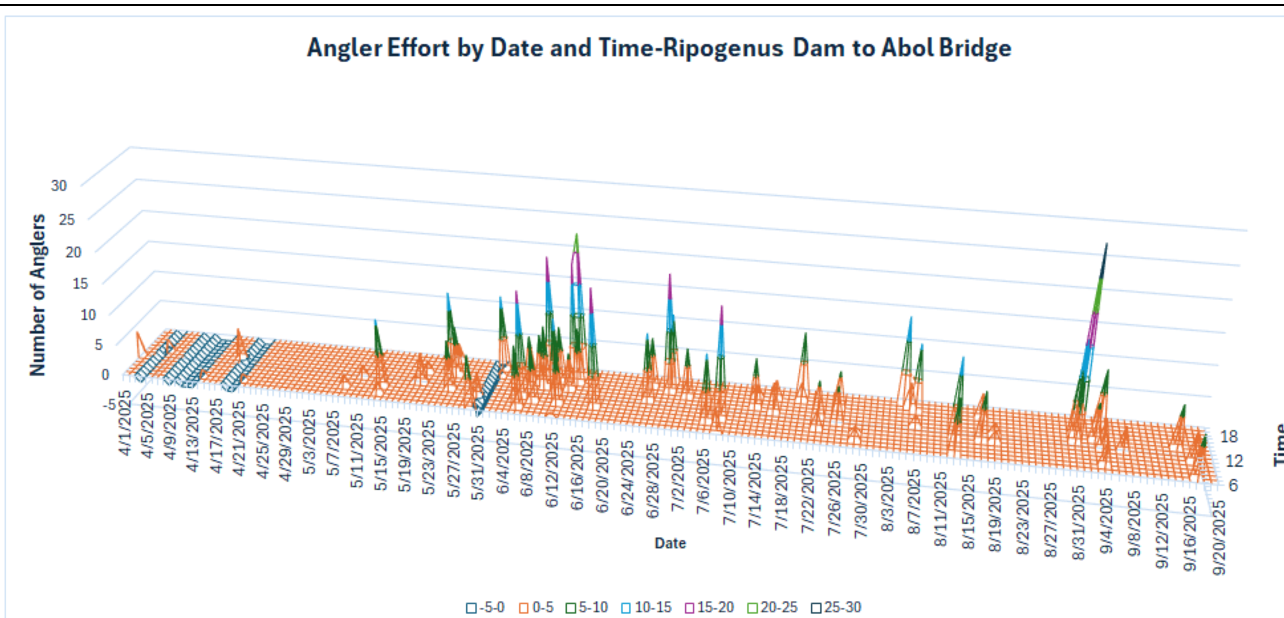

Figure 2. Level of effort on surveyed portion of W. Branch Penobscot River during 2025. The Blue bars represent unfishable days due to weather, rain or wind.

Of anglers interviewed, the majority (Table 5) indicated the reason for their trip to the river was for fishing. During the summer stratum angler effort dropped off and the reason for trips changed. For many anglers interviewed in August their primary reason for being at the river was a general vacation/camping rather than fishing as the primary motive for their trip.

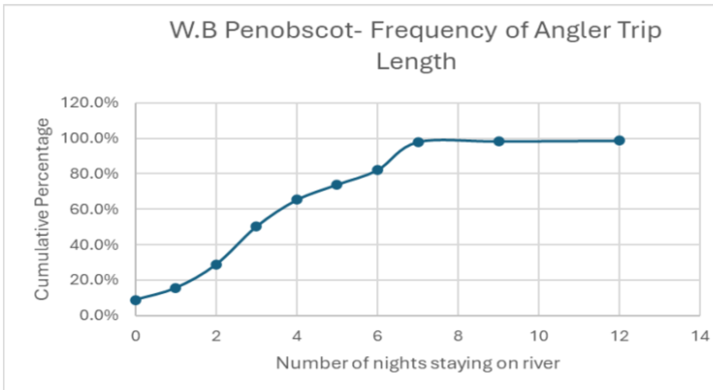

Figure 3. Cumulative frequency distribution of

Table 5. Primary purpose of interviewed angler's trip to the river

	Month					
Reason at River	April	May	June	July	August	September
Fishing	93.8%	96.0%	95.8%	98.3%	45.3%	100.0%
Vacation/Camping	6.3%	4.0%	4.2%	1.7%	54.7%	0.0%

Anglers commented during interviews that they avoided using Zone 1 (Ripogenus Gorge) in the spring because they knew that no scheduled releases, only leakage flows in this area until mid-summer. There was only a single angler found fishing in Ripogenus Gorge before July 1st. The addition of releases into the gorge earlier in the year would expand the usage of this river section.

Anglers shared the river with white water rafters, and kayakers most of the year. There was no apparent resource conflict between user groups. Unsolicited, anecdotal comments by interviewed anglers indicated their perception that insect hatches, smelt drift and the quality of salmon in the river have all declined over time. They specifically mentioned the evening caddis hatch, and a complete failure of the June Hendrickson hatch at the head of the Nesowadnehunk Deadwater.

2. Guide Activity

Guide services are active on the river from mid-May through September. Based on interview responses, shore anglers were using a guide for 6% of trips. This expands to 196 shore-based guided trips. It frequently was not possible to get random interviews for boat anglers. Of the 47 boaters we were able to interview during survey counts, 17% were on guided trips. Based on total expanded boat effort (4,513 hours) and an average boat trip time of 3.45hrs (based on completed boat interviews), we estimated that there were 1,306 boat-days. This produces a minimum estimate of 222 guided boat-days. As we became familiar with the resident guides, we could make subjective determination about which boats on the water were guided trips. It is our assessment that the 222 guided boats estimate is low.

The 2025 angler effort estimate of 4,396 angler-days is below the values report by GNP (1996). They estimated angler effort was 5,900 to 8,000 angler-days each year based on an angler census done at Abol Bridge. This decline in effort is significant, and outside the 95% CI for the 2025 effort estimate. The reason for the decline could be reduced fishing quality, change in angler participation behavior, or challenges to accessing and participating in the fishery.

3. Catch

The raw catch data was compiled by sample data and time (Figure 4). There were 25 instances where catch data were used from supplemental surveys to fill in missing catch and fishing time values. Thirteen interviews were exact date/time matches for one or more angler

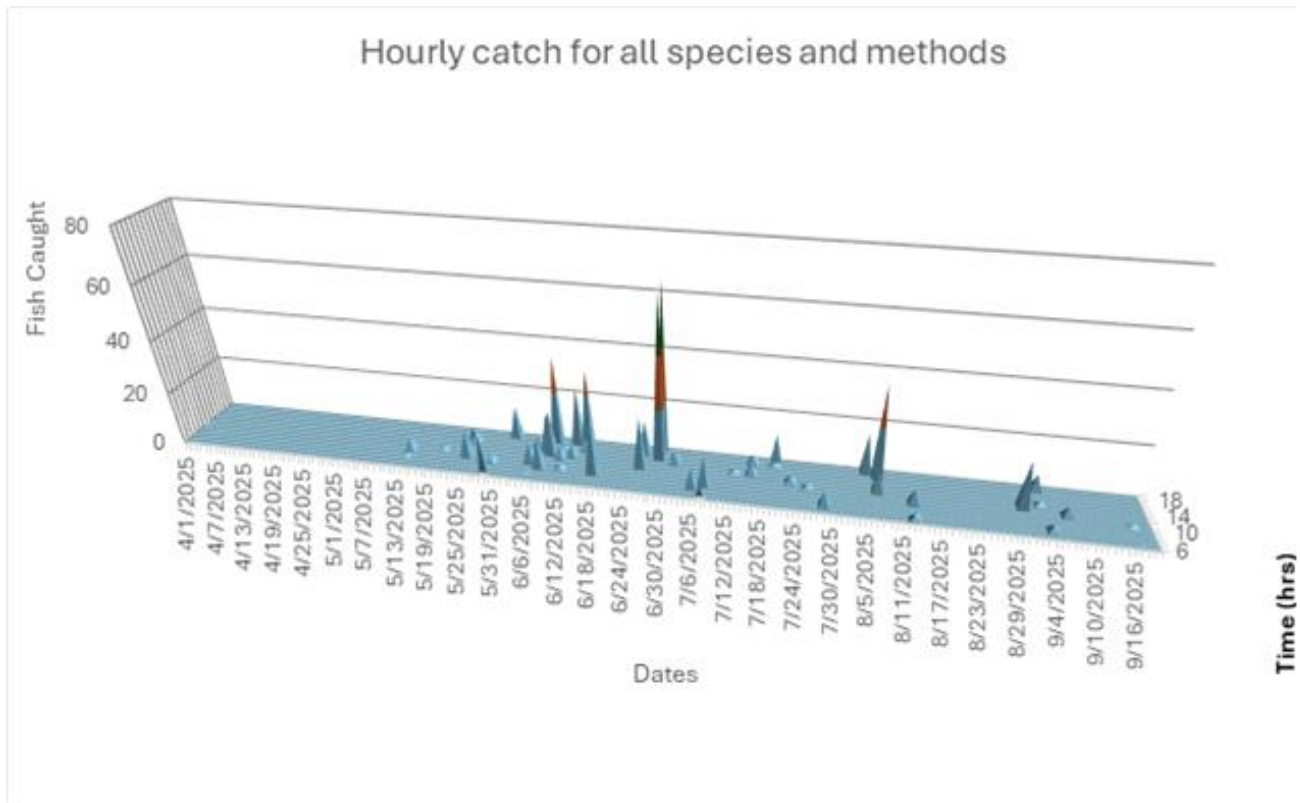

Figure 4 Catch by date and time of day for all species

type and mode. In 12 instances, interviews were averaged from 3-days immediately before or after the sample to replace the missing data. This represents a replacement/fill rate of 1.5% for the 1,640 catch values collected. Most of the substitutions were for anglers in Zone 3 (14 boats/ 3 shore) and Zone 2 (1 boat/ 5 shore) where no interviews were possible because anglers were not reachable for an interview. Anglers denied interviews on only three occasions.

The detailed catch statistics are presented in Appendix D-G, Tables A4-A6 for each sampling zone. Catch is the number-of-fish-caught in the zone in one hour. The total catch from all zones and species expanded to 17,632 fish (±2,720 Standard Error (SE)). The expanded catch for the three main species was: 13,411 landlocked Atlantic salmon; 3,446 brook trout;1,080 fallfish; and a few yellow perch, white perch and smallmouth bass. All credible reported smallmouth bass were caught below Nesowadnehunk Falls. Anglers had to be prompted about non-salmonid catch events, so those numbers may be underrepresented.

The catch varied over the seasons, by zone and by species. The catch was a function of how many anglers were fishing and how catchable the fish were. Peaks in catch occurred around major holiday weekends (Memorial Day and July 4th). Salmonid catch was highest in Zone 3 (Big Eddy) and Zone 5 (Nesowadnehunk Falls) with catch peaking in mid to late June which corresponds to the reported peak of the smelt drift. Fallfish numbers were highest in Zone 2 (Holbrook) and Zone 5 (Nesowadnehunk Falls). The highest catch was 62 salmon in one hour by 11 anglers, during an evening sample at the end of June (Fig. 3).

The size distribution of the Atlantic Salmon catch suggests that the proportion of legal harvestable size salmon (7%) in the river was small (Table 6) and survey agents only encountered one legal fish being harvested during the survey. Only one 26-inch legal fish was reported caught in Zone 1 and one fish over 26 inches was caught in Zone 5, neither was harvested. In Zone 1 and 2 there were 11 fish in the 18-26 inch size range caught (not legal). In Zone 3-5 there were 27 salmon 18-26 inches caught that were legal, but only one was harvested. We estimate there were 408 (95%CI 0-937) legal-size fish catch events during the fishing season, and these legal-size fish are less than 10% of the salmon caught. Atlantic salmon harvest was barely detectable with the level of survey effort used, the potential for an error is high due to a lack of sensitivity. With only about 5% of the possible sample blocks surveyed, rare events, like a salmon being harvested, could easily be overlooked and actual harvest underestimated. The harvest of Atlantic salmon was 0.23% of the reported catch events. This expands to a possible 31 harvested legal-size Atlantic salmon during the year. Functionally, this is a catch-and-release Atlantic salmon fishery in all respects except the regulations.

The Atlantic salmon catch length-classes were graphed monthly to identify spatial and temporal shifts in the size of catch during the year. The data was not sufficient to identify the movement of specific size classes of fish up the river. The graphs were presented in the Appendix H & I. Figures A-1& A-2 (pg. 55 & 56).

From the total frequency distribution (Table 6) of the reported catch, the average size of salmon caught was estimated to be 16.5 inches. The GNP 1996 EIS (pg. 3-37) reported the average size of salmon caught in the river was 18.5 inches and 2.25 lbs. This suggests a significant decline in the quantity and size of salmon available to anglers compared to these earlier samples. The salmon seen during the 2025 survey were robust, with only a few exceptions.

Brook trout were rarely harvested. Only 6 brook trout were reported as harvested during the survey or 3% of all brook trout catch events. This expands to a brook trout harvest of 103 fish for the year out of an estimated 3,446 brook trout catch events in 2025. Brook trout have become a much larger part of the fishery compared to what was in the 1996 GNP EIS report (pg. 3-37), annual average catch of 584 brook trout/year.

Table 6. Reported Number Caught, Harvested and Harvest rate by species for West Branch Penobscot River fishery, 2025.

	Landlocked Salmon			Brook Trout		
Size group	Caught	Harvested	Percent Harvested	Caught	Harvested	Percent Harvested
under 12 inches	222	0	0	142	3	1.55%
12-18 inches	135	0	0	49	3	1.55%
18-26 inches	37	1	0.25%	2	0	0
over 26 inches	2	0	0	1	0	0
Total	396	1	0.23%	194	6	3%

4. Catch/Effort

Catch/Effort or CPUE is the best way to compare how efficient anglers are at any one time or the quality of fishing. CPUE is Catch (fish caught in an hour)/ Effort (number of anglers in an hour). For the river reach surveyed the CPUE for Atlantic salmon was 0.884 fish/angler-hr. Atlantic salmon CPUE varied across zones and by method (Table 7). Within the most heavily fished Zone (3), catch rates for Atlantic salmon weren't statistically different between shore and boat anglers. In Zone 5 the low CPUE of Salmon and brook from boats is likely erroneous (low), because the boat anglers were difficult to interview and because anecdotal comments from guides indicated trips with 40+-fish days in June when they were fishing directly below Nesowadnehunk Falls. None of those trips were intercepted by the surveyors.

When there are short-term, spiking catch events, they can be missed by this type of survey. Given the catch rates calculated overall, there does not appear to be any reason to believe there is an added advantage to fishing from a boat. This points to the need to have flexibility in how catch data is collected and that multimethod fisheries (shore-wide spread mostly accessible and boat-moving and only having short duration accessible at takeout sites) need several independent catch estimation sources. A hybrid roving creel/bus-stop catch survey could address this design shortcoming. FAO-Artisanal fishery surveys that track multiple methods and fisheries in a single survey are good examples for this situation.

Table 7. CPUE table for Fly (boat/shore) by river sections.

River Section	**Zone 1-** above McKay Station through Ripogenus Gorge	**Zone 2-** From McKay Station to Telos Road	**Zone 3-** Telos Road to Big Ambejack-mockamus Falls	**Zone 4-** Big A Falls to Nesowadnehunk Falls	**Zone 5-** Nesowadnehunk Falls to Abol Bridge
Fly Anglers					
Landlocked Atlantic Salmon					
	Catch per Angler-Hour (CPUE)				
Shore	0.955	0.498	1.121	0.266	1.350
Boat	N/A	0.061	1.334	0.226	0.107
Brook Trout					
Shore	0.016	0.118	0.229	0.727	0.464
Boat	N/A	0.004	0.192	0.688	0.021

The river-wide catch rate (CPUE) of Atlantic salmon in 2025 was excellent, with 0.884 salmon caught per hour of fishing. The 1996 EIS (GNP) reported that fishing quality was high with a CPUE of 0.41 salmon per hour of fishing and that the state goal was 0.2 salmon caught per hour. The catch rate of legal sized salmon was 0.06 fish/hour. It is hard to compare this with earlier data as length limits for legal harvest have changed several times.

Over the course of the summer, the size of Atlantic salmon caught has changed and the catch was not the same across the different survey zones, Appendix H Figure A1. While this is in part due to the larger number of anglers in some zones, it is also the result of better catch rates (CPUE-catch per unit of effort) in those zones. Atlantic salmon catch rates were found to be highest in the heavily used Big Eddy area and at Nesowadnehunk Falls. While catch rates varied between boat and shore-based anglers there was no clear trend of better catch rates by either approach. Catch rates of brook trout (Appendix I, Figure A2) were substantially lower than for Atlantic salmon except in Zone 4 where brook trout catch dominated and was the highest of any river section. This may be an artifact in the data as this was the section with the lowest number of anglers and total catch and so the least sensitive data.

Atlantic salmon catch rates are related to water temperatures. In Figure 5, you can see that the highest Atlantic salmon catch rates occurred when water temperatures were at or below 20 ° C. At water temperatures above 20° C catch rates dropped substantially (from 2.8 fish/hour to less than 1 fish/hour). This follows the catch vs temperature pattern shown in GNNC 1991, Vol IX. Anything that can be done from an operation standpoint that to keep water temperatures below 20 ° C will improve angler success and likely the overall condition of the Atlantic salmon population.

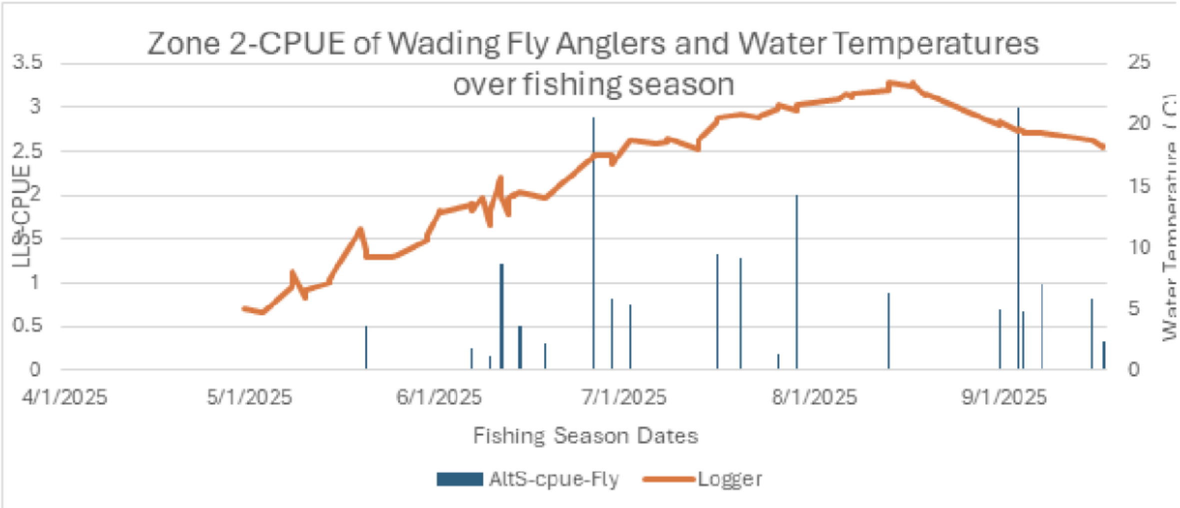

Figure 5. Catch rates of Atlantic Salmon (LLS) across the summer and summer water temperatures in Zone 2 for wading anglers.

The impact of flows and water temperature on shore-anglers catch rates were explored in Figure 6, source data presented in Appendix O. The dichotomy of flows represents the 2-turbine vs 3-turbine flow state for the power plant. While the shore anglers still catch fish at higher flows (>2600 CFS), shore anglers are more successful at moderate (2000-2200 CFS) flows. Catch rates dropped off at 21° C for the 2000-2200 CFS range, but anglers still caught trout to 23° C in the 2800-3000 CFS flow range. Based on the range of temperatures seen, the 3-turbine flows were used most extensively during the warm summer months. Operational constraints that reduce the need for 3-turbine flows during warmer weather will improve Atlantic salmon fishing conditions and angler success rates.

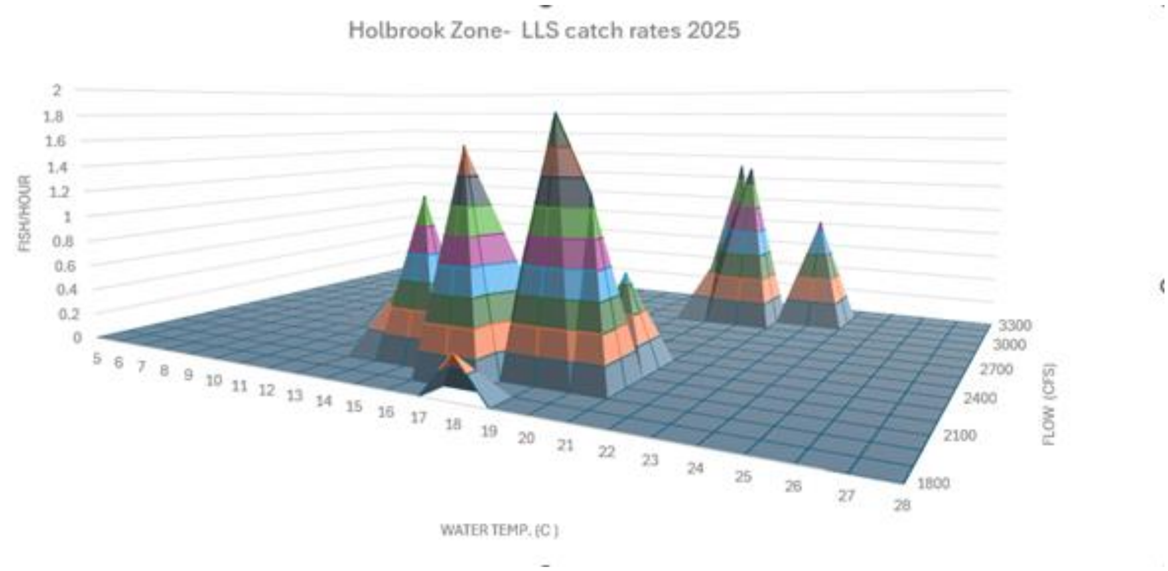

Figure 6. Zone 2 Catch Rates for Land Lock Salmon by flows and water temperatures.

B. Economics Evaluation

1. **Fixed Costs Components**: cost of fishing that everyone pays.

Licenses: Of anglers interviewed ,73% needed in-state ($25 cost) license, and 27% needed out-of-state ($64 cost) fishing licenses. Prorating the costs based on proportion of license type yields an estimated average license cost of $35.45/year for all angler types. The gear replacement survey generated a median yearly-number-of-days-of-fishing= 32 days. The daily fixed cost for an angler's fishing licenses = $1.11/angler-day.

Gear costs: Daily gear depreciation was estimated for the average angler. This was determined separately for Shore and Boat anglers. To pro-rate gear expenses, 30 random anglers were surveyed for their rate of fishing gear replacement for major equipment, years of angling, and number of fishing trips per year. The average number-of-days-of-use were determined for each gear category. A gear cost survey was conducted using two major sport stores, two major online fishing gear suppliers and two fly fishing shops.

The daily pro-rated cost of each gear category (excluding boats) is presented in Appendix K, Table A8, and summary statistics are broken out by angler method and mode (Table 8). To weigh the costs by occurrence of angler type and mode, each category is expanded by the number of angler-days/year, (multiple instances of use are counted separately, i.e. 2 rods are two costs). All expanded categories were divided by the total number of inventoried anglers. The estimated fixed cost by gear combining all anglers is $10.56/angler-day.

Table 8. Fixed Cost of gear for anglers by mode of Fishing*					
User Group	Fixed cost statistics			Angler-days by Method	Expand by **Method Count**
	avg	**sd**	**n**		
Shore-Lure Anglers	$9.02	3.24	6	441	$3,978.41
Shore-Fly Anglers	$11.58	3.08	112	2,829	$32,748.18
Drift Boat-guided	dealt with separately			222	
Drift Boat- not guided	$7.59	1.69	20	649	$4,923.45
Rafts	$37.76	--	2	92	$3,473.92
Canoe	$9.254	2.80	8	317	$2,930.74
Kayak	$6.77	0.51	3	5	$33.84
			Fixed Cost of gear for all anglers/day		**$10.56**

*Boat Cost not included: listed in Table 11.5

Boat costs: Anglers using boats have additional fixed costs for boats and trailers (where applicable) including depreciation, licensing, associated boating gear and mandate safety equipment. To estimate boat costs, individual boat manufacture websites were visited to determine average cost for specific boat types (Drift, Raft, Canoes and Kayak), and the necessary accessories to operate for fishing. Several Guides and individual anglers were surveyed for their typical annual usage of their boats and replacement timeframes. Average costs for all major components were determined for each source and then average across all suppliers. During angler surveys, individual anglers were visually inventoried for equipment use, including size and types of boats. An average daily boat depreciation cost was calculated, Table 9.

Table 9 Boat types counted during angler surveys.				
Boat Type				
Rafts	Drift Boat	Canoe	Kayak	Total
7	66	24	5	102
Expanded number of days of use for each boat type by anglers				
92	871	317	66	1,346
$11.72	$19.44	$2.08	$1.0	Daily prorated cost of boat by type.*
$1,096.64	$16,932	$152.40	$66	$18,274.02
Average daily boat depreciation cost across all anglers				**$4.15**

*Assuming 10-year life on the boats and that it is used 60 days/year.

In addition to the boat depreciation cost, there is mandated and operational boating equipment: oars, anchors, life vests, throwable life preserver and warning device (whistle or horn). The added equipment cost is estimated at $2/boat /day for operational and mandated equipment (see Appendix J, Table A7) or $0.6 across all anglers/day. Licensing/registration for boat and trailer is $60/year. So, this adds $1/angler-day to the average boat angler's daily cost or $0.3/day across all anglers. The fixed cost of using a boat (all types combined) is depreciation, licensing and required equipment and is calculated evenly across all angler types and modes**, cost $5.05/angler-day.**

The average angler/daily fixed cost of W. B. Penobscot River anglers is inclusive of all gear, boat and angling types. **The Average Fixed Cost for anglers across all methods and mode is $20.87/angler-day.**

2. **Variable Cost Components**: what individuals decide to spend money on; housing, food, travel, and guides.

Lodging: a subset of anglers was queried as to where they were staying overnight and for how long. They picked from campground (tents, trail/RV, cabin), motels, and other local options (staying with friends, sleeping in their car). A survey of lodging options within 25 miles of the river (hotels/motels/Airbnb etc.) ranged in cost from $86-$210/night, with a median cost of $133/night. Campgrounds (camping): State campground; $7/person/night (fee and taxes). Private Campground; averaged $20/person/night. The cost of campground cabins had a median value of $60/night. Prorated cost of operating a RV/travel trailer determined by surveying industry sites and user discussion sites. A consensus of posted information on social media centered around a median daily prorated cost of approximately $150/night with a range of $70- $500/night for the size and type of vehicles that were most often seen at the riverside campgrounds (16-20ft trailers and 25ft fifth wheel). This reflects all license, maintenance, insurance, loans, and depreciation costs. Table 10 summarizing the calculations for the average lodging cost. Based on an angler's description of where they described staying overnight, on average they spent $31.86/angler-day. This includes individuals who stayed with friends, at family cabins/camps or slept in their cars (zero costs) or were staying on the river for a primary reason other than fishing (treated a zero mile. And zero lodging). The median trip length was a three-night stay (ranged from 0-60 days Figure 7). Several anglers rented campsites for the season. They would come up fishing 3-4 days a week all summer.

Table 10. Estimate of Average per Diem lodging costs based on angler's responses.				
	count	%	Cost	expanded cost
Cabins	34	10.06%	$60	$2,040
Hotels	9	2.66%	$133	$1,197
Tent/camping	264	78.11%	$20	$5,280
Trailer/RV	15	4.44%	$150	$2,250
Zero Cost	16	4.73%	$0	$0
Totals	338		average	$31.86

Food: To minimize interview invasiveness, the Federal Meal Reimbursement Rate was used as a surrogate for daily food costs. GSA 2025 reimbursement rate for Maine is listed as $67/night. https://www.gsa.gov/travel/plan-book/per-diem-rates/per-diem-rates-results?action=perdiems_report&fiscal_year=2025&state=ME&city=&zip=. Seventy-nine percent of interviewed anglers spent the night on the river. So, $52.95/angler-day was added to the variable costs for that portion of the anglers that stayed overnight ($67*0.79). This number does not account for angler's potables that would not have been covered by this Reimbursement Rate.

Guides: Guiding Service costs for 2025 were determined by visiting the websites of 10 guides who list the West Branch as a location they guide at. Average costs were for All-Day Drift Boat/Raft Trip: $550; All-Day Wet Wading Trip $425; Evening Drift Boat/Raft Trip $325. It is assumed that an average 15% tip was usually given to the guide at the end of excursion. Boat trip valuation=222trips * $550/trip = $122,100 + Tips$18,300. The valuation of shore-based guiding = 196 trips * $425 = $83,300+ Tips $12,500. The total cost of shore and boat-based guides services was $236,200. To simplify calculations, this expense was averaged among all anglers, it adds $80.60 to the angler's daily variable cost.

The travel costs are a combination of airfare costs, vehicle rental costs, cost of gas, vehicle depreciation due to mileage and the cost of time lost to get to the river. A total of 348 interviews were usable to develop an estimate of the median/angler-day cost of traveling to fish the river. Google Maps was used to obtain the distance to the river for each interviewed angler (miles) and travel time (hours). Since 95% of all travel had to pass through Millinocket to get to the river, Millinocket was used as the destination for the Google measurements. The last 20 miles from Millinocket to the river and the ½ hour to drive out to the river, were added to the Google trip measurements. The distribution of travel distance (Figure 4) ranged from 2 miles to 1,600 miles. There was one transcontinental trip by plane that was far less expensive than driving. The Federal reimbursement rate of $0.70/miles was used to estimate each angler's vehicle expense. https://www.gsa.gov/travel/plan-a-trip/transportation-airfare-rates-pov-rates-etc/privately-owned-vehicle-pov-mileage-reimbursement). The cost of travel time was estimated by multiplying the hours of travel by the per capita income for the town of origin (https://censusreporter.org). To obtain the estimated travel cost, the travel-time cost plus the vehicle costs were added and then doubled to account for travel to and from the river. Overnight stays needed during the trip to the river were not accounted for in this estimate. The median distance traveled was 174 miles, the median expense of travel to the river was $97.97/angler-day. Based on the frequency of stay reported the average visit lasted 3 days. The median value is used to avoid any upward bias caused by the ten trips over 1,000 miles.

The **total variable cost is estimated at $263.38 per angler-day** of fishing for all anglers on the W.B. Penobscot River.

3. Total Angler Costs

The cost of fishing at the W.B. Penobscot River **is $284.25/angler-day**. The combined cost of Variable ($**263.38** /**angler-day)** and Fixed cost (**$20.87/angler-day)**. The available information for comparison is the USFWS National Survey for Maine (2012) which had an average angler per day(trip) expenditure of $55. Adjusting for inflation to 2024 dollars= $77. Expenditures (costs) at the W.B. Penobscot River are far higher. This is indicative of a highly valued resource.

4. Net economic impact of W.B. Fishery

The net economic impact of angler activity is the total fishing costs ($284.25) expanded by the total number of angler-days (4,396, Table A1) and multiplied by a commonly used conservative expansion value of 1.5=$1,874,344.50. The economic multiplier was comparable to values from Poudel et al.'s 2018 study of southern fisheries. The Net Economic Impact of guiding activity is estimated at $354,300 and that is already included in the total. **The Net Economic Impact of the W. B. Penobscot River fishery between Ripogenus Dam and Abol Bridge is estimated at $1,874,344 for 2025** (2025 dollars)**.** Allowing for a 2% annual inflation rate and a 50-year license duration. **The cumulative Net Economic Impact of the W. B. Branch Fishery during the life of the Ripogenus Project license is estimated to be $163,575,899** under current fish population conditions and assuming consistent angler participation.

As angler-days have declined from the levels reported in the GHLA 1996 report, there has been a proportional decrease in net economic value for the region. Using the median of the GHLA data, the decline in usage has been estimated at approximately 2,500 angler-days. This indicates a decline in net economic impact of over $1,000,000 per year.

5. Consumer surplus: Distance Travel Model

The consumer surplus is what fishing at the W.B. Penobscot is valued by anglers above what they currently pay (Hunt and Grado, 2010). This can be estimated from an angler's willingness to travel to the resource to fish (Figure 8).

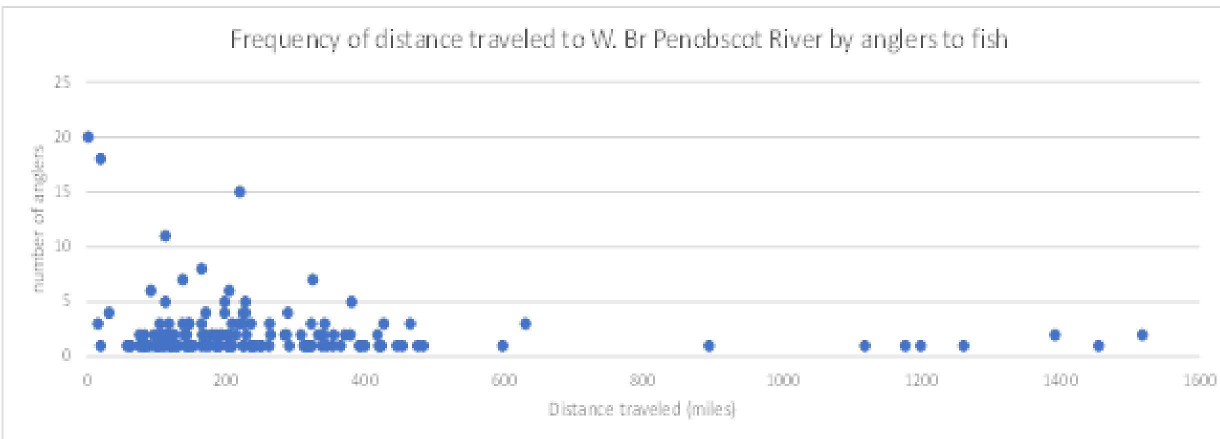

Figure 8. Frequency of angler's travel to W. Br. Penobscot River (miles)

This Distance Travel Model analysis follows the procedures outlined at https://ecosystemvaluation.org/travel_costs.html, developed by King, D.M. M. J. Mazzotta and K.J Markowitz. As part of the Distance Travel Analysis, anglers were binned into distance zones. Table 11 provides a narrative description for the zones, while Figure 9 presents a depiction of the zones. These were selected based on angler behavior and on natural breaks in the distance traveled-frequency distribution. The ARCGIS zones are radial distances (as the crow flies), not the distance traveled. As can be seen in Figure 9, anglers are primarily clustered along the major Interstate access corridor of I-95. There was the potential for a sixth zone that would have included the 16 Out-of-State anglers from beyond the Mid-Atlantic, but to simplify calculations they were averaged in with the Southern New England and Mid-Atlantic anglers. They represent about 10% of the anglers used for the study and were the individuals with the great investment in participating in the fishery. This may have resulted in a slightly lower consumer surplus estimate.

The power function best described the relationship between costs (TTC) and number of trips (V), Figure 10.

Power function best describes relationship between TTC and V

Eq. 1 $$y=1E+07x^{-3.121} \qquad R2=0.9997$$

The proportion of the population in each zone that made a trip to the river was calculated Table 12. The relationship (Eq. 1) was used to calculate the impact of increased costs on angler participation (Table 13). These values were used to generate the Demand Curve for the Fishery, Figure 11. The area under the curve represents the Consumer Surplus value of the fishery. The Consumer Surplus value was estimated at $66.24 per angler-day. The total consumer surplus for the W. Branch Penobscot River Fishery was estimated for angler usage of 4,643 angler-days/year (2025) * daily consumer surplus of $66.24/angler-day = $307,413/year. **Over the 50-year life of the hydropower license, the cumulative consumer surplus, with an annual 2% inflation rate adjustment, is $25,094,776**.

Table11. Distance Travel Zones: Designation and reasons for break points.

Zone	Distance (miles)	Descriptions	Reason for distance break
0	0-20	resident and casual anglers	90%+ no overnight stays, and includes anglers who designated their trip as primarily for reasons other than fishing
1	20-70	Nearer resident anglers	Mix of day trips, and overnight stays. 95% of all day trip anglers are within zone 0 & 1. First major distance cluster Peaked around Bangor.
2	70-140	Far resident anglers	Almost all overnight stays, the second major distance cluster- includes greater Portland Area.
3	140-210	Very far resident and near Out-of-State anglers	All overnight stays- third major distance cluster break just north of Boston.
4	Over 210	Out-of-State	All overnight stays and plane flights. This includes Greater Boston and all the southern-New England anglers.

Similarly to the net economic impact effect, the decline in angler-days indicated the loss of at least $165,000/year of consumer surplus value, the 2,500 angler-day decline * $66.24/day.

Table 12. Travel cost by Zone, population in zone, angler trips per 1000 of population in zone.

travel distance miles		Population by zone/1000	interview count	% of trips by zone	est trips by zone	Avg Travel Cost TTC	V= (trips/1000)
0-30	Zone 0	7.24	45	0.12969	189.99	$50.10	26.259
30-99	Zone 1	233.40	65	0.18732	274.42	$161.00	1.1758
100-185	Zone 2	661.62	95	0.27378	401.08	$303.83	0.6062
185-285	Zone 3	1,192.21	68	0.19597	287.09	$437.41	0.2408
>285 miles	Zone 4	330,523.97	74	0.21326	312.42	$1,005.82	0.00095

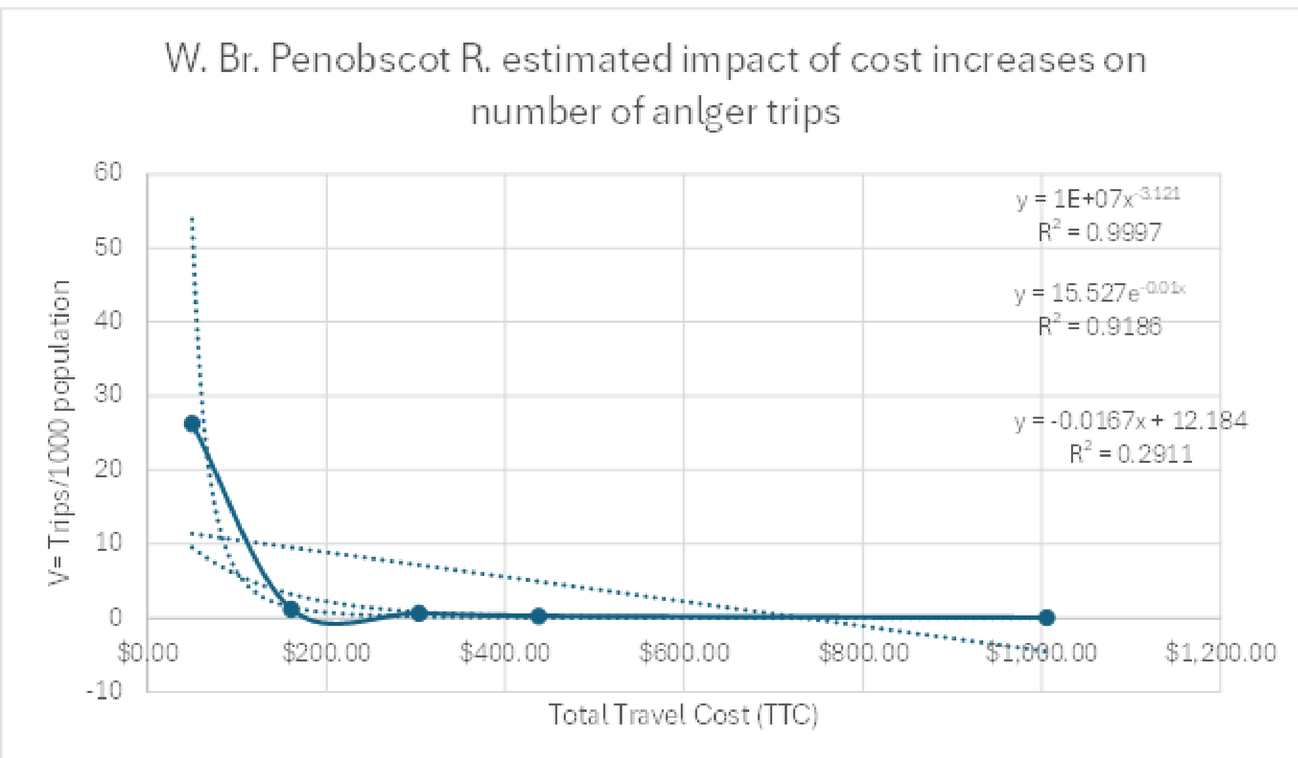

Figure 10. Three functions that describe the relationship between number of angler trips and increasing Total Travel Costs

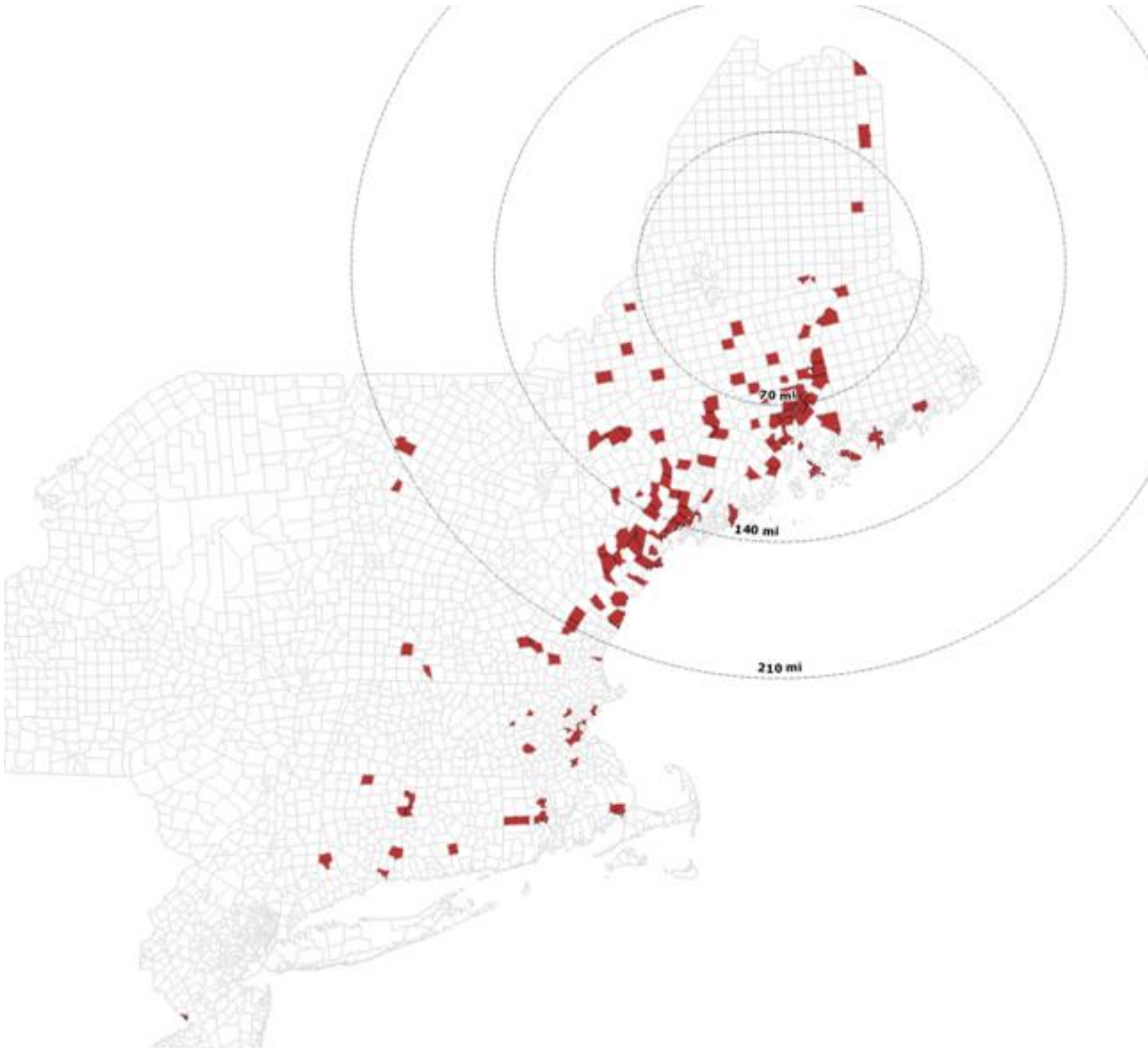

Figure 9. Towns of interviewed anglers and the four distance zones used for distance travel. (70 miles as crow flies is approximately 90 miles by road).

Table. 13. Projected impact of increasing costs on angler participation using Eq 1. Used to generate demand curve.

Increasing Entry Fee ($)	Total visits
0	1,465
10	210
30	168
50	145
100	120
200	87
500	42
750	25
1000	17

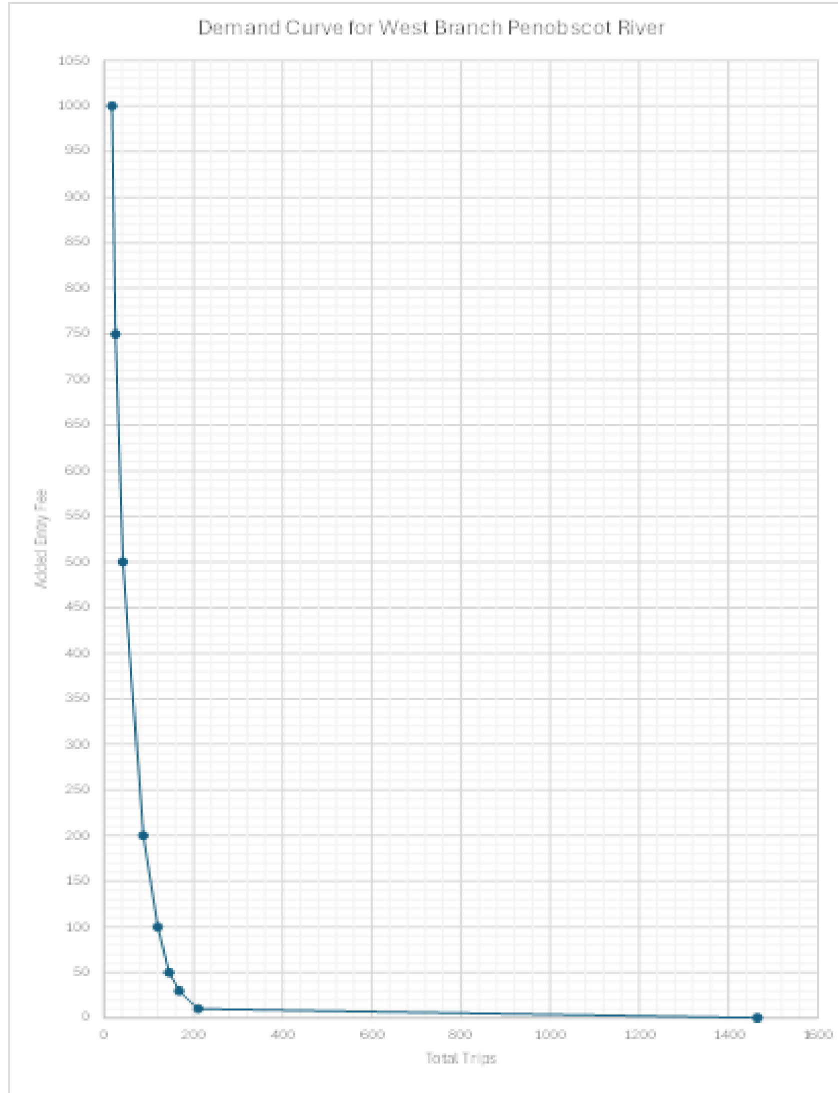

Figure. 11 Demand curve for W.B Penobscot Fishery

C. Atlantic Salmon Growth

Growth of Atlantic salmon in the fishery was evaluated by two collections of salmon scales done early in summer and in the early fall. Twenty-nine Atlantic salmon scale samples were collected by angling during late June 2025. The Atlantic salmon ranged from 16-44 cm total length (TL) Figure 12. Twenty-three Atlantic salmon scale samples were collected by angling during late Aug.-September 2025. The Atlantic salmon ranged from 15cm to 45cm in total length. All fish sampled were below legal harvest size.

The results of the scale reading, provided by Maine DIFW, indicated a complex population that probably has multiple spawning locations that contribute juveniles to the riverine population at several different ages (age0-age3 fish). Some fish spawn in the main river and their young grow in the river their entire life. Some salmon spawn in tributaries and their young move right out to the river, other fish will move down into the main river at later ages, with age2 and age3 being identifiable from their scale growth. There is also the Holbrook spawning channel that was created a short distance upstream of Telos Bridge to help provide consistent juvenile salmon reproduction. There is also the possibility of fish of many ages being contributed from adjacent lake populations. The salmon do not reach a harvestable size until they are at least 6 years old.

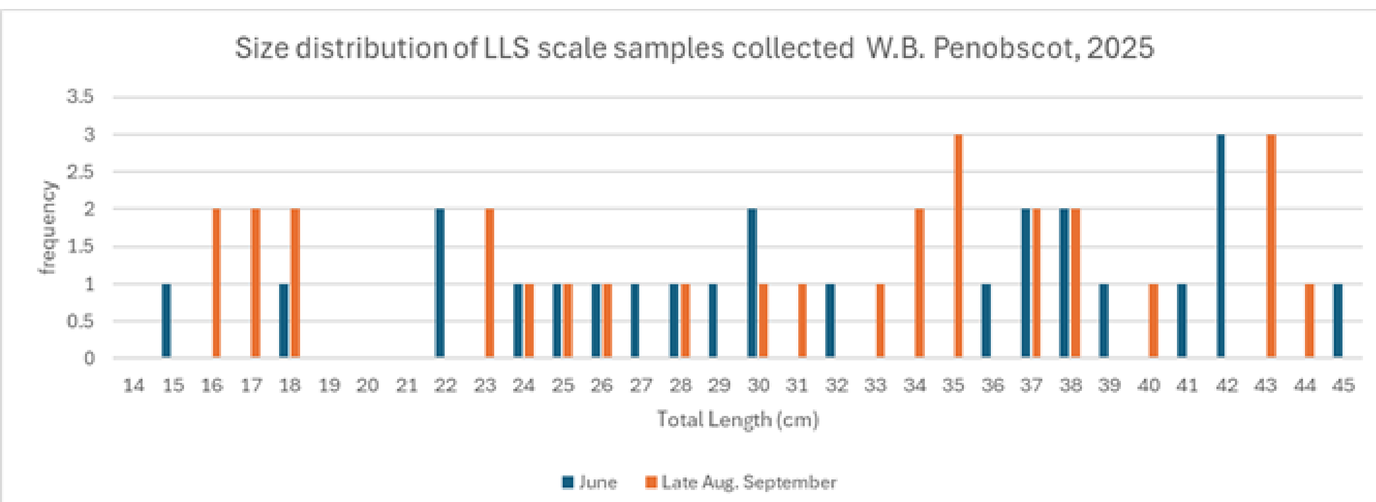

Figure 12. Size range of LLS scale samples collected during 2025 at the W. B. Penobscot River.

The growth of the Atlantic salmon varied considerably between individuals, year classes and years. Specific age and cohort data are presented in Appendix L. The data show no consistent patterns of increase or decrease during the time period covered by these samples. Data from prior Atlantic salmon scale samples (2022) were provided by MDIFW. Box and Whisker graphs of Age1 fish (Figure 13) show no significant year effect trends for this recent time period. These fish come from a variety of sources both in the main river and from tributary streams. Similarly, a Box and

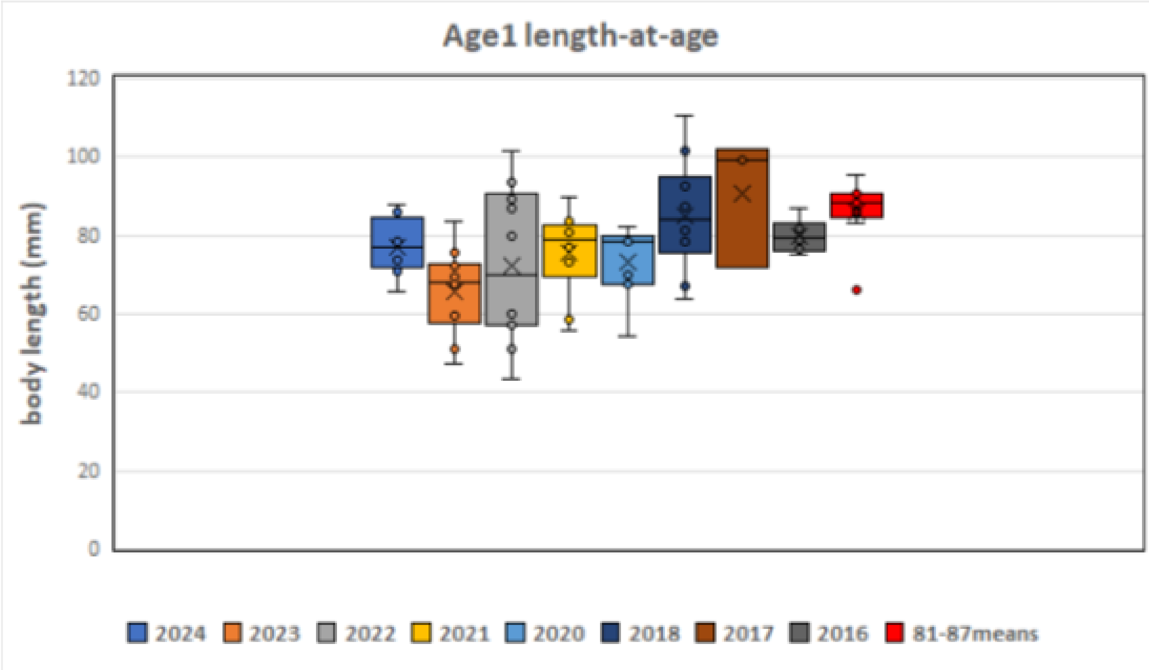

Figure 13. Length-at-age1 for Atlantic salmon caught in the West Branch Penobscot River. Average of means of Length-at-age1 data from pre-FERC licensing studies included for comparison.

Whisker Graph of Age3 salmon (Figure 14) shows length at age overlaps for all year classes except 2021. The 2021-year class was a single fish so no inference can be drawn from that data. This trend continues with no significant difference of length-at-age for Age4 salmon (Figure 15) for recent data. When the current data is compared to the means of length-at-age data from 1981-1987 (GNNC, 1991 Vol IX, pgs. 172-177, Figure 16Alt), the current means of length-at-age (2016-2024) for all age groups are consistently less than the range of historical means (1981-1987) for Age3 and Age4, and overlapped for only one year (2017) for Age1 fish. This indicates a consistent reduction of growth across older age classes compared to conditions prior to the granting of the current license. The data suggests that the average reduction in length for Age3 and age4 salmon is approximately 1.5-2inches.

Comparison of length-at-collection by age class gives an estimation of over-summer growth for resident landlocked Atlantic salmon in the West Branch Penobscot River. Unfortunately, there are no comparable historical data available to determine trends. Other data were single sample events for back calculated length-at-age. Length-at-age data capture the cumulative effects on growth for the entire year. The data does show that at Age3 the salmon had the largest increase in over summer growth, as change in length. This may be the point in their life where the salmon are large enough to begin feeding on the late spring smelt drift. Growth, as length, in Age4+ fish are expected to be smaller as more growth proportionally goes into weight than into length as the fish grow larger. Also, the salmon reach sex maturity at about age4, so significant energy goes into reproductive products rather than body growth.

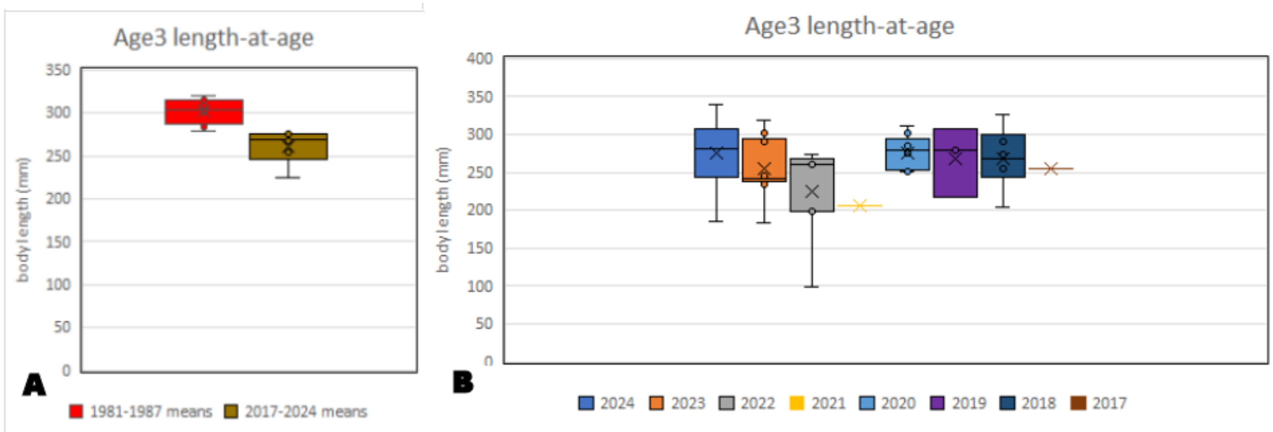

Figure 14. A) Comparison of mean annual length-at-age3 from recent studies and from pre-1990 FERC Licensing studies B) Length-at-age3 for Atlantic salmon caught in the West Branch Penobscot River between 2022-2025.

Table 14. Over-summer growth (mm) for Atlantic Salmon in the West Branch Penobscot 2025

Mean change in size (mm)				
Age1	Age2	Age3	Age4	Age5
25	18	54	22	18

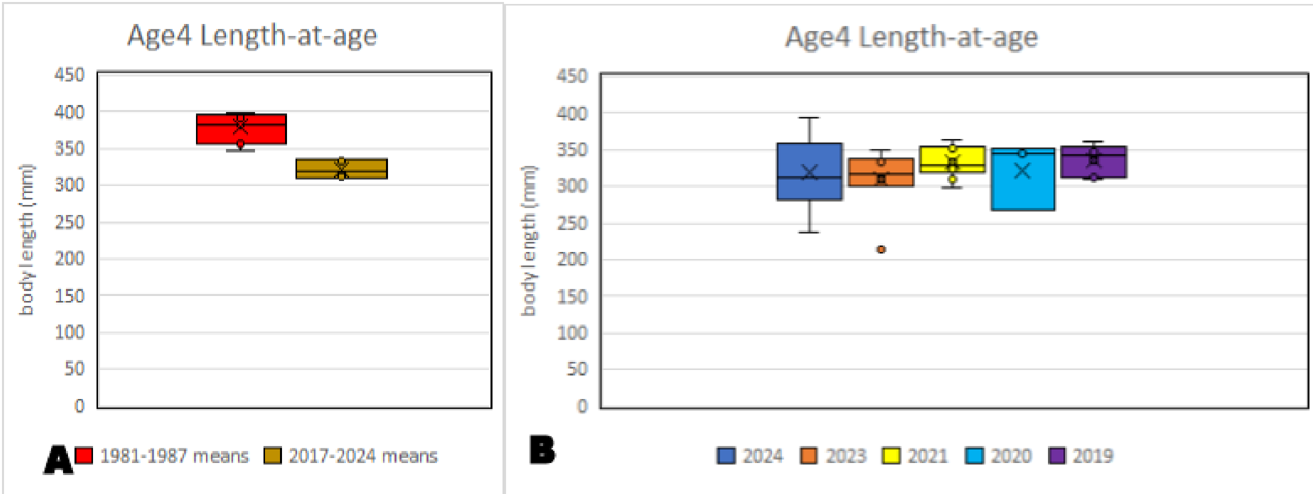

Figure 15. A) Comparison of mean annual length-at-age4 from recent studies and from pre-1990 FERC Licensing studies. B) Length-at-age4 for Atlantic salmon caught in the West Branch Penobscot River between 2022-2025.

D. Environmental Covariates

1. Water temperatures

Water temperatures were continuously monitored at three locations within the study area to look for the effects of water temperatures on angler participation or fishing success. The locations of the Hobo tidbit loggers were in the upper end of the Ripogenus Gorge, downstream of McKay station, and a short distance upstream of Nesowadnehunk Deadwater (Figure 16). While all zones had similar general patterns, there were critical differences between zones (Appendix M, Figure A-3

Figure16 Placement of Tidbit water temperature loggers 2025

Historical data (1991 EIS) indicates May through November water temperatures in the Gorge ranged from 7-18°C. The data was collected over three years (1986-1988). Summer 2025 data (Figure 17) indicates that drawing water, for the Gorge's 100 CFS release, from a surface-water source resulted in as much as 9°C warmer water temperatures this year than were found during the earlier studies. After July 1, Gorge water temperatures can be seen to be consistently higher than releases at McKay Station. As shown in Figure 6, Atlantic salmon catch drops off at temperatures above 22° C. The result is that the top water releases during the summer negatively impact the Atlantic salmon fishing in the Gorge for most of the summer. See discussion in section 2.

In contrast, water temperatures were consistently cooler between McKay Station and the top of Nesowadnehunk Deadwater (Appendix N, Figure A-4). The cooling effects had a diurnal pattern that matches daily changes in flows (Appendix P, Figure A-5, observed, not quantified). There is often enough groundwater or cooler tributary inflow to drop the river's temperature by up to 1°C when flows drop to the lower daily release level during late summer.

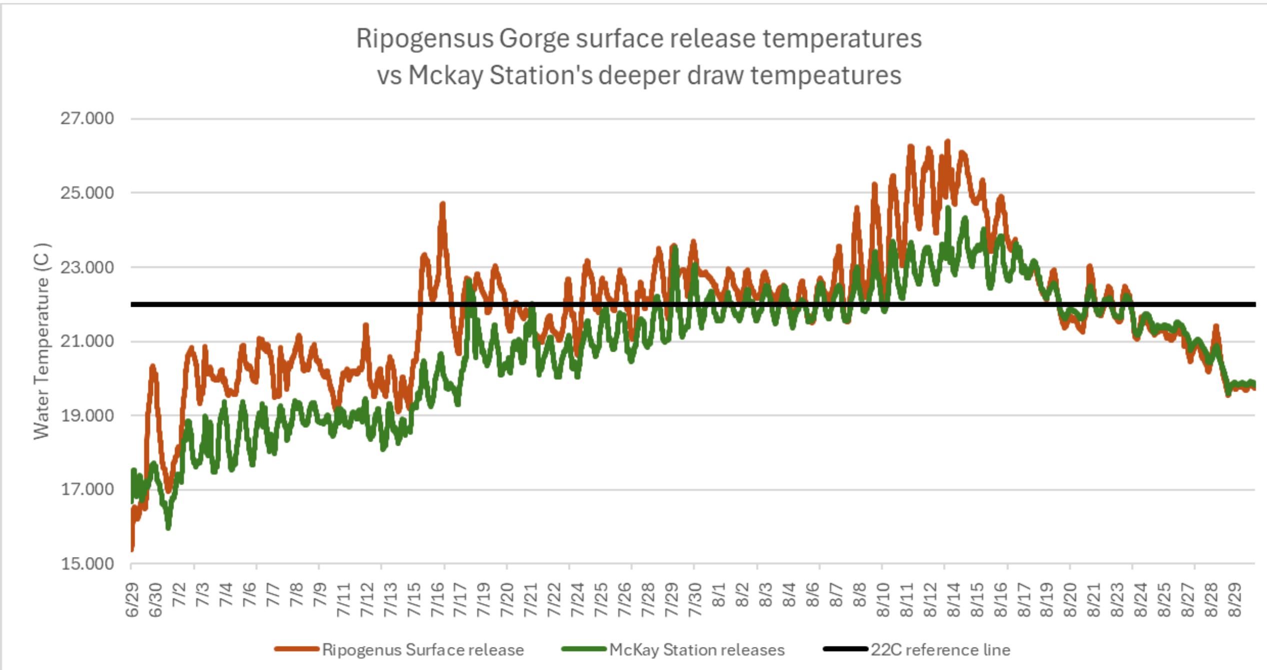

Figure 17. Water Temperatures (C) within the Ripogenus Gorge during Summer 2025.

2. Limitation to fishery and populations

When the water temperatures in the Ripogenus Gorge are compared to the McKay station discharge (Figure 18), water temperatures in the Gorge can be seen to rise by about 1° C as soon as the Surface water release is added (A). It also resulted in temperature spikes that were as much as 4.5° C (B) warmer than the McKay station discharge. There was a protracted period of warmer weather in mid-August (C) that coincided with the highest water temperatures seen in the Gorge. Starting in mid-August the surface discharge in the Gorge and the McKay discharge stop showing much difference (D) indicating that the Epilimion/Metalimion in Chesuncook Lake had reached a uniform temperature at both depths. Luckily, this occurred as daylength were shortening and water temperatures started to decline going toward the fall. These temperature differences all have negative impacts on the Gorge's fish and fisheries.

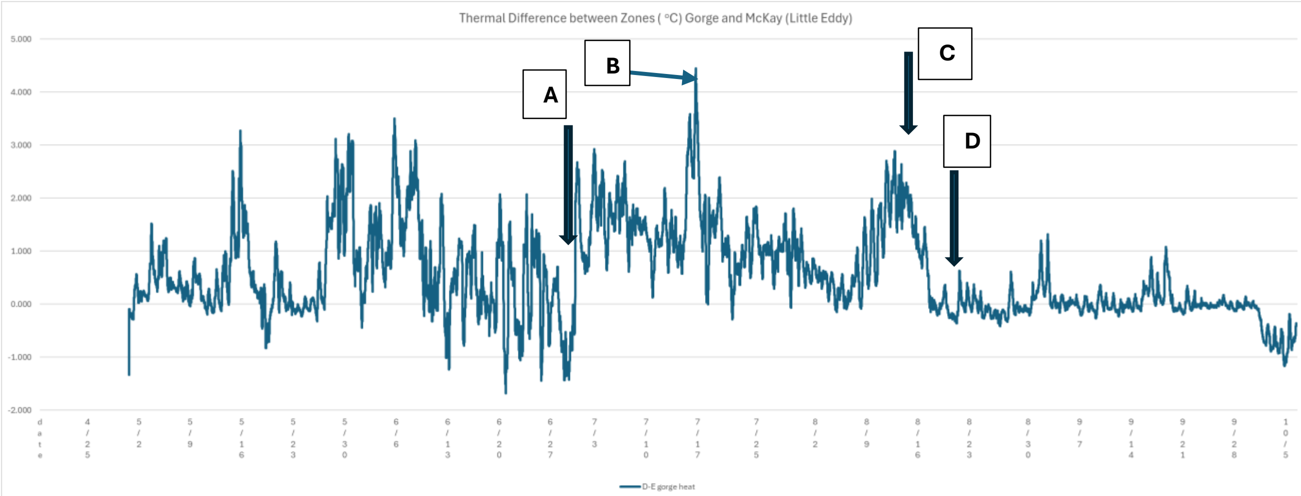

Figure 18. Difference in temperatures between the Gorge and McKay station discharge.

3. Flows

a) Impact of flow levels on Guide Activity, upper and lower bounds of guided boat trips

The relationship between hydropower operations and guided angling activity on the West Branch Penobscot River was evaluated by comparing observed guided boat use with discharge, temperature, and river condition data collected during the 2025 survey. Flow and temperature measurements were recorded during each survey, with discharge values obtained directly from the McKay Station display and temperature information supplemented by continuous loggers deployed throughout the reach. These results are presented earlier in the document and are summarized visually in Figure 15, which highlights thermal responses to different operational regimes (Indicators A–D). This figure is central because temperature and flow conditions interact to define the operational window within which guided boat trips are feasible.

Guide activity represents a significant portion of total boating use on the river. Based on survey encounters, 17% of interviewed boat anglers were on guided trips, producing an initial estimate of 222 guided boat-days (as derived from the expanded boat-effort estimate of 1,306 boat-days; see discussion on pages 13–14). Although this value is presented as a minimum estimate, it provides a baseline for evaluating flow-dependent availability of guided angling opportunities. Broader angler distribution patterns that influence guided activity are summarized in Table A1, which documents angler-hours, angler-days, and effort density (angler-hours per mile) by zone. Guided trips are concentrated primarily in Zones 3 and 5, with angler densities (2,474 and 819 angler-hours/mile, respectively) and catch expectations align with common guiding strategies. Table A2 further differentiates effort by angler type and supports the observation that boat-based angling—where guiding is most common—accounts for roughly 30% of total angler-hours.

Flow-dependent constraints on guide activity are evident when discharge conditions are compared with both angler-use data and the thermal patterns shown in Figure 6. Under moderate, stable flows typical of single-turbine operation at McKay Station, guides are able to anchor safely, maintain boat control, and access established fishing locations. These conditions represent the upper bound of feasible guided activity. During such periods, guided trips can be conducted reliably throughout the day, particularly in downstream reaches where flow attenuation provides more predictable conditions.

In contrast, high-flow periods occurring under dual-turbine operation produce rapid stage increases that limit the ability of guides to anchor or to safely fish mid-channel holding water. These short-duration but large-magnitude fluctuations—often visible in the temperature and flow transitions labeled A and B in Figure 18—represent the upper operational bound for guided trips. Elevated temperatures resulting from the introduction of surface-draw water into the Ripogenus Gorge during these same periods further restrict viable fishing windows. As shown in Figure 18, temperature spikes of up to 4.5°C above McKay discharge were observed during extended warm conditions in mid-August (Indicator C). These elevated temperatures directly reduce Atlantic salmon catch rates and thereby diminish the effectiveness and marketability of guided trips. By late August (Indicator D), stratification in Chesuncook Lake had diminished, reducing the differential between surface and deep-water discharge; however, this occurred only after the warmest portion of the angling season had passed.

Collectively, the flow and temperature patterns documented in Figure 18, paired with spatial effort distribution from Tables A1 and A2, demonstrate that hydropower operations impose real constraints on the quantity and timing of guided boat trips. These effects are operationally predictable: moderate, stable flows expand guiding opportunities, while high-flow events and surface-draw thermal inputs reduce them. Given the economic and recreational importance of guided angling—quantified elsewhere in the report—these findings are directly relevant to hydropower licensing deliberations. Operational modifications that reduce rapid stage changes, limit warm-water pulses, or provide consistent minimum flows during peak-use periods could increase the availability and quality of guided angling opportunities and reduce project-related impacts to recreational access.

4. Flow pattern impacts on biota

It is apparent from the Stranding and Ramping Studies that rapid flow changes (1000cfs+ in under an hour) that typically occur within the project have caused documented mortality of LLS and brook trout (Stranding and ramping studies). The cumulative impacts of these population limiting events could be substantial and affect not just fish, but all aquatic organisms that support the fishery. Figure 19 suggests that large, rapid flow changes regularly occur on the river. Unfortunately, the scale of figures does not make it possible to evaluate this range and severity of the hourly flow changes. Access to this data or the requirement of a more detailed presentation and assessment of the cumulative frequency of the magnitude of flow changes would inform this issue. During the angler survey 1000cfs changes were an almost daily occurrence. A rough estimate would be that during the course of the summer, hourly flow changes, of over 1,000cfs, occurred twice daily, for over 180 potential fish stranding events. There are alternative operational strategies (ramping) that can minimize the potential impacts of flow changes and protect the fish and aquatic insects.

Excerpt from Appendix A Historic Operations Data Assessment Report:

> *"Required minimum flows ranging from 1,000 to 1,422 cfs for the protection of fisheries and aquatic habitat downstream of McKay station during the days and times of the year outside of the minimum whitewater boating flows."*

Fish population and all aquatic organisms are subject to repeat population limiting events over an eleven-year period based on the hourly flow data presented by GHLA for the period of 2011-2022. While the required minimum flow is 1000 cfs to protect fisheries and aquatic habitat, operational protocols allow the flow to be as low as 400 cfs for 72 hours for maintenance and emergency situations. Figure 19 is GHLA's reported hourly flow data from Appendix A Historic Operations Data Assessment Report, page A-33. As can be seen in Figure 19 (GHLA Figure 13, report page A-34), the red box documents repeated periodic flows that go below the 400 cfs outage flow and often functionally go to zero flow over the eleven-year period GHLA documented. Since these flows are calculated from power generation, at times of no power generation, a zero flow was reported. It is assumed that the generators were allowed to spin to create some flow, but for those times when there was power generation and flows were below 400 cfs, then there were license violations and that should never have occurred. This could be avoided with compensating releases into the gorge. Other automated systems have been mentioned at Stakeholder meetings to eliminate this problem. To accurately document river conditions, real time flow monitoring is needed, preferably by a third party like USGS.

If the 1,000cfs minimum flow for fisheries is considered as the point of license violation then Figure 20 (GHLA Figure 14) shows the consistent occurrence of minimum flow violations affecting the resident fish and aquatics populations. During the 2025 survey we observed one of these outage events. While the reported low flow was initially set at 300+cfs, the report eventually listed 250 as the average flow (as it was rising post generator shutdown) so the instantaneous flow as some point during that event must have been well below 100 cfs. Given this pattern of flow management, it is not surprising that there has been a decline in the river's fisheries. These zero or near zero flow events are likely population limiting events. Again, there are alternative operation procedures that can be instituted to prevent this level of impact.

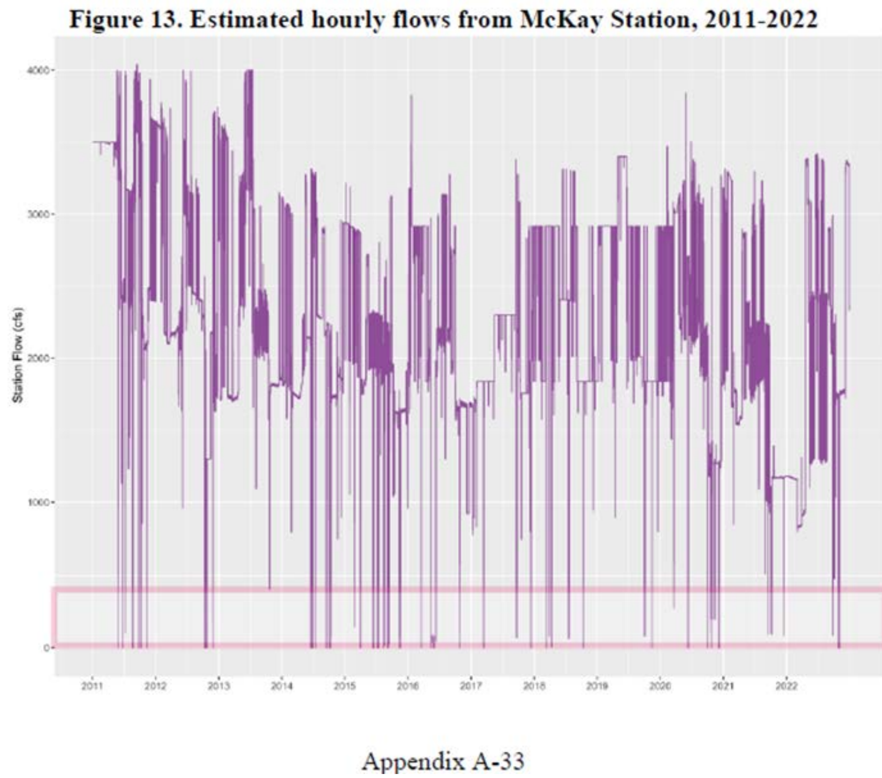

Figure 19. Excerpted Figure 13 from GHLA Appendix A. Pink box is 400CFS flow that turbine spin should provide in emergency generator shut down situations.

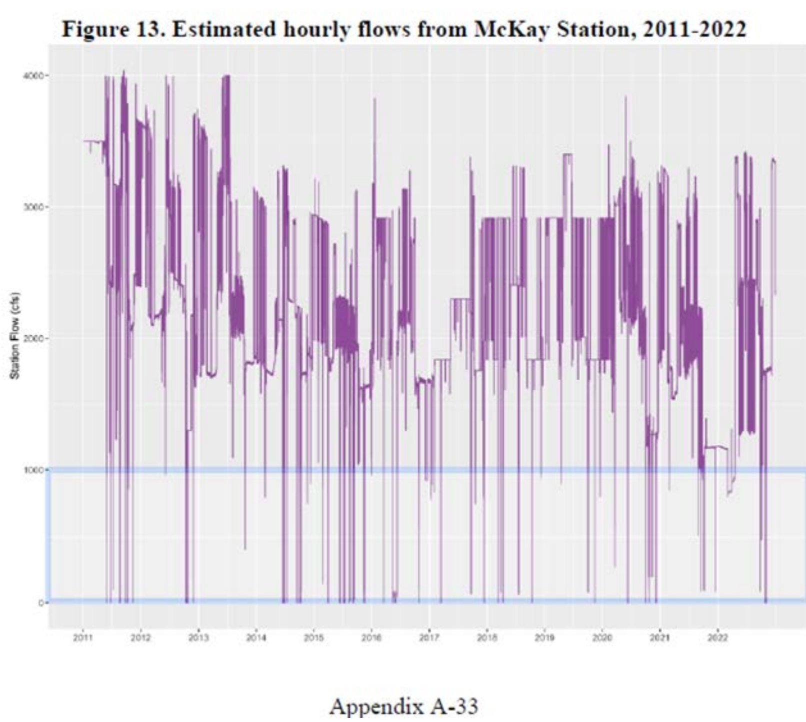

Figure 20. Excerpted Figure 13 from GHLA Appendix A. Blue Box is 1000CFS flow that GHLA should provide for fisheries and aquatic habitat protection.

An additional consideration is the rate at which flows changed. Abrupt flow changes can adversely affect fishing. During early summer mornings, we observed overnight flow changes from 2,000 cfs to 3,100+cfs in a matter of minutes. These rapid flow changes affected angling participation and success. Anglers stopped fishing, indicating that the fish were not catchable until flows “settled out”, which could take several hours. We observed vertical water elevation changes of 9-10 inches in under 10 minutes. There is extensive literature on the impact of rapid flow changes on salmonids and invertebrate populations (e.g. Bradford 1998, Smokoroski et al 2011, McMichael et al 2005, Marty et al 2008, and Schulting 2019). This includes food web destruction, reproduction loss due to scouring, as well as fish stranding mortalities.

Two best management practices were commonly mentioned as mitigation measures. The first is limiting vertical flow changes to a maximum of one-inch rise per hour. The other procedural practice is to limit flows to no more than a 25% change per hour. The second procedure would be more consistent with current company objectives of peaking flows to maximizing generation during short term high compensation times.

Another consideration is the transition of the hydropower generation industry to incorporate battery storage (Anindito et al 2019). Use of battery storage would allow consistent stable flows that are best for aquatic communities and still allow hydro-power facility to profit from high value short term power demands. If GHLA moves to create battery storage capacity associated with the Ripogenus facility, any flow impacts may be resolved because peaking flows would no longer be needed for power generation purposes to maximize profits.

Operational adjustments that should be considered include minimizing surface-draw releases during warm periods, providing more flows to the gorge, year-round, ramping flows to prevent abrupt flow changes, and providing more stable minimum flows. All these actions could help maintain or improve cold-water habitat conditions.

VI. Summary

The 2025 angler survey and economic assessment of the West Branch Penobscot River documents a productive and economically important cold-water fishery directly influenced by hydropower operations at Ripogenus Dam and McKay Station. Landlocked Atlantic salmon remained the primary species targeted and caught, with brook trout contributing substantially to the fishery, particularly in select zones. Angler participation was concentrated in Zones 2, 3, and 5, with peak use occurring from mid-May through early July during the smelt drift period and holiday weekends. Anglers did not use Zone 1 during the first three months of the fishing season because they knew there was no flow added to the Gorge. Total angler effort was estimated at 15,169 angler-hours (4,396 angler-days), with 55% of anglers coming from out of state and the average angler trip lasting three days.

Catch rates in 2025 were high compared to historical values. The river-wide CPUE for Atlantic salmon (0.884 fish/hour) more than doubled the 1996 GNP estimate and exceeded the state's management objective for salmon CPUE. Harvest was minimal: approximately 7% of salmon caught met the legal-size threshold, and the observed harvest rate (0.23%) indicates that the fishery currently functions as a de facto catch-and-release system. Brook trout were also rarely harvested. These patterns reflect both angler preferences and the limited abundance of larger legal-size salmon relative to 1990s baselines.

Environmental monitoring demonstrated that water temperature and flow variability influence catch and may affect salmon distribution and condition. Atlantic salmon catch rates declined sharply at temperatures above 20°C. Surface-draw releases into the Ripogenus Gorge resulted in temperature increases of up to 4.5°C compared to McKay discharge, indicating a potential operational concern during warm periods. Flow variability associated with peaking operations also affected fishing conditions, particularly for shore-based anglers and guided boat operations in key reaches.

The economic evaluation indicates that anglers spent an estimated $284.25/day, with variable costs (lodging, food, travel, and guiding services) comprising the majority of expenditures. The total net economic impact of the fishery in 2025 was estimated at $1,874,344. A distance-travel consumer surplus model indicated that anglers value the fishery substantially above their direct expenditures, producing an estimated annual non-market value of $307,000. Over the 50-year hydropower license period, the combined market and non-market economic value of the fishery equals $163,575,899 (2025 dollars; 2% inflation).

VII. Conclusions

The results of the 2025 survey indicate that the West Branch Penobscot River continues to support a high-quality, economically significant salmonid fishery. High catch rates, strong angler participation from within and outside Maine, and the concentration of effort at signature locations such as Big Eddy and Nesowadnehunk Falls underscore the importance of this resource to both anglers and the regional economy. At the same time, several indicators suggest that the fishery is vulnerable to environmental and operational stressors associated with hydropower operations.

The reduced proportion of larger legal-size salmon compared to the 1990s, along with a long-term decline in overall angler effort relative to historic estimates, suggests potential limitations in salmon growth, survival, or recruitment that warrant further attention. Warm-water events observed in the Ripogenus Gorge, driven by surface-layer releases, present an operational concern given their demonstrated effects on salmon catch rates and the species' known thermal sensitivity. Flow variability from peaking operations continues to shape fishing conditions and may influence angler access and success, particularly for shore-based anglers and guided fishing operations in high-use reaches.

The upcoming hydropower licensing process presents an important opportunity to address these issues. Operational adjustments—such as minimizing surface-draw releases during warm periods, providing additional flows to the gorge, possibly year-round, moderating rapid flow fluctuations, and providing more stable minimum flows—could help maintain or improve cold-water habitat conditions. This would support both fish populations and aquatic insect production, while providing improved angler use opportunities and protecting the long-term economic value of the fishery. Additionally, improvements to angler access, parking, roadside safety, and site signage in Zones 3–5 would enhance user experience and better distribute effort across the reach during peak-use periods.

Overall, the 2025 survey indicates that the West Branch Penobscot River remains a high-value recreational fishery with substantial ecological, cultural, and economic importance whose continued success depends on proactive, science-based management of hydropower operations. Continued monitoring and adaptive management—particularly regarding water temperature, flow variability, and access—will be essential to ensuring the long-term sustainability of this resource.

VIII. Acknowledgement

Funding for the study was provided by American Rivers, Northeast Region and Trout Unlimited, Northeast Region. We would like to thank MDIFW for permitting us to conduct this study and authorizing scale collections. MDIFW biologist Tim Obrey and Zac Glidden provided invaluable insight and data for constructing the survey instrument. Zac Glidden also assisted by analyzing scale samples. We would like to thank Kent Raymond and Ed Spear for their assistance with collecting angler surveys and scale samples. We would also like to thank several other skilled anglers and guides for their assistance in obtaining scale samples: Todd Mercer, Scott Story, and Zac Bradgon.

Data deposition: copies of all databases and analysis files will be provided to MDIFW.

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X. Appendices

A. **Table A1.** Angler effort (angler-hour) and estimated angler-days by section for all anglers during 2025 (Ripogenus Dam to Abol Bridge).

B. **Table A2.** Angler effort by section and type of angler during 2025.

C. **Table A3.** Angler effort by section, type of angler, and mode during 2025.

D. **Table A4.** Total catch for all species by river section for anglers during 2025.

E. **Table A5.** Total catch by species and river section during 2025.

F. **Table A6a.** Total catch for target species by river section and **mode** for fly anglers (wading/shore) during 2025.

G. **Table A6b.** Total catch for target species by river section and **mode** for fly anglers (boats) during 2025.

H. **Figure A1.** Landlocked Atlantic salmon catch by size, survey zones, months, and size group.

I. **Figure A2.** Brook trout catch by size, survey zones, months, and size group.

J. **Table A7.** Cost of equipment required for a boat trip.

K. **Table. A8.** Cost of fishing gear calculated as per-day-cost-of-use**.**

L. **Table A9**. W. Br. Penobscot River Atlantic salmon growth (mm) for each year by fish age from fish collected in 2025.

M. **Figure A-3.** Water Temperatures (°C) for three locations on the W. Br. Penobscot River Blue=above Nesowadnehunk Deadwater, Green= below McKay Station, Orange= Ripogenus Gorge.

N. **Figure A-4.** Difference in *w*ater *t*emperatures between McKay Station and Above Nesowadnehunk Deadwater, summer, 2025

O. **Table A10**. Atlantic salmon catch data used to construct Figure 6.

P. **Figure A-5**. Close up view of the diurnal cycle of water temperature difference between McKay Station and Above Nesowadnehunk Deadwater

Q. **Sample individual interview form**

R. **Sample angler effort count form**

Appendix A

Table A1. Angler Effort (angler-hour) and estimated angler-days by section for all anglers during 2025 for the West Branch Penobscot River, Maine between Ripogenus Dam and Abol Bridge. Average angler trip length was estimated at 3.45 hours/fishing day. The Median trip duration was 3-days/trip.

River Sections	Zone 1- above McKay Station through Ripogenus Gorge	Zone 2-From McKay Station to Telos Road	Zone 3-Telos Road to Big Ambejackmockamus Falls	Zone 4- Big A Falls to Nesowadnehunk Falls	Zone 5- Nesowadnehunk Falls to Abol Bridge	Entire River section
Mean Anglers/ hour	0.20	1.48	2.90	0.47	1.24	6.31
Total Angler-hours	488	3,562	6,952	1,132	2,973	15,169
Standard Error	244	468	829	305	492	1,165
Degree Freedom	19	31	33	36	31	48
RSE	49.9%	13.1%	11.9%	26.9%	16.5%	7.7%
Angler-hours/mile	668	3,152	2,474	316	819	1,277
Angler-Days of Effort	141	1,032	2,015	328	861	4,396
Total Fishing Trips	47	344	672	109	287	1,465*

A single bait angler was encountered in late summer who was a young juvenile fishing with a parent. The parents were unaware of the regulations.

Appendix B

Table A2. Angler Effort by section and type of angler during 2025 for the West Branch Penobscot River, Maine between Ripogenus Dam and Abol Bridge.

River Section	**Zone 1-** above McKay Station through Ripogenus Gorge	**Zone 2**-From McKay Station to Telos Road	**Zone 3**-Telos Road to Big Ambejackmockamus Falls	**Zone 4**- Big A Falls to Nesowadnehunk Falls	**Zone 5**- Nesowadnehunk Falls to Abol Bridge
Fly Anglers					
Mean Anglers/ hour	0.20	1.48	2.73	0.299	0.95
Total Angler- hours	488	3,562	6,572	718	2,275
Standard Error	244	468	807	232	538
Degrees of Freedom	19	31	32	32.9	10
RSE	49.9%	13.1%	12.3%	32.4%	23.7%
Lure Anglers					
Mean Anglers/ hour	Not Legal Gear	Not Legal Gear	0.17	0.2.03	0.33
Total Angler- hours	0	0	410	488	784
Standard Error			175	175	207
Degrees of Freedom			14.5	6	37
RSE			42.8%	35.8%	26%
Grand Total of angler Effort= 13,615 angler-hours					

Appendix C

Table A3. Angler Effort by section, type of angler, and mode during 2025 for the West Branch Penobscot River, Maine between Ripogenus Dam and Abol Bridge.					
River Section	**Zone 1-** above McKay Station through Ripogenus Gorge	**Zone 2**-From McKay Station to Telos Road	**Zone 3**-Telos Road to Big Ambejackmockamus Falls	**Zone 4**- Big A Falls to Nesowadnehunk Falls	**Zone 5**- Nesowadnehunk Falls to Abol Bridge
Shore Fly Anglers					
Mean Anglers/ hour	0.20	1.391	1.42	0.177	0.8775
Total Angler-hours	488	3340	3399	425	2107
Standard Error	244	463	478	154	389
Degrees of Freedom	19	32	38	22	27
RSE	49.9%	13.8%	14%	36.5%	18.5%
Shore Lure Anglers					
Mean Anglers/ hour	Not Legal Gear	Not Legal Gear	0.17	0.136	0.33
Total Angler-hours	0	0	410	326	784
Standard Error			175	90	207
Degrees of Freedom			14	8	37
RSE			42.8%	27.7%	26%

Table A3 cont. Angler Effort by section, type of angler, and mode during 2025 for the West Branch Penobscot River, Maine between Ripogenus Dam and Abol Bridge.

River Section	**Zone 1-** above McKay Station through Ripogenus Gorge	**Zone 2**-From McKay Station to Telos Road	**Zone 3**-Telos Road to Big Ambejackmockamus Falls	**Zone 4**- Big A Falls to Nesowadnehunk Falls	**Zone 5**- Nesowadnehunk Falls to Abol Bridge
Boat- Fly Anglers	Not currently boatable				
Mean Anglers/ hour	0	0.327	1.307	0.180	0.058
Total Angler-hours	0	787	3139	433	140
Standard Error		280	584	224	67
Degrees of Freedom		5.8	15	14	18
RSE		35.6%	18.6%	81.7%	47.7
Boat Lure Anglers					
Mean Anglers/ hour	Not Legal Gear	Not Legal Gear	0.008	0.01	0
Total Angler-hours	0	0	19	125	0
Standard Error			18.9	79	0
Degrees of Freedom			11	5	NA
RSE			96.7%	63.6%	NA

Appendix D

Table A4. Total Catch for all species by river section for anglers during 2025 for the West Branch Penobscot River, Maine between Ripogenus Dam and Abol Bridge.						
River Section	**Zone 1-** above McKay Station through Ripogenus Gorge	**Zone 2**-From McKay Station to Telos Road	**Zone 3**-Telos Road to Big Ambejackmockamus Falls	**Zone 4**- Big A Falls to Nesowadnehunk Falls	**Zone 5**- Nesowadnehunk Falls to Abol Bridge	**Entire River**
Mean Catch/ hour	0.20	1.07	3.808	0.438	2.018	7.344
Total Angler-catch	482	2,581	9,144	1,054	4,847	17,632*
Standard Error	265	369	1,415	599	1,826	2,720
Degrees of Freedom	19	34	18	18	25	28
RSE	55.1%	24.8%	15.4%	56.9%	37.7%	15.4%
Grand Total Catch= 18,108 fish (added zones vs calculation of entire river catch*)						

Appendix E

Table A5. Total Catch by species, and river section during 2025 for the West Branch Penobscot River, Maine between Ripogenus Dam and Abol Bridge.

River Section	**Zone 1-** above McKay Station through Ripogenus Gorge	**Zone 2**-From McKay Station to Telos Road	**Zone 3**-Telos Road to Big Ambejackmockamus Falls	**Zone 4**- Big A Falls to Nesowadnehunk Falls	**Zone 5**- Nesowadnehunk Falls to Abol Bridge	**Entire River**
Landlocked Atlantic Salmon						
Mean Catch/ hour	0.187	0.84	3.26	0.109	1.35	5.58
Total Angler-catch	450	2,019	7,833	261	3,248	13,411
Standard Error	268	566	2,012	119	1,733	2,346
Degrees of Freedom	20	36	9	14	13	19
RSE	59.6%	28.1%	25.6%	45.8%	53.1%	17.5%
Brook Trout						
Mean Catch/ hour	0.003	0.13	0.749	0.34	0.51	1.43
Total Angler-catch	8	330	1,408	820	1,240	3,446
Standard Error	42	144	434	420	629	850
Degrees of Freedom	19	9	29.2	17	12	30
RSE	490%	43.5%	30.8%	51%	50.1%	25%

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Table A5 Continued. Total Catch by species, and river section during 2025 for the West Branch Penobscot River, Maine between Ripogenus Dam and Abol Bridge						
River Section	**Zone 1-** above McKay Station through Ripogenus Gorge	**Zone 2**-From McKay Station to Telos Road	**Zone 3**-Telos Road to Big Ambejackmockamus Falls	**Zone 4**- Big A Falls to Nesowadnehunk Falls	**Zone 5**- Nesowadnehunk Falls to Abol Bridge	**Entire River**
Fallfish						
Mean Catch/ hour	0.005	0.18	0.036	0.095	0.22	0.449
Total Angler-catch	12	437	87	227	521	1,080
Standard Error	12	259	32	176	285	377
Degrees of Freedom	14	13	31	13	23	25
RSE	96.9%	59%	36.9%	77.4%	54%	34.9%
Misc Species		Number of each species reported in survey				
		Above Nesowadnehunk Falls		Below Nesowadnehunk Falls		
Smallmouth bass		0		5		
Yellow perch		7		2		
White perch		1		0		

Appendix F

Table A6a. Total Catch for target species by river section, and mode for fly anglers during 2025 at the West Branch Penobscot River, Maine between Ripogenus Dam and Abol Bridge.

River Section	**Zone 1-** above McKay Station through Ripogenus Gorge	**Zone 2**-From McKay Station to Telos Road	**Zone 3**-Telos Road to Big Ambejackmockamus Falls	**Zone 4**- Big A Falls to Nesowadnehunk Falls	**Zone 5**- Nesowadnehunk Falls to Abol Bridge
Fly Anglers wading or on Shore					
Landlocked Atlantic Salmon					
Mean Catch/ hour	0.187	0.693	1.586	0.047	1.18
Angler- catch	450	1,664	3,809	113	2,834
Standard Error	268	464	1,854	84	1,725
Degrees of Freedom	20	46	5	3	13
RSE	59.6%	27.8	49%	74.5%	61%
Brook Trout					
Mean Catch/ hour	0.003	0.163	0.324	0.128	0.407
Angler- catch	9	393	778	309	977
Standard Error	6	160	257	262	627
Degrees of Freedom	11	8	26	13	11
RSE	71.3	40.9%	33%	84%	64%

Appendix G

Table A6b. Total Catch for target species by river section, and mode for fly anglers during 2025 at the West Branch Penobscot River, Maine between Ripogenus Dam and Abol Bridge.					
Fly Anglers in Boats					
River Section	**Zone 1-** above McKay Station through Ripogenus Gorge	**Zone 2**-From McKay Station to Telos Road	**Zone 3**-Telos Road to Big Ambejackmockamus Falls	**Zone 4**- Big A Falls to Nesowadnehunk Falls	**Zone 5**- Nesowadnehunk Falls to Abol Bridge
(includes Drift Boats, Rafts, Canoes, and Kayaks)					
Landlocked Atlantic Salmon					
Mean Catch/ hour		0.02	1.744	0.041	0.029
Angler- catch		48	4,188	98	69
Standard Error		33	1,260	83	47
Degrees of Freedom		22	9	3	15
RSE		69.1%	30.1%	84%	68%
Brook Trout					
Mean Catch/ hour		0.001	0.2518	0.124	0.001
Angler- catch		3	604	298	3
Standard Error		3	228	286	3
Degrees of Freedom		15	18	12	15
RSE		97%	37.7%	96%	95%

Appendix H

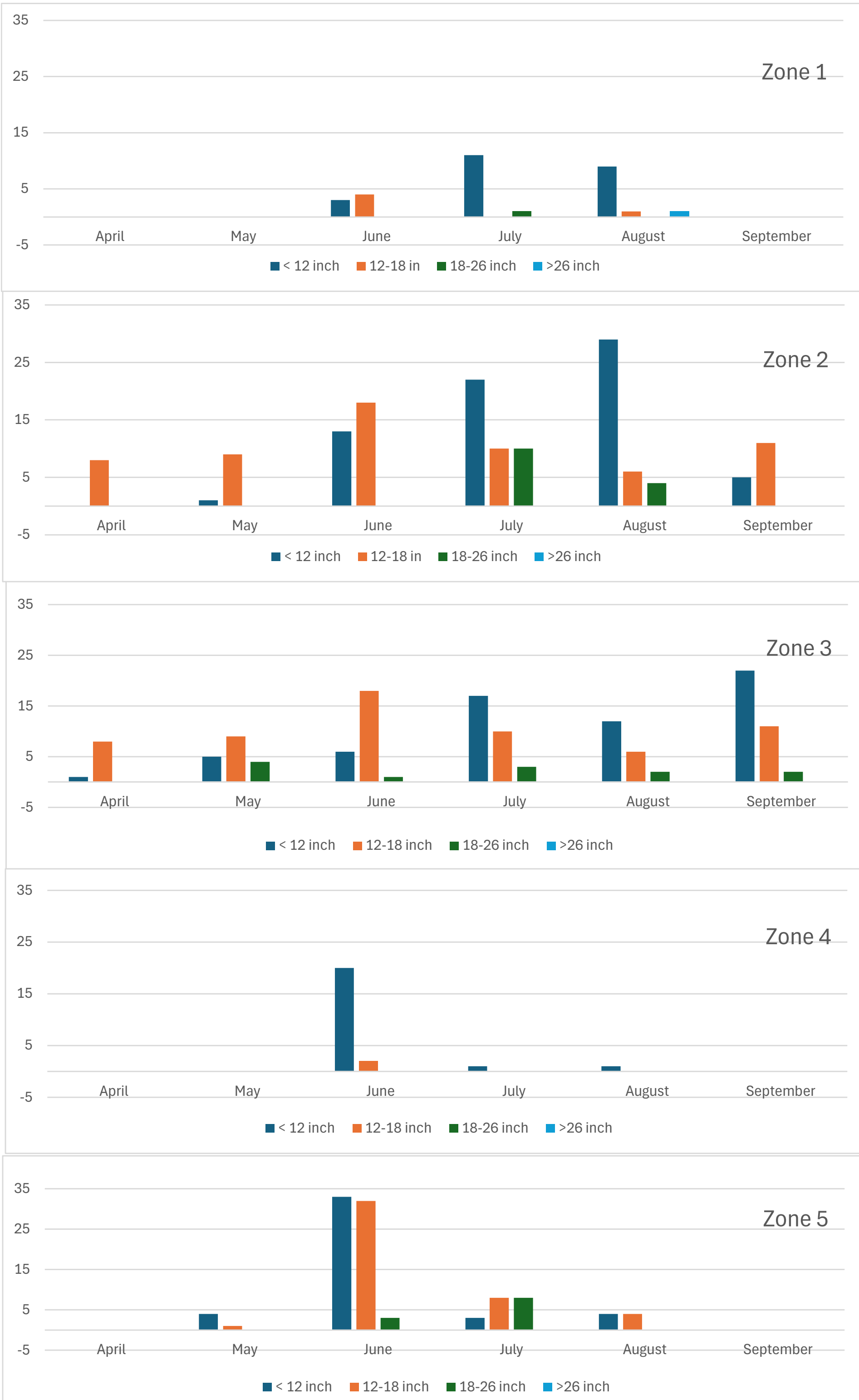

Figure.A1 Landlocked Atlantic Salmon Catch by size survey zones, months and size group

Appendix I

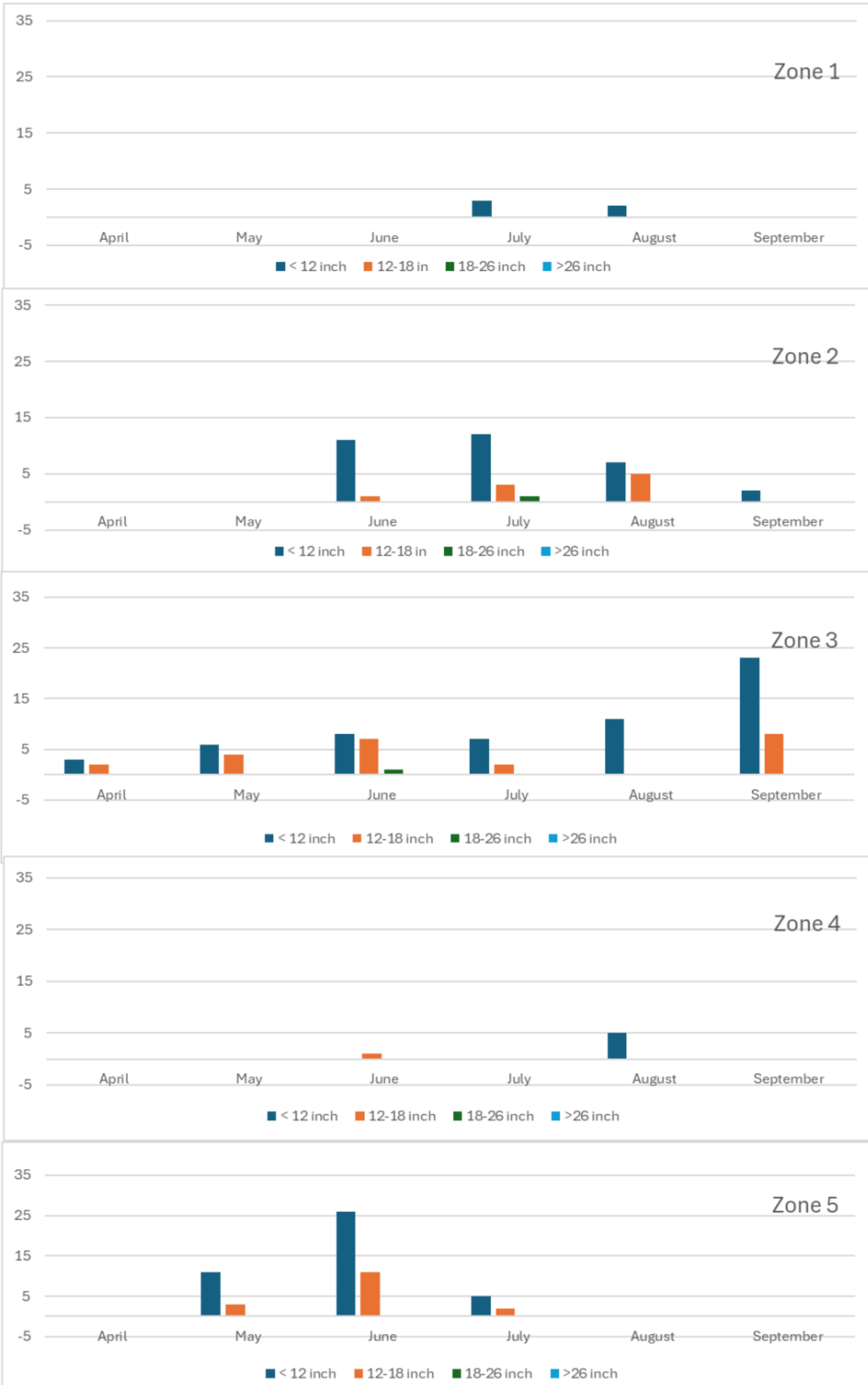

Figure.A2 Brook trout catch by size survey zones, months and size group

Appendix J

Table A7. Cost of equipment required for a boat trip.			
Gear Type	Median Cost	Total cost	Life span
Live Vest @	$60.0	$180	5-10 year
Throwable	$25.0	$25	5-10 year
Warning Device	$15.0	$15	3-year
Tornado Anchor	$145	$145	10+ years
Paddles/ Oars (each- 2x)	$120	$240	10+ years
Trailer for Rafts*	$2500	$2500	10+ years
		$605	Grant total
Assume 30 fishing-days/year/10-year life.		$2.0 per boating day.	

*Prices for drift boat included trailer. Not included in grand total

Appendix K

Table A8. Cost of fishing gear calculated as per-day-cost-of-use.				
Gear Category	Average days of use	Median Item cost	Cost Per day	Number w/item
Reel	58	122.5	2.09	155
Rod	50	189.50	3.79	155
Fly line	35	57.47	1.65	155
Backing	47	17.25	0.37	155
Leaders	18	10.99	0.62	155
Waders	75	321.63	4.29	75
Wader boots	150	159.75	1.07	75
Hip boot	75	75	1.00	11
Fly vest	87.5	86.31	0.99	100
Wading Staff	150	140.34	0.94	19
Fishing Pack/tacklebox	150			43
Fishing Glasses	87	68.94	0.79	81
Fishing Hat	110	30	0.27	103
Raingear	135	183.3	1.36	10
Fishing Net	150	68.93	0.46	13
Fly Box	57	18	0.31	94
Bug Net	45	6.79	0.5	1
Cooler	30	40	0.75	6

Appendix L

Table A9. W. Br. Penobscot River Atlantic salmon growth (mm) for each year by fish age from fish collected in 2025.						
incremental year growth (mm)						
	Year					
Age-class	2019	2020	2021	2022	2023	2024
age 1		73	75	72	66	77
age 2			70	86	99	93
age 3				81	93	103
age 4					85	65
age 5						55
age 6						
age 7						

Appendix M

Water temperatures for all three sections.

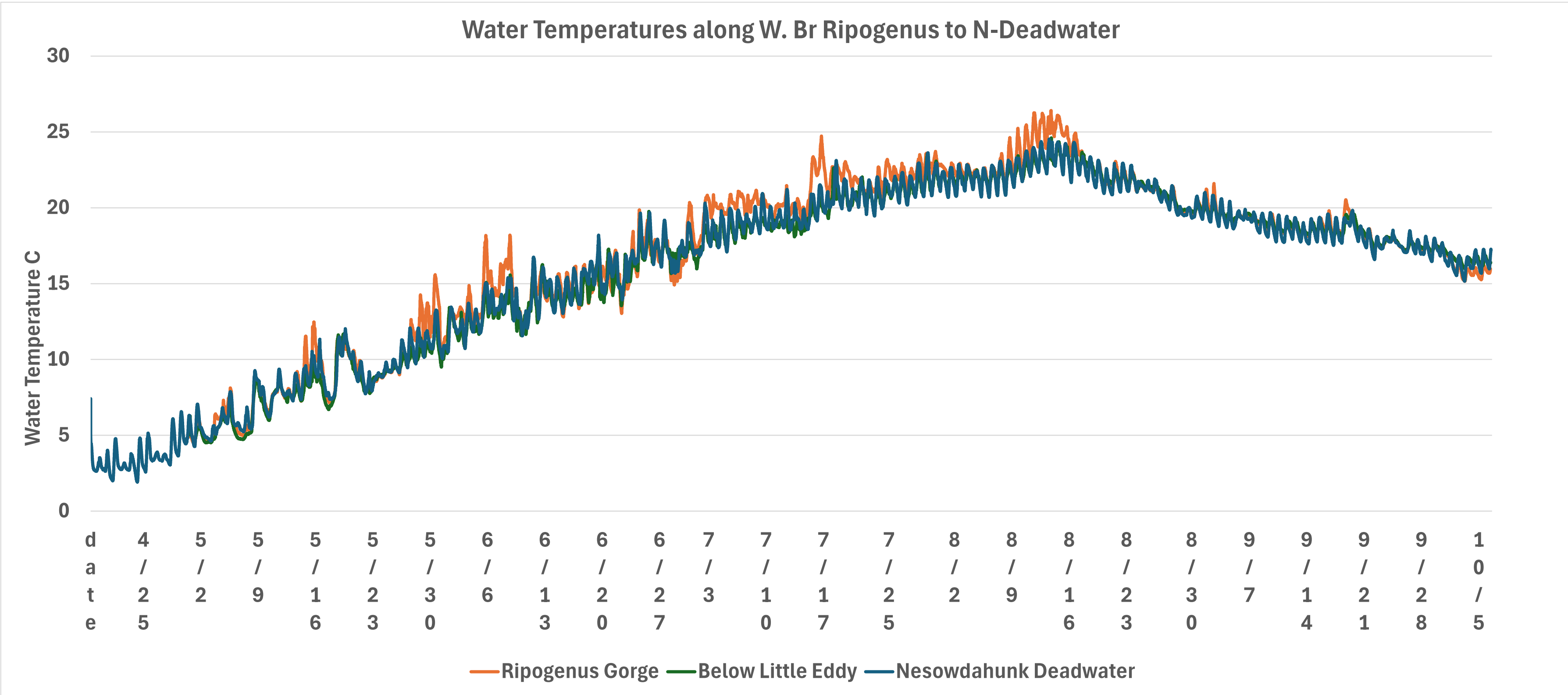

Figure A-3. Water Temperatures (°C) for three locations on the W. Br. Penobscot River Blue=above Nesowadnehunk Deadwater, Green= below McKay Station, Orange= Ripogenus Gorge.

Appendix N

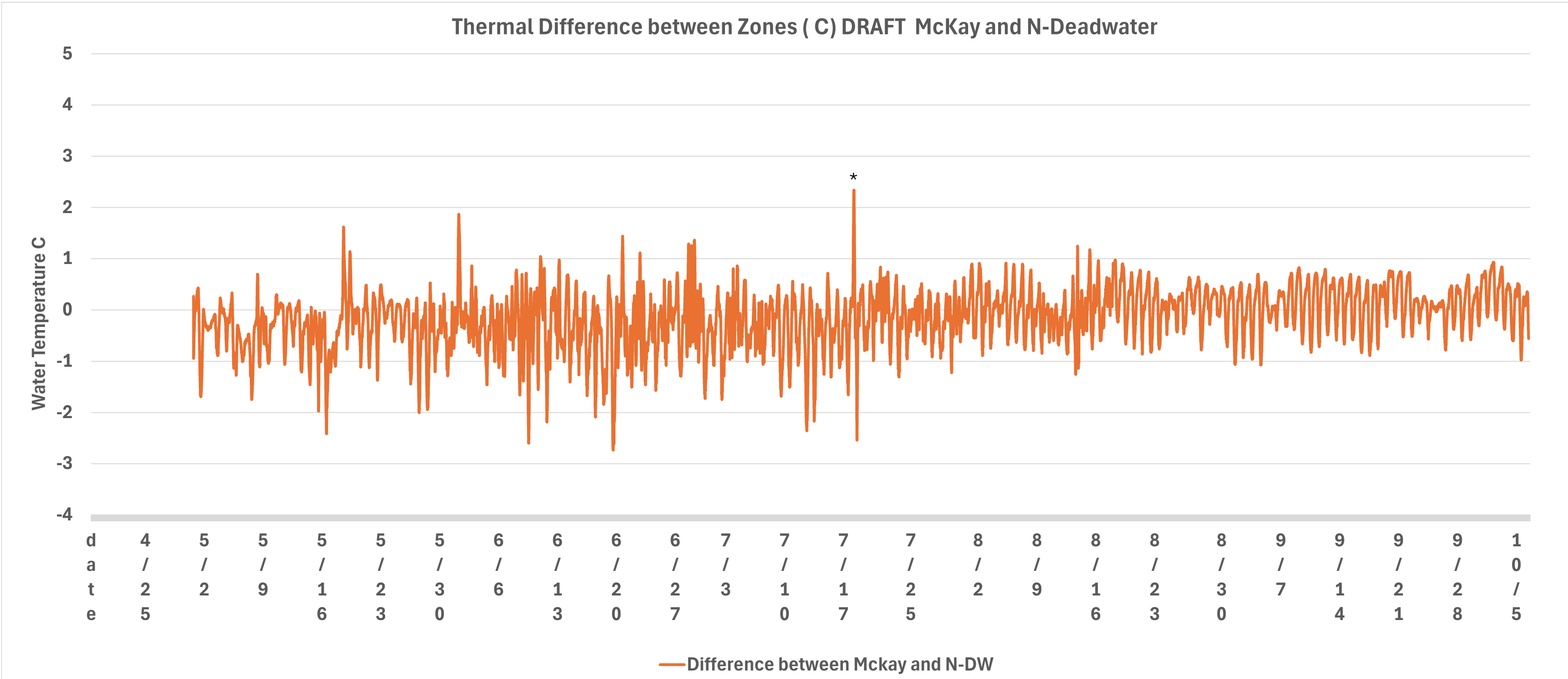

Figure A-4. Difference in water temperatures between McKay Station and Above Nesowadnehunk Deadwater, summer, 2025
*=day with heavy warm rainstorm.

Appendix O

Table A10. Atlantic salmon catch rate used to construct Figure 6.

							Flow- CFS										
Water	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300
Temp C	0																
4																	
5		0										0					
6																	
7																	
8				0													
9								0									
10																	
11								0.157									
12																	
13								0							0.25		
14					0.5	0											
15					1.22												
16																	
17				1.61													
18		0.33			0.75		0.819										
19					1.83												
20					1.29		0.687							0.55		1.33	
21														1.338	0.182		
22																	
23															0.877		
24																	
25																	
26																	
27																	
28																	

Appendix P

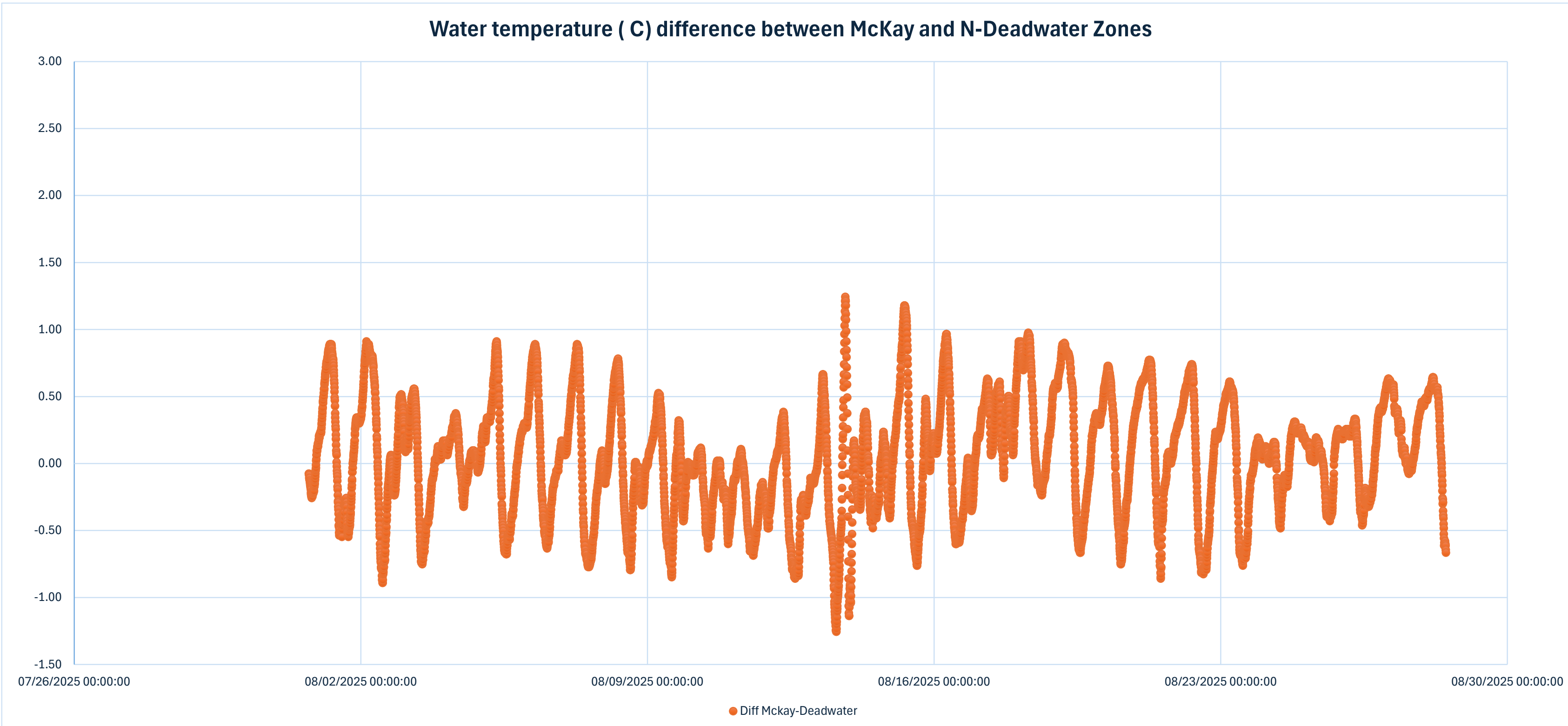

Figure A-5. Close up view of the diurnal cycle of water temperature difference between McKay Station and Above Nesowadnehunk Deadwater.

Appendix Q

Copy of survey forms used in 2025 angler survey. - Individual interviews and Zone effort counts

W. BR Penobscot River Angler Survey Interview Form (5/2025)

Date:_____________ Time:__________ Interview zone:____ Strata:__________
Angler type: Bait, Fly, Lure. Number of anglers interviewed
Fishing Start time:_______, Int. Time:__________ Duration:___________ Days?:_____
Complete trip:_Y / N. Where?:_________
Town From:_______________________, State________ Did you stay overnight to fish? Y N
Best Describes **the Primary Reason** for Trip to Areas? Fishing, Camping, General vacation, other________________________________

Species/ Size	Landlock Salmon (caught)	Landlock Salmon Harvest	Brook Trout (caught)	Brook Trout (harvest)
Less 12 inch				
12-18 inches				
18-26				
Over 26				
Totals				
List other species and sizes				

Gear inventory: Rods__ Waders:___ Hip boots: _____ Tackle Box:_____ Fly Box:____ Fishing vest:____
Fishing Glasses:____, Cooler:____, Wading staff:____, Raingear:__ , Visors/hat:___, Fish net:____-
Bug netting:____, Boat (type and size):_______________,_____ ft. Motor size:___hp
Other Comments____

Appendix R

W. Br Penobscot River Count Zone

Date:____________ Time:___________ Strata:______________ Powerplant flows

Wind: calm, breeze, windy Flows gage:____ River height: low, moderate, high, very high

Rain: none drizzle, light , heavy Sky: clear, partly cloudy, cover cast Water temp:____ Air Temp:___

Zone	Bait	Fly	Lure
1-Rip to Mckay	Not legal		Not Legal
2 Mckay to Telos	Not legal		Not Legal
3 Telos to Big Amberjack	Not legal		
4 Big Amberjack Falls to Nesowadnahunk Falls	Not Legal		
5 Nesowadnahunk Falls to Abol Bridge.	Not legal		

Circle the anglers in each boat.