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Survival and Movement of Fall-Stocked Brown Trout in the Lower Saco River

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Job F-012
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SUMMARY

A telemetry study was conducted to assess the survival and movement of hatchery brown trout stocked in the lower 13.1 mile portion of the Saco River. For more than 10 years this river reach has been managed under special fishing regulations to allow year-round fishing and recreational harvest. Most Maine rivers and streams are open to recreational fishing from April through September.

Fifty-nine fall yearling hatchery brown trout were equipped with radio transmitters and stocked below Skelton Dam (Town of Dayton) in the fall of 2013. All stocked fish were of a size that could be legally harvested by anglers. The movement and survival of these fish were monitored from October 2013 through August of 2014 using a portable and stationary receiver.

Transmission signals indicated 64% of the study fish were alive within the 13.1 mile long study reach two months after stocking. By May of 2014 transmission signals were detected from 25% of the study fish, and by August (2014) signals were detected from 3% of the study fish.

Transmitters were equipped with mortality switches, which were permanently activated in 44% of the fish over the course of the study. Monthly mortality was low throughout the study, with the heaviest mortality observed between March and May. The cause of mortality switch activation was not determined in this study, but likely included mortality due to environmental stress, angler handling, and predation, as well as suture failure resulting in loss of transmitters.

In addition to the activated mortality signals, transmission signals vanished in 51% of the study fish, with the greatest losses occurring in March. The cause of transmission loss was not determined in this study, but predation, angler harvest, transmitter battery failure, and out-migration were likely contributing factors.

Only 12% of the study fish migrated down river from the stocking site and most of this movement occurred immediately after stocking. Virtually all of the stocked brown trout utilized habitat in the Skelton Dam tailrace where good public access provided good prospects for stocked trout to be well utilized by anglers. This investigation also provided evidence that limited numbers of stocked brown trout survived the winter and following summer, to contribute to the development of a multi-age class fishery.

KEY WORDS: BNT, STOCKED BROWN TROUT, HATCHERY FISH MOVEMENT, HATCHERY FISH SURVIVAL, RADIO TELEMETRY, STREAM, MOVEMENT

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ABSTRACT

Seasonal mortality, habitat use, and potential contribution to a stocked brown trout (*Salmo trutta)* fishery were investigated in the lower Saco River. Advanced Telemetry Systems (ATS) transmitters (Model F1820) were surgically implanted into fifty-nine of the 500 fall yearling New Gloucester Strain brown trout stocked annually in the Skelton Dam tailrace. Study fish were monitored from October 2013 through August 2014 using a stationary and portable receiver. The 13.1 mile (21.1 km) long study reach was located between Skelton Dam and Cataract Dam hydroelectric projects; Cataract Dam is the lower most dam located at head of tide. A stationary receiver (ATS R4500SD) was installed a short distance upriver from Cataract Dam and remained operational from October 31, 2013 to March 20, 2014, except between November 1 and November 12, 2013 when a battery failure precluded data collection. A portable receiver was operated from a small skiff to survey the entire study reach on nine occasions between October of 2013 and August of 2014. Over this same period 12 additional monitoring events were conducted with the portable receiver at selective walk-in access sites. Approximately two months post-stocking transmission signals were detected from 64% of the study fish, by May of 2014 signals were detected from 25% of the study fish, and by August of 2014 signals were detected from 3% of the study fish. These detections reflect live fish that remained within the study area. Transmitters were equipped with mortality switches, which were permanently activated in 44% of the fish over the course of the study. Generally the incidence of mortality occurred at relatively low levels during each month of monitoring with the highest mortality (58% of all activated mortality switches) documented between March and May of 2014. In addition, transmission signals vanished for 51% of all the study fish, with the highest losses detected in March of 2014. Only seven (12%) of the study fish migrated downriver from the Skelton tailrace stocking area, most of which departed immediately after stocking. None of the migrants returned to upriver locations until May of 2014 when three of the seven migrants (43%) returned back to the Skelton tailrace. The remaining four (57%) migrants stayed in the lower river in the vicinity of Spring Island during the fall and winter period. Since the stationary receiver was neither operational between November 1 and November 12 of 2013, nor operational after March 20 of 2014, study findings regarding down river movement likely underestimated the extent of down-river movement. Movement upriver above Skelton Dam was generally prevented at the trap and sort fish lift, where all captured brown trout were returned to the downriver study area.

INTRODUCTION

Brown trout (*Salmo trutta*) are not native to Maine, but have been propagated and typically stocked in waters unable to support desirable fisheries for stocked or wild indigenous salmonids, including brook trout (*Salvelinus fontinalis*) and landlocked Atlantic salmon (*Salmo salar*). Factors limiting performance of indigenous salmonids have included environmental conditions such as poor summer water quality and/or biological constraints (e.g., interspecific competition, predation, forage, and limited spawning and nursery habitat). These same factors typically have also created conditions less than ideal for brown trout, although brown trout can tolerate a broader range of biological and environmental conditions than indigenous salmonids (Raleigh 1982; Marcus 1984; Raleigh et al. 1986).

The Saco River Skelton Dam tailrace in Dayton, Maine has been stocked annually since 2006 with 500 fall yearling brown trout that were nearly two years old at the time of stocking and generally at least 12 inches long. The stocking of larger size fall yearling brown trout was implemented as a strategy to increase post-stocking survival and angler returns where threats from piscivorous fish, mammals, and birds have been a concern. Warner (1972) documented significant predation by chain pickerel (*Esox niger*), smallmouth bass (*Micropterus dolomieu*), and largemouth bass (*Micropterus salmoides*) on smaller spring yearling landlocked salmon. The lower Saco River has supported piscivorous fish including largemouth and smallmouth bass, as well as chain pickerel. Stiller (2011) documented predation on yearling brown trout by Common Mergansers (*Mergus merganser*) on the West Branch of the Delaware River and estimated more than half of the trout stocked were consumed by these predators. Piscivorous birds including Common mergansers, Cormorants (*Phalacrocorax spp*.) osprey (*Pandion haliaetus*), and bald eagles (*Haliaectus leucocephalus*), as well as piscivorous mammals including mink (*Neovison vison*) and river otter (*Lontra canadensis*) were commonly observed on the lower Saco River. Annual runs of migratory fish, including American eel (*Anguilla rostrota*), Atlantic salmon, American shad (*Alosa sapidissima*), and river herring (*Alosa aestivalis, Alsoa psuedoharengus*) have provided a seasonally abundant food source that attracts a variety of predators to the area. Trout stocking strategies (e.g., size, timing, etc.) that minimize losses from predation remain an important consideration in the development of recreational fisheries on the lower Saco River.

In addition to brown trout stocked in the fall below Skelton Dam, brook trout have also been stocked annually in the spring (400 spring yearlings) and fall (150 fall yearlings) when water temperatures have not been limiting. These "put and take" brook trout stockings have provided anglers with the opportunity to harvest popular native trout that are easier to catch than brown trout (Baird 2006; Pellerin 2016). Brown trout were stocked to provide season-long fishing opportunities, including the development of a multi-age class fishery.

Maine's current statewide Brown Trout Management Plan (Boland 2001) identifies abundance, catch rate, and size quality objectives for lake, river, and tidal waters supporting brown trout fisheries. Management plan catch rate and size quality objectives for rivers and streams state "Experienced anglers should expect catch rates of at least one brown trout per day" and should expect to “catch brown trout averaging 12-16 inches and include an 18-20 inch brown trout on a good fishing day”. Expectations for producing some brown trout between 18 and 20 inches long necessitates some post-stocking survival and growth of even the largest production fish stocked (fall yearlings) for at least one to two years to achieve this size quality objective. The statewide brown trout plan also acknowledges there is a lack of baseline brown trout fishery data for rivers and streams to evaluate compliance with statewide planning and few population studies have been conducted in Maine. Brown trout performance in the lower Saco River has not previously been investigated by the Maine Department of Inland Fisheries and Wildlife (MDIFW).

River temperatures during the summer have reached as high as 82 °F in the lower Saco River (Leblanc 2012). While these conditions could be lethal to trout, several tributaries drain to the lower Saco River and may have offered refugia for stocked trout. River conditions during the winter may also be limiting. Winter mortality in brown trout and aquatic insects has been documented on other rivers (Needham 1945). At least one author attributes these losses to formation of anchor ice (Butler 1979). Available anecdotal reports on the lower Saco River indicated that at least some brown trout have survived the winter and summer, contributing larger fish to the fishery, but no formal assessment of performance has been conducted to date.

Most Maine rivers and streams are open to recreational fishing from April through September. However, special fishing regulations have enabled anglers to fish the Saco River year round under a two trout daily bag limit, and created an opportunity for fall-stocked trout to be well utilized by the public.

A telemetry study was initiated by MDIFW in partnership with Brookfield Renewable Energy Group (BREG) on the lower Saco River to assess over-winter survival and contribution to the spring/summer fishery, as well as seasonal movement and habitat use. Project funding and support was provided under the 2007 Saco River Fisheries Assessment Agreement (FPL Energy Maine Hydro LLC 2007).

STUDY AREA

The study area encompassed a 13.1 mile reach of the lower Saco River between Skelton Dam in the towns of Buxton and Dayton, and Cataract Dam at the head of tide in the City of Saco (Figure1). With few exceptions most of the river was characterized by non-turbulent, slow flowing water overlying a sandy-silt substrate. Areas of rooted aquatic vegetation and rocky shoals occurred throughout the reach, and water depths ranged from a few feet to 20 feet deep (Leblanc 2016). A few locations in the study area provided higher flow velocities and substrate dominated by rock aggregate and ledge, which provided more suitable habitat for brown trout (Raleigh et al. 1986). These areas were predominantly limited to the Skelton Dam tailrace, an area located approximately 6.5 miles downriver from Skelton Dam known as Little Falls, and an area adjacent to Spring Island immediately upriver from Cataract Dam (Figure 1). Two sets of fish locks at Spring Island created attraction flows, but the locks may have also impeded further down river migration of fish (Leblanc 2016).

Thirty three species of resident freshwater fish have been documented in the Saco River watershed (Hoover 1937), any of which could be present in the study area. A more recent survey conducted by Yoder (2006) documented 15 freshwater fish and four diadromous fish in the lower Saco River study reach. Although brown trout and brook trout were stocked in the study reach neither were captured by Yoder (2006). Similarly, juvenile sea-run Atlantic salmon have been stocked by the Saco Salmon Restoration Alliance & Hatchery (aka Saco River Salmon Club & Hatchery) and adults also migrate into the Saco River, but were not captured by Yoder. The most abundant freshwater fish captured in the Skelton Dam fish lift trap operated by Brookfield White Pine Hydro include: smallmouth bass, black crappie (*Pomoxis nigromaculatus*), white perch (*Morone americana*), largemouth bass, brown trout, yellow perch (*Perca flavescens*), common sucker (*Catestamers commersoni*), brown bullhead (*Amerius nebulosus*), brook trout , and pumpkinseed sunfish (*Lepomis gibbosus*) (Leblanc 2012) .

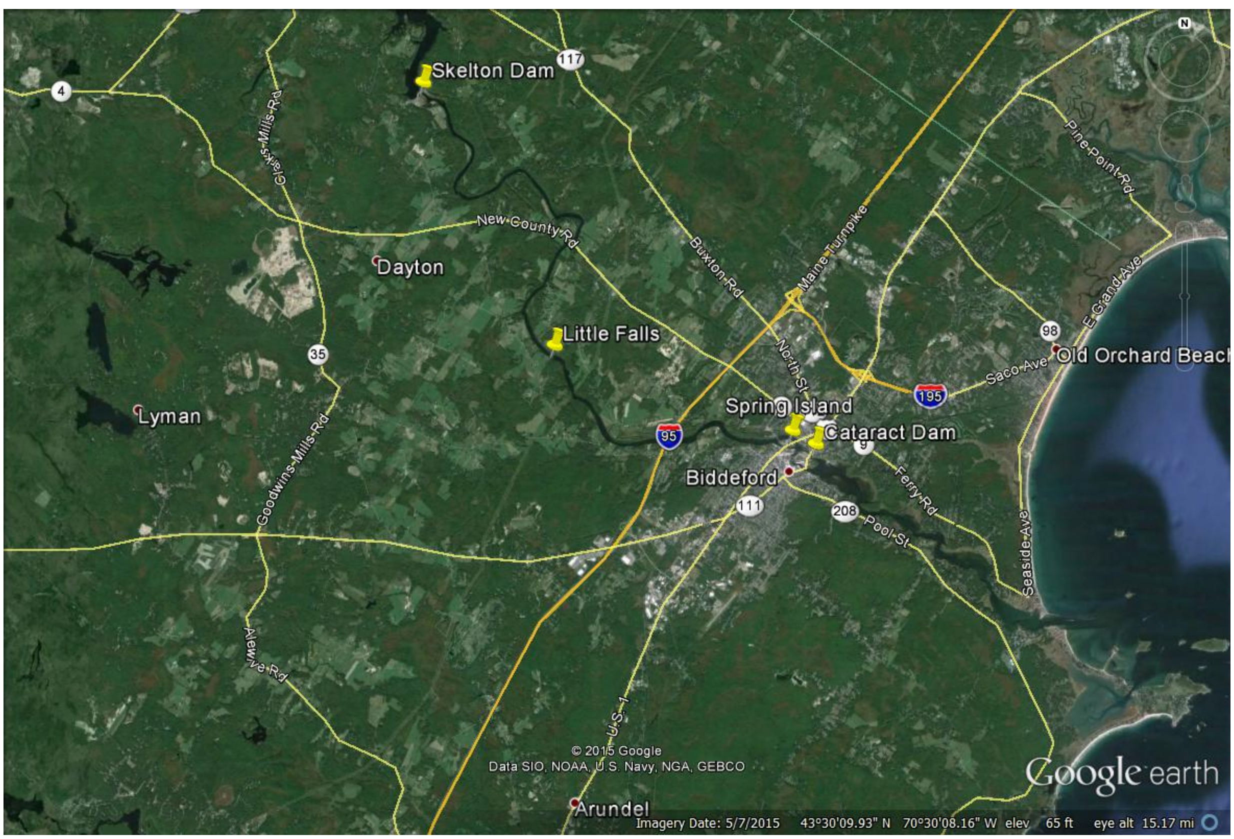

Figure 1. Google image of Saco River study area located between Skelton and Cataract Dams.

METHODS

Model F1820 Advanced Telemetry Systems (ATS) transmitters equipped with mortality switches were surgically implanted into 59 hatchery fall yearling brown trout that were released into the Skelton Dam tailrace. Each transmitter emitted a unique frequency between 148 and 149 megahertz. Mortality switches were activated after 8 hours of inactivity. The transmitters were warrantied for at least 202 days, but operated at the 30 PPM pulse rate the battery life was expected to extend through August of 2014, the duration of the study.

Study fish ranged in length from 11.1 in to 15.4 in, with a mean length of 13.9 in. Although each study fish was not weighed, the 2013 Fish Quality Report for New Gloucester Hatchery (Wells, 2013) stated the mean weight of fall yearling brown trout was 1.2 lbs. ATS recommends using transmitters that weigh no more than two to three percent of fish body weight. The 0.28 ounce transmitter represented 1.4% of the mean fish weight.

A model R4500SD ATS stationary receiver data-logger was installed immediately upriver from Cataract Dam on Spring Island. Study fish were also monitored using a portable Model 410 ATS receiver operated from a small motorized skiff when possible. Monitoring from the skiff enabled the entire extent of the study area to be surveyed. The portable receiver was set on continuous scan-cycle mode when monitoring from the skiff and searched for each transmitter frequency for a period of between five and eight seconds during each cycle. In addition to monitoring from the skiff, strategic walk-in access sites were also monitored when the river could not be accessed by skiff, due to weather, schedules, or flow conditions. Walk-in sites provided access to only a few locations along the river, including the Skelton and Cataract dams, Little Falls, the Route 5 Bridge, Rotary Park, and Diamond Riverside Park. Manual sampling with the portable receiver was conducted when staff availability permitted, but a concerted effort was made to monitor the study reach two to three days each month using the above monitoring strategies.

The locations of detected transmitter frequencies were reported on standardized data collection forms (Appendix 1). Typically the last reported location of each frequency was noted at the onset of monitoring to support more intensive searching for frequencies no longer present at their last known location. Detection location was reported as the nearest known land mark.

Data collected at the stationary logger was filtered to remove extraneous noise events based on criteria discussed with ATS to provide a data set of probable detections. Normandeau

Associates, Inc. compiled and summarized all the raw tracking data, which supported additional analysis and discussion by the author.

Brookfield personnel operated fish lifts at Skelton and Cataract dams during the study. All brown trout collected at the dams were returned to the study reach.

Informational signage (Appendix 2) was developed and posted at public access locations to inform anglers of the study. The angling public was requested to release any brown trout displaying antennae.

RESULTS

Fifty-nine transmitters were surgically implanted on September 25, 2013. The study fish were subsequently held for observation in the hatchery for 27 days prior to being stocked. All the fish survived the surgeries, retained their transmitters, and were subsequently stocked in the tailrace below Skelton Dam on October 23, 2013.

The 13.1 mile study reach was monitored by skiff on 10 occasions between October 28, 2013 and August 12, 2014 (Table 1). Walk-in sites were monitored on 12 occasions over the same time period. Monitoring with portable receivers continued through the fall of 2013 until late

Table 1. Month and day of sampling by tracking method.

Tracking Method	Month (dates sampled)										
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Manual (skiff)	28, 30	8, 15, 19	3, 10	-	-	-	-	29	24	-	12
Manual (Foot/truck)	-	13	17	-	-	18	2, 16, 25	2, 15	6, 17, 27	18	-
Stationary	*Oct 28 – Mar 20 (except Nov 1 – Nov 12)						-	-	-	-	-

*Battery failure precluded data collection from Nov 1 – Nov 12.

December, at which time the river iced over. Monitoring of walk-in sites resumed the following spring in March and April, and skiff surveys resumed in late May when river flows subsided. The stationary receiver remained operational from October 31, 2013 to March 20, 2014, except between November 1 and November 12, 2013 when a battery failure precluded data collection. The stationary receiver was temporarily removed in late March to download collected data. Reinstallation was plagued by electrical problems which prompted removal of the receiver prior to completion of the investigation. Summary results presented in the remainder of this report are based on individual fish detection histories prepared by Normandeau Associates, Inc. and presented in Appendix 3.

All 59 stocked study fish were detected following release and two (3%) survived for the duration of the study. The last manual sampling event in 2013 (approximately two months after stocking) indicated 64% of the study fish remained alive. Once river flows subsided in May of 2014 the entire study reach was resurveyed by skiff and 15 surviving study fish (25%) were

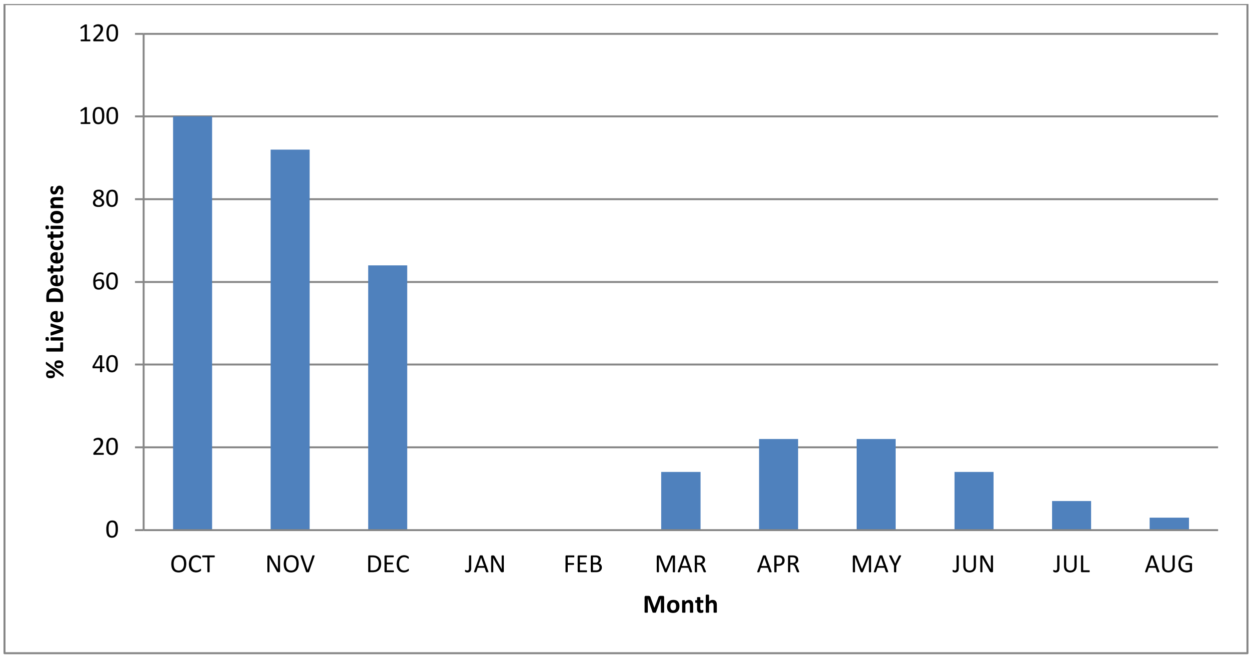

Figure 2. Percentage of study fish detected "alive" by month.

located (Figure 2). One of those fish was subsequently harvested by an angler and reported to a BREG employee (Picture 1). Two additional study brown trout observed by BREG personnel displayed surgical scars (Picture 2), but no transmitter (antennae), indicating that some of the study fish had survived but lost their transmitters.

Picture 1. Study brown trout caught by angler below Skelton Dam in June, 2014

Over the course of the study persistent mortality signals were detected in 26 fish (44%). In general, the incidence of mortality (based on detected mortality signals) occurred at relatively low levels during each month of monitoring, with the highest incidence of mortality (58% of all activated mortality switches) documented between March and May (Figure 3). The cause of mortality was not assessed in this study.

In addition to losses attributed to mortality, transmission signals vanished for 30 study fish (51%) over the course of the study. The cause of this loss was not assessed in this study. These fish did not transmit a mortality signal and were not detected as possible out-migrants by the downriver stationary receiver while in operation. Unexplained losses were most prevalent over the winter months. Resumption of monitoring in March indicated 57% of all unexplained loses occurred over winter, representing 29% of the study fish (Figure 3). The next highest unexplained loses occurred in June (13 %), representing 7% of the study fish.

Picture 2. Study brown trout caught by BREG employee in July, 2014 revealing the surgical scar and loss of implanted transmitter.

Only 12% of the study fish migrated downriver from the stocking site and most migrants departed immediately after stocking. The majority (57%) of the downriver migrants remained in the lower river in the vicinity of Spring Island over the fall and winter period. None returned to upriver locations until May of 2014 when three of the seven migrants (43%) returned back to the stocking area.

Two study fish were captured at the Skelton Dam fish lift and returned to the down-river study area. However, initial operation of the Skelton Dam fish lift in May of 2014 inadvertently allowed some brown trout to bypass Skelton Dam. Some of these trout were likely study fish (Leblanc 2016), but a limited effort to survey the Skelton head pond failed to detect any study fish. No study brown trout were captured at the Cataract Dam fish lift that may have migrated below the study area.

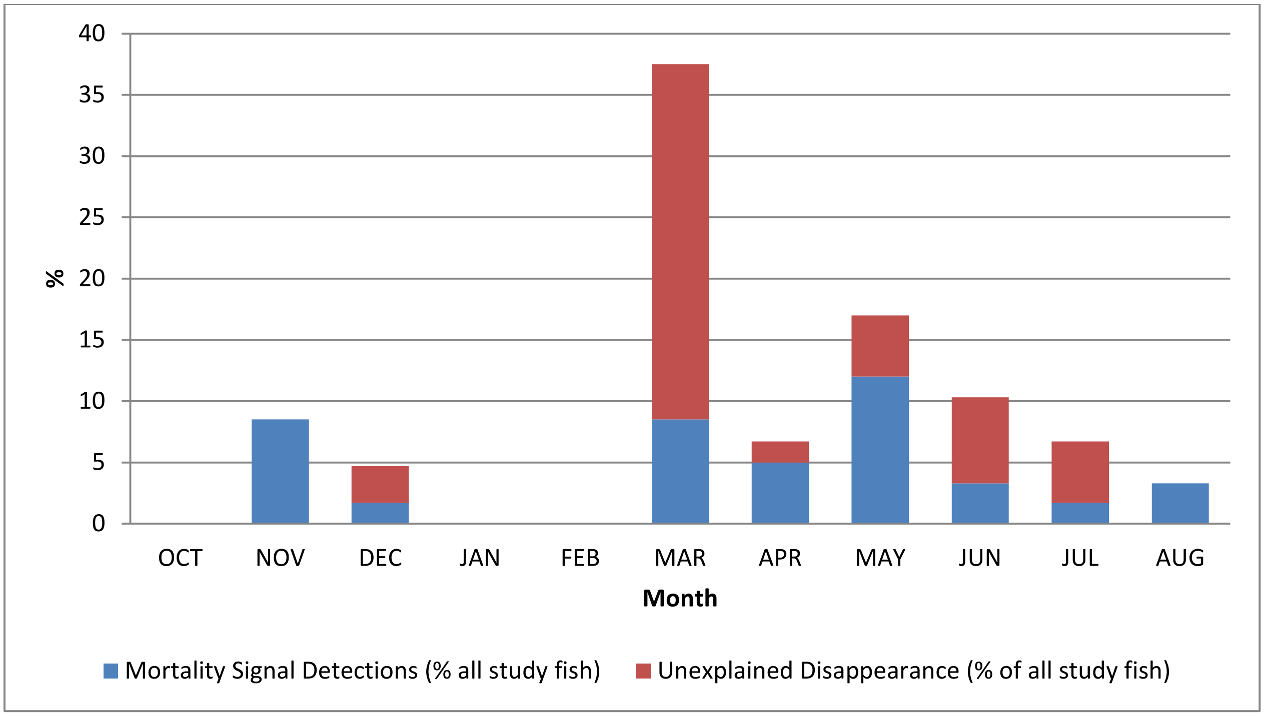

Figure 3. Documented loss (mortality & unexplained) from the fishery by month.

DISCUSSION

Study results indicated 25% of study brown trout survived through the winter and were available to anglers the following spring. The actual contribution was likely higher given documented suture failure that resulted in loss of transmitters and activation of mortality switches in some surviving study fish, inflating reported mortality detection rates that could not be quantified in this investigation. It is also noteworthy to mention the winter of 2013-2014 was atypically severe (extreme persistent cold temps, early ice cover, heavy snow, persistent wind, late ice out, etc.) and to the extent that these environmental conditions adversely impacted brown trout survival, the survival documented in this investigation likely underestimates survival during more "typical" winters. While this study did not investigate causes of mortality in the study fish, likely sources included angler harvest, environmental stress, predation, and angler handing stress.

Until recently, similar investigations had not been conducted elsewhere on Maine rivers to compare and contrast over-winter survival documented in this study. In 2013 and 2014 over-winter survival of brown trout released in the Shawmut Section of the Kennebec River was conservatively estimated at 17% and 31%, respectively for each year (Ashe 2015). These results compare favorably to the 25% overwinter survival documented on the Saco River. However, concerns regarding tag retention and intermittent transmitter reliability on the Kennebec River created uncertainty regarding validity of the survival estimates (Ashe 2015). The Kennebec and the Saco Rivers are similar in that both are large regulated rivers open to fishing year round. However, differing minimum length and daily bag limits (Kennebec River - 1fish daily bag, minimum length 16 inches / Saco River – 2 fish daily bag, minimum length 6 inches) offer Saco River anglers much greater opportunity to harvest and utilize stocked trout, particularly since all trout stocked in the Saco River were of legal size at time of stocking. Consequently, angler harvest and perhaps catch and release handling stress may have reduced the number of brown trout available during the popular Saco River spring fishery and to support the development of a multi-age fishery. The conservatively estimated over-winter survival rate of 25% could be viewed as "respectable", considering anticipated mortality associated with year round angling and harvest, wildlife predation, and environmental stress.

Transmitter signals permanently vanished and could not be accounted for in 51% of study fish. Several possible explanations for this loss included mammalian and avian predation, movement out of the study area, angler harvest, and transmitter battery failure. Bird predation was a more likely cause than mammalian predation, because large birds like bald eagles and ospreys, which were both commonly observed on the river, could carry their prey to perches beyond the detection range of the receiver, or in the case of cormorants could leave the area entirely. These feeding behaviors are less applicable to mammals. Migration of study fish out of the study area was not likely very prevalent. Even though the stationary receiver was not operational after March 20, 2014 (as well as from Nov 1 – Nov 12), the majority (63%) of "lost" transmission signals were documented while the stationary receiver was operational. To the extent out-migration occurred when the stationary receiver was not operational it could likely account for less than 37% of unexplained losses, assuming all the losses were due to downriver movements. Also none of the study fish that could have migrated down river below Cataract Dam were ever recaptured as upriver migrants at the Cataract Dam fish lift. Furthermore, with limited exceptions, upriver migrating brown trout captured at the Skelton Dam fish lift would have been returned to the study area, preventing migration upriver out of the study reach. However, some study brown trout were likely lost upriver during the initial operation of the Skelton Dam fish lift in May, but as noted above, the vast majority of signal losses occurred prior to that time. Angler harvest is not expected to be a primary cause for lost transmission signals. At least one study fish was harvested and coincidentally observed by a BREG employee. Presumably others were also harvested; however, informational signage likely discouraged the harvest of fish equipped with transmitters. Battery life is also not expected to be a significant contributing factor considering that 63% of the unexplained losses were documented within the first six months of battery operation, well within the expected life of the battery. However, battery failure towards the end of summer could account for some lost transmission signals late in the study. Unexplained losses are likely influenced to some degree by all the above potential sources discussed.

Approximately 13% of those fish that over-wintered also survived through the summer, when water temperatures were seasonally limiting. These fish persisted after the popular spring fishery and remained available to anglers through the summer. This finding provided evidence that limited numbers of stocked brown trout persisted to support year round fishing. Furthermore, these surviving older fish had the opportunity to grow to larger size and contribute to the development of a multi-age class fishery; an expectation under Maine's statewide brown trout management plan.

Over the duration of the investigation the vast majority of study fish (88%) lead a relatively sedentary existence, residing in the Skelton Dam tailrace where they were initially stocked. Other brown trout studies have observed a similar tendency for restricted post-stocking movement from release sites (Cresswell 1981; Brown 2007; Ash 2015). Whether this behavior reflects habitat preference or some other influence is unclear, however, it is noteworthy to mention that the habitat present in the tailrace is considered to be the most suitable within the entire study reach and some use of this habitat was anticipated. Furthermore, while only 12% of the study fish migrated downriver, almost half (43%) returned back to the Skelton Dam tailrace stocking area, suggesting some "preference" for this habitat. Since most of the brown trout remained where they were stocked, where walk-in angler access and wade/bank fishing opportunities were very good, angler catch and exploitation potential was expected to be equally good.

CONCLUSIONS AND RECOMMENDATIONS

The results of this investigation offered insight regarding post stocking seasonal movement and survival of fall-stocked hatchery brown trout on the lower Saco River, including their availability to recreational anglers, as well as potential for attainment of statewide performance expectations. Virtually all of the stocked brown trout appeared to utilize the Skelton Dam tailrace where good public access for angling created a high probability that stocked trout were being well utilized by the angling public. There was also evidence that limited numbers of stocked brown trout survived the winter and summer, creating some limited potential for growth to larger size expected under the current statewide brown trout management plan. A much broader understanding of brown trout performance in the lower Saco could be realized from the following additional recommended assessments:

- Understanding age class structure and associated size quality would be useful in characterizing this fishery and more definitively assessing conformance with the statewide brown trout plan. While this investigation indicated some brown trout survival from October through mid-August, growth rates and overall condition of these fish were unknown.

- Understanding the cause of documented brown trout mortality would provide insight regarding factors that influence performance and provide a basis to assess efforts to improve survival and contribution to the fishery. Recovering mortalities equipped with transmitters would be difficult and would likely require use of scuba, as well as more frequent monitoring.

- Understanding the root cause for lost detection signals would also be useful since this loss accounted for over half the stocking. Aerial surveys would be useful in locating lost tags outside the study area if removed by birds or if the fish moved upstream or into tributaries flowing into the study reach. Also, the role of angling as a factor accounting for lost detection signals, as well as limiting survival and future contribution to the fishery would be of particular interest. This concern could be examined by conducting an angler creel survey in the Skelton Dam tailrace. A clerk survey conducted to assess catch, harvest and use would also provide information useful in characterizing the fishery, assessing compliance with statewide performance expectations, and assessing overall program success.

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Appendix 1. Species of fish occurring in the study reach portion of the lower Saco River

Common Name	Latin Name
BLUEGILL SUNFISH	*Lepomis macrochirus*
SMALLMOUTH BASS	*Micropterus dolomieui*
BROWN BULLHEAD	*Ameiurus nebulosus*
BLACK CRAPPIE	*Pomoxis nigromaculatus*
FALLFISH	*Semotilus corporalis*
WHITE SUCKER	*Catostomus commersoni*
SPOTTAIL SHINER	*Notropis hudsonius*
PUMPKINSEED SUNFISH	*Lepomis gibbosus*
YELLOW PERCH	*Perca flavescens*
STRIPED BASS	*Morone saxatalis*
LARGEMOUTH BASS	*Micropterus salmoides*
LANDLOCKED & *SEA-RUN ATLANTIC SALMON	*Salmo salar*
GOLDEN SHINER	*Notemigonus crysoleucas*
CHAIN PICKEREL	*Esox niger*
COMMON SHINER	*Luxilus cornutus*
WHITE PERCH	*Morone americana*
AMERICAN SHAD	*Alosa sapidissima*
ALEWIFE	*Alosa pseudoharengus*
AMERICAN EEL	*Anguilla rostrata*
*BROOK TROUT	*Salvelinus fontinalis*
*BROWN TROUT	*Salmo trutta*
*fish stocked by either MDIFW or the Saco River Salmon Club and known present in the study reach, but not captured by Yoder (2006)	

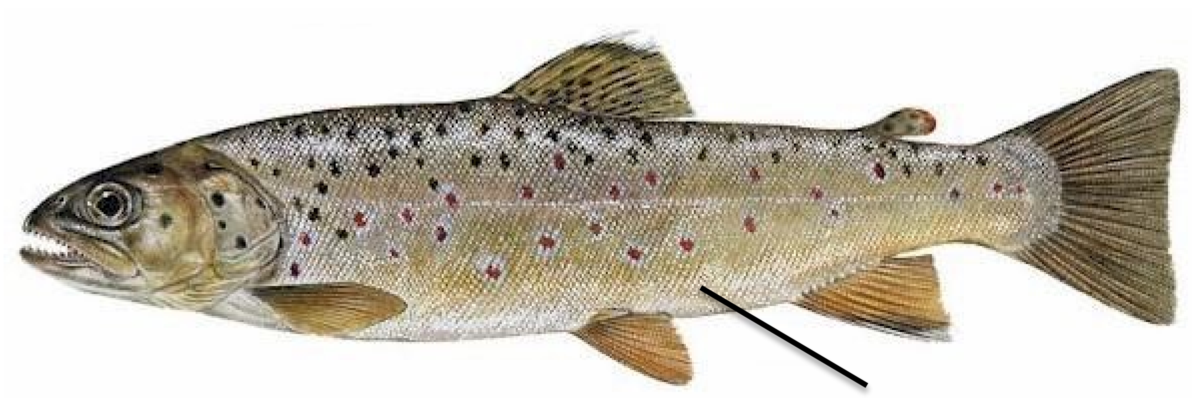
Appendix 1. Copy of Data Collection Form (reference line #23 was removed from the form, and was assigned to a reference tag used as a control)

Saco River BNT Tracking Sheet

Tag Frequency		11/26/2013	12/3/2013	12/10/2013
1	148.514	between skelton boat luanch and sand brook	*	*
2	148.525	tailrace	tailrace	tailrace
3	148.535/534	100 ft upriver of poducts brook	*	*
4	148.546	*	tailrace	tailrace
5	148.554	*	*	*
6	148.564	in front of house below Rt. 5 bridge	in front of house below rt 5 bridge	in front of house below rt 5 bridge
7	148.576	300 yards below skelton boat luanch	*	*
8	148.586	*	*	*
9	148.595	tailrace	tailrace	tailrace
10	148.607	*	*	*
11	148.625	tailrace	*	*
12	148.652	tailrace	tailrace	tailrace
13	148.775/774	500ft below skelton boat luanch /deep water	*	*
14	148.834	tailrace	tailrace	tailrace
15	148.864	tailrace	tailrace	tailrace
16	148.895	mort	MORT	MORT
17	148.924	tailrace	*	tailrace
18	148.955	below skelton boat launch in the shallows	tailrace	tailrace
19	148.985	*	*	*
20	149.003	tailrace	tailrace	tailrace
21	149.012	tailrace	tailraace	tailrace
22	149.024	between little house of prayer and powerline	little house of prayer	MORT
24	149.054	EC between road station or in tailrace	*	*
25	149.065	tailrace	tailrace	tailrace
26	149.073	tailrace	tailrace	tailrace
27	149.084/085	tailrace	tailrace	tailrace
28	149.093	*	*	*
29	149.113	mort	MORT	MORT
30	149.122	tailrace	tailrace	tailrace
31	148.023	tailrace	tailrace	tailrace
32	148.043	tailrace	tailrace	tailrace
33	148.056	*	faint tailrace	faint tailrace
34	148.165	*	*	*
35	148.184	*	*	*
36	148.223	mort	MORT	MORT
37	148.243	*	*	*
38	148.257	tailrace	*	tailrace
39	148.275	*	*	faint tailrace
40	148.284	*	*	faint tailrace
41	148.295/294	below skelton boat launch in the shallows	*	faint tailrace
42	148.314	mort	MORT	MORT
43	148.323	tailrace	tailrace	tailrace
44	148.334	*	500 ft below launch	*
45	148.344	below skelton boat launch in the shallows	tailrace	tailrace
46	148.355	mort	MORT	MORT
47	148.363	little house of prayer below lower ledge	*	*
48	148.372	**MORT** between little house of prayer and	MORT	MORT
49	148.381	tailrace	tailrace	tailrace
50	148.394	*	*	*
51	148.402	*	*	*
52	148.415	300 yards beow lower powerline just above	*	*
53	148.424	*	*	*
54	148.433	Buddas Field (eagle nest)	buddas field	300 yrds above Pottucks
55	148.446	*	*	tailrace
56	148.455	tailrace	Tailrace	tailrace
57	148.465	tailrace	Tailrace	tailrace
58	148.475	tailrace	Tailrace	tailrace
59	148.485	below skelton boat launch in the shallows	Tailrace	tailrace
60	148.493	tailrace	Tailrace	tailrace

Appendix 2. Informational sign posted at public access sites.

ATTENTION ANGLERS



The Maine Department of Inland Fisheries and Wildlife in cooperation with Brookfield Renewable Power are conducting a scientific investigation of brown trout stocked in the lower Saco River. Approximately, 60 brown trout have been tagged with an internal radio transmitter to track their movements over a 9 month period. The tagged fish are identified by an antenna that protrudes midway down their belly. Collected information will support trout management efforts on the lower Saco. We strongly encourage anglers to **release** all tagged trout caught.

Thank you for helping protect and manage the lower Saco River fishery. For information on the study or to report tagged fish contact Francis Brautigam, Regional Fisheries Biologist, Maine Dept. Inland Fisheries and Wildlife, Gray, ME. Phone: 207-657-2345, ext. 112.

Appendix 3. Detection history of individual study fish provided by Normandeau Associates, Inc.

148.023 (female; length = 349):

Trout 148.023 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during each of the ten manual tracking events conducted during October, November and December 2013. There were no detections of this individual from the stationary receiver at Spring Island and it was not detected after the winter of 2013-2014.

148.043 (female; length = 326):

Trout 148.043 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during each of the ten manual tracking events conducted during October, November and December 2013. Trout 148.043 continued to be regularly detected in the tailrace area during manual tracking events conducted during April, May, June, July and August 2014. There were no detections of this individual from the stationary receiver at Spring Island.

148.056 (female; length = 361):

Trout 148.056 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during nine of the ten manual tracking events conducted during October, November and December 2013. Trout 148.056 was next detected in the tailrace area during manual tracking events conducted during April and the first half of May 2014. There were no detections of this individual from the stationary receiver at Spring Island.

148.165 (female; length = 373):

Trout 148.165 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected in the tailrace five days after release and was not detected again until April 2014. Trout 148.165 was detected in the tailrace area during manual tracking events conducted during April and the first half of May 2014. There were no detections of this individual from the stationary receiver at Spring Island.

148.184 (female; length = 339):

Trout 148.184 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected a short distance downstream of the boat ramp five days after release and then regularly in the tailrace through mid-November. The mortality signal associated with trout 148.184 was first detected in the tailrace on March 18, 2014 and was active during all subsequent detections. There were no detections of this individual from the stationary receiver at Spring Island.

148.223 (male; length = 354):

Trout 148.223 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during the first three manual tracking events conducted during October and early-November 2013. The mortality signal associated with trout 148.223 was first detected in the tailrace on November 13 and was active during all subsequent detections. There were no detections of this individual from the stationary receiver at Spring Island.

148.243 (female; length = 370):

Trout 148.243 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during the first three manual tracking events conducted during October and early-November 2013. Trout 148.243 was again regularly detected in the tailrace area during manual tracking events conducted during April, May, June, July and August 2014. There were no detections of this individual from the stationary receiver at Spring Island.

148.257 (male; length = 358):

Trout 148.257 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during nine of the ten manual tracking events conducted during October, November and December 2013. The mortality signal associated with trout 148.223 was first detected in the tailrace on March 18 and was active during all subsequent detections. There were no detections of this individual from the stationary receiver at Spring Island.

148.275 (male; length = 346):

Trout 148.275 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected within the immediate tailrace area during four of the ten manual tracking events conducted during October, November and December 2013. There were no detections of this individual from the stationary receiver at Spring Island and it was not detected after the winter of 2013-2014.

148.284 (female; length = 380):

Trout 148.284 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected within the immediate tailrace area during six of the ten manual tracking events conducted during October, November and December 2013. Trout 148.284 was again regularly detected in the tailrace area during manual tracking events conducted during April and once during May and June, 2014. There were no detections of this individual from the stationary receiver at Spring Island.

148.295 (female; length = 349):

Trout 148.295 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected within the immediate tailrace area during six of the ten manual tracking events conducted during October, November and December 2013. There were no detections of this individual from the stationary receiver at Spring Island and it was not detected after the winter of 2013-2014.

148.314 (male; length = 392):

Trout 148.314 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during the first four manual tracking events conducted during October and early-November 2013. The mortality signal associated with trout 148.314 was first detected in the tailrace on November 15 and was active during all subsequent detections. There were no detections of this individual from the stationary receiver at Spring Island.

148.323 (female; length = 371):

Trout 148.323 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during each of the ten manual tracking events conducted during October, November and December 2013. There were no detections of this individual from the stationary receiver at Spring Island and it was not detected after the winter of 2013-2014.

148.334 (female; length = 353):

Trout 148.334 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected within the immediate tailrace area during seven of the ten manual tracking events conducted during October, November and December 2013. Trout 148.334 was again regularly detected in the tailrace area during manual tracking events conducted during late-April and May, 2014. There were no detections of this individual from the stationary receiver at Spring Island.

148.344 (female; length = 341):

Trout 148.344 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during each of the ten manual tracking events conducted during October, November and December 2013. The mortality signal associated with trout 148.344 was first detected in the tailrace on March 18 and was active during all subsequent detections. There were no detections of this individual from the stationary receiver at Spring Island.

148.355 (male; length = 342):

Trout 148.355 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during the first three manual tracking events conducted during October and early-November 2013. The mortality signal associated with trout 148.355 was first detected in the tailrace on November 13 and was active during all subsequent detections. There were no detections of this individual from the stationary receiver at Spring Island.

148.363 (female; length = 365):

Trout 148.363 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected approximately 6.5 miles downstream of Skelton in ledge-riffle habitat in the vicinity of Little House of Prayer during three of the four November 2013 tracking events. There were no detections of this individual from the stationary receiver at Spring Island and it was not detected after the winter of 2013-2014.

148.372 (male; length = 339):

Trout 148.372 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected approximately 6.5 to 7.0 miles downstream of Skelton in ledge-riffle habitat in the vicinity of Little House of Prayer during late October, November and December 2013. Trout 148.372 was recorded by the stationary receiver monitoring the vicinity of the Spring Island dam on November 27th, December 22-23, 2013 and March 12, 2014. The mortality signal associated with trout 148.372 was first detected in the vicinity of the Little House of Prayer on May 29 and was active during all subsequent detections.

148.381 (male; length = 368):

Trout 148.381 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during each of the ten manual tracking events conducted during October, November and December 2013. The mortality signal associated with trout 148.381 was first detected in the tailrace on May 29 and was active during all subsequent detections. There were no detections of this individual from the stationary receiver at Spring Island.

148.394 (female; length = 357):

Trout 148.394 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected by stationary receiver in the vicinity of the Spring Island dam from October 31, 2013 through February 10, 2014. Trout 148.394 was next detected in the tailrace area during a manual tracking event conducted May 29, 2014.

148.402 (male; length = unknown):

Trout 148.402 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected within the immediate tailrace area during the first two manual tracking events conducted during October, 2013. There were no detections of this individual from the stationary receiver at Spring Island and it was not detected after the winter of 2013-2014.

148.415 (female; length = 364):

Trout 148.415 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected approximately 6.5 miles downstream of Skelton in ledge-riffle habitat in the vicinity of Little House of Prayer during three of the four November 2013 tracking events. The mortality signal associated with trout 148.415 was first detected in the vicinity of the Little House of Prayer on May 29. There were no detections of this individual from the stationary receiver at Spring Island.

148.424 (female; length = 365):

Trout 148.424 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected within the immediate tailrace area during the first four manual tracking events conducted during October and early-November, 2013. The mortality signal associated with trout 148.381 was first detected in the tailrace on May 15 and was active during all subsequent detections. There were no detections of this individual from the stationary receiver at Spring Island.

148.433 (male; length = unknown):

Trout 148.433 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected from an area approximately one-half miles downstream of the boat ramp during most of the manual tracking events conducted during November and December, 2013. There were no detections of this individual from the stationary receiver at Spring Island and it was not detected after the winter of 2013-2014.

148.446 (male; length = 356):

Trout 148.446 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected within the immediate tailrace area during four of the ten manual tracking events conducted during October, November and December 2013. Trout 148.446 was again regularly detected in the tailrace area during manual tracking events conducted during April, May, June and July 2014. The mortality signal associated with trout 148.446 was detected in the tailrace on August 12, 2014. There were no detections of this individual from the stationary receiver at Spring Island.

148.455 (male; length = 359):

Trout 148.455 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during each of the ten manual tracking events conducted during October, November and December 2013. Trout 148.455 was again regularly detected in the tailrace area during manual tracking events conducted during April, May, and June 2014. The mortality signal associated with trout 148.455 was detected in the tailrace on June 27, 2014 and was active during all subsequent detections. There were no detections of this individual from the stationary receiver at Spring Island.

148.465 (male; length = unknown):

Trout 148.465 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during each of the ten manual tracking events conducted during October, November and December 2013. The mortality signal associated with trout 148.465 was first detected in the tailrace on May 29, 2014. There were no detections of this individual from the stationary receiver at Spring Island.

148.475 (male; length = 380):

Trout 148.475 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during each of the ten manual tracking events conducted during October, November and December 2013. The mortality signal associated with trout 148.465 was first detected in the tailrace on May 29, 2014. There were no detections of this individual from the stationary receiver at Spring Island.

148.485 (female; length = 346):

Trout 148.485 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during each of the ten manual tracking events conducted during October, November and December 2013 as well as the first spring tracking event on March 18, 2014. The mortality signal associated with trout 148.485 was first detected in the tailrace on April 2, 2014 and was active during all subsequent detections. There were no detections of this individual from the stationary receiver at Spring Island.

148.493 (male; length = 340):

Trout 148.493 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during each of the ten manual tracking events conducted during October, November and December 2013. There were no detections of this individual from the stationary receiver at Spring Island and it was not detected after the winter of 2013-2014.

148.514 (female; length = 351):

Trout 148.514 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected immediately downstream of the boat ramp during the late-November 2013 tracking events. It was detected within the tailrace from the May 29th manual tracking event as well as those during June and July, 2014. The mortality signal associated with trout 148.514 was detected in the tailrace on August 12, 2014. There were no detections of this individual from the stationary receiver at Spring Island.

148.525 (male; length = 336):

Trout 148.525 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during each of the ten manual tracking events conducted during October, November and December 2013. Trout 148.525 was again detected in the tailrace area during manual tracking events conducted during mid-March and early-April. The mortality signal associated with trout 148.525 was detected in the tailrace on April 25, 2014 and was active during all subsequent detections. There were no detections of this individual from the stationary receiver at Spring Island.

148.535 (male; length = 332):

Trout 148.535 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected within the immediate tailrace area during the first two manual tracking events conducted during late-October, 2013. Trout 148.535 was detected approximately 1.1 miles downstream of Skelton during a manual tracking event on November 26. There were no detections of this individual from the stationary receiver at Spring Island and it was not detected after late-November, 2013.

148.546 (male; length = 337):

Trout 148.546 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during nine of the ten manual tracking events conducted during October, November and December 2013. There were no detections of this individual from the stationary receiver at Spring Island and it was not detected after the winter of 2013-2014.

148.554 (female; length = 372):

Trout 148.554 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected within the immediate tailrace area during five of the first six manual tracking events conducted during October and November 2013. There were no detections of this individual from the stationary receiver at Spring Island and it was not detected after the winter of 2013-2014.

148.564 (female; length = 371):

Trout 148.564 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected approximately 5 miles downstream of Skelton in the vicinity of the Route 5 Bridge during late October, November and December 2013. Trout 148.564 was manually detected in the immediate tailrace area during two manual tracking events during the second half of May, 2014. Its final detection occurred in late June in the vicinity of the Route 5 Bridge. There were no detections of this individual from the stationary receiver at Spring Island.

148.576 (male; length = 355):

Trout 148.576 was released at the boat ramp downstream of Skelton on October 23, 2013. Further manual detections for this individual were limited to the area 150-300 m downstream of the boat ramp during the latter part of November, 2013. There were no detections of this individual from the stationary receiver at Spring Island and with the exception of late-November, it was not detected again during the study period.

148.586 (male; length = 360):

Trout 148.586 was released at the boat ramp downstream of Skelton on October 23, 2013. Manual detections of trout 148.586 were limited to a single detection in the tailrace during late-October and the first half of November,

2013. There were no detections of this individual from the stationary receiver at Spring Island and it was not detected after the winter of 2013-2014.

148.595 (female; length = 385):

Trout 148.595 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during each of the ten manual tracking events conducted during October, November and December 2013. There were no detections of this individual from the stationary receiver at Spring Island and it was not detected after the winter of 2013-2014.

148.607 (male; length = 336):

Trout 148.607 was released at the boat ramp downstream of Skelton on October 23, 2013. Fall-winter detections of trout 148.607 were limited to a single detection downstream of the Skelton boat ramp during late-October and two detections in the vicinity of Poducts Brook during mid-November. Trout 148.607 was manually detected in the immediate tailrace area during a single manual tracking event during late-May, 2014. There were no detections of this individual from the stationary receiver at Spring Island.

148.625 (male; length = 344):

Trout 148.625 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected within the immediate tailrace area during the five of the first seven manual tracking events conducted during October and November 2013. The mortality signal associated with trout 148.625 was detected in the tailrace on March 18, 2014 and was active during all subsequent detections. There were no detections of this individual from the stationary receiver at Spring Island.

148.652 (male; length = 347):

Trout 148.652 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected within the immediate tailrace area during the nine of the first ten manual tracking events conducted during October, November, and December 2013. Trout 148.652 was detected by manual tracking in the tailrace on March 18, 2014. The mortality signal associated with trout 148.652 was detected in the tailrace on April 2, 2014 and was active during all subsequent detections. There were no detections of this individual from the stationary receiver at Spring Island.

148.775 (male; length = 369):

Trout 148.775 was released at the boat ramp downstream of Skelton on October 23, 2013. Fall-winter detections of trout 148.775 were limited to two events in the tailrace during late-October and two events downstream of the Skelton boat ramp during late-November. There were no detections of this individual from the stationary receiver at Spring Island and it was not detected after the winter of 2013-2014.

148.834 (male; length = 346):

Trout 148.834 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during each of the ten manual tracking events conducted during October, November and December 2013. There were no detections of this individual from the stationary receiver at Spring Island and it was not detected after the winter of 2013-2014.

148.864 (male; length = 359):

Trout 148.864 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during each of the ten manual tracking events conducted during October, November and December 2013. The mortality signal associate with trout 148.864 was manually detected in the immediate tailrace area during a single manual tracking event during late-May, 2014. There were no detections of this individual from the stationary receiver at Spring Island.

148.895 (female; length = 332):

Trout 148.895 was released at the boat ramp downstream of Skelton on October 23, 2013. Fall-winter detections of trout 148.895 were limited to a single event in the tailrace during late-October. The mortality signal associated with trout 148.895 was detected downstream of the Skelton boat ramp on November 8, 2013 and was active during all subsequent detections. There were no detections of this individual from the stationary receiver at Spring Island.

148.924 (male; length = 346):

Trout 148.924 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected within the immediate tailrace area during seven of the ten manual tracking events conducted during October, November and December 2013. Trout 148.924 was detected by manual tracking in the tailrace on March 18, 2014. The mortality signal associated with trout 148.924 was detected in the tailrace on April 2, 2014 and was active during all subsequent detections. There were no detections of this individual from the stationary receiver at Spring Island.

148.955 (female; length = 343):

Trout 148.955 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected within the immediate tailrace area during nine of the ten manual tracking events conducted during October, November and December 2013. There were no detections of this individual from the stationary receiver at Spring Island and it was not detected after the winter of 2013-2014.

148.985 (female; length = 389):

Trout 148.985 was released at the boat ramp downstream of Skelton on October 23, 2013. Manual tracking detections of trout 148.985 were limited to a single event downstream of the Skelton boat ramp during late-October 2013 and a single event in the tailrace during late-May 2014. There were no detections of this individual from the stationary receiver at Spring Island.

149.003 (female; length = 363):

Trout 149.003 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during each of the ten manual tracking events conducted during October, November and December 2013. Trout 149.003 was again regularly detected in the tailrace during all three April 2014 tracking events. There were no detections of this individual from the stationary receiver at Spring Island.

149.012 (male; length = 362):

Trout 149.012 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during each of the ten manual tracking events conducted during October, November and December 2013. Trout 149.012 was again detected in the tailrace during late-April and May tracking events. The mortality signal associated with trout 149.012 was detected in the tailrace on June 6, 2014. There were no detections of this individual from the stationary receiver at Spring Island.

149.024 (female; length = 335):

Trout 149.024 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected approximately 6.5 miles downstream of Skelton in ledge-riffle habitat in the vicinity of Little House of Prayer during late-November and early-December 2013 tracking events. The mortality signal associated with trout 149.024 was detected in that area on December 10, 2013. There were no detections of this individual from the stationary receiver at Spring Island.

149.054 (female; length = 374):

Trout 149.054 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected by stationary receiver in the vicinity of the Spring Island dam from October 31, 2013 through March 20, 2014. Manual tracking events during November, 2013 confirmed its presence near Spring Island dam. Trout 149.054 was not detected back upstream for the remainder of the study.

149.065 (male; length = 334):

Trout 149.065 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during each of the ten manual tracking events conducted during October, November and December 2013. The mortality signal associated with trout 149.065 was detected in the tailrace on July 18, 2014. There were no detections of this individual from the stationary receiver at Spring Island.

149.073 (male; length = 391):

Trout 149.073 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during each of the ten manual tracking events conducted during October, November and December 2013. The mortality signal associated with trout 149.073 was detected in the tailrace on March 18, 2014 and was active during all subsequent detections. There were no detections of this individual from the stationary receiver at Spring Island.

149.085 (female; length = 309):

Trout 149.085 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during each of the ten manual tracking events conducted during October, November and December 2013. There were no detections of this individual from the stationary receiver at Spring Island and it was not detected after the winter of 2013-2014.

149.093 (female; length = 366):

Trout 149.093 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected by stationary receiver in the vicinity of the Spring Island dam from October 31, 2013 through March 20, 2014. Trout 149.093 was detected back upstream in the tailrace during manual tracking events on April 25, May 29, and June 27, 2014.

149.113 (female; length = 368):

Trout 149.113 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was detected downstream of the Skelton boat ramp during the first two manual tracking events during late-October. The mortality signal associated with trout 149.113 was detected in the tailrace on November 8, 2013 and was active during all subsequent detections. There were no detections of this individual from the stationary receiver at Spring Island.

149.122 (male; length = 352):

Trout 149.122 was released at the boat ramp downstream of Skelton on October 23, 2013. This individual was regularly detected within the immediate tailrace area during each of the ten manual tracking events conducted during October, November and December 2013. There were no detections of this individual from the stationary receiver at Spring Island and it was not detected after the winter of 2013-2014.

COOPERATIVE

STATE FEDERAL

PROJECT

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

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

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