



Monthly Hatchery Report

February, 2016

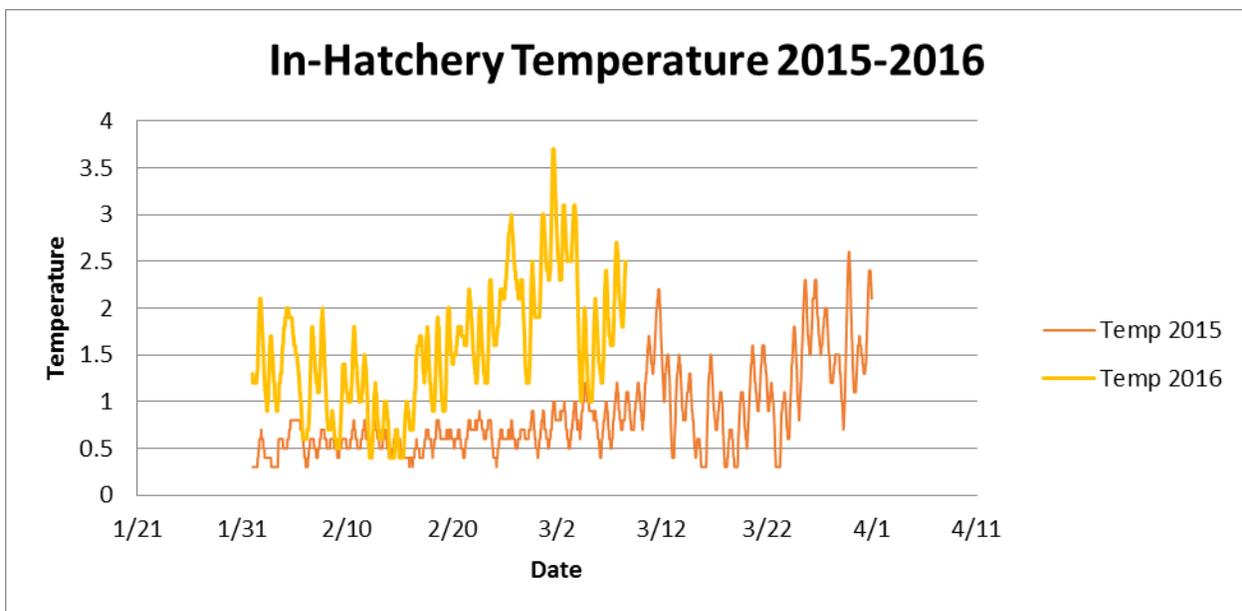


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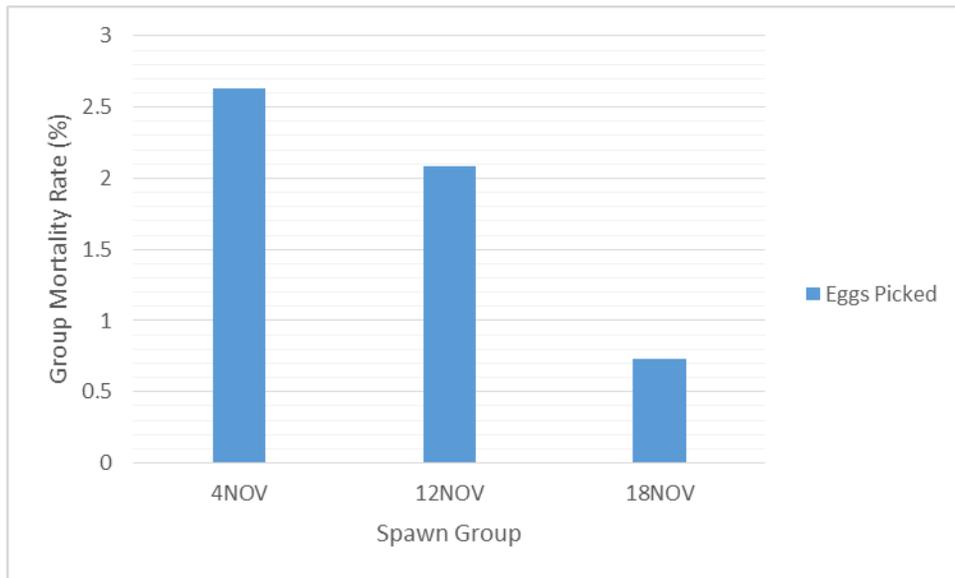
A report of monthly activities and events

March came in like a lion this year, bringing some heavy rain, high winds and above average temperatures. With little to no snow pack this year, a stark difference from the 14 feet of snow we had in the woods this time last year, we will hope for the rain to continue through the spring.

Temperatures in the hatchery have been consistently above normal throughout much of the winter. As shown in the graph below, temperatures have fluctuated quite a bit this winter, rising to nearly 4°C toward the end of the month. This has quickened development and we have already seen the earliest groups of eggs beginning to hatch.



Egg survival has been good this spring. To date we have seen only 2.02% mortality in the egg life stage. In the fall, fish are spawned at different times depending on whether they are ready or not. This timing could be days or even weeks apart. This year we receive three groups of eggs that were spawned on three different dates – November 9th, November 12th and November 18th. Some of the groups have seen a little higher mortality rate, but this variability is normal. The graph below shows the different rates of mortality for each group.



We have been tracking egg development using a development index. The index estimates egg development based on daily water temperature. There is a range from 0 to 100% developed (DI), where 0% DI is at fertilization and 100% DI is first feeding as fry. This can help determine how quickly or slowly eggs may be developing, and can help predict when they will hatch, as well as emerge. At 58% DI, the eggs should be nearly 90% hatched. Below is a table showing DI on February 28th for 2015 and 2016.

Date	February 28 th 2015	February 28 th 2016
Max Development	50.24	57.86
Min Development	39.28	39.97
Average Development	44.05	47.90

On the 24th of February we had our biannual meeting with the collaborators of the Parr Project. Due to inclement weather NOAA, ASF, USFW, and some DMR representatives attended via phone conference. DSF employees and board members, along with local DMR representatives were there in person. Following in bullet format are a few important take homes from the meeting.



- In the 2015 fin clipping season there were 752 hours of clipping performed by volunteers.
- During 2015's electrofishing season:
 - o EMARC hatchery parr were present in 100% of tributaries sampled and 96% of mainstem sites sampled.
 - o 2015 was a slight decrease in parr/unit sampled (down 1.7 parr/unit from 2014), but is still higher than the decadal median and is the fourth highest parr density seen in the past 25 years.
- Broodstock collection on the East Machias River is much more of a certainty than other rivers because of the Parr Project – this is a large positive success for the project so far.
- There is no significant difference in condition factor of wild and parr stocked fish. Also, no significant difference in the weight-length relationship.
- There is no significant difference in condition, length, and weight of parr stocked at 45 fish/unit (Northern Stream) and fish stocked at 120 fish/unit.
- It is agreed that this project should continue for longer than 5 years to truly evaluate the strategy. Continued smolt capture and electrofishing data will help evaluate.
- There has been an increase in genetic diversity in the broodstock fish collected as 1+ parr from the East Machias River due to the Parr Project.
 - o The 2010 spawn year had 60% of family groups recaptured where by comparison 2009 and 2008 only had 45% and 51% of family groups recaptured (respectively).



- For the 2011 spawn year which only has 1+ parr that have been collected there is already a 60% family group recapture. This value should go up as more genetic samples are processed.

You can find more detailed meeting minutes at the end of this report.

We have presented one movie at EMARC this winter as part of our Winter Movie Series. We showed “We Are Salmon Junkies” on February 26th and had a good turnout of close to 20 people. We are planning on showing a series of movies throughout March and April, and hope to keep the crowd coming! This is a great opportunity to showcase all we have to offer at EMARC to local community members and folks who may not otherwise come through the facility.



Parr Project Meeting Notes – February 24, 2016

Winter Parr Project Meeting

EMARC

2-24-16

10:00 EMARC Update – Zach (DSF) /Dwayne (DSF)

Habitat Restoration / Protection

Beaverdam Stream – upper culvert/dam was removed last fall by DSF. Plan to have Wigwams program to go in a remove remnant log drive dam between upper site and lower culvert site.

Andy – NRCS and ASF have the federal dollars but requiring around \$110,000 private dollars to match. Working internally with them the plan forward. Looking at a bridge for the lower site, along with further stream construction work at the upper site.

Dwayne – parcel in Wesley. 3 miles along river corridor. Have a buyer lined up...working on convincing. Interesting parcel that has canoeing, camping, timber harvest, corridor protection possibilities. A project like the Parr Project brings more importance and attention to something like this and/or other protection/restoration sites.

Hatchery Update

See presentation

Temp – warm, dry summer with a few large rain events. Emergence began May 14th. Persistent high temps into the beginning of fall/fin clip time. High temp 25.6C Aug 24th. Last fish stocked by Nov 2 with a temp of 9.1C

Growth – fish were smaller this year than 2014 due to high temperatures and bacterial infection that came through the river. Avg weight at stock out was 5.7g...but important to note that the fish were smaller in the river last year well.

Mortality – survival fry to parr in 2015 around 78% for comparison in 2014 survival 93% around the same time.

Fin clipping – 752 hours put in volunteers. Took a little over 3 weeks to fin clip. Volunteers are high school students, college students, community members, etc.

Stocking – stocked around 192k fish and we kept stocking densities the same in 2015 as 2014. 120 parr/unit in everywhere except Northern Stream that was 45/unit (control). Also stocked a site below our smolt traps as well as a couple sites above our smolt traps that we haven't stocked

A Report on activities from the *Peter Gray Hatchery*, East Machias, ME.



before. Unfed fry (10,500) stocked in Harmon and Creamer Brook (small, cold tribs). Estimated lengths at stock out smaller in 2015 (more consistent naturally than previous years).

Redd counts – 9 redds in EMAC watershed. 4 in Northern Stream and 5 in Chase Mill Stream.

2016 – Around 345,000 eggs at EMARC. 8 schools involved in the Salmon in Schools program.

Questions/Comments/Concerns?

It would be good to have the variances around these numbers (size at stock out) to make it easier to compare things statistically, but important to note that the size at stock out is similar to the fish in the river...with the exception of 2013 where the hatchery fish were just a bit larger. Another thing that would be helpful is to have the dates they were stocked out and/or the median date they were stocked to make sure that isn't a variable in the size at stock out. One possibility is using standard days for emergence to stock out for the fish in each year and compare that. Another option is taking actual length data during stock to compare with our estimations based on weights. Essentially make an EMARC specific regression/formula.

10:45 Brief smolt trapping update and bridge construction update. – Colby

Made contact with Eric Hamm out of Augusta DOT. He called and let him know the contract hasn't been awarded yet, so not sure which of three companies will be performing the work. Should happen very soon though and DSF and DMR will be able to sit down and have a meeting. Although DOT spelled out specifically in the bid packets about the smolt migration and the guaranteed attachment of the smolt traps. The bridge construction shouldn't affect our smolt trapping operation at all. Good thing is they know when we pull the traps for the end of the season they can start their in water construction.

11:00 Electrofishing update – Colby

See presentation

Sampling – two time periods due to high flows. Hatchery parr found in 100% of tributaries and 96% of mainstem sites. No fish at Munson Rips on the mainstem. There are parr in other areas but the sampling is randomly generated – example there are parr right outside EMARC, but that wasn't fished this year.

Beaverdam Stream – parr densities were boom and bust until recent years when it has held steady around 15 parr/unit. In the past was based on natural spawning which had densities of 1 or



2/unit up to 40 large parr/unit. Beaverdam stream is our most productive water for salmon in the EMAC River. There could be variation in other parts of each tributary and mainstem types seeing that we can't efish every single piece of habitat. Data is being compiled for Northern Stream that compares from 6 to 16 sites throughout the stream. High probability we are producing more smolts in Beaverdam since supplementation began.

Northern Stream – some adult stocking was done and it improved parr densities. In 2014 and 2015 the parr production was generated just by parr stocking. No difference in parr density from adult stocking and parr stocking in recent years. In the large spawning year of 2011 we didn't see a lot of natural spawning like we did in some other downeast rivers.

Seavey – lacks in some productivity compared to Beaverdam and Northern, but last year there was a 5.8 parr/unit increase that gave a density of 10.2 parr/unit.

Mainstem above Rt 9 – 6 parr/unit. Down from last year like the rest of system (except for Seavey). Why is it down? Environmental? Stocking densities? Predation?

Drainage wide medians – This is pulling all of the values from each site. Last year at first drainage wide stocking resulted in densities of over 10 parr/unit drainage wide. 2015 a slight decrease of 1.7 parr/unit, but still higher than decadal median and is the fourth highest value we've seen in the past 25 years. There were concerns last year with low smolt production that we had collapsed the population, but we didn't see that result. Condition factor of the fish comes into play here. Important to note that we are bouncing around at a much higher level (parr density), that means some years we may spike much higher because there will be a lot of fish in the river. Colby – each down year there are fears of being able to collect our parr broodstock to maintain a good diversity and family group retention. There is no concern of accomplishing that in the East Machias River due to the parr project. A large positive success for the project so far.

Growth and Condition Comparison – able to compare fry stocking vs parr stocking. Also able to compare 45 fish/unit and 120 fish/unit. 2015 wild and parr stocked fish were smaller in length and weight compared to 2014. Factors affecting both types equally. Size difference of fry stocked and parr stocked is driven by the small, cold tributaries we put fry into (slower growth). Size and weight not tell all so we look at condition factor. No significant difference in condition factor of wild and parr stocked fish, also no significant difference in weight-length relationship. We want condition factor above 1. Our range of k factors can dip below 1, but majority are above 1 and upwards of 1.3. This all takes into account density dependent growth, but we also need to know if we have density dependent mortality.

For 45/unit parr vs 120/unit parr there is no significant difference in the condition, length, and weight of fish. Results indicated poor rearing conditions in 2015. Advise to maintain or increase stocking density. However the smolt production could tell us a different story this year. If we generate less smolt again we may need to look at what our densities are doing to overwinter survival. Just because more parr in fall doesn't always translate to more smolt in the spring. 1 smolt per unit would



be an interim goal (would love to 3), but currently growing 0.1 to 0.2 smolt/unit. EMAC p8 component is smaller (in EMAC) than on the Narraguagus and Sheepscot. Lost a large portion of p8s last winter so bad survival for them overwinter. The importance of being able to maintain broodstock is right at the top of the list and a success we can point to already with this program. Genetics have been processed (and continuing to be processed) compiling the data from the parr captured for broodstock. We feel that we should be able to improve family group retention with the parr stocking strategy.

11:45 Parr Project Moving Forward

Adaptive Management Plan

- We don't currently have a written plan, but we have an adaptive management approach that we've been following
- Some things should probably be discussed and written down
 - o Ex. We have 345,000 eggs on station, what if we see another bad year for smolts?
 - o Depending on those decisions other things may need to start to take place. (permits, framework, etc.)
 - o Options could be to spread the parr out more in the watershed. This includes Chase Mill Stream, more in lower mainstem and increased stocking density in Northern Stream
 - o 300,000 par for 1939 units of habitat would be around 155 parr/unit (currently at 120/unit)
 - o Ideally the fish will be kept in EMAC (keep in mind this is where DSF currently has funding) and also we are trying to figure out what is best for this watershed (carrying capacity, etc.)

Oliver - DMR does have some concerns about increasing densities and would recommend status quo, but they are open minded and appreciative of talking about it ahead of time. I think it would be good to lay out some options and plans to handle the additional fish on station. In favor of plans contingent on smolt trapping and efishing results. More data the better. I do see a need in trying to summarize this project to date b/c I see requests come across my desk from governor's office about expanding parr project. Not comfortable answering that question without more data. Plan in place based on contingencies would be excellent.

Dwayne – we are actively fundraising for the next five years of this project, b/c we feel it needs to go longer. Although we need more data, we feel what we've seen so far is promising enough to go after more funding. Funding to continue EMARC and possible build some flexibility into our Pleasant River facility.

Some thoughts of NOAA and DMR revolve around if we get the same result from 45/unit and 120/unit stocking. Just don't want DSF to waste resources that could be used other places downeast for more benefit to the salmon.



DMR mentions that there is vacant habitat that don't rely on river specific stock and perhaps those are areas that should be considered if we have "extra" fish for the East Machias River.

DSF mentions that it would be good to find out what the affect over time is with high stocking density. If that number is a high level and in a given year the conditions are good it could spike up b/c the fish are in the river. So, if we do it over ten years and we never see a spike up that would tell us more about the potential. Not enough years of data under this strategy to say if we are harming anything or how much we are helping.

It's agreed that if we don't start seeing more smolts we need to figure out why. Perhaps if we can't get higher than a couple hundred smolts and 1000 smolts then what DMR and NOAA are saying is those fish can have a larger impact if they are spread to other areas.

DSF is concerned and active in this entire region and have been harping on the fact of vacant habitats not stocked. We would be all for that if we felt we were wasting resources here and harming anything. Also the backers behind this program want to see this strategy truly tested...given a very good opportunity. For example, give it a run of a decade if possible and then also try new things. How long is long enough to try? The data along the way should tell us, but with the salmon lifecycle we may be talking a decade.

Genetic diversity increase for the East Machias River. 2010 spawn year 60% of families recaptured. For example in 2009 only recaptured 45% of families. 2008-51%. 2011 spawn year even just with 1+ parr we already have 60% family recapture (which should go up). Obviously more is better. Family groups are evenly distributed throughout the hatchery and that carries over to stock out...so you have all family groups represented in every part of the river. The remainder of fish collected for brood stock that aren't tied back to hatchery parents are assumed wild spawning. Other way to think about it is their 203 parr sampled and we assigned 68% back to family groups. There is a component that isn't being assigned so that is from natural reproduction. Goal is to have that component proportional to the hatchery genetics to try to maintain as much diversity as possible.

It is important to note that as this project progresses we may discover things we don't even know yet and the project is bringing attention to the region and the fish. Also EMARC helps us if we want to replicate on other rivers, b/c of the data we are accumulating here. We have opportunities to move forward and we should do that. We do need to look at if we have put too many fish or maybe not enough fish. Peter Gray never found he put too many fish in...each river is different.

ASF mentions that the smolt run is pretty critical and if it's bad we need to reconvene in short order. If it is good we need to increase densities, because that is one of the goals of the project. If smolt run goes up we need to push the limit. We need to continue to test that otherwise we could jeopardize some of the support for the project.



DMR would like to put together some contingencies. Not advocating to reduce densities, but rather do you hold where you are or increase. Two things about that though: 1 the densities is one are DMR had the biggest heart burn over at the start of the project and how it was being promoted. 2 we don't have a place in the state where we have gone overboard on the densities, usually conservative. This is a place where we could and see the results of stocking higher densities (which is favorable).

NOAA agrees that stocking limits should be pushed. One issue is the lack of study design here. If each year is different density across the whole watershed. Would be better to have 50 here, 75 here, and 100 here...but don't have the staffing to efish all of that. If same fall parr densities with any density stocked do you really need to spend those resources to stock more. DMR and DSF and NOAA can play around at the assessment committee to come up with a number of pre smolts present in the river. With that data and the smolt data and the efish data we can look at that make a wise choice.

Another major concern is mortality, especially as the smolts migrate downriver through many lakes. What's the mortality through all of those? Through the Narraguagus in Beddington Lake there have been studies where survival through a lake was as low as 8-20%. Any way to factor that into our estimate on the EMAC? May not be densities and overwinter, but we are losing them in predation during spring migration. Water level also has impact on that thru constriction of water ways (less water = more predation). Also what affect could the increased densities of salmon have on the predator populations? We have juvenile data for lots of rivers to compare and it doesn't seem that's going to be the smoking gun. Could be smolt numbers but that is only one year...out of only 3 years sampled.

Getting back a bit to the contingency discussion...we haven't really said what if. There are a couple scenarios. Smolts are going to be worse better or same.... (Similar with juvenile estimates). What do we do if we need to go out of drainage with these fish? Not sure the best forum for the agencies and DSF to sit down and have these discussions, but they need to happen. Another item to remember is these fish are mobile so they may be swimming into vacant areas of habitat.

We do have long term data sets of efish data on the EMAC so we could pull those values together into a drainage wide estimate to give us more to compare. All about trying to find that sweet spot of stocking density. That sweet spot that creates the healthiest fish, the highest parr densities, and the highest numbers of smolt.

If in the next five years and smolt doesn't increase what are potentials? Do we put EMAC fish in vacant habitats or do we raise less EMAC fish and add another river's fish in the hatchery to maximize the hatchery space? Nothing is off the table for DSF, but we are a ways from that b/c we really want to stick with this method for a long enough time to wash out some



environmental factors (variables). A long term test and assessment is important, but speaking moving forward (this could be a decade from now). The Union River is an option...could be eggs for egg planting....could potentially come from an expanded Pleasant River Hatchery. Looking at donor funding and backing the Machias River is the most likely place to go if we are going to split EMARCs capabilities. The rivers share a bay and is right next door. Currently the Machias River has unfed fry stocking and some egg planting. Well over 1500 units of mainstem habitat that go vacant every year. DSF would love to see all vacant habitat downeast stocked. Vacant habitat could be explained at Union River (no river specific stock currently) and then there is vacant habitat in other downeast rivers because the hatchery product isn't there. Machias is the best example. EMARC is as much a demonstration that the fish could be raised in Peter Gray's style of hatchery, as well increasing the stocking densities and assessing the populations all along the way. Some question if we continue to stock and don't see more smolts in the future...is this just a factor of the East Machias River itself? Obviously too early to conclude such things.

It would be nice to be able to smolt trap at the outlets of say Beaverdam Stream or Northern Stream. This would help us answer some questions about whether the fish are dying in the winter or being eaten. Obviously at current staffing levels (resources) this would be hard to manage, but the data would be very valuable...especially considering the discussions that occurring about stocking densities and smolt numbers. Would be good to figure out the number of presmolts in the system before winter. Brood stock collection of 200-250 fish each year could also be impacting the smolt numbers as well. Some of the decline of p8s in last year's smolt trapping could also be explained if the fish raised at EMARC (as close to river size fish as possible) stayed in the river. This could be proven if we get a lot of p20s this year in the smolt trap.

If there were more capacity to hold brood stock more eggs could be available for Downeast Rivers. Perhaps commercial aquaculture holding brood to recondition them so there are more eggs available.

Measuring Success

Large parr abundance – increased and has maintained over past couple years

Increase in family group recapture. This is a huge plus for this type of stocking program and is good to know for the adaptive management.

- There is value of genetic diversity in the brood stock that will play out for years to come. East Machias broodstock line becoming better. How high can we get that family retention? Confidence in the fact we can collect broodstock each year.
- Collecting new data and increased data collection in East Machias.



- Smolt trapping, electrofishing – data and volume of data on things we didn't have before

Partnerships – people in this room, NASF, private dollars. Combination of staff of DSF and DMR to collect more data.

Outreach and Education – SIS, fin clip, interns, tours, events, etc...

Future Success

Smolt population – hopefully increasing as year's progress

Adult Returns

Increased genetic diversity – hope to continue to make the EMAC pop genetics better, stronger

Increase in watershed restoration (physical habitat, water quality etc.)

Determine applicability of this method

- So now that we are in year 5 of this project we have done:
 - Set up – pumps, tanks, etc.
 - Budgets for each year – so now we have a pretty good handle on what this costs to do
 - Paved the way for replications if funding shows.