BEFORE THE

FEDERAL ENERGY REGULATORY COMMISSION

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IN THE MATTER OF: : Project No.

TRANSCANADA HYDRO NORTHEAST INC. : 1904-073

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The Emerson Room

Courtyard Keene Downtown

75 Railroad Street,

Keene, NH 03431

Thursday, November 20, 2014

The above-entitled matter came on for technical conference, pursuant to notice, at 9:16 a.m., Bill Connelly, the moderator.

P R O C E E D I N G S

(9:16 a.m.)

MR. CONNELLY: My name is Bill Connelly from FERC. I have Steve Kartalia here who is with Blog and Matt Buhyhoff and before we get started, it would be nice if everyone could go around the room and introduce yourself and say your affiliation and spell your name for, Larry, our court reporter.

And I guess the purpose of the meeting for today is kind of to allow us to get information to understand the downstream passage of juvenile American shed and American eagles at the Vernon project. This is to see what's needed in terms of studies and additional information for our understanding.

So we have a bunch of questions we're going to ask everybody. Something that might seem like what's been done before. But we just want to make sure we understand everything very clearly. So if you just kind of bear with us on that.

So we have kind of an agenda that we sent out with the meeting notice. First what we're going to talk about is what information is needed regarding the timing, relative abundance and delay, and certain droughts.

But before we start getting into that, we'd like to have John Rangonese give a brief view of the typical fall

operation for the Vernon project. Before we do that, let's start with the introductions, please. And you start Andrea, and let's go around the room.

MS. DONLON: Andrea Donlon, A-n-d-r-e-a D-o-n-l-o-n, Connecticut River Watershed Council.

MS. GRIFFIN: Jennifer Griffin, TransCanada. The last name is Griffin, G-r-i-f-f-i-n.

MR. HOWARD: John Howard, the last name is H-o-w-a-r-d, I'm with First Light Power.

MR. GRIES: G-a-b-e G-r-i-e-s, with NHFGD.

MS. WILL: Lael Will, L-a-e-l W-i-l-l, Vermont Fish and Wildlife Department.

MR. CARPENTER: Matt Carpenter, M-a-t-t C-a-r-p-e-n-t-e-r.

(Laughter.)

MR. CARPENTER: New Hampshire Fish and Game.

MR. SPRANKLE: Ken Sprankle, U.S. Fish and Wildlife Service, S-p-r-a-n-k-l-e.

MS. GRADER: Melissa Grader, M-e-l-i-s-s-a G-r-a-d-e-r, U.S. Fish and Wildlife Service.

MR. DAVID: Owen David, O-w-e-n D-a-v-i-d, New Hampshire Department of Environmental Services, 401 Water Certification.

MR. BUHYOFF: Matt Buhyoff, B-u-h-y-o-f-f, FERC.

MS. BLAUG: Elisabeth Blaug, and Elisabeth is

spelled with an S, E-l-i-s-a-b-e-t-h last name is B-l-a-u-g. And I'm in the FERC's Office of General Counsel.

MR. CONNELLY: Bill Connelly, C-o-n-n-e-l-l-y, FERC.

MR. KARTALIA: Steve Kartalia, FERC, K-a-r-t-a-l-i-a.

MR. RAGONESE: John Ragonese, R-a-g-o-n-e-s-e, TransCanada.

MR. SIMMONS: Rick Simmons, S-i-m-m-o-n-s from Normandeau.

MR. TRESTED: Drew Trested, D-r-e-w T-r-e-s-t-e-d, with Normandeau.

MR. GURSHIN: Chris Gurshin, G-u-r-s-h-i-n, Normandeau.

MR. LEACH: Steve Leach, L-e-a-c-h, Normandeau.

MS. FISCHER: Maryalice Fischer, F-i-s-c-h-e-r, Normandeau.

MR. SULLIVAN: Tom Sullivan, S-u-l-l-i-v-a-n, Gomez and Sullivan Engineers.

MS. O'DEA: E-r-i-n O-'-D-e-a, Erin O'Dea, in-house counsel with TransCanada.

MS. OGNISTY-WINSTON: Kim Ognisty, O-g-n-i-s-t-y with Winston and Strawn on behalf of TransCanada.

MR. DAVIS: Eric Davis, Eric with a C, D-a-v-i-s, Vermont-ANR.

MR. CROCKER: Jeff Crocker, Vermont Agency of Natural Resources, C-r-o-c-k-e-r.

MR. BRUSH: Tim Brush, B-r-u-s-h, Normandeau Associates.

MR. KENISTON: Shawn Keniston, S-h-a-w-n K-e-n-i-s-t-o-n, TransCanada.

MR. CONNELLY: All right. So I guess I'm going to have John go over the operating.

MR. RAGONESE: Yeah, so, I mean, first of all every season is very different from year to year in terms of, you know, average or total precip and runoff. But in terms of sort of like -- you know, August through, you know, the first part of December operation, you know, again, just a little background.

Vernon has a 26-mile long reservoir. The operating range is generally limited to two feet or less unless we're having incredible spill and we end up having to use some gates that require us to go lower or rebuild, but this two-foot operation is a daily fluctuating operation. It doesn't always, you know, move two feet. Sometimes it only moves a few inches. Rarely, probably, does it to a full two feet in a day. We generally, you know, our top operating range is around 220 and the low operating range is around 218 on a normal basis. And we're probably more along the lines of, you know, 219.5, .6 and we're probably more

like 218.1, .2, something along those lines.

In terms of our generation, there are -- and just look up here a little bit, I'll --

MR. CONNELLY: Use the laser pointer if you want.

MR. RAGONESE: Oh, yeah. So there are ten units at Vernon. This is an overhead view of the station. These are the, you know, plan views, so these are -- basically are discharged kilowatt or sort of, you know, end of the draft two, they're not exactly looking like this all the time. You know, I say you won't see this, they're in the water. But essentially there are four of the oldest units are on the far right and these are numbered one, two, three, four. These are essentially two megawatt units. They pass around, I don't know, maybe, for lack of a better word or number, just use about 13, 1400 CFS.

These are our new four units. So these are Francis turbines. These are Kaplans axial directional Kaplans. So the flow is going directly at them from above. So they're vertically oriented. And then there are two more larger Francis units that are around four megawatts in size as well. These are basically, you know, sort of like twos, fours, and old fours.

The priority operation is essentially these here (indicating) because they are very efficient through a range of flows. Now, they typically will generate -- or you might

see generation going through these in the 1200, 1300 CFS all the way up to -- I've got another number slipping my head. Shawn, do you have that on the top of your head? I can't remember now. I want to say, 17, 18, or --

MR. KENISTON: Somewhere in there.

MR. RAGONESE: Yeah, somewhere in that range.

You know, not 2000 CFS. But because they're Kaplans you can rotate the blade and you can rotate the gates and so you have a very high efficiency range between that. Whereas these have a very poor efficiency range outside of their prime operating range of 13-1400 CFS. These have a little bit more flow going through them, these are more like 16, 18 but they're fixed wheel transit turbines.

So our priorities are these brand-new units that have good operating and efficiency. And then we would want to run these two larger units before we would end up using these. So essentially, you know, as flows increase, minimum flows intricately pass through with one of these or two of these. And then we would either increase these or -- now it all changes. Sometimes we have annual -- you know, we have an annual inspection. So they're not always the way I'm saying, but in general that's the priority just because of efficiency and megawatts.

So in the fall you would see pretty much a station would go to full operation until it would reach

somewhere around 16,000 CFS. At that point, you know, we might go as high as 17,000 CFS, but once we start seeing flows that would exceed that, we have to use our spillway.

Now, to describe the spillway -- or there's a number of different places where water goes through other than the -- let me start with, there's a tube that runs through the station right here (indicating) and this tube is our primary downstream passage orifice and it goes through the station. There used to be a couple of exciter generators that are no longer in place. We basically used that conveyance structure in the dam and the powerhouse to pass one of the fish passage. There's another fish passage device that basically comes in off this corner and then comes right out in here (indicating).

There's a slue escape right here. And this is basically a surface gate that can be dropped down. And it's basically to handle trash or leaf debris. And then there is -- and I'm going to go down here because it's a little easier to see. This is a slue scape which is all vertically oriented. And we have four tandergates. These are about -- oh, I can't even read it now -- they're 20 by 10 or 50 by 10. I can't read that. Yeah, 50 by 10, along those lines. But basically these are 10-feet deep. Then there is a series of hydraulic blackboards, and these are -- basically you have a hydraulic set of pistons that are holding these

wooden boards up in place. They can be released, the boards flap down, but they don't go wash away in the river. But they come back up. Whereas these are stansion flashboards which basically boards that are sitting in kind of an I-beam or a slot. We typically try to pull those boards out of the slots to provide a little bit of a flow. But under an emergency situation you can basically, you know, for lack of a better word, sort of take a hammer and knock these pilings out, and when we knock those supports out in the middle, they fall over or get where we can pull them out and all the boards just get released into the river. This is sort of a last resort.

And then we have these two large retainer gates that are 20-feet deep. So you can see the elevation is definitely lower and they're on the other end.

Now, for those that aren't -- a slue escape operates from the top down. Tandergates operate from the bottom up. So they essentially have a sort of a pivot point out away from the dam, a set of radial arms that come off that pivot point, and a sort of a curved gate. And that gate just kind of swings up on an arc. So if you raised it, the water would, you know, just to crack it, for example, the water would spit out the bottom along the concrete sill.

Whereas the hydraulic flashboards, they would tip

over from the pivot point on the crest and the water would go over the top and the same thing with the flashboards here. So these are bottom sort of surface -- bottom opening gates, and others have surface. There's also a series of subgates that are below and in the concrete essentially. These are essentially at the bottom of the reservoir on the upstream side.

(Pause.)

MR. RAGONESE: Again, this is what a tandergate looks like. It would arc its way up. This is some of the flashboards that would typically, you know, tip over, and this is what a subgate sort of looks like. Right there. Sluegate called subgates.

So in the fall when flows would exceed station capacity, we would typically open our far tandergates on the far side. And these have -- I think each one has a capacity around 6,000 CFS. If flows exceeded that, we would probably either open the tandergates on this side or we might use the subgates. If there's ice on the pond, or ice is moving, we typically want to have our tandergates sort of clear of flow if ice is moving. We don't see that in the fall. So August, low flows, typically we're not spilling -- typically. September generally we start to see some increase in the flow, but typically not spilling. October you have more rains. It depends on when the leaves falls.

As soon as the leaves fall, you start getting a lot of precip in the river after a rain storm event, rather than getting, you know, what we typically might see in August of 20 percent of the precip shows up as runoff, you might see, you know, in upwards of 35, 40 when the ground freezes, you pretty much see, and the early part of the fall, you might see 70 or 80 percent.

So, really, it depends. I go back to sort of the two-foot fluctuation range. There's a lot of drainage area, there's a lot of inflow between the storage reservoirs and these projects including bellows and wilder. So, there are a lot of times we're sort of spilling at Vernon, and we're not spilling upstream at Bellows Falls. It doesn't happen all the time. It kind of depends on, in some cases, what's happening. There's a number of core reservoirs that control flow on the West River and on the Black. And sometimes they mitigate those storms, and sometimes the storms are really more hitting on the New Hampshire side and they don't really do a thing.

So, case in point here, for example, this past year we had sort of -- I don't know, Maryalice, you can maybe characterize this different because we had to cancel the different studies, but basically we had sort of an average August. We had some, you know, rain and we had -- I don't know if we spilled this August. But, September was

incredibly dry, like way below normal. So we didn't do anything on the entire river from 50 Mile Falls down except run minimum flows and even then we had the curtailment in flows when we typically would increase them. But there wasn't any water in the river.

And then come mid-October, everything was switched around. We got, you know, four inches of rain in some of these basins and we're spilling like crazy. I mean, spilling like crazy.

And then when we sort of planned on having, for example, certain studies we thought we actually would be able to do it turns right back around and we're not spilling anymore and we're back to what you saw yesterday which is basically, you know, a couple of units, you know, 3,000 CFS.

You know, in the fall there are going to be precip events. You know, we will see spills, we will see high flows, but they're not sustained. They're going to be events. And, you know, in terms of sort of migration, that's what we often see. We're going to see these high flow events and fish are going to move.

Does that help?

MR. CONNELLY: Yeah. So I had a question about -- Bill Connelly -- question about the subgates. How big are they and how do they work?

MR. RAGONESE: How do they work? Well, they're an open and close gate. They're an open and close gate, so they don't modulate any flow. And they are -- they look just like this.

MR. CONNELLY: Okay.

MR. RAGONESE: These were -- a lot of these were -- not so much rebuilt. We've done a lot of work on these in about the last ten years or so.

MR. KENISTON: It was probably the mid-90s.

MR. RAGONESE: Yeah. What we look at, when we get ready to operate these gates, is we're kind of trying to forecast what the flows are going to be, what they're going to peak out at. And these all are part of our -- you know, sort of our passage equation, you know, the amount of flow we can pass on to through the gam. So, for example, you know, we might not operate these as much in fall, under normal situations, but when we had say, Irene, or a big event, you need to get these open before you get to the point where you need them. So that's when we -- because they're going to flood. You can't go out there, you know, that whole thing is under water. So you actually can't get out there and -- so we would open them and then there's this corridor that sits in here behind here and that's all under water at that point. So we might, you know, predict flows that increase to the point, or water increase to the point

where we couldn't get in there and that's when we would open up before we get to that point.

Does that answer your question?

MR. CONNELLY: Yes, thank you.

MS. GRADER: John?

MR. RAGONESE: Yes.

MS. GRADER: Melissa Grader, Fish and Wildlife Service. Which of the units passes the minimum flow typically?

MR. RAGONESE: Well, in the fall, typically it's going to be the new efficient units, five to eight. In the spring, or if we're funning in the fall, the -- sorry, I'm just trying to get this right. If we're running the fish ladder, ten would be the primary minimum flow. Because we would -- when the fish ladder is operating and we operate the fish ladder in the fall if there were, in this case, remaining adult salmon below Vernon dam, we still operate the fish ladder. So that's why you saw it yesterday operating because we believe a number of salmon below and so when the dam is operating or when the ladder is operating, this is just to give you an example, this is the entry. This is sort of the entrance area for the fish ladder right in here. We run number ten to create a more lineal flow as opposed to if we were running these, the flow is out here and then might -- if these aren't running. So this would be

the minimum flow.

When the ladder is running, this is number one, this is number two, three, four, five, six, in terms of like an operating barrier. That's something that we worked out with the Fish and Wildlife Service and the Agency when we rebuilt these. And these are the ladder.

Now, that doesn't mean we might not run these somewhere before these. But this is definitely the running first unless it out of sorts or something.

MR. KARTALIA: Steve Kartalia, FERC. I had a question about the tandergates. There's a set of them close to the powerhouse and then there's the two on the New Hampshire side of the spillway.

MR. RAGONESE: Uh-huh.

MR. KARTALIA: In the fall and the ones on the New Hampshire side appear to go almost to the river bed. I guess that's the shallower side of the river; is that correct?

MR. RAGONESE: I don't think the river, per se is shallow. That's where there's rock where we anchored the dam.

MR. KARTALIA: Okay.

MR. RAGONESE: So, to say that it goes out -- the rock goes out there, but it is definitely at the base -- at the base of those tandergates is bedrock.

MR. KARTALIA: Okay. So in the fall when you receive flows that would require spillage, are you more likely to open tandergates close to the powerhouse or out on that end of the dam at the -- under flow conditions during the out migration season when you would need to spill --

MR. RAGONESE: Typically it's one of the two --

(Simultaneous conversation.)

MR. KARTALIA: -- it's out on --

(Simultaneous conversation.)

MR. RAGONESE: -- typically it's out on --

(Simultaneous conversation.)

MR. KARTALIA: Okay.

MR. CONNELLY: Are there any other questions for John?

(No response.)

MR. CONNELLY: So now we'll start at the information needs. And some of this is -- there are four things that popped up a lot in the Agency ledgers. There was the timing of the shad and eel runs, the relative but -- it was often referred to as magnitude or the run of the information about delay and the downstream passage routes. So this is the kind of information that we would like to kind of understand better, what the agency is meaning for each of these terms.

So we'll start off with "timing". So with regard

to timing, we need to know the timing for the runs. Does the timing mean like start and stop of the run or do you need to know when the peak occurs or do you need to know the overall distribution of the run?

So let's say, you know, a certain percent happens in the first two weeks, then there's a big peak for the -- the peak occurs, and then the remaining part of the distribution happens towards the end. So if you guys can fill me in on that, I'd appreciate it. And each agency would have different answers, that's fine too.

MR. SPRANKLE: Ken Sprankle, U.S. Fish and Wildlife Service. Timing is, of course, important for us because we provide schedules of operation for downstream, protective measures.

(Simultaneous conversation.)

MR. SPRANKLE: That's one. You raised a couple points, and they're all of interest to us. It's however you want to assign them. All of the things you mentioned are important, of course to us. But I guess one aspect of timing is, you know, when does it begin? When does it end?

For example, the timing, if you want to parse it out further, the timing of particular passage events, you know, what triggers that, how long it persists, under certain conditions it may be operational. It may be

environmental. It may be in relationship to temporal components, knowing that, you know, it may be dependent on when adults were able to get upstream and the water temperature conditions were such in the spring that that's when they spawned and subsequent river conditions provide certain growth situations.

So, I mean, it complicated and I think it will vary from year to year; when adults get up there, when they spawn, you know, are the juveniles afforded opportunities to grow early on? And some of our research would suggest that size may be a trigger. You know, certainly water temperature flow. You know, there are a number of different things that may operate to effect when fish decide to migrate.

MR. KARTALIA: I noticed in the comment letters on TransCanada's proposed study 34 that from both Fish and Wildlife Service and Vermont ANR, one of the modifications that both agencies suggested was running the study from August 15th to November 15th. And that, I assume, is the attempt -- or the goal of that temporal expansion of the study would be to conservatively capture the entire -- the earliest possible and the latest possible --

PARTICIPANT: Correct.

MR. KARTALIA: Correct? Okay. And is that based strictly on shad or do you think the November 15th would

capture the end of any silver eel migration? I've read in certain parts of New England that the silver eel run may go into December. But I don't know if that's -- you know, that might refer to Maine. It might not be applicable to the Connecticut basin. Do you have a sense for what -- if that timeframe would capture the eel run as well?

MR. SPRANKLE: This is Ken Sprankle, Fish and Wildlife Service again. We refer to Alex Herro to help us on these questions because he's a recognized eel expert naturally.

MR. KARTALIA: Yeah, right.

MR. SPRANKLE: So given what we've discussed for timing, he suggested, as we thought when we approached him on it, that it would be best to shift. We had been talking about September/October and we thought there would be benefits for potentially gathering data on eels potentially. But also more to the fact that the juvenile shad that we do again identify the timing of operations and we have expanded that somewhat over time based upon new research. And so at the county lab there was research conducted that really kind of made us question the start date for downstream passage for juveniles. And as a result of the research that was published, we pushed that date earlier to August 1st. There's going to be a lot of variability, we all know that. I mean, that's -- there's no question that that occurs.

But our sense is that for juvenile shad, thing are going to pick more towards mid to late August, September certainly in Portland. Depending on what the river conditions are and also going beyond that, kind of the experience of when they were spawned, the progeny and the growth conditions and so forth, that may influence -- that may protract the run and it may go into November.

And, Gabe, I don't know if you want to speak up on observations. You know, I have observed juveniles later into the season up there, but, you know, a lot of it depends on conditions that change from year to year.

MR. GRIES: Gabe Gries, New Hampshire, Fish and Game. One thing that I've observed just mainly in the Hunts Meadow area just downstream -- there's a backwater just downstream of Sasamo.

MR. CONNELLY: Upstream, you mean?

MR. GRIES: Yes. Yes.

MR. RAGONESE: While fishing in the evening into, you know, this time of the year in November still seeing lots and lots of shad coming to the surface that affect us both in the main river and in the backwater area. So they're certainly around. Whether those fish are still viably moving downstream or not, I can't say. But they have -- I have observed them in a number of years that late in the season.

MR. CONNELLY: So, Ken, you mentioned the reports, is that something that's like -- are those reports completed and available?

MR. KENISTON: Reports?

MR. CONNELLY: You mentioned research, rather. Sorry. Regarding, you know, seeing things -- seeing the shad start earlier than you expected.

MR. SPRANKLE: Oh, that was published by a county lab. It was Ben Letcher and Matt O'Donnell and it wasn't -- it wasn't definitively shown. It's very difficult, obviously to do studies on juveniles. They weren't marking them, but it was based upon inferences based upon densities, catch rates, sizes of fish and so forth that, you know, led them to suggest that the out migration could very possibly begin at a much earlier timeframe.

MS. GRADER: They couldn't confirm it because the bypasses weren't open at the time. This was just from their field sampling, not at the bypass samplers at either Turners or Holyoke.

MR. CONNELLY: So potentially they saw fish early.

MS. GRADER: They were repeatedly sampling and then the catch rates went down. And so the inference was that it was because the fish were moving out, but they couldn't corroborate or validate that until the fishways

were open and as soon as the fishways were open, I believe that they started -- they were passing fish. But they couldn't say that fish had passed earlier at those sites because they weren't open.

PARTICIPANT: Can I just ask a question. When was the key to that study? Because we have been operating them earlier lately.

MR. SPRANKLE: Yeah, and that was the result of --

PARTICIPANT: Yeah, I know, but the study didn't continue after that.

MR. RAGONESE: It didn't.

MS. GRADER: No.

MR. RAGONESE: It was for a masters --

MS. GRADER: I think it was 2000 was when it was published, or 2000 -- the research ended in 2000. I don't recall when it was published.

PARTICIPANT: Probably a few years.

MS. GRADER: With respect to eels, Melissa Grader, I would just add that -- I mean, again, the earlier the expansion of that time period was to acknowledge that we have documented eel kills in August. So we know that there are place where they do move out earlier than September 1. And on the far end, you know, there are a number of sites where the passage season for eels goes into November 15th or

ISM and that's just acknowledging that at some point, you know, you can't run these bypasses because of ice conditions. Although I think there might be literature indicating that there's a temperature threshold maybe 10 degrees -- I can't recall what it is, but there's also potentially that could be used as a cutoff date.

MR. KENISTON: For eels?

MS. GRADER: For eels.

MR. CONNELLY: So then the next thing that showed in the letters was talking about the relative -- the magnitude of the run. And sometimes that was defined as relative but it's in the record and sometimes not, so I would like to hear from the different agencies what "magnitude" means to them and why that's important for shad and eels.

MR. SPRANKLE: This is Ken Sprankler, U.S. Fish and Wildlife Service. It was our intention to have it in terms of relative abundance and the point being to understand in a relative sense with some information on timing of the run how the numbers of fish in terms of relative abundance -- when they first encounter the project through monitoring, and where they may choose to go based upon detections and how the systems may be set up. And have a sense for what the environment conditions are, you know, have a history of information associated with that. And

then also look at potentially how either operational and/or environmental conditions may have influenced where the relative abundances show up.

MR. CONNELLY: So it's --

MR. SPRANKLE: You know, inside of where the partial fish boom may occur, units nine and ten, five through eight, one through four. You know, I don't know.

MR. CONNELLY: So with regard to relative abundance, so you don't mean -- it's our understanding like how many fish total happen one-year pass through or how big the migration is versus --

MR. SPRANKLE: There's never an expectation for an absolute abundance.

(Simultaneous conversation.)

MR. CONNELLY: But we care about where -- where all the concentrations of fish occur?

MR. SPRANKLE: In a relative sense. Relatively speaking.

MR. CONNELLY: Okay. So, for example, like, say 20 percent of the fish observed during the season might happen --

MR. SPRANKLE: Correct.

MR. CONNELLY: -- through the fish versus the tandergates?

MR. SPRANKLE: Correct. And what were the

conditions if that occurred? How does it change over space and time. If that answers your question. But this all leads into really our approach to utilize several different methods to get at very important study objectives and not having to rely solely on a single method. All these methods have limitations, we all recognize that. And I know we'll get into the radio telemetry, but I'll stat it now that that sort of information that we feel is -- to us in acoustic was the best approach to go would allow, you know, to put the radio tagged fish data in some context. Again, we feel there are some limitations with that, we all acknowledge that. So, we can talk more about that later.

MS. GRADER: I would just add, I mean, it's not just gestation where the relative abundance is, but temporally. So, you know, and then being able to relate that to environmental and/or operational conditions.

MR. RAGONESE: How is this going to work? Like what if I don't understand what he just said, do I ask a question, or do you -- is this for you guys? I'm just curious.

MR. CONNELLY: I don't think if you ask a question; right?

We have time to get through what we need to get through still. So --

MR. RAGONESE: So when you're saying relative

abundance and we say relative abundance, I'm not sure it always means the same thing.

So when I think of relative abundance I sort of picture a curve, you know, and it could be a curve over time, it could be, you know, 52 curves, if you had a weekly, you know, whatever aid you want to go with. But it's sort of a curve usually with X axis being time and the Y axis being, you know, quantity. And you're saying that the use of hydro acoustics is to create that curve?

MR. SPRANKLE: You know, the way I envisioned it, I thought it was written. But, again, we need discussion on this. For example, right now if we just focused on the power house, you're stating how, you know, over the course of August, September, October, different things occur. You use different units differently. It's not always the same. And, you know, we recognize that. And so, the point being that with radio tagged fish, you know, we're just going to be able to release those mid to late in the run and the proposed single transducer is one point. And the concern being though, how does that represent all the different conditions. And, you know, to assume a linear relationship for just some of the questions on having a single transducer.

To get to your point, you know, what we would like to be able to understand is, you know, under -- in all

the different permutations, because just the data will be gathered. You know, what percentage of the fish that encounter the powerhouse based upon the data that's being monitored, we're over at nine and ten and utilize that section where --

MR. RAGONESE: Yep. What I'm trying to get at. I hear you. Okay. That's good. Good clarity. But what you're saying is that to get -- let's just say a ratio or a proportion or distribution obvious route selection, you would need to know a total number and a southern number -- a subset to be able to understand that relationship and that would be something that you expect Hydro-Acoustics to be able to produce?

MR. SPRANKLE: The data would need to be put in a context so that it could --

(Simultaneous conversation.)

MR. RAGONESE: Well, in the context of operation. That's all real data, I mean, hard data.

MR. SPRANKLE: Yeah, right.

MR. RAGONESE: But what I'm saying is that, your -- your with Hydro-Acoustics, you expect to be able to get numbers to do that?

MR. SPRANKLE: Numbers is a term that I guess is open to discussion for who -- you know, how the study is designed. And I don't know if we're going to get into that

level of --

(Simultaneous conversation.)

MR. RAGONESE: What I'm getting at is I buy the sort of time that you're going to see things. You'll see a start and end.

MR. SPRANKLE: Yeah.

MR. RAGONESE: And you might see, you know, more bleeps on some days than other bleeps.

MR. SPRANKLE: Yes.

MR. RAGONESE: But it's kind of that -- that's what I was trying to get. You're thinking that beyond the bleeps --

MS. GRADER: Not absolute numbers.

MR. SPRANKLE: It doesn't have to be absolute.

MS. GRADER: What we want to know is when do concentrations of fish come through, where do they come through, and what do those concentrations relate to?

MR. CONNELLY: Environmentally or operationally?

MS. GRADER: Exactly.

MS. WILL: Lael Will, Vermont Fish and Wildlife. I think if you were to take an example, so operate the fish ladders and we do monitoring of that, we know that those numbers are not absolute numbers. There's always some error involved, you know, either there's turbidity or outages or we don't get an absolute number, but it's an indication of

the relative abundance when fish are move through and what their concentration is. And we can use that information to inform decisions. So I think in the same context of this, we don't expect it to be an absolute number, but it's got to be an indication of when fish are moving and what they're, you know, general abundance is.

MR. KENISTON: And what might be triggering them to move in concentrations.

MS. WILL: And we see that in their -- you know, operations, what's happening operationally, flows, temperature, turbidity, all of that stuff, and we can take that and look at it in a broader, you know, context.

MR. CONNELLY: And you also want to know what proportion of fish use which route?

PARTICIPANT: Correct.

MR. CONNELLY: Okay. Do you have

MR. CARPENTER: Matt Carpenter, Fish Conservation Program. I just think in an ideal world that you would want to know where every fish went, what route they selected, what the conditions were, what the spill conditions were, what the flow conditions were, so the limitations really are just the technical, you know, feasibility and the cost. So --

MR. CONNELLY: Which we'll get into later.

MR. CARPENTER: Okay.

(Simultaneous conversation.)

MR. RAGONESE: That's good. That's what I wanted to know.

MR. KENISTON: Our main goal here today is to understand exactly the pieces of the biological -- you know, the behavior and how we can select the appropriate study methods to get at all these questions the best we can, you know, and what would be the best use of the specific technologies to get the job done best. And then that would feed into the information we need to make recommendations about how the project ought to operate or what modifications might need to be made which is directly related to the relicensing.

MR. CARPENTER: It's the same with the timing. I think the August 15th, November 15th, is somewhat arbitrary. You know, we really don't know just sort of the best guess then.

MR. CONNELLY: Does anyone else have anything else to ask or add before we move on to delay?

MR. KENISTON: And we will get more into the specifics of the pros and cons of different --

MR. CONNELLY: Yeah, this part of the discussion --

(Simultaneous conversation.)

MR. KENISTON: We just want to make sure we

understand before we move into the more specific study method section that we understand what questions we're trying to answer here.

MR. CONNELLY: All right.

MS. WILL: Just one other thing.

MR. CONNELLY: Sure.

MS. WILL: Lael Will, Vermont Fish and Wildlife. I think one thing to point out during this is that, you know, we know that these eels kind of distribute themselves throughout the basin. We have data when we go electro fishing that they're in these lakes and ponds and that's where they rear for ten years. But the study that was proposed to determine the distribution and abundance of eels is only going to go project area. And we had talked about this in the past of, you know, TransCanada going out to collect eels outside a project area. All these eels have to go through the project. So having these data would allow us to have better information on their abundances throughout the basin because they have to go through the project. And that's something that's been brought up before, but I just wanted to make point in terms of the relative abundance.

MR. CONNELLY: Thank you.

I guess one thing to follow up with that, so I mean -- okay. But I was good there.

(Laughter.)

MR. CONNELLY: I don't want to open any worms -- a can of worms.

Okay. Let's move on to delay which is something I'm particularly interested in. And I'm not sure what the agencies mean by "delay" and I'd like to know what is meant by "delay"; how would you define it, and like empirically, and then, you know, what is it going to be? Is there a delay? So, with regard to the delay, the NCC submitted a number of papers that talked about mentioning delay using hydro-acoustics to get at delay. I read most of those, and most of the papers kind of said something along the lines like, we saw fish and just left it there.

Or, you know, we purposely did not put hatchery fish were observed to be milling. And then some talked about, okay, so there's a way -- and you can kind of -- if you're using a technique that gives you a 3D kind of trap of where a particular fish went, they're flying like a bullet, then obviously there's no delay. And if they're kind of circling around and doing figure eights and loops and whatnot, then there might be delay. And there are ways you can kind of quantify it. There's like an index of singlocity or whatever to quantify the movement. But I never saw anything saying where there's a threshold like, boom, if they do this more than this, X amount of time, or they turn more than seven times, or if they spend more than

a certain amount of time in a certain place, that is the way versus flying like a bullet. So if you guys can elaborate on what delay is? How you measure it? How did you quantify it and the importance of it, I'd appreciate it.

MS. GRADER: Well, I think I'll take a first stab. I think that there is different kinds of delay. There is the delay that we expect and literature says typically occurs for migratory species when they hit an impoundment and, you know, velocity slow down. It's harder for them to find out where that major velocity is. And so there's the within impoundment, let's say, far afield, and then there's the near field which would be closer to the vicinity of the intakes or any bypass facilities. And both are needed pieces of information. The near field one particularly would inform how effective or efficient a particular bypass facility is and potentially inform what modifications may be necessary to improve the efficiency. In terms of how you go about determining what actually is milling -- where does milling become delay, where does delay become so significant that it impacts the run, well, any delay is not good. I mean, the goal is to get the fish out there as quickly as possible because we know that they need to get out there as quickly as possible to improve their chance of at sea survival. So, I don't know how much I can speak to how different technologies can get at answering

that question other than --

MR. CONNELLY: We can talk about that later, but, yeah.

MS. GRADER: Yeah.

MR. CONNELLY: What you have in mind right now would be nice to know.

MS. GRADER: Well, from what I've heard, what I've read and what I've heard in recent conversations is that it theoretically is possible to do with hydro-acoustics. It may be very expensive, it may be logistically complex, but it is possible, either with Didson or with Split B, maybe more so. I guess they both have their drawbacks and benefits and we're going to go into those later.

Delay also, you know, can be gotten at with radio telemetry. So I'm not here to say that it can only be, you know, one or the other. I think they both have benefits and drawbacks which we're going to talk about later.

Anybody else want to chime in?

MS. WILL: I have not read anything that quantifies delay. I have read, you know, a lot of papers about general descriptions of how they characterize delay, the milling are indicators of delay. But to say that this fish was delayed for three days and that's not acceptable, I haven't read anything to that effect. But to Melissa's

point, you know, we want these fish to be able to get out to the ocean as soon as possible. And so if they are having difficulties, you know, moving through the system, we would like to address that.

MR. SPRANKLE: You know, at the onset of this it was discussed that, you know, we have an opportunity to look at with the relicensing these multiple projects that all, you know, may affect the fish populations to different degrees. And we we were going to look at this comprehensively. So, I think that that's an important point I want to restate. And in the case of the shad with the upstream extent, being up stream of Vernon dam, if we can get an understanding of delay at Vernon, we get an understanding of delay at Turners Falls and understanding of delay at Holyoke, we as biologists can then go to literature, use, you know, information we have to understand whether or not that is an impact or not. Or when it may become an impact. So, that's one thing that is a great opportunity here that these studies and the information we're gathering are most directly going to be kind of comprehensively reviewed for a few months -- that affects primarily through Vernon, the pump storage and in terms Falls Holyoke is kind of hanging out there a little bit. But we have some opportunities there as well. So those are good questions.

I won't speak so much to the juveniles but as a corollary with adults, you know, what we see and what I'm most familiar with is that these fish will undertake rapid movements up to the first barrier they encounter and then they're delayed. And, so, you know, it's pretty apparent based upon telemetry data, when you look at it, and I think the acoustic data -- I'm not sure. I'm not so familiar with that. A lot of that is more near field, near project. So, you know, again, there are tradeoffs with the different data and I think, you know, the radio telemetry certainly has been used more as a tool, general dynamic.

PARTICIPANT: Go ahead, Matt.

MR. CARPENTER: I think there are a few ways at getting at delay. One would be more of a telemetry study, I guess, where you're looking at the rate of movement to increase one section of river and comparing it to a section with a dam. You could look at a free-flowing system, you know, in other studies, maybe, where they're moving, and you could look at overall timing from beginning to end. I'm not sure that those studies exist. You may compare it to the timing on the Connecticut where there's multiple dams. And I think there's -- Ken may be talking about which is trying to infer timing by looking at cumulations of fish at each dam and then noting the time in between -- comparing the time that they remain at the dam to when they show up at the

next dam. And I guess that's where the hydro-acoustics would come in.

MR. KENISTON: I have a question about delay as it may or may not relate to eels. Everything I've read in the discussion of delay and milling, has focused on juvenile shad for this downstream migration assessment. And my question is, is there interest from the agencies in trying to understand delay or is delay a concern for silver eels? And when we get into the methods, the reason I want to know if you're interested in delay for eels is we will have captured, tagged eels and I guess for each of those eels the study report is going to have a two-D map with time and it will show, you know, eel 34 was in the four bay for four hours or three days and then left and went downstream. And I think we all expect, because of the nature of the eel population in this upper part of the river, we expect the numbers to be fairly low. And I want to know if hydro-acoustics -- because the way I understand it, might be used for describing delay in juvenile shad, it kind of gets at the schooling nature of the shad whereas eels don't do that. So would that be something that is even a goal of this particular study. So, maybe give that some thought. I don't know if you have any answers now about that.

MR. GRIES: We're certainly interested in delay for both juvenile shad and for eels, if they exist. It

wouldn't be something that we would say, oh, yeah, you know, we know everything there is about eels at this particular project or another one, so we're not interested. You know, we certainly area. And, you know, there's just not a lot of raw data that exists. So, you know, if the technology is able to ascertain that --

MR. KENISTON: Okay. So maybe as we get into the study methods later, we can revisit that question and discuss whether the technology of hydro-acoustic, the various options, could answer that question.

MR. GRIES: Certainly in my mind, I mean, you know, all these things that we're talking about for juvenile shad also, you know, are relative for eels as well.

MS. GRADER: To follow up on what Gabe was saying, I think we know that they typically do delay in impoundments and I think that what Alex Harrow has done at Turners Falls showed that they delay in front of racks. That's at that particular site. You know, and each site is very different.

We also know that in some situations if they're delayed for too long a period, and potentially it's temperature related, they'll shut down and they won't continue their migration. That's significant. That's extremely significant. Those eels are not getting to the sargaso. They're not able to spawn, they're in the river

for additional time. They're susceptible to whatever sources of mortality they're prone to while they're in that environment. And so they need to get out. We need to know if they're delayed, how long they're delayed, where they're delayed. And then we can talk about the technology to get at that. I get that there's probably not a lot of eels up there. We really don't know how many. And it might be feasible to get at them with additional technologies other than radio telemetry.

What came up at Monday's meeting at First Light was that if because there's only so many eels and there's a lot of need for test eels, we get in a situation where we have to go out of basin, based on what Don Pew was saying down at the Susquehanna, maybe eels from out of basin are more motivated and they tended to move really quickly, and so perhaps aren't representative of the wild population. So that's a concern, to the extent that out-of-basin eels may have to be used for these tests. So that would potentially be a drawback just relying on radio telemetry for delay.

MR. CARPENTER: I was going to say, I think that goes back to putting this in perspective. Since we don't know how many eels there are up stream of these projects, but there is a tremendous amount of habitat and we see silver eels migrating out of Lake Wasasaki where there's 11 dams between them and the ocean. This would allow you to

put into context. It may not be the best floor to lay, but if you're radio tagging eels and you're focusing on delay there, at the same time you're looking at the -- you're getting a better sense of how that fits -- what are the rest of the eels doing? And I don't know if hydro-acoustics is the best way to get at that, but if you're not going to go out and do some broad-scale sampling, it seems like it might be impossible.

MR. BUHYOFF: Yeah, Matt Buhyoff with FERC. Sorry, I'm stuck back in abundance. I have a four-month old at home so --

(Laughter.)

MR. BUHYOFF: -- I'm not getting much sleep.

(Laughter.)

MR. BUHYOFF: So I'm moving a little slow. I heard what for me were kind of two different concepts regarding abundance and just help me out if this is the case. One was -- I don't know, for this case we talk proportion or magnitude of eels entering different areas of the dam; right?

Number two I heard something was more -- you know, traditional, relative abundance estimates. So, you know, the number of eels above the project. All right. And I take it both of those concepts are important in terms of abundance?

MR. CONNELLY: Yeah.

MR. BUHYOFF: All right.

MR. CONNELLY: So following up on that, why is knowing how many eels that are above the project important?

MS. WILL: Because they have to move through the project to get down to the ocean.

MR. CONNELLY: Yeah, but if there's only one above the project, or there's five million by the project, it doesn't really matter, passage is still needed. So --

MR. CARPENTER: Yeah, I agree. It's more --

MS. GRADER: I think it gets to being able to relate the relative abundance over time to either operational or environmental conditions. I think I would guess that a lot of people in this room would be able to like to hone down or narrow down or try to be more specific if there are certain times when 90 percent of your eels out migrate under these environmental conditions, you know. I mean, that -- you don't want people to have to operate, you know, facilities and measures any more than they have to, to protect the species. So it would inform, you know, operations of any protective or structural measures.

MR. CONNELLY: But that 90 percent it could be nine out of ten eels. Or it could be 90 out of 100 eels, or 9,000 out of 10,000 eels. It doesn't really matter; right? You just want to know when the bulk of the eels are moving

regardless of how many that may actually be?

MS. GRADER: I guess. So it wouldn't be so much the magnitude. But you have to be able -- over time you have to be able to have numbers over time to be able to relate it to different factors.

MR. CONNELLY: Okay.

MR. CARPENTER: The more eels you can look at, the better the confidence you have that you understand that route selection delay timing. That's why it doesn't really, you know, I understand why you wouldn't want to do surveys outside your project area. You're interested in silver eel migration through the project. But you can only get that in a limited way with a few radio tagged eels. So we're hoping hydro-acoustics will give us more information and put it in context.

MR. RAGONESE: Can we answer the question you had about delay, how we look at it as biologists also?

MR. CONNELLY: Does that seem clear to you?

MR. LEACH: Yeah. Yeah, that was helpful.

PARTICIPANT: Do you want some further discussion on that?

MR. RAGONESE: No. We want to discuss it.

MR. CONNELLY: Before we go on I'll make sure we beat the abundance horse to death.

MR. CARPENTER: And he wants to talk about delay.

MR. CONNELLY: Yeah, so if we're going to talk abundance.

MR. KENISTON: For delay I didn't speak up on this. There was a published paper that has to do with physiology and juvenile shad.

MR. CONNELLY: Right.

MR. KENISTON: So I'm going to speak to an actual impact biologically. And it has to do with water temperature and their ability to osmo regulate when they hit the salt water. So specifically, John, for juveniles they will have a window of time to out migrate that will be influenced by a lot of things, what's going on with the river flow conditions and that will move them along quicker clearly. But possibly in lower flow -- this is all possibilities, in lower flow conditions, you know, maybe the delays become more pronounced and the extent to what these delays eventually add up to with licensed projects, you know, does that put those fish at a disadvantage in their ability to survive when they reach the Long Island Sound and have to physiologically adapt to a salt water environment. So it's later in the run. So it's understanding of run timing, the magnitude, you know, do most of the -- do 95 percent of the run get out before those water temperatures were encountered, or, you know, is that not the case. Were

the upper basin fish disproportionately impacted? And, you know, what may that mean? I don't have answers for that.

But in terms of what, you know, is an actual -- what does "delay" mean biologically, that's what I'll make as a reference.

MR. RAGONESE: Yeah, I mean, what I was going to ask our team to elaborate on was how we quantify delay. We're not disagreeing that there are impacts that delay. And the later in the season as temperatures rise and physiological changes -- you know, we all understand that. It's more about -- it's kind of like what we were talking about or you were talking about with magnitude. You're trying to equate or correlate magnitude of a run to some condition, whether it be operations, whether it's environmental. So maybe -- and I would -- I'll go to -- not on a limb here, but I would say that, you know, we've used radio tagging for over 30 years to do this. And it's a technique that allows us to quantify, characterize, and identify not really what delay is, but just quantify, you know, run times. And so I call delay, whether it's one day or 50 days, it's fall run time. It's a number.

So let's have you guys just talk about it. And I've like to put it in the context of, you know, where -- just use eels, for example, where we're putting in eels at three of our projects and there's another project or two

downstream. They're all using the same system. We're actually looking at delay, not just through our project or to -- it's the overall, you know, a significant 100 miles of river. So delay could be, as Melissa said, near field, or it could be, you know, through a significant reach. And that's what, you know, we sort of feel you can use numbers to do as opposed to the other technology which is somewhat hard to define an individual or a set of individuals. And characterize that.

I mean, we don't use the word delay, we use essentially, you know, as a time. Steve or somebody. Go ahead, if you would.

MR. LEACH: Yeah, to get to that point -- Steve Leach from Normandeau. We typically use the term "residence" as opposed to delay because simply because that's not defined. So to underscore that without knowing how the fish would behave regardless of the structure, depending on environmental conditions, simply have to be able to relate the movement and migration to the reaction of the environmental conditions, for example, increased flow, insights, movements, how does that relate to this structure?

MR. BRUSH: Can I elaborate on that some?

MR. RAGONESE: I also -- I'm just going to say, I mean, diurnal, just things like that. You know, it can be sub-daily changes or observations. And they may

characterize them as delay, but it's only because the sun doesn't -- you know, isn't below the horizon 24 hours a day.

MR. BRUSH: Tim Brush from Normandeau. To carry on what was Steve was saying. Going back 20 or more years, you know, the term "delay" has been brought up many times. And we made a conscious decision not to use that word because for a couple of reasons. Each project is somewhat different, so what may be a legitimate delay at Vernon may be totally different at Turners or Holyoke or anywhere else. So there's no sort of common unit that you could use or common definition.

Bill asked a good question about how do you define delay? Melissa gave a pretty good answer. It's difficult to define. We moved away from the term because it has a negative connotation, for one, and because it's it's not definable; one project is not the same as what it might be anywhere else. And also where you're at in the basin may have a different -- may have a bearing in that, you know, it's more important the further up you are in the basin, for instance. All of that is not necessarily comparable river to river or project to project because all you need is one bottle neck somewhere in the river and it doesn't matter what the other ones are. So there's a lot of reasons why you can't put a definition on delay, in my view. And so we moved away from it to a neutral term that have no

connotation, you know, negative or positive typically for bay residency when we're talking about Nearfield.

And then if you can characterize that with the distribution of -- statistical distribution of those times, then you can look at whether you can do anything about that in a reasonable way through fish passage techniques whether they be spill or new facilities or whatever they are. So you won't see delay typically in our reports because of the reason I just explained, unless it's clear that, you know, we can conclude that that really is affecting the run.

One of the things that we're lucky about in the Connecticut is that we have a relatively speaking, a pretty robust self-sustaining run. So we know fish are getting out because they're coming back. Could it be improved? Perhaps, and that's what all this will lead us to in another year or two or few years.

MR. CONNELLY: Thank you.

MR. KARTALIA: You might want to just qualify that. You're talking about shad when you talk about fish coming back represent --

MR. BRUSH: Yes, that's right. I was referring to that.

MR. CARPENTER: I think they call it residence time. And I think telemetry is definitely the best way to get it. There's no doubt, the more specific information you

have about location and movement, and time, and I guess -- I don't understand very well the limitations tied to any of these.

I think what you get or what I would hope you would get from hydro-acoustics is because it's so hard to get your hand on a silver eel with a tag, and there's so much individual variability and with a small sample size, you would hope that with hydro-acoustics you could put it in context of a larger number of eels in terms of, you know, what are they doing? Are they moving right to the project? Are they also -- are you picking them up repeatedly in front of the dam? And it would help you to get a sense of, is your data representative, your telemetry data?

MR. CONNELLY: So go back to residency, just as kind of a -- for me that kind of -- at least immediate appeal which I haven't thought about too much, so using kind of residency at an obstruction versus the residency through a more free-flowing area, I mean, that's kind of a useful metric you would think.

MR. SPRANKLE: Rate is what we're talking about. It's a rate. Yeah, it's a rate.

(Simultaneous conversation.)

MR. CONNELLY: Well, I guess in terms of miles per hour, or miles per day, or something, I suppose this is time at the dam versus time through 16 miles of free-flowing

river?

PARTICIPANT: Distance over time.

MS. GRADER: Yeah, and that's what up on the Penobscot, that's what they're doing with some of the salmon studies, that's exactly what they're looking at.

MR. CONNELLY: Okay.

MR. KENISTON: It is what, river miles per unit of time?

MS. GRADER: Well, they're looking at total transit time and then -- and then kind of categorizing the different stretches of river, whether they be riverine or impounded, whether there be a barrier, you know, and what proximity to the barrier does that transit time, you know, change. Things like that.

MR. CONNELLY: Okay.

MS. GRADER: Yes, for upstream migration for a salmon, I should say.

(Simultaneous conversation.)

MR. CONNELLY: Yeah, but --

MS. GRADER: It's the same.

MR. CONNELLY: I like things that you can quantify like having a kind of nice way to do things, you know. So there's no wiggle room for interpretation -- you know, having this kind of nailed down when they're going to breed is another story, but then we have a kind of nice unit

that can deal with that is more or less effective.

All right. So I think we can get underway for now. So now the last thing we're curious about is the downstream route selection. And I guess right now (1:41:19) proposes to put a hydro acoustic transducer at the fish pipe, but there are potentially other up or downstream passage that could be important. And so I guess, just to make sure I understand, you may or may not be able to get at that usage of those other routes based solely on a transducer at the fish pipe. Is that a good summary of the --

MR. SPRANKLE: It is for the Fish and Wildlife Service.

MR. CONNELLY: Okay. So --

MR. KENISTON: And I think John pointed out earlier -- I think -- a complete list of possible routes through the dam. So when we start talking about study methods and array configurations and things, then that list of passage routes will kind of direct the conversation, I guess.

MR. RAGONESE: Yeah, I mean, if you look at me -- John Ragonese, TransCanada. Our position is that study 34 using hydro acoustic isn't for ground selection.

MR. CONNELLY: The radio telemetry will get that.

MR. RAGONESE: Yeah.

MR. CONNELLY: Okay. All right. So now we talked about these four different things, the S4 --understand, passage issue projects, is there kind of a priority list? Because that would kind of -- some things will be easier to get at than others. So I mean, I don't want to necessarily hammer your position into stone, but is there something you're more concerned about, how about that, than others in terms of like knowing the timing, knowing the relative abundance, knowing the delay, or knowing the route selection? Is there things that have a higher priority?

MR. SPRANKLE: I would say -- Ken Sprankle speaking for Fish And Wildlife Service. You know, we outlined in our study request, you know, what we felt were our data needs an the objectives. And so all of those are important.

MR. CONNELLY: But sometimes they are tradeoffs.

MR. SPRANKLE: What's that?

MR. CONNELLY: Sometimes they are tradeoffs.

MR. SPRANKLE: Yeah, they all interrelate I think the tradeoffs are, you know, we're really having difficulty with the methods. And I think I'll point out -- well, okay, so for radio telemetry as an example, and we state this in our letters. I would say that I think we're on record.

MR. CONNELLY: With what?

MS. GRADER: I think they're all equally important and the information that would be gotten from all of them is going to inform, you know, what type of section 18 prescription, if any that we'll be submitting as part of these proceedings.

MR. CONNELLY: Okay. The reason I was kind of asking that, I was just trying to think of -- I'm not trying to pin you guys down or anything, but sometimes you have a bit more information on different aspects of fish migration from previous studies and so forth. So I was just kind of wanting to get at that a little bit better.

MR. GRIES: Yeah, New Hampshire agrees too that those are important and interrelated.

MR. CONNELLY: So I guess we just move on to safe methods now, probably would be a good time to take a break.

MR. KENISTON: Five minutes, ten minutes?

MR. CONNELLY: I think ten minutes would be good.

MR. KENISTON: Ten minute break. Meet back at 10:42.

(Brief recess taken at 10:32 a.m.)

(Record resumes at 10:52 a.m.)

MR. CONNELLY: I think we can get started now if everyone is here. A little bit of housekeeping, I need everyone to sign sign-in sheet please. I think some people

over here haven't signed it.

MS. BLAUG: I just want to start out by noting that it has been suggested that perhaps we have not been crystal clear as to the purpose of this meeting and what we can talk about. And I know most of you have been involved in prior meetings the last few months where FERC has not been in attendance because we've noted that there's a pending rehearing request. And the reason why we did not attend those meetings was, the meetings were not publicly noticed and hence we could not discuss at all the pending rehearing requests. This meeting has been publicly noticed. So we're not intending to tiptoe around the big elephant in the room which is the rehearing request, but the purpose of this technical conference is to help us understand. We think that there are some gaps, information gaps starting with the, you know, post-study plan determination from February and then the rehearing request suggested that there were just maybe some misunderstandings or misinterpretations both on the part of TransCanada and Resource agencies and us too. So we are trying to understand, you know, fill in those information gaps and understand the methodologies that are being proposed. And, you know, obviously we can't talk about these things without talking about issues that were raised on rehearing. We're not litigating the rehearing requests. We are trying to understand where all the parties

are coming from and how we can fill those information gaps. Does that help? Does that explain things a little more clearly?

So nothing is off the table. I mean, don't feel like you can't raise something because we're not going to talk about it.

MS. DONLON: What's the process on FERC's end for making some sort of a decision on prehearing requests?

MS. BLAUG: Well, this is going to help inform -- the rehearing request is pending before the Commission, but this technical conference hopefully will help inform, you know, the decision.

MR. CONNELLY: Whether or not there would be a hearing?

MS. BLAUG: The Commission is going to have to act on the hearing one way or the other. It's either going to grant rehearing, deny rehearing, or grant in parts, deny in part. And hopefully at the technical conference will help inform what their decision is going to be. We can't possibly speculate, because it's a Commission decision, but we, of course, will provide recommendations. Does that answer your question?

PARTICIPANT: So it sounds like you don't know a date that that might be happening or anything?

MS. BLAUG: Even if I did know a date, I couldn't

tell you.

(Laughter.)

MS. BLAUG: But, no, we honestly do not have a date. I'd have to kill you if I tell you.

(Laughter.)

MS. BLAUG: So if there's any questions about that, please feel free to ask. John, does that help you out?

MR. RAGONESE: Yeah, that helps me. Sure.

MS. BLAUG: Okay.

MR. CONNELLY: All right. If anyone has any questions or anything to say, I was going to start with the study methods part of the meeting. And I guess we'll start with talking about asking questions regarding the radio telemetry.

Okay. So my understanding, we kind of got at this a little bit already, but radio telemetry is a commonly used technique by a lot of different hydro power projects. And I know the American Shad are being reared for this power project. Eventually they'll be bigger than their fish and wild counterparts.

Right. So then there's kind of an indication that they'll behave differently.

And then earlier you mentioned the eels taken from outside the basin also, they move faster than their

native counterparts. Is that for the Susquehanna?

MS. BLAUG: Potentially. I mean, on the Susquehanna, they were out of basin and they moved quickly.

MR. CONNELLY: So where is that site connected? They're taken from the Susquehanna and --

MS. BLAUG: No, they were taken from Maine.

MR. SULLIVAN: No, they were taken from New York --

MS. BLAUG: Oh, Delaware.

MR. CONNELLY: Okay.

MR. SULLIVAN: To be clear, I was involved. This is Tom Sullivan from Gomez and Sullivan. I was involved in that study. So they were clearly silver eels. They were in the Delaware. The in-basin eels were not necessarily -- it wasn't necessarily clear we had silver eels. So there was some fight getting done, there was some electric fishing done, but it wasn't really clear that the were all hybrids, you know, type of thing. It was very clear the ones that we put in from the Delaware system were all there.

MR. CONNELLY: So there's a kind of index that you use to tell if it's a silver eel or not?

MR. SULLIVAN: Yeah, I'm not the best one to actually answer that but one of the other guys could answer. But, you know, eye diameter, coloration, I mean, those are the ones I use.

MR. CONNELLY: Okay. So I'm just curious, is there, I mean, any other evidence that you would consider the wild fish, either eels or shad might act differently?

MR. SPRANKLE: Yeah, and we've spoken to this in our letter. So, you can refer to that. You know, one of the first concerns, of course, is the ability to just obtain a suitable number of fish.

MR. CONNELLY: Yeah, do you know how that worked out this year? It was this year was a good following, right?

MR. SPRANKLE: Yeah, we're waiting for a report. So I guess I'll say that it was good to do the trial. The fish generally didn't -- were not grown to the size that we were shooting for and they were delivered, again, later in what the natural run timing would be. So we're concerned about abundances and attaining a size suitable for tagging which, you know, we have noted now at better than 110 to 115 millimeters. But Normandeau can speak more on that.

We had concerns about successful transport and holding of these fish. Again, we're waiting for a report on that. But, you know, the fish -- if we're going to use the cultured fish, they need to be reared at our North Attleboro site, so a good distance waiting to be loaded onto trucks, brought there, dropped off. And so there's concerns for that whole candling and transport process, what that may

mean for the fish, how long they may be held. There are concerns associated with the application of the tags naturally. That's a concern.

MR. CONNELLY: Has that been tried yet?

MR. SPRANKLE: That's been tried. So, again, we don't have a report yet on that, but that's about the concern.

Of course, you know, most directly mortality of the fish, but then whether or not there are tagging effects that may be associated with the tagging procedure itself or maybe related to later expressions of effects which may be swimming performance, behavior, you know, when do those effects become pronounced? You know, it may be some period of time out. That may depend on a number of factors, the size of the fish, how long it was held. I don't know, there's all kinds of things to be concerned with there.

And continuing on would be the timing of obtaining the fish and, again, how that fits in with what we -- the best information we have relative to the overall run timing of juvenile shad out migration.

We don't have and understanding of when these fish are released where they'll be released. And we deal with this. We've dealt with it for decades, you know, the small studies and so forth. And, you know, we work through these things. But the concern is, you know, where you

choose to release these juvenile shad, how does that relate to the wild juvenile shad that are out migrating, coming down the river? If you release them in the middle of the river, is that where most of the wild fish are? Maybe under a certain condition they're there. Maybe under other conditions they're on another bank, a near shore bank, a far shore bank, so the concern being that, you know, based upon where the fish are released, how might that affect where the radio tagged shad first encounter or are directed at the project facility.

So those are concerns. Again, all of the methodologies we're talking about have limitations. We can go into these limitations for really anything we're talking about. But specific to radio tagging these are some of the concerns we have, and, you know, it's hoped that as it has been done in the past, you know, we're hopeful that it would have an ability to provide information. So, I don't know, is that helpful, those -- those concerns?

MR. RAGONESE: I would like to talk about the trial.

MR. CONNELLY: Oh, I see.

MR. SPRANKLE: So, Steve, I'm going to basically let you lead the discussion if that's good.

MR. LEACH: I guess what I'd like to do, this is Steve Leach of Normandeau. I'll sort of refer to Rick for

the big picture items and I'll talk the technical details of the trial.

MR. RAGONESE: But we have a -- we have sort of an internal review of the report. We're planning to get that out very shortly. We couldn't get it out in advance of this because we basically just finished the trial. But I think essentially the result of trial was -- let me put it this way, based on the results of the trial, two things, it's very important that we did it because there's a lot of new information that came out of it. And we would probably be planning to modify our juvenile shad radio-tech.

MR. SIMMONS: In the larger context we've used low-tech nanotechs. We basically ended up testing two tags on the fish. The first was a method developed by our Pennsylvania office with the Conniwingo devices and they had done juvenile telemetry several years ago down there. They had good success. They had good survival in their tank trials. But the fish were 120 and larger. So we had dummy tags made up for the same tags they used several years ago on that study. And it worked okay up until about day four. The tags -- the fish we were tagging were a little smaller, none of them were 120. We've had some that were over 110 that we selected. So we started to see mortality at day four and I'll let Steve get into the details, but we felt -- and Paul Heicy actually came up and helped tag, I was with

him tagging on that. And we thought that the tags had some drag issues and that it was a little much for the smaller fish that we were dealing with.

So what we did is we also have another multex mix for different nanotags. So over on the Merrimac the last three years, we've been using a smaller nanotag that we glued to a fish head. So when we saw that there were effects of this tag on the fish four days into it, we decided, well, our other tag is half the weight. And I've got examples here to show you folks.

So we decided that we needed to -- we weren't proposing to hook tag in the beginning because of the success and we thought that the modified -- it's basically a steel pin that goes through the back of the fish. It's a little gun that's developed for the balloon tag work that we do. And they modified that to apply the radiotag. And so when you add up the weight of the little, tiny seamless pin and things like that, it basically ended up being twice as heavy as -- well, there's the hook tag up above glued on to a dry space.

And that looks really big there because it's blown up.

(Laughter.)

MR. SIMMONS: You can see why we didn't like the bottom one. It definitely -- the fish three or four days

in, it started to struggle. And, again, we will get into those details.

But the one up above, we've successfully used that for three years over on the Merrimac. We then applied that tag. We were able to get ahold of 20 from Load Tech. We had ten that we're actually using another job. So we tagged I think about -- was it six days into it, Steve, maybe or the week after -- the first test was still going on when we finally got ahold of these other tags and we applied them to another group of fish. They did better than the first group. The tag below, when we had those on 30 individuals, we could feed the untagged fish in the tank. We weren't seeing the tagged individuals feeding. So we immediately were concerned.

The tag up above, the small one, I think within a day -- and this is similar to our trial of the Merrimac, they were all feeding, swimming about, there's no drag on that top tag because it lays right against the fish. We tag it behind the dorsal. It fits a lot tighter to the fish and they just behave a lot more normally. And we also -- we let 29 or 30 of these, the fish on the bottom of the smaller tag, we did another study this year on the Merrimac and I got permission from Kirk Olney to talk about that a little bit, but basically we had fish tagged, like the one on the bottom would pass Garvins Falls and within a matter of four

or five hours they were six miles downstream passing -- Dam.

On that test we've had a total of 22 pass garvins out of 29, seven didn't get there. We have quite a bass problem. Not a problem to the fishermen, but --

(Laughter.)

MR. SIMMONS: -- but there's a lot of predators out there and this is what they eat.

So we got 22 got to Garvins and out of those 22, 15 of those passed Hookson. That's six miles further downstream. So we've got, I think average time -- I don't know if we've got an average, but some of them pass quick. They basically would do the six miles in 3.8 hours was probably the quickest fish. And the longest one was probably 47 hours. That was on the first release and anywhere in between. So they move pretty quickly. Our survival is really good with these fish, especially on the Merrimac. And this hook attachment, we've actually been doing this since 2007, but we started with pit tacks and that's -- we glue them right right on to the same size book and we would do tag tests and we found they did really well. Go ahead.

MR. SPRANKLE: Rick, we were talking earlier, so I know the answer to this. But, these are wild fish; right? Not hatchery fish?

(Simultaneous conversation.)

MR. SIMMONS: On the Merrimac, we only deal with wild fish, but back to the trials, we stuck with the hatchery fish. They came in good shape. You were there Ken. They looked good. They seemed very healthy. And I'll let Steve -- Steve actually was there for a couple weeks straight, when we got the hatchery fish, we got them into our large tank and they never stopped swimming at like two feet per second. They did not. It was like they were in overdrive. So we got 1,000 fish going around this tank like crazy. Never seen it before. Never seen it at all. We've only -- I've never used hatchery fish. So we'll go out and get our wild fish and we'll sometimes hold them weeks and we'll feed, we'll even catch them in August and raise them up and try to get them to bigger sizes. We were very surprised at what the hatchery fish did.

Again, they were healthy, they did a good job growing them out. The survival and transport was excellent. What were those 1 percent maybe.

MR. LEACH: In the first day it was just under 1 percent and then even less than 2 percent up to six days.

MR. SIMMONS: So why we knew they were acting differently is we captured just under 200 right out front with the shock hole. But the day before the hatchery fish were delivered we got a tank of wild fish. Because we wanted to take the hatchery tagged fish and put them in with

the wild fish. Because everybody is into they behave differently. We weren't planning on tagging the wild fish. We knew they were coming smaller, and they were, than the hatchery fish on average. But we noticed quite a difference, the wild fish were not swimming crazy around the tank. They would actually attack the food, they would hang out, they would swim slower, they just seemed -- they were normal to me because I've never seen a hatchery fish.

The hatchery fish, and we basically ran a camera the whole time except at night. And when you see them swimming around the tank, it's like, what's going on? Are they afraid because I'm hovering over this tank? The wild fish were not. So we continued the tagging experiment with a smaller tag about five, six days into, and we grabbed the hatchery fish, they seemed to do fine. We selected them up. We tagged, I think 18. And we started to see -- Steve, when was the mortality --

MR. LEACH: Are you talking about the first trial?

MR. SIMMONS: How about we go through the three trial just so that we understand -- just so we can --

(Simultaneous conversation.)

MR. RAGONESE: I don't mean to interrupt, but I just want to get an idea of exactly what we did?

MR. LEACH: Sure, I'll bulletize the three trails

that we did with the caveat that they were sort of linear in time. So bear in mind that we had things going on environmentally during that period including a major cold front, and also that these fish have been helped throughout that period. So they weren't three simultaneous trials. There was overlap in each.

The first trial mixed tagged, hatchery reared fish, tagged wild fish, and primarily untagged wild fish, but also a few tagged hatchery reared fish into one tank. That was with the larger tag that you see at in the top -- top floor there. And preceding that the hatchery reared fish, as Rick was noting, were held in one tank. The wild caught fish were held in another tank, much lower density, and that may be important.

The difference in behavior before they were mixed, Rick noted, wild fish tended to hold position or swim at a reasonable rate of speed. They would turn as a school and attack food. The hatchery reared fish would swim continuously, rapidly in a circle, and feed aggressively opportunistically as they swam. Once they were mixed, it was impossible to tell the difference, they matched their behavior which tended to be the faster circling. I can't say definitively that it was as fast, but they tended to match, they couldn't be discriminated at that point.

The second trial is with the smaller nanotag that

you see in the bottom picture with all hatchery reared fish, mixed with untagged hatchery reared fish. And the third trial was using the remainder of the first test. We sort of concluded that the majority of the fish remaining were probably wild, we can't prove that, but they were probably wild based upon the numbers that originally went into that tank which was the majority wild, and based on their behavior and their sort of general fitness level. So the third trial then was essentially a repeat, we hope with a higher proportion of wild fish, a repeat of the second trial.

However, the cold front that I mentioned sort of occurred at the mid point of trial number two and I believe already passed by the time we started trial number three.

MR. RAGONESE: And the reason we said it was the cold front is -- we described earlier, we were talking about during our fall sort of operation, were low, low water and then come around 22nd, 23rd of October, we had water out of the kazoo.

MR. LEACH: It's meaningful in a couple of different ways. One is that the observed water temperatures dropped five or six degrees. The other is that observations were very problematic for a couple of days because everybody who's been working on the Connecticut River of late knows what happens when you get a high flow event, you can't see

in the water.

So I'll make a couple of comments on general behavior, at least in the short-term on these, Rick already alluded to it, at any given time in trial one, something like 20 percent of the fish were clearly affected in behavior. And their behavior would be either listing to the side as they swim and that was evidently caused by drag, or barrel rolling the entire time around. Barrel rolling would increase in frequency over a period of days. And I say at any given time because by attrition it seems that as some fish would die, they were probably the ones that were distressed if they were listing or barrel rolling. A day later another couple of fish would be listing or barrel rolling.

So, in short, we had behavior that appeared to be normal. That is, fish that were tagged would keep up with the school in general at about a rate of 80 percent of tagged fish for four days. After that things started to go down hill in terms of mortality.

MR. CARPENTER: Which tags are we talking about now?

MR. LEACH: I'm talking about trial number one which is the big, big tag with the steel pin.

As far as behavior in the other trials, virtually all fish swam vertically with the school, responded to

start-up tests identical to untagged fish.

MR. CONNELLY: Good feeding behavior?

MR. LEACH: Good feeding behavior both -- both fish tagged -- both wild and hatchery reared fish untagged in their respective retention could be readily observed attacking food on the surface. That's the thing everybody talks about that sort of behavior. Tagged fish were less likely to strike the surface. They were not likely to strike the surface with the first tagging method. They were slightly more likely with the second tagging method. And they were readily observed, again, doing this sort of schooling attack behavior where the school itself would turn on a patch of -- we'll call it prey, but it's fish feed, and that, I believe, is representative of normal behavior.

MR. CARPENTER: Did you mention a size difference between wild and hatchery? Was there?

MR. LEACH: When we did the tagging in trial number one, we actually culled. So we were shooting for something similar. But the information is there, yes, in size difference.

MR. CARPENTER: There was one?

MR. LEACH: Let's see if we can pull it up. There is an overall size difference. There's a lot of overlap as well.

MR. CONNELLY: How small are the fish that you

can tag on the Merrimac?

MR. SIMMONS: This year, 99 was the smallest that we tagged. If we get them 100 and above they handle the tag well with the small hook.

MR. CONNELLY: And is that like a group or portion of the wild fish you encounter like distribution? Is that near average or is it near the upper end?

MR. SIMMONS: I would say when we do our studies on the Merrimac, it's usually the first week of October there. Their average is probably 103, you know, they're right in there.

PARTICIPANT: Shad?

MR. SIMMONS: Shad.

(Simultaneous conversation.)

MR. LEACH: To answer the question as far as the fish that we selected for tagging, the difference is -- the overlap was strong. The minimum for hatchery-reared fish was 106 and actually the minimum for wild-caught was 108. That was a fact of our selection. With mean 114 actually for hatchery-reared and 113 for wild-caught. This is all post-mortem measurements. We didn't attempt to measure the fish before tagging for the obvious reasons.

Well, I should state that -- because additional handling would most likely cause additional stress and therefore unwarranted mortality.

MR. CONNELLY: So on the Merrimac, do you just go out and pull -- grab a bunch of fish and hold them for a while and then tag them?

MR. SIMMONS: Yes.

MR. CONNELLY: Okay.

MR. SIMMONS: We catch and let go fishing --

MR. CONNELLY: Okay. Tag them and hold them for 24?

MR. SIMMONS: We will always hold them. We'll get them back to our tank. Sometimes we'll hold them a week. Sometimes a few days. We usually see a small 1 percent mortality, you know, from the handling, you just be careful with. And we'll get them feeding and then we'll tag them and we run tank tests there with smaller numbers we'll run like five-day tank tests. We haven't done a ten-day tank test with a hook tag until this particular study. Because, again, we were kind of going to rely on the other attachment method from the Pennsylvania office, but we saw that wasn't working out. We zoned away from that tactic.

MR. CONNELLY: With the Merrimac, are those reports filed with the project numbers? Is it for Garvins Falls and --

MR. SIMMONS: I can provide those. It started out -- we've been doing this three years. The pit tag we were doing three or four years prior to that. So it's the

very -- and I have examples of all the tags with me. So we knew that the hook wasn't going to impact the fish that badly unless you jab it in the wrong spot. You're going to kill it -- if want to kill a fish with a hook, you can. So you've got to be careful. You've got to get it in there. We did a lot of work with that and we started off slowly. We would do like a 20 fish test and call it a pilot study because we just wanted to see, can these fish handle this? Will they act normally? They did. And they fed as we saw also recently on the Connecticut study.

So we feel that's a great way to do it because when we do those studies, we wait until the fish start migrating. So for me, as someone working for 30 years, I see the run starting later on in September from all the studies -- and I've done dozens of hydroplants in New England and although you'll get early fish moving, it might be 1 percent of the run and that's usually on a rain event or some other special thing. Because my experience, shad stick to their native areas where they're born until temperatures start to drop, mid September everybody says, I will tell you, our fish bypasses from mid-September until the first of October on the Merrimac and I looked these reports over last week, and we may get 100 fish, 150, once the temperature drops to 15 and there's a rain event, it could be 10,000 a night, it could be 50,000 a night. So

there's a trigger that turns these fish on.

So what we try to do with our studies is we want to time that so that we have plenty of wild fish out there because they're targets. So if you -- if we started doing something like in late August or early September, you release a radio tagged fish, they're kind of out there alone. And they're an easy target. So we wait because we always want to know, what's going on, can we get them in with a school, so we'll capture them wild, hold them a day or two, sometimes maybe a little longer, tag them and let them go. And then we'll -- you know, we'll do it -- and that's what we can do here on the Connecticut.

MR. RAGONESE: So to go back to what our -- just a second, Ken, you know, what we're really thinking about doing essentially two things. Not relying on the hatchery fish, not using the large tag, but instead capturing wild juveniles and using the smaller tag and a significant larger number of --

MR. SPRANKLE: Okay. So that's all very helpful. I'm just wondering what the tradeoff is with the smaller tag relative to the burst rates and the battery. I mean, that's --

(Simultaneous conversation.)

MR. SIMMONS: Ten days compared to 16 with the larger tag. And, again, that was one of the reasons we

wanted to go with a larger tag to get a few extra days there. But when load tech says ten days, they'll go a couple on that. They just try to protect themselves, so they'll say a small tag only goes 15 days, we'll hold them, they'll be 19, 18, you usually get a little more time.

MR. RAGONESE: So our thought was to develop some kind of a systematic saving protocol out in front of the project, above the project somewhere, but clearly, you know, we found fish ready to go right outside the stream. So somewhere upstream of the log group -- sample hold and tag basically for the minimal amount of time to identify whether or not the fish are going to survive, you don't waste a tag. But mostly to take advantage of the battery life to the greatest extent possible. But sample and tag through a larger period of the run than what the hatchery-tagged fish would have allowed us to do as well.

MR. CARPENTER: How many did you say you got from the Merrimac this year?

MR. SIMMONS: Like 29 --

(Simultaneous conversation.)

PARTICIPANT: We were supposed to do 40, but we couldn't catch the fish. And that rain event came through and blew all the fish out of the river. So --

MR. SIMMONS: Yeah, that's the challenge.

MR. GRIES: And, John, you said you'd be tagging

more?

MR. RAGONESE: Yes.

MR. GRIES: Do you know --

MR. RAGONESE: Well, we're thinking at least over 300.

MR. GRIES: Instead of the 100?

MR. RAGONESE: Yeah, the 100 we felt the 100 was too small a number.

MR. SIMMONS: Well, just because it's season now. The season is here, we need more tags to cover our season.

And with a ten-tag, we are letting them go every three or four days or five days. We're going to have active tags out throughout that period. So it should give us some good data on residents' time.

MR. RAGONESE: And our thing is that these would be picked up at Turners as well.

MR. DAVIS: Eric Davis, Vermont ANR. So where were the -- after they were tagged, where were the fish released?

MR. RAGONESE: We didn't release them. We just looked at them in the tank. Because they were tagged.

(Simultaneous conversation.)

MR. DAVIS: And so where would the plan be to release them --

MR. SIMMONS: Well, on the Merrimac, we were just

up above the project maybe a quarter mile. We tried to release them further one year, and we lost, what, more than half of them?

PARTICIPANT: Probably.

MR. SIMMONS: Above Garvins we've got this boulder field with some tremendous small-mouth bass. So we would wait until the evening, which you really should, that's when these fish start to break down schooling and migrate. But it's also the best time for the bass to pick them off in shallows. So we got a little closer this year so we could get more targets. Because there's it's a canal that goes down to a powerhouse. There is a flashboard on the dam, so a slightly different set up.

MR. RAGONESE: In this particular case we haven't identified necessarily where we really -- you shouldn't really just put them in front of humans. But you would want to put them in a location where you're likely to capture downstream migrants as well, not ones that are sitting in the setbacks waiting to decide if they're ready to go.

MR. SIMMONS: And if I may, in a lot of our studies that we talked about this, this week with the shad. We can release the quartiles across the river. We do this in a lot of places. So everybody says, you're not going to line them up to the fishpipe, are you? Well, of course, we

are. We're going to -- they don't do anything you tell them to do, or want them to do. But we could take our groups of fish and do 25, 50, 75, across the channel, upstream of the dam so that we spread them out so that each release of maybe 20 in a release would be spread across the width of the river basically.

I want to stay away from the shorelines. Sometimes they'll come in close. That's where they get killed. They learn quick.

And the other piece is, by grounding these fish as the run is going on, we've got plenty of other targets out there and we like to grab these -- and get them back in that water so they're with the same cohort that they came down the river with. So it should be -- it's not like you want to -- one of our problems with the hatchery fish is receiving them they were in good shape. But three weeks later, they sucked. They were not in good shape.

In fact, the mortality Steve can talk about. And the untagged they just, within a couple of days, they died. So we -- if we're running the study and want to get to November and we take a delivery late September, the biggest panic for us is what happened on this study? Two inches of rain the day we tagged them the first day. Water turned to chocolate, temperatures dropped. We don't know how that affected the fish in the tank or they couldn't see each

other all of a sudden and we couldn't see really well what was going on, but as time went on and also we started to slowly get fungus. The longer you hold these fish, they do get descaled.

And, again they -- the hatchery did a great job. And the people that delivered the fish got them there in very good shape.

I would be fine using those fish maybe the first week. But as you -- as we looked at our larger tank, we would start to have to pull the fungused individuals out. And, again, that just happens because in the process of getting them from the hatchery truck over to your tank. Go from the hatchery pool to the truck and then four hour drive, and these fish get descaled. I mean, you can look at them and the scales fall out. So if you've got a fish that's missing five or 10 percent of its scales within a week it's going to develop this fuzzy white fungus that then spreads to the rest of the tank sometimes. So it's a lot of tending to keep these things in good shape.

So we, on the Merrimac, like to get them wild, not hold them a long time, sort of stressing them and get them right back where they belong. And we feel that's a better way to see the selection. And, of course, if you go across the different rain storms and events, if we started mid-September and start our releases and go to the first of

November, that's a pretty good time period that captures the run. I would say the fish in mid-September are probably not going to do much because that's my experience. But, maybe they'll be on the Merrimac, certainly the last week of September has proved to be a big week in some years. And then the next year it's the first week of October or the second. And it's always following what's going on in the system. And from all the literature that you read, it's rain events. They drop the temperature a couple of degrees, it turns these fish on, and then they're leaving en masse.

MR. RAGONESE: So the bottom line is, really glad we had the hatchery fish trial. So, tell those guys thank you. It's a huge benefit to have them try it this year. They did a great job. But in the end it really opened our eyes to the fact that we're not interested in going that route again. We think we have greatly increased the reliability of radio tagging shad by performing this study. It's just increased our confidence in what was originally our study plan to use radio tagging for many to study many of these questions as well as we think it also has enabled us to address a lot of the sort of either the unknowns or anecdotal concerns about, you know, trying to attach to which were real. I mean, they've been the case. We've all -- you know, but I think technology has improved the tagging system so that we can use them. I mean, these tags weren't

around a few years ago. So if they are around now, you might as well use them.

MR. CONNELLY: So would using wild fish kind of deal with some of your concerns about route selection and delay differences between the wild fish and hatchery fish or the tag Fish?

MR. SPRANKLE: Ken Sprankle, Fish and Wildlife Service. I hope it does. I mean, you know, you can't say for certain. I think, you know, they had observations. I think -- I guess we're not sure right now what the fine scale details will be for next year, but how they have talked about doing observational work and so forth, so this is all helpful to hear. Of course, we need to review what was shared with us also.

What I do want to speak to is what Rick had said, and I don't disagree with, you know, his personal experiences in other river systems for the timing about migration movements. But what I would like to say is, you know, all these river systems are different, as we've talked about, and based upon where the projects are. So I think what we don't know is what the wild fish will be doing up stream of Vernon Dam. And some points to support my argument on potential different timings for juveniles goes back to some -- relates back to papers that have been published that would suggest populations for American shad

at the most upstream extent of their range in a river system have the greatest growth potential opportunities that can speed growth if growth is a migratory factor influencing, you know, when the decision was made to help migrate. You know, that can potentially cause juveniles to be out migrating at earlier dates than lower in river systems. I think that's understandable.

And then also from a density standpoint, we know that there are density dependent effects that are related to growth. And, so, again, if we're talking about juvenile shad that are produced all the way to the most upstream extent of the main stem, the densities, relatively speaking are quite a bit lower than if you were downstream at Holyoke, no one is going to argue that point. So, again, just kind of relating back to that I feel for my agency that we have an opportunity to get information we need on the juvenile outmigration. I wouldn't necessarily want to rely on experiences in other systems or even within the Connecticut River lower in the system that that is necessarily going to reflect information on timing that relative abundance among the different projects, configurations, and uses of the facility and environmental conditions and how subsequently that may affect routes.

I am really encouraged and pleased by what we heard today for the radio telemetry work. But, again, I'll

go back to the different methods we had suggested. We'll provide different information. I still think that the acoustic information applied more comprehensively at the powerhouse in particular will be important to put these radio tagged fish into context and relation to what the wild migration is doing.

MR. CONNELLY: So going -- two thoughts. So if you're collecting fish as they migrate, potentially can you address the fact that some of the bigger fish are probably upstream and first if you start collecting as soon as you start seeing fish; right?

If you're worried about waiting until mid-September when the bulk of the fish move, but you'll miss those fish that are going from either farther upstream where they are bigger and moving first. But if you are collecting them as you see them, then that wouldn't necessarily happen; right?

MR. SPRANKLE: Yeah, well, the question is kind of the episodic nature. You know, again, it gets into a sampling design that no one has discussed. I mean --

(Simultaneous conversation.)

MR. SPRANKLE: If you're handling very intensively you would have the potential to get a handle on that. I mean, that's something that we would have to -- you know, something would have to be proposed for us to react.

I'm not --

MR. CONNELLY: And my other question is, so I understand your concern -- go ahead.

MR. SPRANKLE: Go ahead, finish your topic.

MR. CONNELLY: About maintaining the upper -- the part where this goes furthest upstream and how there may be different -- does anyone know -- if you look at the whole Connecticut region as a population, what percentage is upstream? Is it a large chunk, a small chunk, totally --

MR. SPRANKLE: We don't know what -- there are a lot of good questions on this. We don't know the relative contribution. You know, from the progeny.

MR. CONNELLY: Well, how about from adults?

MR. SPRANKLE: Well, if you look at adults, yeah, what was the number this year?

MS. WILL: 27,000.

MR. SPRANKLE: 27,000.

MR. CONNELLY: And how many are downstream?

MS. WILL: I don't think 270,000.

MR. SPRANKLE: We had close to 400,000 at Holyoke were passed, but there's a lot more to it because there different sex ratios and I mean the fish biologist recommends, you know, how much the fish have spawned out before they get upstream, and that varies a lot from year to year. So they're -- you know, these are all -- it gets more

complicated than that. But, just if you want to just talk about numbers, you know, you can see it -- referenced by those numbers.

MS. WILL: So my question is, why does that matter? You brought up earlier, you know, the relative abundance of the eel and if it's one eel or 100 eels, does it matter? So if it's 10 percent of the population or 5 percent of the people, you know, these fish still have to move through the project, so why does that number matter?

MR. CONNELLY: I was just curious.

(Simultaneous conversation.)

MR. RAGONESE: We would argue it matters a lot, actually. We would argue over and over that it would matter a lot whether it was one eel or 20.

MR. CONNELLY: So so, I had one more thought -- I lost it.

MR. BRUSH: Tim Brush from Normandeau. This is primarily for FERC's edification. Most of the other people probably already know this, but we also do the work for Miangi (2:52:20) which is a quarter of a mile up stream from Vernon. And we've got some, I don't know, when the shad numbers were significant enough to really count them, but we've got this historic data set that essentially indexed based on impingement sampling and going back -- it must be 40 years -- I don't remember what the numbers were back that

far back. So at some point when it became significant enough, we've got a long-term data set to be able to gauge timing. So we can use that certainly to be ready with our monitoring set up and then use it as a guide to say, this is what we need to allocate our labor resources or whatever. And then also pay attention to the flow and temperature in 2015 and sort of relate that to the long basin.

MR. CONNELLY: That did it -- that's what I did for my graduate research, so I'm fascinated by them. So have you seen trends in the timing --

MR. BRUSH: It's been so long since I've actually sat down and looked at data --

(Simultaneous conversation.)

MR. BRUSH: And we also do a stain survey that's a randomly selected series of sampling stations out of a large number of sampling stations. And we've been doing that for, I don't know, close to 10 years, something like that. And that will go -- the impingement won't happen in 2015 because the plant shut down, but the heat sampling is going to happen in another year. So we would have that also as a gauge of how the fish are growing through the season and that sort of guidance to help us make decisions out of the sample.

MR. SPRANKLE: I was just going to caution the use and I think people appreciate the fact that, you know,

we don't know how impingement rates may change in relation to what, again, what's going on with the fishes that migrate downstream under different conditions. You know, most of their run -- you know, it's kind of an unknown thing. Really that impingement was designed -- you want to know what's being killed and permanent and so forth. I just think, you know, we just need to be cautious on the data. You know, the beach scene, I mean, that's a lot of different sampling data and so forth. So, that's something that --

MR. RAGONESE: Our understanding though is that the whatever -- yeah, they all have limitations, it's a sample, why do you need to expand it, whatever? But when you see strong correlation between adult returns and returns that you see on samplers or a beach scene, very strong correlation. There's some level of competence in what you're seeing, or they're both sort of randomly correlated.

MR. BRUSH: And I'm just talking about using it as a guide.

MR. RAGONESE: Yeah, that's all. We're just talking about --

(Simultaneous conversation.)

MR. RAGONESE: -- you know, maybe we say, well, based on this index this is the time period and then we just go plus one, or plus two. But we can figure it out. It's not like we can't figure it out. It's plain and simple.

MR. SIMMONS: There's a figure though, I think you came up with it, Tim on a day that shows the number of adults passed at Vernon and then the number of juveniles captured in the same year, and they track. So it's a great spot to tell us, big run, we don't have issues data, 28,000 adults. But I'll tell you that the juvenile index is going to shoot up. They track each other. So it's telling me that we actually have a good spot and it's general data. I'm not saying, you know, you know too Ken, but when you see something like that, you know that you can go out and be seen or efish and you will see the peak of that run, the beginning, the end and the peak as they start to arrive towards Vernon. And there is a correlation between how many adults got up there and how many juveniles we captured which does tell me very strongly that they're connected. That we have a good sampling method over time to see how many juveniles are up in the pool and things like that. So, it's another way to tell what's going on. Are the fish migrating?

(Simultaneous conversation.)

MR. RAGONESE: And the context is to just develop a sampling protocol.

MS. GRADER: Right. But I mean, my recollection from looking at the impingement data is that most of impingement happens under high-flow events which are times

when it would be difficult to capture.

PARTICIPANT: Yeah, that was B fishing or the --

MS. GRIFFIN: (Off microphone.) Yeah, this is Jennifer Griffin. It was the work which was the beach scene.

MS. GRADER: And talking to what Tim was saying about the impingement data, that's all. I thought you were saying, Tim, that you could -- we could potentially look at the impingement data to inform when the fish might be moving. I'm saying if you can, they're moving when it's high flows and that's not necessarily the best time to collect fish. It's hard right?

MR. SIMMONS: It's hard. But the high flows definitely turn the fish on and move them out of the system. That's the -- you know, the lower temps -- that's when they start moving.

MR. KENISTON: I would like to ask a question. Is your question related to shad still?

MR. CARPENTER: No, you go.

MR. KENISTON: Go ahead, ask yours first.

MR. CARPENTER: I'm more familiar with it -- can you consistently get your -- I mean, do you run the risk that conditions will prevent you from getting the fish that you need? And can you just have a backup plan?

MR. SIMMONS: Well, we would -- yeah, you know,

we've been thinking about that and we would probably catch and hold them for a week. You know, I'm okay with holding them for a short period. So if we saw a storm coming, you know, we would probably go out and get enough test fish to carry us through that storm.

PARTICIPANT: We didn't tell them about the screen did we? Pulling off at Turners.

MR. RAGONESE: No, I don't think we can -- I'm just saying as a backup plan, isn't there a way we could capture juveniles at Turners?

MR. SIMMONS: I wouldn't want to then drive them back up river. They're just to fragile.

MR. RAGONESE: Well, I got it. I got we don't want to do that. But as a plan B.

MR. SIMMONS: Plan B is they don't think we can capture and collect 300 --

(Simultaneous conversation.)

MR. SPRANKLE: No, no, I'm not arguing that at all.

(Simultaneous conversation.)

MR. SIMMONS: That was a good question.

(Simultaneous conversation.)

MR. SIMMONS: That's a good question and we would have to plan for that. When we see these big flow events, you have to get your fish in front of that. And when it

happened here, I think we started our tagging experiments, what is it the 12th or --

PARTICIPANT: Of October.

MR. SIMMONS: Yes. I mean, that's towards the end of the run in my world. Because, that's when the run is peaking is mid-October, the second week of October. So, you know, we would have gone out and captured maybe a thousand or 500 and held them. And, again, we're talking releases of maybe 20, 30 at a time. So it's not like a need a tank full of 1,000 fish. I wouldn't want that because the lower the density, the less oxygen. They're easy to tend to. There's less food buildup and all the chemical things that could go wrong. So we would probably have three to four tanks set up and we would prepare for that.

Now, if a hurricane comes through, we're screwed.

PARTICIPANT: That would happen with the hatchery fish too.

MR. CARPENTER: I actually have to leave at noon, so, John, when he did his initial, you know, summary of the plan, and I was interested, do we have a way of looking at the way you can influence route selection and residence time by changing your spill? I mean, that's a question, how much control do you have over the situation and what's the best study to get at that? Can you influence the fish by the way

you're operating? Because we could get at the end of these studies and say, this is what we do, and this is how the fish react. But we still don't know what the constraints are in terms of, you know, changes in operation. Some of them may be of no cost to you. That might improve the facts. So if there's a way the studies could address that.

MR. RAGONESE: Well, I mean, in theory you potentially could modify your operation on -- you know, in relation to say a release. You could do that. The question is whether or not you have enough, you know, numbers to reliably --

(Simultaneous conversation.)

MR. RAGONESE: So the flip side is, you know, what we would like to not have is, you know, a big rain storm event because then we lost everything. We don't have any data. You know, we have some data that says, you know, the fish are all downstream and then, you know, in theory we might be able to -- we'll identify which ones went through the unit because of their -- but I guess what I'm trying to get at is that if we see, for example, that there's no discriminate use of going through the turbines based on, you know, if it turns on, we see fish going through. If it turns off, we don't see fish going through. And we see all ten units like that, then you could say, well, you know, then based on entrainment and survival you might want to

prioritize or do something. Or you might want to say, well, you know, they just don't go into units one through four even when they operate. Or the blue ver does this. You know, you might see that.

But to come up with all of the variables is a lot of radio-tech.

MR. CARPENTER: Is it something you could get at better with hydro acoustics if you knew --

MR. RAGONESE: No, because we're going to -- well, I would say no, you know, because we're going to have individual. We're going to know -- we're going to have every one of these routes. We're going to know when those fish go through.

MR. CARPENTER: So, just hypothetically, could you set up hydro acoustics in a way that you would see bulks of fish going choosing a route, then you could change your operations and see if that changes?

MR. RAGONESE: Well, first of all, you can see bulks of fish with hydro acoustics. What you don't know is whether or not you change the direction of that bulk of fish because if they're going -- if you see another bulk of fish, is it the same bulk of fish, or is it not? You don't know that with hydro acoustics. That's the problem. You cannot --

MR. CARPENTER: But it's a consistent pattern?

MR. RAGONESE: You cannot relate in hydro acoustics -- let me make this really clear, you cannot relate observations in one beam to observations in another beam. You cannot do it. You cannot do it. Because you have no identification and that's why you use radio tagging because you can't identify them.

MR. CARPENTER: But if there were a bulk of fish -- let's just say in a black and white situation, you have a cloud of fish, and this is about my extent of hydro acoustic knowledge. A cloud of fish is going one way and it consistently chooses a certain path.

MR. RAGONESE: The same cloud?

MR. CARPENTER: Just a -- you are continuously seeing passage in one area, no other areas. Then you change operations.

MR. RAGONESE: Uh-huh.

MR. CARPENTER: You no longer see passage in that area. You see it over here. And now you're continuously seeing passage over there.

MR. RAGONESE: Okay.

MR. CARPENTER: Would that be enough to --

MR. RAGONESE: What does that tell you?

MR. CARPENTER: That tells you that you are able to influence --

PARTICIPANT: Where the clouds of fish are.

(Simultaneous conversation.)

MR. RAGONESE: Do you turn the other one off?

MR. CARPENTER: Because you changed your spill. You changed your operations in a way that influence the route selection on there.

MR. RAGONESE: Well, you don't -- you can't say you changed it. You're just observing another school of fish.

MR. CONNELLY: No, he's saying -- All right. Let's say you operate to the -- in all the fish that hydro acoustics see go down the turbine side of the spillway or whatever. Right? And then night changed. Operations are maybe not -- different turbines or running or there's fewer. Now the fish are now exiting the water on the other side of the dam.

MR. RAGONESE: Because they're open, you mean?

MR. CONNELLY: Yeah. However. So basically you don't care if all of a sudden one individual fish from the cloud -- from a cloud goes over to here, you just think that the bulk of fish under one operation regime used one side of the dam, or one passage route, but under a different operation regime the hydro acoustics somewhere else pings at clouds of fish --

MR. RAGONESE: Yeah, if you have hydro acoustics on every conveyance structure, you're going to be able to

tell just like radio tagging whether or not I have fish there or I don't have fish there. That's what you're going to tell. That's all you're going to tell, whether I have fish presence or absence. Whether or not they've moved, they've gone elsewhere, you can't do that. You can't do that.

You can only tell the presence --

MR. CONNELLY: But you were talking tracking individual --

MR. RAGONESE: No.

MR. CONNELLY: -- it's just where your bulk of fish go?

(Simultaneous conversation.)

MR. CARPENTER: It vastly increases your sample size.

MR. RAGONESE: You can see presence or absence. You can't relate it to behavior. And you can't relate it to an individual. That's what we're saying.

And the cost of that type of system is not worth that little bit of information that you get because you can get that from radio tagging. That's what we're saying.

MR. DAVIS: Questions. Can you --

MR. RAGONESE: That's a very expensive --

(Simultaneous conversation.)

MR. DAVIS: -- it's very dependent on sample size

of the radio tags and your confidence, which I argue, you know, I agree with the wild fish, it's much more competent by the still small sample size and is it worth increasing that sample size to get that understanding of whether you can influence fish passage by changing operations

MR. RAGONESE: I mean, you would have to -- it's not like you're going to be like have this live feed of my hydro acoustic data. So I know that, okay, well, I see these fish. Now I'm going to shut that and go there. It's not going to work like that.

MR. DAVIS: No, but --

MR. RAGONESE: You've got to plan for it. You've got to say, okay, well, let's just say, we'll take what we believe may be the peak of the run, third week in September, fourth week in September, and we're going to operate one tandergate and we're going to operate the other tandergate. And you're going to see presence and absence in those two situations. You're going to do the same thing with radio tagging. It's no different. Only with radio tagging, you're actually going to see whether or not on that release how many got there, how many? Percentage. Distribution, route selection. You're not going to do that with hydro acoustics. You're just going to see presence, absence.

MR. DAVIS: Eric Davis, Vermont DC. So, I don't think -- you know, I think telemetry is certainly a regarded

form and valuable insight is gained through that methodology. Certainly, hypothetically if hydro acoustics were employed, you would have data covering a larger degree of operational scenarios than through a couple of the leases of tagged fish.

MR. RAGONESE: I'm not sure what you mean. We would have to plan for them both.

MR. DAVIS: Well, you would naturally have operational changes through time; right?

MR. RAGONESE: No. I mean, that would be how you would want to set up the system. You would want to say, do I want to just observe normal operations and you would rely on what you have going on.

MR. DAVIS: Right.

MR. RAGONESE: If you want to say I want to see that operation, you could do it that way potentially.

(Simultaneous conversation.)

MR. RAGONESE: This year, this year in normal operations. This year in normal operations. For example, if we said, we want to do this test and we were monitoring normal operations, in this year, we would see minimal flow every day of the operation, through the 23rd of October. Every day. One unit, minimum flow.

MR. DAVIS: That's this year?

MR. RAGONESE: That's right. So that's what I'm

getting at. So if you wanted to rely on sort of normal operations how they come, that's what you would do. If you wanted to say, my fourth week in September I'm going to pull tandergate one versus tandergate five and power house. Or not open the tandergates, only operate units. You know, we planned for that. We'd release water upstream so we could conduct -- you know, if we have the water, we could conduct an operational scenario. And you could do that when you release the radio tags.

With hydro acoustics you don't even know whether or not you're going to get any response. You don't need -- because you don't know where the fish are. So what if you turn the units on -- I mean, have a gate open on one week and have another gate open on another week and you have a different environmental condition going on. What if you had, you know, a 17,000 cfs flow one day and a minimum flow the week before? What are you looking at now? You're just looking at presence and absence; what does it mean? I don't know.

MR. DAVIS: Yeah, I mean that's a question --

MR. RAGONESE: That's the point. That's the dilemma with relying on this kind of behavior with hydro acoustics. It's just presence/absence.

MS. GRADER: I would say -- I would say it's difficult to do a kind of test scenario which Matt was

proposing, which I think would be wonderful if that could be done, with radio telemetry because you have -- you say, oh, at 8 a.m. I'm going to kick on, you know, these units. You release the fish and you have no idea how long they're going to take to get down there and whether you'll still be in that operational situation or not. Whereas if you have hydro acoustics that are there all the time, then they'll be monitoring presence/absence continuously over very operational and environmental conditions and then you look and analyze the data and relate it to those operational environmental conditions and see if there's anything you can invert, if there's any patterns that emerge.

I had a question, Rick, about the size of the fish. You had said, I think, that when you were catching the wild fish, you were kind of doing a filter to try to get the larger ones. So do you have an idea of what percentage of the fish were those larger-size fish out of the ones that you collected?

MR. SIMMONS: The day that we started tagging, we took 15 out of the tank. And we didn't want to measure the fish we were tagging because it adds that much more --

MS. GRADER: Right.

MR. SIMMONS: -- to these poor things. So we took 50. We measured them. We threw them into an empty tank and 14 percent of that group of 50 was over 110. But I

think could with more measurements later on -- I don't know if that held true for the whole 1,000 that we had, but it was probably pretty close. So they did a good job. And what we did by measuring 50 was, we developed an eye for the size of the fish. And so I was the guy -- and I hate doing it because you're going into a tank. You're panicking the fish. You're scooping up 100 or two into a scene, you're bringing them to the edge, and then you're using a milk jug to keep them in water and scoop them up and so we felt that added a little stress to it. So we were definitely concerned that, oh my God, we're going to Braille through everything in this tank to try to find something greater than 110. And as it was, we did. We had to go through a lot of fish.

MS. GRIFFIN: And, Rick, that was the hatchery fish?

MR. SIMMONS: Yes.

MS. GRADER: But so you're saying the 100 millimeter threshold, do you think, for the smaller nanotags that roughly --

MR. SIMMONS: Yeah, because I've got lengths of the fish that we had on the Merrimac. The smallest was 99 and this is a successfully tagged and released fish that moved.

(Pause.)

PARTICIPANT: Probably 90 percent or so of the fish that we did on the Merrimac were between 99 and 102.

(Simultaneous conversation.)

MR. SIMMONS: The vast majority of them are that size at that time of year. And the same with the Connecticut River.

As Ken said last year, he was seeing them in the 90s and --

MR. RAGONESE: Just to be clear, this is John -- the 14 percent you were talking about was the hatchery fish.

MR. SIMMONS: Hatchery fish.

MR. RAGONESE: So I --

MS. GRADER: I meant the wild fish.

MR. RAGONESE: But in the wild, the majority were in that 100 --

(Simultaneous conversation.)

MS. GRADER: Okay.

MR. SIMMONS: We brailed through the -- fish too.

MS. GRADER: Yeah. Thanks.

MR. LEACH: This is Steve Leach with Normandeau to -- that sample that Rick referred to, the mean was 93. But the variance was higher than with the hatchery fish. The variance standard deviation is eight. You know, so basically what that translates to is a portion in the range with a maximum. That sample would be 111. So this is a

small sample from a small population captured -- 185 fish captured, was it 26 sampled. And from that the ones that were successfully brailed to tag, they were all of appropriate size. Just personal experience, it was relatively easy for Rick to have done -- to have selected. Hopefully that answers --

MS. GRADER: I'm just trying to get at -- I mean, it sounds like even bumping the sample size up from 100 to 300 you think that there's a good chance you will be able to get enough that are --

MR. SIMMONS: I think so, yeah, from what I saw.

The other thing we noticed with the hatchery fish. When we scooped them up in the jug, they would stay in the water, I would bring them over to Paul and put them in the thing. When I then -- we finished tagging a group of those and we said, let's tag some wild fish and put them in here. Almost every scoop I did they were jumping out of the jug. I mean, they were more vigorous. And I know that's kind of qualitative. I was there one day tagging, but I had to put my hand over the jug to keep the -- I mean, they're like race horses. And so that's just another minor thing. It's not like we quantified that. But, if I didn't put my hand over it, they were all going down in the grate and going down the fish ladder and that's what happened to a bunch of them.

MR. BUHYOFF: This is Matt Buhyoff with FERC. John, I just had a quick question, jumping back a little bit. Regarding our kind of hypothetical scenario, one eel versus 1,000 eels, and, you know, we were asking, you know, does it matter? And you kind of said briefly, it matters a lot to you.

MR. RAGONESE:

MR. BUHYOFF: I was wondering if you could expound on that?

MR. RAGONESE: Well, I mean, we have for many years with Fish and Wildlife Service concurrence had triggers. So present example, you know, trigger, you know. Why would you want to build a fish passage for one eel? Because maybe one eel isn't that material in the scheme of a population. It has a trigger point. We do that all the time. Did you guys do it all the time? So it's in that context.

MR. KENISTON: Are there other questions -- telemetry questions about shad or can I -- is this a good time for me to ask a question about eels and telemetry?

Is that all right?

Okay. Well, we're talking about the possible drawbacks related to tagged fish source and natural versus hatchery. Obviously in the case of eels, there is no source of hatchery eels. So, my understanding is, if this works,

if the eel telemetry study, study 19 works according to plan, the first source of the tagged eels would be Turners Falls area or possibly Holyoke. And then if we can't acquire enough eels, we would look at out of basin sources.

We heard earlier some of your observations of the Delaware versus Susquehanna eel and how there seemed to be fairly different behaviors. And some of it might have been related to a condition of the fish, yellow versus silver, you said there was some uncertainty about that.

(Simultaneous conversation.)

MR. SIMMONS: I will say, with silver eels, when we're out sampling for them, we use the eye measurement of that paper. It's not clean. There's always a certain percent that end up not being silver even though the eye size. But Drew can speak to that a little more than I. But you have to be careful. You know, for me they've still got to be a really big eel. It's got to be -- have no yellow on it, it's got to have that white, they're called silver eels. But you could just see it. And so you can get into trouble if you -- some really big eels don't move. And I think we tagged a couple that really didn't do much after we tagged them.

MR. TRESTED: This is Drew. We've done a bunch of downstream silver eel work and on the Merrimac in

particular we've done Merrimac and Kennebec rivers recently. On the Merrimac, a lot of times when we tag them they may sit at that release site for -- some of them have sat for up to a month, to a point where you're thinking, that eel must have died during surgery. And you get a flow even and they're up and moving, they're down moving around the four bay and then they're out through the project. So it varies.

On our Kennebec River study and those were out of basin eels that we used there. They were from another river in Maine, but they weren't from the Kennebec. Those eels, they would move through the night of release for the most part. Probably 90 percent of each batch would be down and through the project that night and then on their way down to the next dam.

MR. KENISTON: Okay. And these are all at FERC-licensed projects?

MR. TRESTED: Yeah.

MR. KENISTON: So the ports would be available to us --

(Simultaneous conversation.)

MR. TRESTED: Yep, the Merrimac River is Garden Falls Dam --

(Simultaneous conversation.)

(Laughter.)

MR. KENISTON: Okay. So there are some studies

we can review to assess the relative drawbacks of out-of-basin versus in-basin behavior. Are you aware of any studies that have looked at the behavior of tagged versus untagged fish? I realizing it's a much larger fish, so, you know, intuitively might think the influence of the tag is smaller since it's such a large fish. But do you know if there are studies available that we should review that looked at those type of behavior differences, maybe?

MR. TRESTED: Is that just specifically for eels?

MR. KENISTON: Specifically for eels, yeah.

MS. GRADER: We can have Alex Harrell comment on it, but we have to check with him. I mean, and I would just say that -- I mean, maybe I gave the wrong impression by bringing up the Susquehanna about out-of-basin. I think what I was trying to point is that there may be differences. We don't know. There are cases like you were just referring to where if you use out-of-basin fish and they don't just cull downstream, but for whatever reason, on the Susquehanna they did, you know, who knows why.

MR. KENISTON: Right.

MS. GRADER: So I think my guess would be that there's going to be some kind of a tagging effect like there probably is with every species and it's just kind of at some point you have to throw up your hands --

MR. KENISTON: Yeah, I just wanted to make --

(Simultaneous conversation.)

MR. KENISTON: Okay. Yeah, I just wanted to make sure that if there were studies anybody knew about that had been done that we got copies of them and reviewed them. But --

MR. GRIES: (Off microphone.) Those are basic concerns. And, you know, it's similar to juvenile shad when they were talking about hatchery fish. If you're taking, you know, eels from out-of-basin or, you know, ones down at Holyoke that are already actively migrated and put them, you know, seven miles upstream or whatever, you know, those are just basic concerns that --

MR. KENISTON: Sure. I understand.

MR. GRIES: -- might impact the -- you know, whether they're unfounded or not, I -- you know, I don't know.

MR. RAGONESE: Which begs the question, you know, maybe we should wait until there are significant numbers that we can document so that at a location like Holyoke before we do anything to confirm this. You know, have a trigger on the studies too. Because we don't -- you know, we do know the adults are few that are going up through. There are few adults going up through. We don't see them, you know, we monitor for them in the ladders. So we have a sense whether or not you can create a population estimate.

You said ten years to maturity in the trips. Well, it isn't just ten years. It could be as long as 26 years, or whatever it might be. So we don't know that either.

But I guess what we're trying to say is you're asking whether or not there's a behavior of our operation on the passage of eels? You know, we tagged a lot of fish to do exactly that. There's a big fish, you know, the presumption is, it's not a tagged, you know, drag issue. We could use nanotags, for that matter, if you want. I don't know what the tag is.

(Simultaneous conversation.)

MR. RAGONESE: There's always that --

PARTICIPANT: So there is a drag.

MR. RAGONESE: There's always a qualitative, no, I mean, there's always a percent of unknown about whether or not you're doing this or not. But if you're asking us and requesting us to look at eel passage at Wilder, Bellows, and Vernon, which is what you asked us -- let me finish -- and if there aren't fish in this basin why aren't we doing it? I mean, if you're going to get out-of-basin fish in order to accomplish that because there's not enough fish to get at Holyoke to do these studies, why are we doing the studies.

MR. GRIES: Well, there has been now. And that goes back to the point of, you know, we don't know for certain what that population --

MR. RAGONESE: No, but at the place where we're going to -- the concern was, a couple days ago, for just first light, not even being sure we had enough eels to be able to run the first light. So now we're talking about trying to also do three other projects upstream from that same source, because you don't want to go out-of-basin. We said, all along in our study plan, we're going to have to go out of basin because you're not going to have that many eels.

MS. GRADER: The problem is catching them. We're not saying that those numbers don't exist in the watershed. We're saying you can't capture them. Only a certain percentage actually goes down the bypass. Some of them go through the turbines, some of them go through the louver, you know, at Holyoke.

MR. RAGONESE: All I'm getting at is, you know, you're asking us to do these studies and yet there's a -- on the one hand there's this limited supply. We're not -- we're not saying there may not be issues with out-of-basin eels. We're just recognizing the fact that that's the only place you're going to get to raise that.

MS. GRADER: And we're okay with that. We're just raising it as a potential. We're fine with going out-of-basin if you have to do that to get the numbers --

MR. RAGONESE: Well, I think that needs to then

go in the record. We're fine with it going out of basin to get the fish and radiotag. That's what I'm trying to get at. Because we're talking all about these issues, but I'm not sure there's any other alternative. So, I like that you said that, because we were kind of to the point. There's no other choice. If you can give us a good choice, there's another choice.

MR. CONNELLY: So I think probably now would be a good time to take a break before you get into hydro. Because it's -- so should we come back in an hour or so?

MR. RAGONESE: Get some lunch, you mean?

MR. CONNELLY: Yeah.

PARTICIPANT: Lunch on your own?

(Simultaneous conversation.)

MS. GRADER: I've got to leave at two, so --

PARTICIPANT: Shorter lunch? 45 or -- meet back --

PARTICIPANT: Is 45 minutes enough for people?

PARTICIPANT: I mean, there are a lot of places very short walk.

PARTICIPANT: Can we get back at one o'clock.

PARTICIPANT: But if we meet back at one, is that good?

MR. RAGONESE: Good.

PARTICIPANT: Okay. One o'clock.

(Whereupon, at 12:15 p.m., the meeting was recessed to reconvene this same day at 1:00 p.m.)

A F T E R N O O N S E S S I O N

(1:00 p.m.)

MR. CONNELLY: Now we are going to start on the hydro acoustics part of the day. Some of this we discussed already in terms of what you can and cannot get from hydro acoustics. This is what some of the agencies are interested in. So as we talked about earlier in knowing where concentrations of fish might occur at the target, that's one of the main interest. But I think I saw from Fish and Wildlife that there was interest in how long this could remain in those areas and whether or not the targets moved among areas. Can we kind of expound on that a little bit more?

MS. GRADER: Probably it was in one of our letters. What was the first part of that?

MR. CONNELLY: So I know you definitely were --

MS. GRADER: How long they're there, you mean?

MR. CONNELLY: Where concentrations of fish occur at the project? One of the key pieces of information.

MS. GRADER: Right.

MR. CONNELLY: There's also a column, those targets remain in those areas and whether the targets move among areas as we talked a little bit about earlier.

MS. GRADER: Right.

MR. CONNELLY: So --

MS. GRADER: What are you asking?
MR. CONNELLY: I was thinking, well --
MS. GRADER: Well, we do think that -- I mean, that it would be easier with Didson technology versus the split beam, from what we understand.
MR. CONNELLY: For shad or eels?
MS. GRADER: For either.
MR. CONNELLY: Okay.
MS. GRADER: To get at those types of questions as well as acknowledging that radio telemetry can get at some of those questions. It's that the hydro acoustics potentially could, as we brought up before, cover a larger time period over, you know, continuous monitoring versus the discrete monitoring of when a tagged fish goes through the area, work areas and -- you know, because you're going to find that out from the tagged fish too how long it's -- is it here and then over here and then back over here before it goes through? But that's at that particular point in time whereas with hydro acoustics you will be able to be continuously monitoring masses of targets and where they are, relative abundance over time. And you're very operational -- (Laughter.)
MR. CONNELLY: Actually, before we too far down -- could we hear a little bit about the differences about what you get with Didson versus blue beam in terms of

tracking and distance and range and stuff like that?

MR. RAGONESE: Cost --

MR. KENISTON: And which technologies or methods are capable of identifying an eel or, you know, a uniquely shaped nonschooling fish as opposed to a school of fish.

MR. GURSHIN: This is Chris Gurshin from Normandeau Associates. So both the split beam sonar and the Didson or the newer version, Aris, which is a high-frequency, multi-beamed imaging sonar, they're both hydro acoustic which is kind of a broad term for anything -- any device that is used under water that uses acoustics or sound. The split beam is a single beam and it sends out sounds and a proportion of that sound reflects back. And on the receiving side, the split beam electronically divides that beam into four smaller beams essentially. And using the pairs or the quadrants can determine the time of arrival, from the differences from the time of arrival can determine the target's position within the beam. With that information you can compensate for sensitivity loss for the target being outside of the center of the beam where it's more sensitive. So then you get a better accurate measure of the size or the acoustic size which is a pretty good relationship with the physical size for many things.

MR. CONNELLY: So it will give you a better of size of split beam versus Didson?

MR. GURSHIN: It does it differently. Acoustic size in terms of the target -- the amount of sound and if you reflected. The Didson is composed of 96, I believe, overlapping narrow beams that create like a fan. And it's variable widths of the -- of the vertical axis, as well as the width of that fan depending on what kind of lens you put on for concentrating that sound energy or spurning that, depending on what your goals are. But each of those individual beams is a single beam without that split beam technology. So while fishes within a single beam within the multi beam, you don't really get -- you can get echo strength, a relative signal strength but it's not compensated. You really don't know where that fish is in within that particular beam because the beams are narrow and overlapping for large targets that move across the beam, you can infer direction, but only in two dimensions. Whereas in a split beam, because you know where it is, on the X and Y axis and the Z, you can -- you can trace the individual echoes or the detections while swimming through the beam. And you can construct a path in three dimensions. Whereas in the Didson, you're kind of limited to two dimensions.

Now, the sound -- the frequency of the Didson and Aris is very high and as such the amount of acoustic contribution from the swim bladder is less important. And, in fact, the tissue and the skin and the bones actually

reflect -- make a bigger contribution to that echo. And so what the end result, that plus the narrow overlapping beams detecting that animal or target over multiple beams, you can -- you can generate a shape. And that shape is used to inform you of what that target might be.

MR. CONNELLY: Meaning multiple echoes?

MR. GURSHIN: Nope.

MR. CONNELLY: Being back at the various single little beams, in other words, at the same time?

MR. GURSHIN: Yeah, the simultaneous echoes among the intercepting beams, and also you get the reflections over a very small range of the pulse so that you can build a shape -- a two-dimensional shape. And that shape is often used to help classify. Sometimes a species level, if you're interested in a sturgeon or something pretty characteristic -- that has a characteristic shape, sometimes you can get on to family levels. But then that image recognition is better at close range and then it deteriorates as you get further out.

For eels, you can -- because these have that Anguilla form swimming pattern and they're long, they have a higher probability of correct identification than you would from trying to confirm what the saw-tooth-like pattern of multiple echoes from a split beam.

MR. KENISTON: Can I ask a question? So, even

you know you've mentioned the movement of an eel, the way it swims, and that piece of information would allow you to distinguish it from something like a chain picker which might also be about the same size, long and thing, but not swimming in that motion? Potentially?

MR. GURSHIN: Potentially.

MR. KENISTON: If it was close enough?

MR. GURSHIN: In fact that's one of multiple questions we have of this technology that is being pursued in a feasibility study that Normandeau is in a contract with EPRI up in the Saint Lawrence where the purpose of that study -- a much longer term and series of goals is to identify what sonar technology provides, if any, a way that monitor eels in a larger riverine system so that they can later apply that downstream at large-scale hydros.

Now, in that study we are simultaneously looking at split beam and Aris as well as another multi-beam technology. And in that we hope to get some information through some experimentation to get at, well, what about -- what is your error in classifying targets like eels versus a walleye or versus a submerged stick, or pickerel or musky or something like that. So we actually plan to do that kind of a study. So, the short answer is, there is uncertainty in all of those.

MR. KENISTON: The question is open.

MR. GURSHIN: Yeah, it's better with Didson than Aris.

MR. KENISTON: And at this time it is known that with the split beam I think you said it could map a fish in three dimensions so you could see a fish sounding toward an opening as opposed to just in two dimensions where it is looking down from the surfaces.

MR. RAGONESE: If it was an individual fish.

MR. GURSHIN: So here --

(Simultaneous conversation.)

MR. GURSHIN: Both of these technologies measures time and that's it. Everything else is derived mathematically based on the physics of underwater acoustics.

So, for each detection within the beam of an individual fish or target you get a location on X and Y, Z axis, but there's always error with that. So, it depends where you are on that beam because it also depends on the size of the target because a smaller target -- the reliability of those detections on the outer beam is far less than it is in the center of the beam. It also is less meaningful at close ranges where the cone of the beam is spread over, maybe let's say a foot whereas far away it could be spread over ten feet. So that track or that route is probably more meaningful at far ranges than near ranges.

It depends on how you deploy it. So a few things about -- in the context of what we're talking about currently is what you don't have is regular telemetry is the first hurdle is correctly identifying what you're seeing, what you're interpreting from the echo. And then the other thing is, you can only describe that movement within the beam. You don't know what it's doing before it enters the beam and when it leaves the beam. And as far as using or trying to throw the movement through the beam to exiting a particular route, well, it depends on how well you can get that beam deployed and sampling effectively near our structure. And depending on the beam geometry of the area you select, that could be problematic because other environmental conditions that make it also difficult, mainly background noise, leaves, turbidity -- I mean, so when you're talking about detecting juvenile shad, well, in the day time they're more likely to school and form tight groups of fish. And this is probably -- well, for the beam those single echo detections become almost meaningless when a school passes through the beam because you're getting multiple overlapping echoes. And because of constructive and deconstructive acoustic interferences sometimes you won't detect anything when something is there, or conversely it might produce echoes at locations where they aren't there. So you can't trace the movements of detections among a school of fish.

Now, in the night time they do disperse more and break down and you're probably more likely able to trace or to track individual fish or targets through the beam. Unfortunately, if you're interested in episodes of migration, and you believe that they're closely correlated with higher rainfall events, or high-flow events then you probably change your classification effort as more debris and other factors like silt and in the water and who knows what comes down.

And then you've got a lower ability to discern targets. And in a split beam for juvenile shad, you could make an educated guess that if you see ten targets and each of those are the acoustic size and relates to what you would expect for juvenile shad to be, you're confidence is higher. If you see a single fish of that size, could it be that or could it be a small mouth bass, or could it be a shiner. If you see, you know, a school of them, yeah, you're more likely to say that's probably juvenile shad.

With an Aris or Didson you can see schools, but at much close range because they start to --

MR. CONNELLY: So what's the range difference? Can you talk about that?

MR. GURSHIN: Oh, the width, beam width. The typical beam width of a split beam are six or seven degrees or 15 degrees depending on the manufacturer and whatnot.

But you're limited here mainly by the physical geometry of river channel. If you point the transducer up or down, you can cover the entire wire column except for the boundary margins where, you know, you're not going to sample technically probably within a boundary to the bottom if you're pointing up. And you're going to probably have a thin few inches of range that you can't make sense out of in the opposite foundry.

But, if you point it sideways to try to look across multiple gates, for example, or intakes, you're limited on where you put that transducer in the water column and how it spreads. So, you know, just a few calculations, you know, a six degree beam and optimistically take a 30-feet depth, you're going to get somewhere around 100-foot range of detectability. But that breaks down, certainly when -- depending on how well you aim it -- before it hits a boundary, the surface of the bottom. Of course when there is more surface -- the surface conditions are noisier then that range deteriorates. Then with the Didson and Aris, you're eels you're looking at out toward meters to have reliable detection. You might see targets beyond that depending on what model you choose, but you're confidence is less. For individual juvenile shad, you're probably more likely to -- I don't know have the exact, you know, range for detectability on individual juvenile shad because

they're so small. I would suspect you're talking on the order of several meters, but not 20 meters.

MR. CONNELLY: So is it something like that?

MR. GURSHIN: Probably five meters, or it's probably let's say, you know, on the order of five meters.

MR. RAGONESE: So just to kind of interject here, so Chris went to Vernon for the first time yesterday as well. And you've been in our study team 22 for a single or a proposed single hydro acoustic unit monitoring sort of presence, absence or timing, he felt that maybe we might want to think about revising the location because of the turbines we saw, even in there. He was surprised at the level of turbines that we even saw in front of the dam there. And so he questioned whether or not -- so, I don't know, we had some discussion --

MR. GURSHIN: Yeah.

MR. RAGONESE: -- I assume where there might be a better place to move it. But even for those that were out there, we might not have thought there was a lot of turbines, but it bothered you. And would you describe that a little?

MR. GURSHIN: There was certainly a number of places where there were large eddies of certainly small eddies forming throughout the four bay behind the ice beams.

MR. KENISTON: And that entrains the error that gives you bad signals?

MR. GURSHIN: Yeah.

MR. KENISTON: Okay.

MR. GURSHIN: Which is those smaller air bubbles, we got our sound more pronouncedly in the imaging zones because they're the higher frequency so sometimes you get -- depending on the size of the bubbles, that frequency might reach its resonance so it might scatter sound stronger.

So that's the trouble with using Didson anywhere where there's a log turbulence. It just becomes like your TV without cable.

MR. RAGONESE: And slightly different equipment, but when we did this the last time it burned. That's what we saw.

MR. CONNELLY: Did you have something.

MR. BRUSH: Yeah, Tim Brush from Normandeau. I want to compliment what Chris has been talking about based on some of my experiences. And I'll start with the last comment about the previous pilot skill study since eight years ago, something like that. There was one of the significant factors that led us to believe it wasn't going to work the way we were applying it for that study. It was different from what we are trying to do here.

I think it was Bill that mentioned when you first

started this conversation about the three-dimensional aspect of whether you could sort of track a fish, taking a trajectory to a unit. I just want to be clear that you're not envisioning this like what an HTI 3B acoustic tag fish would give you as far as a trajectory which could give you, you know, from hundreds of yards up in the four bay all the way through into the unit index. That's not what you would get for this. You would get a little tiny little trace because of the volume that's being sampled in a conventional fixed aspect of acoustic structure. So you can derive or actually you can see, in some cases, if you get a good trace, what the trajectory is. But it's a tiny little snapshot of the overall trajectory. I want to be clear about that.

MR. GURSHIN: Yes, this is Chris Gurshin again. So for a 15-degree beam which is the widest split beam that can physically be made, at 30-foot depth, if you were to do an upward or downward looking configuration, because it will only give you about eight feet at the farthest range and a lot less the closer you get to the transducer. So how meaningful is their movement on an eight-foot or less special scale? How meaningful is that, you know, just to what they're doing on a four bay or impoundment scale. Where radio telemetry you can get that information over a larger, more meaningful scale. Furthermore, you know for

sure what species it is and you know the individual. Where if you don't have that certainty with this, with the sonar.

MR. BRUSH: I'd still like to make one other point in the context of contrasting Didson or Aris to conventional fixed fast track acoustics. So in my -- I've had some experience with both. Not nearly as much as Chris, but I have used both tools and the way I sort of characterize them is that the fixed aspect conventional hydro acoustics is something you might apply over the width of a dam to -- this technique was developed largely in the Columbia River basin to or at all the coordinates.

So it's been effective there because you had a lot of sampling over a long -- you know, over the width of that river and a long time scale, so there was a lot of power. The scale of those facilities helps facilitate the use of that tool.

Now, with Didson or Aris, I view that more of a tool that if you want to focus in on a specific area to look at more of a behavioral type of thing, that can be a useful tool. My experience with it was at Holyoke. A few of the folks here would understand this thoroughly, I think, if you asked us to try the tool out to look at juvenile sturgeon movement down the canal and into the bypass, right where the louver comes in to the left bank of the canal and then the bypass pipe goes. So we're looking at fine scale behavior

right at that point. There's a little ramp -- a wire ramp and we're trying to assess whether the tool will be useful to evaluate it, so individual behavior in that point. And so we were literally, you know, feet from the fish because it's a narrow point right there. And I found it to be somewhat useful. Maybe I'm not using it because of, you know, limited utility and the expense of, you know, at that point it was like $5,000 a day to rent the gear.

So my primary point being that if you want to sample more of a population scale thing -- approach the conventional hydro acoustics are the better tool. If you're looking at a specific point at a project like near a bypass or near a behavior in and around a guidance structure or something like that, then the Didson or Aris may be a better approach to help refine a broader data set into something, you know, based on behavior.

MR. CONNELLY: So going back to the tracking you say the school of fish are in the units, but can you track by the same of the school? I can't remember what the phrase is. There's that kind of individual versus an integrated kind of approach looking like you analyze the data?

MR. GURSHIN: With split beam sonar you can get phase information while you cannot quantify or describe the movements of individuals in the school, you can, for some directionality of, you know, based on the leading edge and

the trailing edge what kind of direction to take.

MR. CONNELLY: Okay.

MR. GURSHIN: And as far as the multibeam has been used a lot, more in the ocean environment for describing morphology of schools, studying school behavior and morphology. With the split beam you can get the density within the school and do things like that.

MR. CONNELLY: So at the first beam they talked about how they had to change it and intakes and stuff. But those -- from my understanding they weren't sampling continuously; right? That they were kind of disabled for a while and switched back and forth because there were so many are at risk, you have four producers say, but only one kind of unit that was sort of processing it. So --

MR. GURSHIN: You can't ping fast enough on all transducers because you're using one echo sounder and one transceiver to produce the signals. So you're kind of splitting that and so you're just physically limited to how fast you're pinging. You can probably do it pseudo continuously, but at a much slower ping rate. But that has less utility, so that's probably why they had to switch back and forth. Of course you could -- if you made the investment to get an echo sound for every -- instead of splitting four transducers for one general purpose transceiver then you have one dedicated and you can probably

do more.

MR. CONNELLY: So that means studying, you know, much increased costs and also like the same amount of data that would go through; right?

MR. GURSHIN: Yeah, you increase your data amount -- amount and data, and certainly costs, yeah, if it's --

So like the transducers are usually separately priced and then the echo sounder or, you know, the EPT was like 38,000 a piece. And then whatever transducer you buy, it can range from a few thousand up to 38,000, depending on what frequency and -- you use. So, there's always a big cost difference.

MR. CONNELLY: So the frequency in the beam type that will affect how many transducers that you have for a transceiver?

MR. GURSHIN: Yeah, you can multiplex or you can slow or fast multiplex which means the s low multiplexing is your pinging. And then switching to the next transducer, you're interweaving those pings among your -- that's fast multiplexing. Sorry.

Fast multiplexing is when you interweave -- the pings alternate. Whereas slow multiplexing you sample for -- I don't know, 15 minutes, ten minutes and that one transducer and then you switch.

MR. CONNELLY: Okay.

MR. GURSHIN: It's really a factor of each vein captures electronics a little different and they'll say theirs is better. But it also depends when the transducers -- irrelevant of the frequency, more or less it more has to do with your ping rate. Yeah. Which requires information on what -- you know, what size fish are you trying to detect, as well as how fast they are moving. Which also is related to flow. So it depends on the situation.

MS. DONLON: Andrea Donlon, Connecticut River Watershed Council. I missed the meeting -- the first light meeting on Monday, but their sampling plan showed that the Cabot station transducer covered 10 percent of the Cabot intake area in that little sample 50 percent of the time. I was wondering if the diagrams per your plans B and C, Figure B-1, what coverage percentage are you talking about?

MR. RAGONESE: What are you --

(Simultaneous conversation.)

MR. RAGONESE: Those are just examples.

MS. DONLON: Okay. Well, I mean, what -- is 10 percent of Vernon --

MR. RAGONESE: I mean, are you asking us to comment on first lights?

MS. DONLON: No, I'm saying that -- I'm asking you what your -- you came up with a $2.93 million proposal based on these transducers across the -- several upstream

stations and then this prorated transducers across the Moore Bay area. In this price, what percentage of the -- what do you call it, intake or clofield area?

MR. RAGONESE: Yeah, so I think I understand your question a little bit. So I think in most places where we're saying we would deploy a hydro acoustics in the intake, you have a transducer in each bay.

MS. DONLON: Oh.

MR. RAGONESE: Which is what their sensors were on. What they're referring to in terms of 10 percent is okay, the square footage or the square -- you know, surface -- two dimensions, that was 100 square feet in that intake are being discovered in 10 percent of that.

MS. DONLON: Right.

MR. RAGONESE: I don't think we had --

(Simultaneous conversation.)

MR. GURSHIN: Are you looking at a particular figure or document?

MS. DONLON: B1 -- B3.

MR. GURSHIN: Right. That's actually in there. It's on page C12 under sampling coverage. It's estimated around 18 percent of the river's total cross section.

MS. DONLON: Right.

MR. GURSHIN: But that's now what we're proposing at site 34. Study plan 34 proposed to use a single 15

degree split beam to sample a location where it has the highest probability of encountering juvenile shad for the sole purpose of creating a fine resolution to the signal of when they're there.

The timing in space is being addressed by the radio telemetry, and the question about the timing over space and time is better addressed with radio telemetry using multiple batch releases over maybe like two times a week, I think, is what we were thinking over a migration run.

MR. RAGONESE: Did that help you for your --

MR. GURSHIN: I think that --

MS. DONLON: Just disregard that proposal.

MR. GURSHIN: Yeah, that was an example. They had --

MR. RAGONESE: Just an example.

MS. DONLON: Well, we're disregarding it because of the cost; right?

MR. RAGONESE: No, we were just illustrating costs. So we're trying to provide examples of scales. That's what it is.

MS. DONLON: Okay.

MR. RAGONESE: Rather than just throw a diagram, we described it in great detail.

MS. GRADER: And what Andrea, I think, is getting

at is that what we're saying there is covering 18 percent; right, of the area?

MR. RAGONESE: One example.

MS. DONLON: 2.9. Well, I guess, you know, I'm hearing, even though I haven't been as involved in this study, it sounds like the agency wants something other than leader proposed plans. So I'm wondering if there are schemes that are not as expensive as multiple millions of dollars that would achieve --

MR. RAGONESE: There are no schemes that are less than a lot of millions of dollars. Yes.

MR. CONNELLY: I had a question. I did have a question.

MS. GRADER: Well, because I have to leave soon, I had a question too. Melissa Grader, Fish and Wildlife Service. So you've been to the site, it sounds like it's very turbulent everywhere. What about upstream of the trash and ice, is that a less turbulent area and a possible location for deploying? Then we can get into how many you need, but deploying either a split beam or a Didson/Aris type system.

MR. GURSHIN: What would be the objective of this?

MS. GRADER: The same thing, timing.

MR. GURSHIN: Well, more than timing though.

(Simultaneous conversation.)

MR. RAGONESE: Well, we're not proposing what the timing --

MR. CONNELLY: So, okay. The timing would cover the majority of the river or a big chunk of the cross section?

MS. GRADER: Ideally we would -- I mean, what we want and what the site is -- what's feasible at the site, I don't know if that can happen. I mean, ideally we have receivers, transducers at the intake. And they're saying that's too turbulent. Next best case, we have them within the four bay and the near field area to try to discern if they're using a bypass or are you going through the turbines. It sounds like that might not be possible because it's too turbulent. Maybe the best we can get with that technology is to go upstream and then figure out how much of an area we need to cover to get -- to have confidence that we're actually capturing where the bulk of the fish go during a run; right? I mean, timing. We need to know.

MR. RAGONESE: Timing or where?

(Simultaneous conversation.)

MR. RAGONESE: Well, see, that's what I'm trying to make sure --

(Simultaneous conversation.)

MS. GRADER: I'm saying -- but you told me so

far, we can't get at any other questions with this technology other than timing. That's what I'm hearing.

MR. KENISTON: I'm kind of hearing the same thing. I mean, we're looking at route selection, but the area of where you would need to deploy them is --

MS. GRADER: Is too turbulent.

MR. KENISTON: -- unsuitable because of turbulence, then you --

MS. GRADER: Then you have to look to another --

MR. KENISTON: You can't get route selection --

(Simultaneous conversation.)

MS. GRADER: -- to get that.

MR. KENISTON: Is that accurate or are we hearing it wrong?

MR. GURSHIN: There are variable turbulent issues across the dam. I think any of those are feasible, but you just have more difficulty. I haven't been there for a whole season to really appreciate the worst of the worst. So --

MR. CONNELLY: So I have a question for you. In order to say, you know, what goes out to the fish pipe might not be really representative of the drawing. I was wondering if you could kind of explain that a little bit more.

MS. GRADER: We have no idea whether shad use that; right? I mean, the studies that have been done have

all been on salmon. So even though it looks like a really nice place that's confined and hopefully that is how they're going out. There is no data to show that that in fact is where the majority of the fish go. So setting up a transducer there, even though it sounds like we can't anyway, because it won't work because it's too turbulent, you know, might in fact be the completely wrong place to put it because all the fish are getting entrained. And then that would absolutely provide us no information.

MR. CONNELLY: But there's no reason to think that fish do use the pipe as -- that that's not representing in terms of timing what all the fish are doing; right?

MS. GRADER: Right.

MR. CONNELLY: Okay. So if we could find one place when fish pass through, that would be the standard of, you know, what's not sampling, per se.

MS. GRADER: I think so.

MR. CONNELLY: Okay. File grievance letters, it made me think like the fish that use the fish pipe don't represent necessarily the rest of the population. I was kind of wondering why that might be. Or if that happened somewhere else.

MS. GRADER: Yeah, again, I don't know. It may or it may not be because even if the fish do use the pipe, you don't know if they're using it differentially dependent

upon environmental or operational conditions. So it may not in fact be representative. Or it's representative of that set of conditions, you know.

MR. CONNELLY: Well, I was asking you if you had experience elsewhere if you knew, for exhibit, where -- you know, facility to be dealt with, you know. Most of the fish -- the timing -- you get the answers of timing based on a different based on where you sample. That's like worst case scenario.

MS. GRADER: Yeah.

MR. CONNELLY: I was wondering if you guys had any --

MR. SPRANKLE: This is Ken Sprankle, Fish and Wildlife Service. I'll bring up kind of a corollary thing. We have -- for upstream passage you have the entrance ways and you assume that that's going to be representative of the run. That those fish ways only operate under certain conditions and things change and the fish go to different places in the river. And I mean, this is just, I think, the alternative. The corollary to this on the downstream for adults. That under certain flow conditions, you would expect these facilities to attract and entrain fish and pass them. And as conditions change, one could only, I think, question what happens in that situation. And we can look to what goes on with upstream again with that being designed

for a certain set of conditions, fish move up, and then all of a sudden conditions are different and we don't pass it. And they may be in a different part of the river.

So I think that at that's another way to look at this. I mean, maybe that's a better way to get it across to you what we're thinking.

(Simultaneous conversation.)

MR. GURSHIN: This is Chris Gurshin again. To go back to what was said earlier, I'm not saying it's impossible to sample in the four bay near the dam. I think John was just alluding to my site visit, opened my eyes to other concerns that I didn't have previously. And I wouldn't want to commit ourselves to any one location without some degree of testing. In the rehearing request I provided two examples of potential configurations; Figure A-2. Initially my most promising configuration probably would be to mount it on the bottom and look up. So the beam spreads wide and covers more area near the opening of the fish find. But you have to do it far enough away so that the eddies and other turbulence near the surface doesn't increase your acoustic dead zone at the surface and also doesn't interfere with the boundaries of the dam or the louver.

MR. CONNELLY: So in that figure then, you would assume anything that went through the beam went into the

pipe?

MR. GURSHIN: Yes. Well, during the night you can probably get direction and you could say, okay, within this pie shape set of coordinates heading in that direction you can -- your best educated guess is to assume that more likely they go through.

MR. CONNELLY: Right.

MR. GURSHIN: You don't know for sure. Well, with radio telemetry you do know for sure if you put out the downstream antenna to verify that.

MR. CONNELLY: Yeah. And if you were trying, you know, to quantify the leading edge of both school you would have that --

MR. GURSHIN: Yeah, I wouldn't --

(Simultaneous conversation.)

MS. GRADER: What came up at first light was one of the reasons to go behind the raft was because at that point the fish are assumed to be committed.

MR. GURSHIN: That's right.

MS. GRADER: So it would be, you would have higher confidence in making that assumption if placed there.

MR. BRUSH: Tim Brush from Normandeau. I wanted to just make one clarification point about the use of the fish pipe. You do know that juvenile shad use the fish pipe, you can observe that. When they come through, they

pop out of that water fall like popcorn popping out. So you can observe that. We don't know what the proportion of the use of that is.

MR. RAGONESE: And that is not how we intend to employ acoustics -- was for timing.

MR. CONNELLY: So I asked Christopher about a transducer on the downstream side of the pipe and I was kind of curious why that might be?

MR. GURSHIN: (Off microphone.)

MR. CONNELLY: Oh, is that right. Okay.

MR. KENISTON: I think both Fish and Wildlife Service and Vermont ANR as one of their suggested study 34 modifications said that that particular array could be eliminated.

(Simultaneous conversation.)

MS. GRADER: Yeah, that was their last comment.

MR. CONNELLY: All right. So that still stands?

MS. GRADER: There originally were three in the FERC study plan determination, the upstream of the comment at the dam and then downstream. And we had said that the downstream one could go.

MR. KENISTON: I guess while we're on the subject of suggested possible modifications to proposed study 34, another one in that forwarded list that's in both agency letters is that assuming no anomalous environmental or

operational conditions, you could agree possibly to conduct a single season as opposed to two. And that's -- would that apply to -- in your mind, to both shad and eels or -- and would it hinge on the operational? Like the way it's worded in the letter is that environmental or operational conditions. So --

MS. GRADER: Right. It was out.

MR. KENISTON: Right. Right.

MS. GRADER: Something like that happened that might change how to operations.

MR. KENISTON: Got you.

MS. GRADER: Do you want to go forward.

MR. GURSHIN: So if seemed like everything was in the normal range for that first season, then --

MS. GRADER: Yeah, I mean, more information is always better. But it's especially concerning when, you know, it was an unusual season for whatever reason.

MR. GURSHIN: Okay. Thanks.

(Pause.)

MR. KENISTON: One question, also in the -- I guess it's the rehearing request one of those diagrams showing possible arrays, one diagram was -- I don't know if it's called Option C or C, it was one of the examples you gave -- or the one example you gave that would actually target eels. And it had a couple of horizontally aimed --

PARTICIPANT: Is it C-1?

MR. KENISTON: C-1. That's the only configuration that I saw that had those horizontally aimed themes lower in the water column. And that -- I just want to clarify that that is -- the purpose of that is just because you think eels would be traveling deeper. And that's why you think that that deployment scheme is the only one that would target eels. But the others are not likely get eels?

MR. GURSHIN: It's to fill in the bottom depth layer.

MR. KENISTON: Right.

MR. GURSHIN: The studies have been done that can describe some of those depth preferences for eels. In some cases it's the full water thong. There's some evidence that they prefer the bottom more so, but they frequent the vertical migrations up to the surface and when the surfaces start through they're all over the place. And upstream this location is self dive that looms over by the Islands. And that -- so the bottom is more likely to detect eels during the day than at night. They're often swimming in -- they can be found in all depth layers.

MR. KENISTON: Okay. Is that -- I mean, anyone from the agencies want to comment about whether that assumption seems right as far as the diurnal behavior or --

I know, for example, some fish way prescription specified bottom gated entrances for eels. And I think we all wish we knew more about what eels did, but that isn't correct, so that's just kind of our best guess at this point what they're doing and that that -- if you are looking for eels with hydro acoustics that those deeper water column beams would make sense based on what you think eels are doing?

MS. GRADER: I think so. I think from what I've heard and I defer to Alex Harrell but I think what I've heard him say is that, yes, in general they're going to be more authentically oriented, but when they do come up to a barrier that they start to do searching and they can go up and down the water column. I think it also probably varies with the size of the facility at your deeper, wider intakes. Probably it's more likely that they're going to be deeper than if it's a relatively shallow intake. But I would defer to Alex Harrell.

MS. WILL: He's got a paper that talks about the benefit.

(Simultaneous conversation.)

MS. WILL: A 1999 paper that we --

MR. CONNELLY: So I had a question about the sub-gates.

MR. GURSHIN: Uh-huh.

MR. CONNELLY: So is there something that can be

used for a passage? If you opened them say for eels?

MR. RAGONESE: Say that one more time?

MR. CONNELLY: Could those subgates be used for eel passage?

MR. RAGONESE: Could they be used for eel passage in terms of, are they operational or --

(Simultaneous conversation.)

MR. RAGONESE: I'm not sure what you're asking. A study, what? What are you talking?

MR. CONNELLY: This is not related to the study. This is for my own edification.

MR. RAGONESE: They're operational.

MR. CONNELLY: They're operational.

But can it be too expensive to open those, or is that something that could be done easily?

MR. RAGONESE: I don't know. I mean, there's a motor and they open. I mean, it's not expensive to open them. It's expensive to waste water that isn't -- we're not seeing eels.

MR. CONNELLY: Okay.

(Simultaneous conversation.)

MR. RAGONESE: At some point in time when there is a requirement to develop downstream passage for eels through Vernon, we would probably look at where they need to go.

MS. GRADER: So this is just one of those weird things though that there's that data gap; right? And the data gap is we don't know how many eels are upstream, how many of those are ready to move back downstream. And without collecting data at the project, we don't have the ability to really understand how protective a given trigger that you would -- it sounds like you'd want us to come up with for this particular instance would be. So, you really need that information to help inform if the development of the trigger and what that trigger would be is appropriate at the site.

MR. RAGONESE: We do wish you knew how many eels were there. Yes.

MS. GRADER: But there is the ability to find that out with --

MR. RAGONESE: How?

MS. GRADER: Well, I mean, it would be costly; right? You could put Didsons along the entire intake area; right? And if that's basically where they're going to go out, then you'll be able to -- you just said that that's what they used to determine the number of fish that are going out on the Columbia River out west, that they use that technology.

MR. BRUSH: Conventional hydro acoustics, not the Didson.

MS. GRADER: Okay.

MR. BRUSH: The Didson is more for a service-focused area of interest.

MS. GRADER: But we know that Didson can be used to discern eels as targets.

MR. RAGONESE: Not so easy. Didsons yes, not others. Correct. Didsons.

MS. GRADER: So there is the ability to collect those data is my point. And so, not proposing to collect the data and not -- then how can they come up with a trigger that's defensible beyond the fact that we know they're efficient eel out stream because they pass upstream in the ladders.

MR. RAGONESE: How many fish go upstream in the ladders?

MS. GRADER: Well, we just recently started looking and having the --

(Simultaneous conversation.)

MS. WILL: That is not an absolute indicator because of their behavior. They can go under the racks and you don't get a visual estimate of true abundances as an indicator of --

(Simultaneous conversation.)

MR. RAGONESE: I'm having a problem with what you're talking about. I'm just saying, how many have we

observed going up the fish ladders? Or how much have we observed going up -- aren't we studying that now?

MS. WILL: Yeah, we annually monitor -- well, in our previous reports Ken Cox has always said that we don't even report those numbers because it's not a real indication of how many fish are passing up the fish ladder because they can go into different -- you know, underneath --

MR. RAGONESE: Okay. But aren't we doing a lot of studies to evaluate --

MS. WILL: So I can tell you --

(Simultaneous conversation.)

MR. RAGONESE: -- how eels going up are -- aren't we doing that now?

MS. WILL: For 2014 we had 124 eels accounted at fish ladder affirmed. And we had at fellows falls 35, and we had eight at Wilder. And this year was the first year that salmon was used to count eels at Butler. Prior to that we didn't have data.

MR. KENISTON: And what you're saying about the data maybe not being representative is that unlike the salmon that are going to be swimming right past the window, the eels might go undetected in places where the researcher can't count them?

MS. WILL: And I've heard the same thing from Alex Harrels has cautioned me on that as well.

MR. RAGONESE: For devil fish?

MS. WILL: As far as not relying on those numbers to be, you know, where shad you're fairly confident unless you've got a high turbidity event, you know, or something else that happens. The eels, the way that they move through there isn't really indicative of -- but it at least gives you an indication of, you know, when they are moving through, where you can look year to year to say, well, there's more than last year, or less than last year, that sort of information.

MR. RAGONESE: So, just so I understand, is the Fish and Wildlife Service asking us to deploy hydro acoustics for eels? That's really unclear what the position is. Because we thought that and then we've heard since then, no, so we're not really clear. We have to get a stage position. And we have indicated that like say the approach that first light took, a sampling, that identifies timing and to some extent, you know, represent sort of a sampling beam width of if we see eels it gives us an idea of whether or not eels are plentiful. So, what's the difference between our sampling?

MS. GRADER: Well, first I would say, we didn't submit a study request pertaining to hydro acoustics for eels. We're supportive of the state's request and supportive of FERC's SPD because we think there is good

information that can come out of.

I'm not understanding, if you want us to set triggers for the requirement for downstream passage and protection measures for eels based on a trigger which is a number, how are we ever going to know when that number is reached?

There's my bomb, I'm leaving.

(Laughter.)

(Simultaneous conversation.)

MR. RAGONESE: We've done that before.

MS. GRADER: But eels are very difficult as we are all -- you know, how are you going to do it with eels? How?

MR. RAGONESE: All right. I'll pick a number; how's that?

(Simultaneous conversation.)

MS. GRADER: And then what?

MR. RAGONESE: That's exactly what we've done before.

MS. GRADER: But how do we know when it's reached? We can all pick a number, but how do you document when it's reached? That's the question.

MS. WILL: But Fish and Wildlife Service did submit the American eel timing study request that did talk about using hydro acoustics.

MS. GRADER: Yes. We did.

MS. WILL: Right. So --

MS. GRADER: We did. That was a standalone study, yep and then in the RFP --

(Simultaneous conversation.)

MS. WILL: -- you could, you know, sample five nights or whatever, but it says, you know, passive monitoring of eels using hydro acoustic methods as an alternative after trapping because there's so much effort involved.

MS. GRADER: And that's what they were doing at First Light. And that's wonderful. And what these guys came back and said is, oh, first light is doing it, so we'll use their information for our timing requirement of the study. And then FERC says, PD said to a standalone hydro acoustics.

Sorry, I have to leave.

(Pause.)

MR. KENISTON: Just checking, bear with us a second, we're trying to --

MR. RAGONESE: Well, while you're checking, I'll take the floor, if you don't mind, to make sure it's on the record. Our position is, we have improved the reliability of radio tagging to cover the polls that the agencies are looking for, for shad. We are relying on route selection

for eels using radio tagging. The increase in costs for the duplicative nature that is supposedly being sought through hydro acoustics, which in our opinion is somewhat fraught with uncertainty. But the cost of that is incrementally sort of unfathomable. Where does that come into the discussion?

Yeah, we understand what the desires are and there's an expectation that this technology is going to solve everything and if we do two technologies, we're going to get twice as much. But in reality you're going to get four times as much uncertainty. Because you've got uncertainty on both and, you know, all you do is multiply them together.

We have -- you know, we're not opposed to using technology. In one of your questions you asked us about, well, are there any alternatives. Now, we've used three-dimensional acoustic tagging, tracking, whatever you want to call that. And it's incredibly expensive and it had poor results. You know, we work our way into these technologies based upon, you know, sort of sound -- and we've been ones to do some of that R&D to some extent. We did it at Moore. I mean, got a whole array of these acoustic sounders out there trying to figure out things. And, you know, we saw a few echoes, but they didn't mean anything. They didn't mean anything to us. And the idea

that, you know, we're going to deploy hydro acoustics for the few eels that we expect to potentially -- you know, capture in a beam, or a few beams, or many beams, when it's still in a research and development phase as, you know, illustrated by the equity research, I just -- I don't get why there's sudden expectation that we should be doing the same R&D at -- our -- when we have these goals met through reliable and well-used technology. I don't get it.

So I'm curious if there is some kind of explanation as to where is it -- is it really one fish will drive a decision? Or is there some context as to why they're not -- there's a real incremental value here. We just don't see it. We see it as a great wish list. And if I was in Ken's shoes, I'd ask for everything too. But the reality is, it's not actually even a sound position from our standpoint in terms of specifying the technology. We can reiterate that. (1:18:01) in the position of describing how to do a study as opposed to a study.

MR. DAVIS: Eric Davis. John, I think your assumption that radio telemetry will provide, you know, data that resembles the patterns of wild, untagged fish, you know, that's an assumption that --

MR. RAGONESE: We've been doing it for 30 years.

MR. DAVIS: I mean --

MR. RAGONESE: I mean, you guys have bought into

that is what I'm saying.

MR. DAVIS: Yeah, no, it's valuable data.

(Simultaneous conversation.)

MR. DAVIS: We are certainly looking to that data, but also, you know, the technologies complement each other. With telemetry you have a longer track record of travel, and granted, with the hydro acoustics you can only infer what's in that beam, but you have a lot more targets. So, you know --

(Simultaneous conversation.)

MR. RAGONESE: And what do the more targets do, again, Eric?

MR. DAVIS: The more targets give you a sense of what that native fish population is.

MR. RAGONESE: What do you mean, you can measure and quantify; is that what you're saying? Because you can't.

(Simultaneous conversation.)

MR. DAVIS: We're making this leap --

(Simultaneous conversation.)

MR. RAGONESE: The bigger node is somehow quantifiable is -- we're not trying to quantify shad. We're trying to find out what's our prime defect on passage? That's what we're trying to do.

MR. DAVIS: Well, certainly relative abundance

and magnitude is, you know, one of the agency's objectives.

MR. RAGONESE: Yep. And that is what we're trying to also achieve with a monitor.

MR. DAVIS: I don't think radio telemetry really gets to that.

MR. RAGONESE: Radio telemetry doesn't get what. What we're saying is that by having a sampling, not an array, not a full-scale, all routes covered system. It is unnecessary to get to that level. I mean, it's used everywhere. You don't count everything. You sample.

MR. DAVIS: And we're not looking for absolute abundance of the number of shad that are, you know, in the Kennebec River.

MR. CONNELLY: I think we've got it. So I think we understand where everyone -- what everyone's viewpoints are. I think all of our questions have been answered. And so, I don't have anything else, so I guess we can adjourn this.

MS. WILL: That sounds good to me.

MR. CONNELLY: Thank you.

(Whereupon, at 2:10 p.m., the meeting was adjourned.)