SUPREME COURT OF THE UNITED STATES
No. 142, Original

STATE OF FLORIDA,)
)
Plaintiff,)
)
V.) VOLUME VII
)
STATE OF GEORGIA)
)
Defendants.)

TRANSCRIPT OF PROCEEDINGS

The above-entitled matter came on for HEARING before SPECIAL MASTER RALPH I. LANCASTER, held in the U. S. Bankruptcy Court, at 537 Congress Street, Portland, Maine, on November 9, 2016, commencing at 8:57 a.m., before Claudette G. Mason, RMR, CRR, a Notary Public in and for the State of Maine.

APPEARANCES:

For the State of Florida: PHILIP J. PERRY, ESQ.
JAMIE L. WINE, ESQ.
MATTHEW Z. LEOPOLD, ESQ.
NATALIE HARDWICK RAO, ESQ.
STIJN VAN OSCH, ESQ.

For the State of Georgia: CRAIG S. PRIMIS, ESQ.
BARACK S. ECHOLS, ESQ.
KAREN McCARTAN DeSANTIS, ESQ.
JOSH MAHONEY, ESQ.
EMILY K. MERKI, ESQ.

Also Present: JOSHUA D. DUNLAP, ESQ.

INDEX

EXHIBITS

PROCEEDINGS

SPECIAL MASTER LANCASTER: Welcome back, Mr. Perry.

MR. PERRY: Thank you, your Honor.

SPECIAL MASTER LANCASTER: I understand congratulations are in order?

MR. PERRY: Thank you, your Honor. I'm very proud of my wife.

I would like to introduce our -- a new counsel who will be working with us today, particularly with Dr. White, who is our first witness; and that's Matt Leopold.

SPECIAL MASTER LANCASTER: Welcome.

MR. PERRY: He's from Carlton Fields in Tallahassee, Florida.

SPECIAL MASTER LANCASTER: Thank you.

MR. PERRY: Thank you, your Honor.

SPECIAL MASTER LANCASTER: Before we begin, if I read the statistics correctly, both Florida and Georgia -- the people of Florida and the people of Georgia agreed on the presidential race. Might I suggest that their counsel confer and see if they can agree? That's just a suggestion.

MR. PERRY: Thank you.

MR. LEOPOLD: Good morning, your Honor.

SPECIAL MASTER LANCASTER: Good morning.

MR. LEOPOLD: We would like to call Dr. Wilson White to the stand.

SPECIAL MASTER LANCASTER: Please.

THE CLERK: Please raise your right hand.

Do you solemnly swear that the testimony you shall give in the cause now in hearing shall be the truth, the whole truth, and nothing but the truth, so help you God?

THE WITNESS: I do.

THE CLERK: Please be seated.

Pull yourself right up to the microphone and please state your name and spell your last name.

THE WITNESS: My name is James Wilson White, III. That's J A M E S, W I L S O N, W H I T E, III.

MR. LEOPOLD: Your Honor, if I may approach the witness?

SPECIAL MASTER LANCASTER: Please.

DIRECT EXAMINATION

BY MR. LEOPOLD:

Q. Dr. White, I have handed you your prefiled direct

testimony in the case. Do you see that?
A. Yes.
Q. And do you adopt in full this as your sworn testimony here today?
A. Yes, I do.
Q. Thank you.
MR. LEOPOLD: I hand him over.
MR. ECHOLS: Good morning, your Honor.
SPECIAL MASTER LANCASTER: Good morning.
MR. ECHOLS: Your Honor, before I begin with Dr. White, in light of your comments at the end of court day yesterday and just this morning, I thought that I would respond to a point that you made.
I have had neither the gravitas nor the experience that you do, so I have a simple demonstrative; but I will not put anything on the record.
SPECIAL MASTER LANCASTER: Thank you.
CROSS-EXAMINATION
BY MR. ECHOLS:
Q. Good morning, Dr. White.
A. Good morning.
Q. Now, Dr. White, you are an ecologist who researches and has experience with mathematical

models; is that correct?
A. That's right.
Q. But you are not an oyster biologist?
A. That's right. I'm more of a broad population biologist. I study population dynamics.
Q. And, similarly, you're not an expert in fishery science. Would that be accurate?
A. I disagree with that. I --
(Discussion off the record.)
BY MR. ECHOLS:
Q. Great. So you do consider yourself an expert in fisheries?
A. Yes, sir.
Q. And fisheries management?
A. Yes, sir.
Q. Including oyster fisheries?
A. The -- I would consider myself an expert in the theory and mathematics of fisheries management. So that can apply to oysters or any species.
Q. Just one thing, Dr. White, sort of like when we did your deposition, we have madam court reporter taking everything down. If you could speak a little more slowly for her.
A. I'm very sorry.
Q. No problem. She told me I had to do that, too.

Now, you, sir, were retained here by the State of Florida to develop a computer model which would examine the changes in the oyster population of Apalachicola Bay. Correct?
A. That's right. The purpose was to identify potential contributing causes to the fishery collapse in 2012.
Q. And what you determined from your model is that high salinity conditions associated with freshwater flows or reductions, rather, in freshwater flows into the bay contributed to the oyster population crash. That's your opinion?
A. That and that there was no evidence that harvesting contributed. Yes.
Q. Correct. And the secondary conclusion is just as you said, that harvesting pressure throughout the 2009 to 2012 time period was not different from prior years when the fishery was healthy. Is that correct?
A. That's correct.
Q. And in order to reach this conclusion, you developed what's called an integral projection model?
A. That's correct.
Q. And that's the basis for the conclusions that

there was not overharvesting and that higher salinity caused by Georgia consumption and lower flows contributed to the collapse of the fishery?
A. That's correct.
Q. Now, when you put together one of these models, sir, you have to define certain parameters; isn't that right?
A. Yes.
Q. And those parameters are supposed to be based on the best available science; are they not?
A. Yes.
Q. And if we -- if you could look, please, to your written direct, paragraph 28, which is on page 6.
A. Yes.
Q. And as you explained in your written direct, there are certain parameters that you input that relate to the particular species that you're examining that do not change over time; is that right?
A. That's right.
Q. And among the types of parameters that do not change over time for a model like this are things like the growth rate?
A. That's right.
Q. And similarly, that would also apply to the

1666

parameter of what's called maximum asymptotic size?

A. That's right.

Q. That's something that does not change over time?

A. That's right.

I want to clarify by does not change over time, that's in contrast to things that depend on salinity, for example. And because the salinity changes over time, there are parts of the model that also change over time in response to salinity.

Q. And we -- just, again, I'm sorry, sir. If you could go a little, little bit slower.

Now, asymptotic maximum size, at least for me since I was never good at math, especially higher math, it's kind of hard to explain and understand it. So I tried to get a demonstrative that would show how this works mathematically and just made a chart.

And I apologize to you; since I pulled it out this morning, I don't have a printout. But this is just something I pulled out of an ecological journal to try to understand this mathematically.

Now, would it be the case that this curve reflects the general theory or concept behind

1667

asymptotic maximum size; that is, as a particular species gets older, it gets larger in size, but then it sort of tops out and continues at that largest size or larger size?

A. That's not quite correct, no.

Q. Please explain.

A. Absolutely. So what's important to understand that what's not on this chart is data, for example. So the way you -- the way you described this relationship is you collect a bunch of data. You have fish or oysters or whatever of different ages. And you have their sizes, and you plot that. It would be sort of a cloud of points. And then the line, a line like what's shown on this graph, would be drawn to sort of go through the middle of that cloud of points.

And so this -- this parameter we're talking about, the asymptotic maximum size, it's one of these cases where the technical terminology differs a little bit from what we might -- sort of the everyday lay person usage of the word. It's not the actual maximum size that any individual oyster could reach; it's the average maximum size of a large oyster.

So if you actually plotted data around that

1668

curve, for the very old -- presumably that's supposed to be age that's on the horizontal axis of that figure. For the very old individuals you would have some individuals that are smaller than that curve at a very old age and some that are larger. So you can have individuals that are larger than that asymptotic size.

That's just describing the shape of that cloud of points.

Q. But as you just explained in your written direct, the maximum asymptotic size is supposed to reflect the average of the largest size or the larger size that these species grow to?

A. That's right.

Q. Now, when you submitted to us the expert report in February of this year, you included a parameter for maximum asymptotic size for your model; did you not?

A. Yes.

Q. And if I could ask you, please, to turn to --

MR. ECHOLS: What tab is it?

BY MR. ECHOLS:

Q. -- tab 2 in your binder, please.

A. Yes.

Q. And tab 2 in your binder is your -- if you would,

1669

please identify -- it's FX-798 -- your expert report?

A. Yes.

Q. And you -- because it doesn't have page numbers, I believe we flagged the relevant page for everyone.

A. Is that the sticky note here?

Q. Yes, please.

A. Great.

Q. Are you there, sir?

A. Yes.

Q. Now, on that page, that table of FX-798, where you have the asymptotic maximum size for oyster parameters, you have listed there 61.5 millimeters. Do you see that?

A. Yes.

Q. And the source listed for that is Kimbro expert report?

A. That's right. This was derived from data that Dr. Kimbro had collected in the bay.

Q. And so the way we should understand you have chosen 61.5 millimeters here is that when you first structured your model, you were using 61.5 millimeters as the average maximum size for the eastern oyster in Apalachicola Bay. Right?

1670

A. That's right. Based on Dr. Kimbro's data from the bay, yes.
Q. It wasn't quite clear yesterday with Dr. Kimbro whether he gave you the number or whether you calculated this yourself.
A. Yes. So there's a standard mathematical procedure for calculating the shape of that curve given the type of data I described. If you have the age of the animal and the size of the animal, you can fit the shape of that curve. Dr. Kimbro gave me the data, and so I used a few lines of computer code to calculate the shape of that curve.
SPECIAL MASTER LANCASTER: Dr. White, excuse me. Would you just -- I know this is difficult. But would you just slow down a little bit because the reporter, as talented as she is, can't read minds.
THE WITNESS: Yes, your Honor. I'll do my best.
SPECIAL MASTER LANCASTER: Thank you.
BY MR. ECHOLS:
Q. And, actually, if you wouldn't mind, could you move the mike a little bit closer? I'm having a little trouble hearing you.

1671

A. All right. Is this better?
Q. I think so, yes.
And so what you determined from the data that Dr. Kimbro gave you was that the appropriate value for your model for asymptotic maximum size was 61.5 millimeters. Correct?
A. Yes. That's right.
Q. You have since determined that that is not a good value to use; have you not?
A. That was the value that was supported by the data at the time, and with new data we updated the value.
Q. Right. But with respect to the eastern oyster in Apalachicola Bay, they grow to -- at a very old age or on the way to being a very old age to more than 61.5 millimeters; do they not?
A. They do. And that was reflected in the model and in the original relationship we developed because you can have oysters that are larger than 61.5 millimeters in the model. As I described, they're spread around that. So, yes, there were oysters larger than that in the original formulation.
Q. But it's accurate, is it not, sir, that the average maximum size, as you described the

1672

meaning of this particular parameter -- the average maximum size of an old Apalachicola eastern oyster is bigger than 61.5 millimeters?
A. I agree that the -- the updated data we obtained from Dr. Kimbro is a better reflection of what's happening.
Q. And, I'm sorry, sir, I'm not -- I'm not referring to the particular data. I'm just speaking generally, because this kind of parameter is supposed to reflect the biology of the species; is it not?
A. Yes.
Q. And the biology of the species of the eastern oyster is that it grows to much bigger than 61.5 millimeters. In fact, they're not even legally harvestable until they get to 76 millimeters. Right?
A. Again, they grew larger than 61 millimeters with the original relationship, which was based on data we had collected in the bay at the time. So that was our best available estimate of the growth rate.
Q. To determine what the size that a species grows to may be, like the eastern oyster, there are other sources you can look at. You don't have to

1673

conduct an experiment. Do you?
A. I'm not sure what you mean by other sources. I mean, there were literature estimates of growth from other places, but not from Apalachicola Bay.
Q. In some of the other parameters that you defined in your model, you cite articles -- academic articles and such to come up with the proper figure, because this has been written about -- this species has been written about in academic articles; and there's information there about that. Right?
A. That's right. Whenever possible, we use data from Apalachicola Bay to best represent what was happening in the bay. But in the case of some values that there was no information from Apalachicola, we looked to published literature sources; that's right.
Q. I'm sorry. Your testimony, sir, is there was no information for Apalachicola with respect to how big eastern oysters grow?
A. No. There was. There was the information that Dr. Kimbro collected.
Q. No. Separate and apart from Dr. Kimbro. Before 2013, 2012 when Dr. Kimbro went out into the bay, was there no information available anywhere in

1674

Florida about how big Apalachicola eastern oysters grow?

A. There may have been. I did not check because I had Dr. Kimbro's data in hand, and that was data that was just collected. I knew the source of the data, and that was the best data to use.

Q. I'm sorry. We just have to keep going a little slower for madam court reporter.

I take it you didn't talk to Mr. Berrigan, for instance, to ask him what is the average maximum size eastern oysters grow to?

A. No.

Q. And I take it you didn't talk to any oystermen in Apalachicola Bay to ask them what is the average maximum size oysters grow to?

A. No.

Q. And I take it you didn't go to Wikipedia or anything like that to see what the average maximum size oysters grow to in Apalachicola Bay is?

A. No.

Q. Let me ask you to look at, please, an exhibit which is pretty large; but I have only got flagged a couple of pages that are relevant.

And for the record, I have handed you, sir,

1675

what is a joint exhibit, meaning submitted both by Florida and by Georgia here, which is JX-62. Have you seen this document before, sir?

A. I think that I have, although I have not read it fully recently.

Q. Okay. Hopefully not, given how long it is.

Now, this document is called the Oyster Fishery of the Gulf of Mexico Regional Management Plan. If you wouldn't mind, sir, turning back to the flagged page, which is 3-13, the first flagged page.

A. Yes.

Q. And if you wouldn't mind taking a look there at the -- it's 3-13 at the -- partway down the section entitled Growth, the last two paragraphs there in that section.

Actually, just the last paragraph in that section.

A. Yes.

Q. It starts with oysters expend.

A. Yes. I see that.

Q. And do you see, sir, that in this regional management plan for the Gulf coast oysters, it notes that in the Gulf -- which would include Apalachicola Bay; would it not?

1676

A. Yes.

Q. That in the Gulf, the oysters can reach harvest size, 76 millimeters or 3 inches, in about a year-and-a-half or so. Is that right?

A. That's what it says, yes.

Q. This was information available to you when you constructed your model?

A. Yes.

Q. And similarly, it goes on to say that at five to six years they can get up to 150 millimeters?

A. It does say that.

Q. And you see it even goes up to 300 millimeters. But what you used for your parameter in your model was 61.5 millimeters. Right?

A. That's correct.

This is good example of a difference in the meaning of the word maximum as it's used sort of colloquially here or in the usual layperson way versus the very technical meaning of the asymptotic maximum growth. Certainly, you could have oysters growing to very large sizes in the way I constructed the model because we allow for spread around that average maximum size. And, in fact, if you look at the model results, the model did a very good job of predicting how many

1677

oysters were of, you know, 80, 90, 100, 110 millimeters. And that prediction corresponded with the observed abundance of oysters of that size.

So the model was predicting that there were very large oysters in the bay. In fact, it was predicting the right number of very large oysters in the bay.

Q. Let me ask you, sir, to turn back to your written direct testimony. And I would direct you to page -- the table is reflected on page 23.

A. Yes.

Q. And now, this is the written direct testimony that you submitted for purposes of this case. And it has a revised parameter table 1 on it. Right?

A. That's right.

Q. And let's go back to the oyster parameters section in the middle there. And you have an asymptotic maximum size reflected there. Do you see that?

A. Yes.

Q. And, again, that's a source from Kimbro expert report. That's Dr. Kimbro?

A. That's right.

1678

Q. And here it appears that you fixed the mistake in the first report and have doubled the size more or less to 120.35 millimeters. Right?

A. I don't characterize it as fixing a mistake. We received new information and used the best available information in our updated values.

Q. Would you say that this is better information than you originally used in the report you submitted in February?

A. Yes. That's why we -- that's why I used it. If I did not think it was better information, I would have not used it.

MR. ECHOLS: Okay. We can take that down.

BY MR. ECHOLS:

Q. Let me change topics, if I could, with you please, sir.

Now, in your original report you submitted, sir, you did not look at shelling or reshelling at all; is that right?

A. That's right. That was not appropriate given the scope of the modeled analysis.

Q. And I think -- tell me if this is correct -- you explained you are not an expert in restoration ecology?

1679

A. That's correct.

Q. However, in your written direct here, you make some comments about Dr. Lipcius's analysis of the reshelling that Florida has done over the past couple of decades; do you not?

A. Yes.

Q. And if you turn -- in your written direct, please, if I could refer you back to that, page 16, please. Here is the -- are you with me, sir?

A. Yes.

Q. And this is a chart that you included in your expert report reflecting that in Dr. Lipcius's report, he did this LOESS sort of average curve that in red showed that based on his analysis, there had been less reshelling over time done by Florida in the years prior to 2012. Right?

A. Excuse me. Yes.

Q. And if you look at what you say down below in paragraph 71, the last sentence in that paragraph 71 you say is that you disagree with Dr. Lipcius's conclusion that shelling was declining before the 2012 oyster collapse. Right?

A. Yes.

1680

Q. Were you here in court yesterday, sir?

A. Yes.

Q. So now, having been here yesterday, you know that that statement is incorrect; do you not?

A. No.

Q. You do not know that it's the case that Florida's reshelling activity prior to the 2012 oyster collapse was lower than in prior years?

A. No. That's not my conclusion.

Q. As a matter of the oyster biology, sir, isn't it the case it's important to have the shell there at least a year or year-and-a-half or so before the spat arrives so that the spat has someplace to settle?

A. In general you have to have some sort of substrate there for the spat to settle on, yes.

Q. And given that it's the case that these baby oyster spat grow in about a year, year-and-a-half, wouldn't it be more relevant, sir, to look at the years prior to the collapse to see whether there was shell laid for spat to land on?

A. Yes.

Q. And now, what you do in your chart, however, to make the curve look like there's more shelling

1681

taking place is you have included the year 2014. Isn't that correct?

A. I used the data to create that chart. I simply took the dataset that Dr. Lipcius had produced as part of his analysis. I didn't modify the dataset. I just used the same one.

Q. Right. And Dr. Lipcius put this data through 2013 because the question was how much shelling had Florida done prior to and during the collapse. Do you recall that?

A. I recall seeing that in Dr. Lipcius's -- I think it was in his prefiled direct testimony, although my understanding would be that since the collapse really began in 2012, you would want to only look at data up to 2012.

And as a matter of fact, just yesterday, to check my assumptions about that, if you conduct that same analysis that I did and exclude data -- only include data, excuse me, up until 2012, you see exactly the same pattern.

Although I also want to clarify, the point of my creating that blue curve was really just to illustrate that drawing that kind of line is not a really valid statistical test. Dr. Lipcius created the red line. Creating that line in a

certain way averaging over a certain time period, it happens to show decline. If you choose a different time window, you can show an incline or decline. It's a very arbitrary approach to drawing a trend line and not really a valid way of describing a statistically meaningful pattern.

The approach that Dr. Kimbro took is really better because in that way, you can include confidence intervals and actually say with statistical certainty what was happening.

Q. Just for madam court reporter, if you would.

But the question being whether Florida's reshelling activity prior to the collapse was increasing or decreasing, you would want to look to that reshelling activity prior to the collapse. Would you agree with me, sir?

A. Yes. And as Dr. Kimbro's analysis showed, it was not different from historical norms.

Q. Yes. We took care of that yesterday. And you were here, and you saw that that was entirely inaccurate.

Now, with this particular chart the way you have done it, by including 2014, the blue line makes it looks like Florida's shelling efforts have increased or were on the uptake before the

collapse. Correct?

A. If you take out the data from 2014, the line changes, yes.

Q. It's -- are you trying to communicate to the Court that Florida's efforts on reshelling prior to 2012 were increasing?

A. Well, if you redo that analysis, only including data up to 2012, yes; it still shows that the -- the blue line shows that it's increasing, although as I said before, I don't rely on that type of curve to make a statistical judgment about what was happening or not. That's not an appropriate way to charge a trend or not.

Q. Can we look at our shelling exhibit that we used before, please.

Now, the Court has seen this a number of times before. I'm not sure if you saw it yesterday. But this is based on the official Florida state records about the amount of shelling that was taking place. And I just want to ask you to confirm that in your expert analysis, what this shows is that Florida's shelling was increasing prior to 2012, the collapse?

A. Without doing a statistical analysis of my own on

this particular data, I'm relying on the analysis of Dr. Kimbro which does show that, at the very least, the shelling in that time period was -- was comparable to the long-term average.

Q. Can we go back to Dr. White's chart with the lines here. One of the other things that you state in your direct testimony is that Dr. Lipcius, you say, skewed the results because he -- because he included the very aggressive high shelling that Florida did after Hurricane Elena. Do you recall that?

A. Yes. I wouldn't say he skewed it because he included that, but merely the way he calculated that line gave very high weight to -- to that particular datapoint, and that if you calculate the line in that way, it inevitably leads to showing a decline from that unusually high point in the mid-1980's down towards the 2010's.

Q. And if I can direct you in your written testimony, please, to paragraph 70 which is on page 15, and if you would read that to yourself, sir. This is where you describe how you think Dr. Lipcius made the curve look like there was a decrease in shelling by including the extraordinary reshelling efforts in 1986 and

1987. Correct?

A. Yes.

Q. And it is the case, is it not, that when that fishery collapse took place after the hurricanes, Florida did engage in some extraordinary reshelling efforts. Right?

A. It's my understanding that that is why there were really high reshelling numbers for those years. Right.

Q. That's what you testified to. Right?

A. Yes.

Q. And part of the reason Florida engaged in that extraordinary reshelling effort during that period is because they wanted the oyster fishery to come back. This was an important restoration effort. Right?

A. It is my understanding that because there was considerable habitat destruction, they had to add shell to create a new habitat, yes.

Q. And the habitat wasn't very good during this current collapse either, was it, in 2012-2013?

You have seen documents attesting to that?

A. I'm aware that there were some places where there was poor habitat and some places where there was good habitat, although I want to clarify that

1686

habitat is a very broad term.

And there are multiple aspects of oyster habitat. There is the shell that has to be present. Another aspect of oyster habitat is the water column, the water conditions. And it's possible to have shell present, but have poor water conditions. And if you have poor water conditions, the oysters won't be able to survive even if there is shell present.

Q. If I could refer you back, please, sir, we have had through a number of witnesses the discussion with the Court and the witnesses about the amount of shelling that Florida did after Hurricane Elena. But each time, unfortunately, I haven't had the exact numbers in front of me. But I have now in JX-62, that giant document, the second page that we have flagged. You know, this is what we in Georgia were referring to to be able to identify how much shelling was actually done.

And so back on the page which is 16-36, do you see that?

A. Yes.

Q. Okay. And the hurricane was around the time period of 1985-ish, I believe. Does that sound about right?

1687

A. Without checking.

Q. Yes.

A. Somewhere in there.

Q. Somewhere in there.

If we go to the very bottom of this table, this is table 16-two in -- on page 16-36. We have here some of the shelling activity that Florida engaged in back after the hurricane in order to help the oyster fishery to restore. Do you see that?

A. Yes.

Q. And this is one of the sources you -- that Dr. Lipcius used and that you used in that prior chart with the curve. Right?

A. That's right. I saw Dr. Lipcius's data. I didn't check the source or anything.

Q. And what we have here that Florida did then when there was an oyster collapse is it engaged in, as you described it, extraordinary reshelling effort. So we have -- for instance, in Apalachicola Bay in 1986, we have got 120 acres that were shelled with processed oyster shell, and in that very same year another 225 acres that were shelled with oyster shell as part of the effort to restore the fishery. Right?

1688

A. Yes.

There was habitat destruction. There was an effort to restore the cultch habitat.

Q. And Florida continued this extraordinary shelling effort in 1987. If we can go and flip over to the next page.

Actually, it looks like I -- that's east bay. So there was shelling taking place in more locations.

But in 1987, as you can see, we had some additional major shelling taking place in Apalachicola Bay. We had one batch of 160 acres and another batch of 60 acres that were reshelled. Correct?

A. That's right.

Q. And this was a good management activity that Florida was engaging in at this point in time to restore the fishery after the collapse. Would you agree?

A. It's my understanding, not being an expert on oyster reshelling per se, but that if you have habitat destruction that has removed or silted over oyster shells, then you would need to add in new oyster shell to provide habitat. And that will work only if the water column conditions,

1689

if the salinity and temperature of the water is suitable for oyster growth. If that -- if those -- and I presume that following the hurricane, that would be typical of the type of disturbance that might silt over a lot of shell. So you would need to add shell back in. But the salinity and temperature in the water would be just fine, and so you would have good oyster growth. If you don't have proper salinity conditions, then adding shell doesn't do anything because the oysters can't grow anyway.

Q. You do know, sir, do you not, that the salinity and conditions in the bay in 2013, '14, and '15 were pretty good?

A. Without looking at specific data, I'm aware that there was more rain in 2013, for example, and the salinity -- there were periods of lower salinity, yes.

Q. And the drought had ended, and so the environmental conditions in the bay were in circumstances that it would have been helpful for there to be some shell for the spat to land on so that they could grow up and repopulate the fishery. Right?

A. Without specifically examining the salinity. You

1690

know, my analysis ended in the end of 2012; so I haven't looked specifically at what those salinities were to make that judgment.

Q. Sir, are you familiar with the -- we have looked at it quite a bit yesterday; so you probably saw the University of Florida Sea Grant report, the oyster task force -- Dr. Kimbro was a part of it, Dr. Pine, Dr. Havens -- when they were investigating the cause of the collapse. Do you recall that?

A. Yes.

Q. And do you know, sir, that that report also has some suggestions about the level of reshelling that Florida should engage in in order to assist the recovery of the bay?

A. You know, I have not read that recently. I would like to look at the exact comments before -- before commenting on that.

Q. Yes. I want to do exactly that.

And for the record, I have handed you, sir, the oyster situation report which is GX-568 -- which we looked at for quite awhile yesterday. And I would direct you, if I could, to page 5. And do you see on the left-hand side there's a column titled Management and Restoration. Are

1691

you with me, sir?

A. Yes.

Q. And if you go down, if we could --

MR. ECHOLS: What is it, the second to last bullet, if we could show the whole thing, please.

BY MR. ECHOLS:

Q. On that left-hand side that begins management actions such as shell planting, are you with me, sir?

A. Yes.

Q. And this is again, you're aware, the report put together by a number of scientists who were tasked with looking at what should Florida be doing to assist the oyster fishery to recover. Right?

A. Yes.

Q. And in this report from April 2013 -- so shortly after the collapse -- these scientists together put in this management and restoration section that management actions like shell planting would help expedite recovery; isn't that true?

A. That's what it says, yes.

Q. And do you see in the middle of that paragraph how much shelling they suggest should be done?

1692

A. Yes.

Q. And how much is that, sir?

A. They suggest, based on this modeling tool ECOSPACE, that approximately 200 acres per year for five years is what they recommend.

MR. ECHOLS: Can we put my shelling chart back up, please.

BY MR. ECHOLS:

Q. So we can all agree, I think, can we not, sir, based on the official state records that Florida has not been engaging in 200 acres of reshelling per year since the collapse. Correct?

A. I agree.

Q. And, in fact, in the prior 10 years before the collapse, Florida did not reshell even a total of 200 acres. It's only 180?

A. That's right.

Q. And do you know how much Florida spent in 2013 when it shelled 16 acres?

A. No, I'm not familiar with the dollar values.

Q. It's in the -- that same official state record. It's slightly less than $110,000. Were you aware of that?

A. No.

Q. I would like to change topics again. Well,

1693

actually, this is slightly related.

If you go to your written direct, the table, again, of the parameters which was page 23, please.

A. Thank you.

Q. And do you see that's where the table starts, this revised parameter table. But then it continues onto the next page, if you would take a look on page 24. And right above there, sir, the bolded grille parameters, you have a parameter identified as dead shell erosion rate. Do you see that?

A. Yes.

Q. Could you please explain to the Court what dead shell erosion rate is.

A. Excuse me. Yes. So the way the model operates in order to represent all the different important factors, the biology of the oyster, you have adult oysters growing and producing larger and larger shell. And when they die, for example, due to predation, their shell gets left behind. And the model keeps track of how much dead shell there is sitting there on the bar, which is important because that's the habitat that the juvenile oysters have to settle to.

1694

Dead shell doesn't just stay there forever. It gradually dissolves in the water essentially. And so this dead shell and erosion rate is the rate at which that shell will break up and dissolve and disappear over time.

Q. But it is a gradual process, is it not, from when the shell breaks up and erodes over time?

A. That's right. It is a -- it's a -- it takes several years is my understanding.

Q. And if you, hopefully, will take my word for it, I asked Dr. Lipcius to, again, create a graph so we could see just how long this lasts.

MR. ECHOLS: And if we could have that demonstrative, please, of that shell erosion rate.

MR. LEOPOLD: Your Honor, I just want to note for the record that this exhibit was not shared in advance with counsel.

MR. ECHOLS: This is graphing the parameter, your Honor, in Dr. Kimbro's report so we can all understand it a little bit better.

BY MR. ECHOLS:

Q. And if it's totally off, please let the Court know. But what I tried to do is in the best,

1695

most accurate way make it easier for us to understand what this dead shell erosion rate meant. And at least based on our running the graphing calculator, we came up with a curve that shows we have got percent of shell remaining on the left-hand side; and then we have got years across the bottom.

And so if this is accurate and if we're reading it correctly, would that suggest, for instance, that after two years you should have about 80-some percent shell remaining based on the erosion rate?

A. Yes.

Q. And that's -- I mean, that's not inconsistent with your understanding; is it?

A. That's right. You know, this -- this particular parameter is one I obtained from a published study by Dr. Eric Powell. So it seems to be correct.

Q. This is one that you didn't have to do an experiment to figure out because you could just go to the academic literature, and it's already been published about what the dead shell erosion rate is. Right?

A. That's correct. And it's my understanding it was

1696

an estimate of the oysters in Apalachicola Bay in Dr. Powell's study.

Q. And, once again, if you say 50 percent or so, there would be 50 percent of shell remaining, if you draw the line across, that hits around six years or so. Does that seem about accurate?

A. Roughly, yes.

MR. ECHOLS: And we can take that down.

BY MR. ECHOLS:

Q. Now, part of the work that you and Dr. Kimbro did reaches conclusions about the extent of predation by the rock snail; is that true?

A. That's right.

Q. And the basic way predation by the rock snail works is it lands on a live oyster and kills it, either by boring a hole in the top or going through the lip part and then eating the meat out. Is that about right?

A. That's right.

Q. And when it does this, the shell is left behind, which we have talked about before is typically called a gaper or a box. Does that sound right?

A. That's right. And that's also how it was represented in the model, yes.

Q. And so what happens when you have large-scale

1697

predation by rock snails, you should have a lot of shell left on the floor of the bay; should you not?

A. Certainly right after the predation you would certainly see a lot of shell, yes.

Q. Is it your understanding, sir, that this shell would typically disappear, be washed away by tides or something like that; or would you expect that it would remain?

A. That's a little bit beyond my expertise as an oyster field biologist. I know in discussing things with Dr. Kimbro in developing the model, that it's certainly possible for tidal currents to move things around. Certainly, there's -- things can be silted over and things like that.

Q. You wouldn't expect that if you have a substantial amount of dead shell at the bottom of the bay, that it's just going to wash away in any short amount of time; would you?

A. Again, that is really beyond my expertise, not being somebody who spends time in the field in Apalachicola Bay.

Q. Well, this dead shell, at least you -- is a good substrate, you know, if conditions are good for spat to land on and then grow up to be adult

oysters; is that right?
A. Yes. I agree that, as you say, given good conditions, it's good habitat.
Q. Were you here when we were looking at pictures with Dr. Kimbro of the experiments that were being conducted in January 2013?
A. Yes.
Q. And did you see there that at least in this one area where his research assistants had laid down the quadrats, they came up with no shell whatsoever. Do you recall that?
A. I remember that photograph, yes.
Q. And so that would be a situation where we don't have a lot of dead shells present, you know, from a claimed predation event. Right?
A. In that particular quadrat, that's right.
Q. So those shells are gone. So they either washed away or the shell had been picked up out of the water, maybe through harvesting or some other method. Correct?
A. That is a possibility. Another possibility would be, for example, that that -- the random sampling procedure that they did happened to put a quadrat down in a place where there hadn't been a lot of oysters beforehand and hadn't been a lot of

predation. It's hard -- it's impossible to say without knowing more information.
Q. So it's possible then it was a mistake for them to test that section with their quadrat sampling?
A. No. That would be part of the point of doing random sampling is to get an unbiased estimate of what's present in the bay.
Q. But you would agree, as we just went through, the shell didn't erode and disappear, you know, between mid-2012 and January 2013?
A. Based on, you know, the rates of erosion alone, a shell can't dissolve in -- totally in that amount of time, no.
Q. Given that harvesting is one particular method of the shells being removed from the bay, let's change topics and talk a little bit about harvesting, if we could, please, sir.
A. Yes.
Q. And if I could refer you back to your written direct to paragraph 165, which is on the very back of the written direct. It's on the total back side, last page.
A. Yes.
Q. And here you are saying that based on your model, which you created to assess whether Georgia water

consumption was related to the oyster collapse, your model generates a harvest rate. Is that accurate?
A. That's right. It estimates what proportion of oysters would have to be withdrawn from the bay or withdrawn from Cat Point Bar in order to accurately predict how many oysters are -- were observed in the fishery with the dataset; that's right.
Q. And that's right that in connection with your initial model that you did, you only analyzed Cat Point, a single oyster bar, not any others. Right?
A. That's right. The model requires salinity data, and it also requires very high resolution observations. And so Cat Point was the one bar in the bay that both had a long-term salinity record collected by the national Estuarine Research Preserve, and it was also very intensely sampled by DACS. So it was the best dataset to analyze.
Q. And if we still can just slow down a little bit, please, sir.
And after we pointed out or Dr. Lipcius pointed out you had only sampled one oyster bar,

you, prior to submitting your written direct, did another one. You added Dry Bar. Right?
A. That's right. Just to confirm that there was no need to -- to confirm that if you did analyze a different dataset, you would obtain a similar result. The Dry Bar dataset was not as -- not sampled as frequently by DACS; so it wasn't an ideal one to use. But we did analyze it and found a similar outcome.
Q. Do you think it was appropriate to -- strike that.
You weren't here when Mr. Berrigan testified; were you?
A. No, I was not.
Q. But you know generally that Mr. Berrigan is -- had been in charge of DACS and the resource sampling for about 30 years in Apalachicola Bay. Right?
A. Yes.
Q. And are you aware, sir -- let me ask you this. Is it your position that different oyster reefs are essentially their own individual ecosystems?
A. That's not the way I would -- I would describe it because different oyster reefs are connected. For example, larvae produced in one reef can

travel throughout the bay and settle on a different reef. So they're connected. I wouldn't call them independent or something like that. But I would certainly agree that reefs at different parts in the bay exposed to different salinity conditions would be expected to have different patterns of change over time.

Q. So you wouldn't agree that -- that different oyster reefs are different as far as the level of growth and amount of oysters depending on where they are in the bay and the salinity conditions that they're exposed to?

A. I'm sorry. Could you restate that question? I'm not sure I -- I'm unsure what you're asking.

Q. Sure. No. You used, at least originally, Cat Point Bar only as the reference for your model. Correct?

A. That was the dataset that the model was describing. Yes.

Q. And despite that others may have testified that it's impossible to draw conclusions from one reef to the entire bay, you disagree with that?

A. I -- I'm not sure I have seen any testimony that says that specifically. I know, for example, Dr. Kimbro testified yesterday --

Q. Slower.

A. Dr. Kimbro testified yesterday that different reefs are different in salinity and other factors. And as long as you account for those factors when drawing conclusions, you can certainly extrapolate patterns from one bar to a different bar.

Q. And with apologies, I don't have this in hard copy; but just to make sure that I'm not doing this on my own, I'm putting in front of you what is -- has been said --

MR. ECHOLS: Do you have that -- Berrigan?

BY MR. ECHOLS:

Q. And, again, apologies; I don't have the hard copy, but we'll blow it up.

If you look at the very bottom of page 148 -- we'll make it big here so you can see it -- there is an answer that he says, I probably identified it quite often.

And this is in the deposition testimony. And we used this when Mr. Berrigan was here on Friday, so it's also in the trial testimony.

And Mr. Berrigan there was explaining that what happens on one reef, in his view having been

there for 30 years, is not a good representation of what to expect for the rest of the bay; they're individual ecosystems. He goes on and says, it's difficult to make a statement of one size fits all.

And if we look over, as we continue to the next page, he says, specifically, as a matter of fact, it's impossible. It shouldn't be done.

I take it you are not in agreement with Mr. Berrigan?

A. I'm sorry. I just want to be clear about what we're looking at here. Is this Dr. Berrigan's -- Mr. Berrigan's deposition?

Q. Yes. This is Mr. Berrigan's sworn testimony in deposition back when I deposed him. And he also testified to this on the stand on Friday.

A. Right. And it's not possible to have a hard copy of this?

I know, having looked at the deposition before, there is a broader context of these statements. I would like to review that, if that's possible.

Q. Is it too small for you to read on the screen?

A. No. I'm sorry. For example, I can't see the question that was asked or -- I know there's

other information around this time in the deposition.

Q. I'll let you --

MR. LEOPOLD: Your Honor --

BY MR. ECHOLS:

Q. The way this process works, your counsel will have a chance to ask you questions after. So I'm sure, to the extent there is something else that I'm missing, he will refer you to it.

MR. LEOPOLD: Your Honor, we would request that counsel give the witness the entire transcript so he can have it during this section of questioning.

MR. ECHOLS: I'm actually done, judge.

BY MR. ECHOLS:

Q. Let's go back to harvesting and paragraph 165 of your direct testimony.

A. Yes.

Q. And your testimony to this Court is that based on your model, the harvest rates preceding and during the collapse were consistent with or lower than historical harvest rates. Is that accurate?

A. Yes.

Q. And if we look at our chart that we have used a couple of times on landings --

A. Thanks.
Q. And so now, sir, what we have here is the official Florida state landings data from FWC. And it's correct, is it not, as a general matter, that harvested oysters are supposed to show up in landings data?
A. Yes. That's my understanding, yes.
Q. And I take it you have seen landings data before, whether here or in other of your work. Right?
A. Yes.
Q. And now, is your testimony to this Court that despite the fact that the official state data from the State of Florida shows that in 2011, 2.81 million pounds of oysters were harvested and in 2012, 3.03 million pounds of oysters were harvested, that these are inaccurate and, in fact, that the harvest rates preceding and during the collapse were consistent with or lower than historical harvest rates?
A. No. That's not correct. These two things are not in any sort of conflict. The landings data that we're looking at, these are fishery -- what we call fishery-dependent data. So this is what's reported by the harvesters as they're coming off the water. That's the amount of

oysters in pounds or tons that they're taking off the reef. That's different than the harvest rate that I have estimated from the fishery-independent dataset, which is talking about the proportion of the resource that's on the reef that was harvested.
For example, if you had, say, a bar with a thousand oysters on it, if you were taking 10 percent of the oysters every year, for example, if the bar stays the same size, you will always get 100 oysters. If the bar gets bigger in a particular year and you're still taking 10 percent, you would get -- let's say if the bar doubles in size, you would then get double the amount of oysters that you took, even though you're harvesting at the same rate.
So the landings data -- the fishery-dependent data don't give the whole picture because you don't know how many oysters are actually on the bar. That's what the fishery-independent data from DACS is telling us. And that's why I based my analysis on that, not simply on the landings data.
Q. So as you just explained then, in order for this -- these harvest amounts, the 2.81 million

and the 3.03 million pounds of oysters to be harvested in those years, in order for the rate of harvest in those years to be the same as even this year where there is .82, there must be a ton of oysters out there to get to that rate. Right?
I mean, you probably have to have 10 million pounds of oysters out on the bar for this rate to be the same as here?
A. I wouldn't want to speculate on exactly what the number is; but it suggests because the -- because the fishery-independent dataset estimates that the harvest rate was consistent, that means that, yes, the likely explanation for that is that there were more -- that there was a good crop of the oysters in the '11, early '12 period.
Q. So what your model shows is that there was an excellent, historically great, higher than ever crop of oysters out there in Apalachicola Bay in 2011 and 2012?
A. That's right. And that's also consistent with the data I have examined from -- the fishery-independent data that I examined from Cat Point Bar that the model was fit to.
Q. All right. Let me change topics.
Well, as a general matter, sir, you have had

access during the course of working on your expert report to state documents like the DACS resource assessment reports; have you not?
A. Yes.
Q. And do you recall at least in a general sense that there were references in the 2011 and 2012 time period to overharvesting and sub-legal harvesting?
A. I would want to look at an actual document before characterizing it. It has been a little while since I read some of those.
Q. All right. Well, I think the Court has seen them enough. I'm not going to bother to pull up what we have looked at before.
It's your opinion, however, sir, that there was not overharvesting and sub-legal harvesting taking place to any significant level. Right?
A. Well, it's important to recognize that although the -- the DACS reports and other things were based on this fishery-independent dataset, they weren't actually making the same type of fishery calculations that I was in my model. They weren't actually calculating a harvest rate in the way that a -- say, a fishery stock assessment would.

1710

And that's the analysis that I performed. So my analysis of the data is able to provide the actual estimate of what was happening with the harvest. And, yes, it shows that there was no increase.

Q. And I think, as you previously at least described it to me, that you, because you're using the scientific method, don't look to anecdotes and speculation about overharvest that might be out there that people would say?

A. That's right. The model has to use actual scientific data. It has to have a mathematical relationship. There's not a good way to plug in sort of anecdotal reports and things of that nature.

Q. And anecdotal reports, you don't take those into account or plug them in even if they're in official Florida state documents year after year. Right?

A. If there's no data or mathematical results, it's not possible to translate that into something that can actually describe what's happening with the oyster population.

Q. I want to change topics again, please, sir. If I could refer you back to your written direct,

1711

paragraph 114, page 30. Now, here, sir, in your written direct you are, again, criticizing or critiquing something that Dr. Lipcius had in his report; is that accurate?

A. That's right.

Q. And what you say is that you looked at his analysis of how oysters increased or declined in abundance on reefs that were harvested and reefs that were not harvested. Right?

A. That's right. I -- it's my understanding from looking at the numbers that the reefs that Dr. Lipcius was looking at, the ones that he calls the sort of unharvested bars, those are bars that actually do have harvest; but they're -- some of them were summer bars or things like that. They were not perhaps the most heavily-targeted bars.

Q. So that we're not speaking in the abstract, let me give the Court and you the specific analysis that I'm referring to.

MR. ECHOLS: And for the record, this is the submitted direct testimony of Dr. Lipcius, Georgia's oyster expert.

BY MR. ECHOLS:

Q. And you have read this; have you not?

1712

A. Yes.

Q. And if I could direct you, please, to page 12.

MR. ECHOLS: And if we could, please, blow up the chart, the Lipcius dem 3.

BY MR. ECHOLS:

Q. And this is part of the analysis that you are responding to; is that right?

A. That's right.

Q. And so the Court understands what you're responding to in your written direct, what Dr. Lipcius did is look at eight -- one, two -- nine different bars in Apalachicola Bay, four of which we have heard a lot of discussion about because they're the generally-harvested, productive bars, North Spur, Dry Bar, Cat Point, and East Hole. And he also looked at some bars that are less harvested and some, as we talked about with Mr. Sutton, and others had been reshelled. And those we have as the nonmajor fish bars. And you understand the analysis that Dr. Lipcius did here; do you not?

A. Generally speaking, yes. I didn't look at the exact code he used to produce this analysis, but generally speaking, yes.

Q. Well, you critiqued it and said he was mistaken.

1713

You didn't look at his analysis?

A. I critiqued it based on the possibility of a compounding factor in the analysis that he hadn't accounted for.

Q. And you say that the compounding factor is he failed to take into account salinity. Right?

A. That's right. As we were discussing earlier, bars at different places in the bay have different environmental conditions. And it happens that the way the bars for this analysis were selected, the so-called major harvested bars are further away from the mouth of the river; so they all tend to be -- they all tend to have higher salinities in general and be less influenced by the river. And most of the bars colored in blue, the nonmajor harvested bars, as he calls them, are more influenced by the river.

So that environmental factor alone would be expected to lead to differences among the bars independent of any other factor that could be happening.

Q. And I'm going to go back to your direct testimony as soon as we make sure that it's clear what this shows. What this analysis shows is that for the harvested bars, the more

heavily commercially-harvested bars, before the collapse -- and this is for legal oysters; the next page has sub-legal. This is for legal oysters. Before the collapse, for instance, on North Spur, there was some abundance of legal-size oysters; but that post the collapse, there were very few legal-size oysters. Right?

A. That's right. Calculated over these fairly broad time intervals from 2008 to 2012 for the pre and '12 to '14 for the post, yes.

Q. And you can see a similar pattern for Cat Point, for East Hole, for Dry Bar. But what is interesting is that even if you take a bar like Hotel Bar, which is close to East Hole, so generally you would expect similar salinity conditions?

A. Broadly speaking, I would say so.

Q. Broadly speaking.

But if you had a bar that was not harvested, that before the collapse you had a particular abundance of oysters, but even after the collapse there were more, that's the way you understand this analysis. Right?

A. Well, without having a more detailed understanding of this and without checking, I

don't think it's correct to say that Hotel is not harvested. There are oysters harvested at bars throughout the bay.

Q. Well, it's lightly -- it's not harvested as much as Cat Point and East Hole. Would you agree with that?

A. It's my understanding that Cat Point is one of the more heavily harvested bars, but I think that the reason that DACS does assessments of those bars and the reason there's reshelling and things like that is because there are oysters taken from those other bars.

Q. But you do understand, sir, that what this analysis shows that Dr. Lipcius conducted is that for the nonmajor fished bars, they were not as harmed or not as fished out, lower in abundance from before to after the collapse if you go from the official DACS department abundance data?

A. Without conducting a more thorough analysis of this on my own, I'm hesitant to characterize things in that way. And that's because of the way these data are calculated in this broad window, it's difficult to say exactly what happened right before the collapse in 2012 and early 2013 when we're looking at numbers that are

averaged over such broad windows.

Q. Let's go back to your written direct so the Court understands what your analysis of this was. On page 31, please.

A. Yes.

Q. And is this the right page, sir, where at least in part you critique and criticize and explain how in your opinion Dr. Lipcius was mistaken?

A. That's right. Again, I did not redo his analysis or examine the way he calculated oyster densities or anything like that. But I did want to illustrate the potential compounding factor of salinity that could be clouding his analysis.

Q. But you don't list here, do you, sir, the salinities at these various bars. You have something that you call a salinity anomaly. Right?

A. That's right. The point of my analysis was to show that looking at the collection of bars where we're considering that some bars tended to have higher salinities than the other bars and that the salinity -- the bars colored in blue that we're calling the nonmajor bars tended to have in general lower salinities because they're closer to the mouth than the bars colored in red, the

major bars. And so that anomaly is simply saying if you look at the salinities of all those bars together, are they above that collective average, or are they below that collective average?

So are they higher salinities in general or lower salinities in general?

Q. So when we looked at the map a moment ago at Hotel Bar and it shows that from before to after the collapse, Hotel was actually doing better. Do you recall that?

A. Yes.

Q. Here you have Hotel Bar on your salinity anomaly chart. And if you look at the anomaly, you have got a 2.87 at the 50th percentile, which on -- this is on the blue, lightly harvested or nonharvested bar. And then if you compare that to the heavily harvested bars, it's 1.17 up to 2.14 on the harvested bars. Is that accurate?

A. That's right. If you look at the map of the blue ones, Hotel is the one that is furthest from the river mouth. So that is to be expected.

Q. But what -- this is a positive anomaly, meaning that the salinity at Hotel was higher than at the harvested bars?

A. For that particular bar, that's correct.

1718

Q. Right. And the salinity was higher at this lightly-harvested bar that was doing better than at Cat Point, Dry Bar, East Hole, and North Spur. Correct?

A. Well, again, I don't know what the harvest rate of Hotel Bar is. I made the calculation at Cat Point Bar and Dry Bar, but I haven't made an actual calculation of the harvest rate at Hotel Bar. So, you know, I wouldn't want to characterize that one way or the other.

Q. Is it your understanding, sir, that part of the reason that we look at salinity, Dr. Kimbro looked at salinity is because there's the issue of predators, like the rock snail, being attracted to higher salinity locations. Right?

A. That's correct.

Q. And is it your understanding, sir, based on your knowledge of oyster -- I'm sorry, of rock snail biology, that the rock snails are attracted to salinity anomalies as opposed to absolute salinity?

A. I'm sorry. Could you -- could you say that again, please?

Q. Sure. What you didn't show the Court in this analysis is the salinity at these different

1719

locations. You have the salinity anomaly, which is some difference apparently from the average. Is it your understanding that the way rock snails migrate is that they may be in one location that's relatively high salinity, but they find another location that's higher; and so they want to go to the better, higher saline bar? Is that your understanding of the way rock snails operate?

A. My understanding is that they have particular salinities where they're most, you know, physiologically suited.

Q. And you studied the rock snail and the oyster, I take it, and the interactions between them as long as Dr. Lipcius has, for 35 years. Right?

A. I have been working on them with Dr. Kimbro and his research team for the past few years.

Q. How many is that? How many years?

A. Since 2014. It's about two years.

Q. And you do understand, although you have numerous places in your direct testimony where you're criticizing and calling Dr. Lipcius's work as being mistaken or misleading, that he's a tenured professor at the Virginia Institute of Marine Sciences?

1720

A. That's my understanding, yes.

Q. And you yourself are tenured, too, I take it?

A. Yes, that's right.

Q. And it is the case that Dr. Lipcius has reviewed and signed off on some articles that you and your graduate students have written. Right?

A. That's right. He was the -- what we call the handling editor at the journal; so he sent out the papers to different peer reviewers and then reviewed their positive assessments of the paper and judged that was acceptable to accept the paper for publication. That's right.

Q. And I take it you, as well, just like Dr. Lipcius, were involved in the most successful oyster restoration ever conducted worldwide that was done in Chesapeake Bay?

A. No, I was not.

Q. Let's go to our last topic, please. Let's go back to your written direct testimony.

If I could direct you, please, to page 47. And now, your general conclusion, sir, is that Georgia water consumption contributes to the decrease of biomass of oysters. Right?

A. That's right. The low flow conditions in 2012 led to a rapid decrease in oyster biomass.

1721

Q. You don't say in your expert report that your analysis shows that Georgia water consumption caused the collapse. Do you?

A. I don't specifically use that word.

Q. And your model doesn't show that?

A. The model shows that low flows led to a decline, and that had there been higher flow, the decline would have been mitigated; and there would have been considerably more oyster biomass on the reef.

Q. And the reason that the oyster biomass would be lower is because there were three different things that you said could be happening, the predation, the lowered recruitment, and is it the dermo disease? Are those the three aspects of it?

A. Those were the three aspects of oyster biology in the model that depended on salinity. That's right.

Q. And you, sir, did not calculate or determine any relative impact of either of these three aspects, whether it was predation or disease or recruitment failure. Right?

A. I didn't specifically make that calculation.

Q. So --

1722

A. I --
Q. Right. Now, this page -- this particular page here that we're showing the Court says, change in biomass at Cat Point on an unimpacted scenario.
Do you see that?
A. Yes.
Q. And this unimpacted scenario is something that you yourself didn't calculate. The unimpacted you got from -- is it Dr. Greenblatt?
A. That's correct.
Q. And the premise behind this unimpacted scenario is that the State of Georgia is not consuming any water at all. Is that right?
A. My understanding is that it's something along those lines, yes.
Q. And so what your model shows is if we wipe out all water consumption by the State of Georgia, there would be at Cat Point at the very most about a 10, 10.3 percent increase in biomass at Cat Point. Right?
A. That's right. That as the collapse is occurring, you would have had substantially more oysters on the reef if you had had higher flow conditions.
Q. Let's turn to page -- or to paragraph 152, please. Now, when you submitted your expert

1723

report in February, sir, you had only run this unimpacted scenario. Isn't that true?
A. That's correct.
Q. And, in fact, in the second sentence of paragraph 152, you explain, since Dr. Lipcius pointed out that that was so unrealistic, that you reran the model with a very conservative remedy scenario similar to the relief Florida is seeking in this Original Action. Right?
A. That's right.
Q. And you did that?
A. Yes.
Q. And are you aware, sir, that this very conservative remedy scenario contemplates a reduction by 50 percent of all agricultural watering in the ACF Basin in Georgia?
A. I'm not aware of the actual particulars leading to the remedy. That's the action of other experts.
Q. So you're not aware then, I take it, sir, that this very conservative remedy scenario involves removing water from 50 percent of a 4.7 billion dollar agricultural economy in Georgia?
A. Again, I was not part of that part of this calculation; so I wasn't familiar with that.

1724

Q. Let's see what it looked like when you ran this very conservative remedy scenario and how much it helped the oysters in Apalachicola Bay. If we could go to your tables, on page 51 at the top is one of those tables. Is this, sir, the results of your model, your mathematical model, showing what the change in oyster biomass would be at Dry Bar under your -- the remedy scenario that Florida is seeking?
A. That's right.
Q. And what your model shows -- regardless of whether we accept any of the parameters, what your model shows is that at the very most, if you cut off 2 billion plus of Georgia's agriculture, you would get about a 1.3 percent increase in biomass of oysters at Dry Bar. Is that right?
A. At Dry Bar, that's correct.
Q. And you looked at Cat Point as well on the prior page. And at Cat Point, another one of the major commercial oyster bars in Apalachicola Bay, you ran the same analysis with your model; did you not?
A. That's right.
Q. And what your model shows is that at Cat Point under the remedy scenario that Florida is

1725

seeking, that it would result in no more than a 1.2 percent increase in oyster biomass at that reef?
A. That's right. And, again, this is a conservative estimate. I think I'm aware that there's been a revised remedy scenario proposed that would actually have increased flows. So this would be conservative.
And then, again, as we discussed, this is an estimate for Cat Point, which is further from the mouth of the river. So it's also conservative in the sense that you would expect larger increases at bars that are closer to the river and would be more influenced by changes in flow.
Q. And you're aware that, I take it, since you spoke to the revised remedy scenario that not only would that revised remedy scenario wipe out all of Georgia's agricultural water consumption, but would also decrease the municipal water consumption. You're aware of that, I take it?
MR. LEOPOLD: Objection, your Honor. Mischaracterization.
MR. ECHOLS: I asked if he was aware of it, Judge.
SPECIAL MASTER LANCASTER: You may

answer.

A. Again, I'm not part of the analysis that calculates those things. I have no knowledge of what factors lead through any scenario. I focused on what happens to the flow and the salinity.

MR. ECHOLS: I have no further questions, your Honor.

MR. LEOPOLD: Your Honor, I can proceed with my direct examination or take our morning break. Whatever you prefer.

SPECIAL MASTER LANCASTER: Why don't we take a break.

(Time Noted: 10:23 a.m.)

(Recess Called)

(Time Noted: 10:36 a.m.)

SPECIAL MASTER LANCASTER: Counsel.

MR. LEOPOLD: Thank you, your Honor.

REDIRECT EXAMINATION

BY MR. LEOPOLD:

Q. Dr. White, thank you for your testimony today. I just have a few questions for you.

You testified earlier as to your state-space integral projection model; is that right?

A. That's correct.

Q. Would you please explain to the Court how that model was developed and operates?

A. That's right. So the overall goal of the analysis was to understand what factors in oyster biology or in harvesting led up to the collapse of the oysters in 2012. And so we developed a -- or I developed a biological model that included all of the major biological factors that we knew about for oysters. So the model described the change over time from year to year, from week to week in the oysters on oyster bars. So it includes factors like predation, oyster growth and oyster reproduction, a lot of known factors, most of which we were able to get parameter values and mathematical relationships for from Dr. Kimbro's expert report, from the work he was doing in the bay, and from other published sources.

There are other factors that we didn't have an independent scientific estimate of that would be expected to affect oyster biology. The No. 1 of one of those is the harvest rate. As I think I had said earlier, there is not an independent fishery -- independent estimate of the harvest rate in the bay. I mean, the harvest

could have been a factor leading up to the collapse.

And so what the model does is it predicts -- at each week in time over this 20-year time span from 1992 to 2012, it predicts how many oysters are on the bar of each size. So from small oysters all the way up to legal-size oysters and beyond. And it makes that prediction based on all these known factors, the growth and mortality that I described. And then it has to estimate how much harvest would have been taking place in order for that model prediction to match the observed data.

So essentially let's say in the year 2000, it would predict how many oysters there were of a -- of, say, you know, 3 inches, 4 inches. And it would calculate the harvest rate that would be necessary to get the observed number of oysters of those sizes. It then sort of spits out that number, and so we can see how the harvest rate would have changed over time.

Q. Thank you, Dr. White.

And why was it important for you to rely on fishery-independent data to calculate that rate?

A. Right. The -- in the fisheries world, there are

two types of data we consider. There is fishery-dependent data that are collected by the fishermen themselves. So these are things like landings data or the number of boats that go out and things like that. Fishery-dependent data are not always as reliable because they're not collected in a scientific manner. So the number of trips that are made or the number of oysters that are landed, they depend on how many oysters are in the bay; but they also depend on things like the market price for oysters, which can go up and down. They depend on -- the price of gasoline can affect how many boats trips you want to take.

So fishery-dependent data aren't collected in a scientifically consistent method. So there are problems -- potential problems in inferring patterns of actual oyster abundance from those type of data.

Fishery-independent data are collected in a scientific way. You have exactly the same kind of sampling effort at every single instance. So from the data that that has collected, there's actually a remarkably good time series of oyster abundance from that time leading up to 2012.

1730

Because it's scientifically and independently collected, you know that that was the actual abundance of oysters on the bar; and we can use our model to then estimate, based on those observations, how much harvest was taking place, how many of those large oysters were being taken away.

Q. And do you know whether the landings data that you were shown earlier is fishery-independent or dependent?

A. The landings data are always fishery-dependent data because it's the amount of stuff that the harvesters took.

Q. And if you would, Dr. White, could you explain, again, your conclusion as to the effect of harvesting in the run up to the oyster collapse of 2012.

A. Absolutely.

So the hypothesis that we had going in, one of several competing hypotheses was that there may have been an increase in harvest leading up to that collapse. So the model estimated a harvest rate in that 2009-2012 time period right before the collapse, and it was not statistically distinguishable from the harvest rate at previous

1731

time periods in the earlier 2000's. It actually was lower than the one for the period of time in the 1990's. So that suggests that the harvest was consistent over time for many years leading up to the collapse and did not increase in the years prior to the collapse.

Q. And did you cause -- did you draw a conclusion as to whether overfishing was a cause of the fishery collapse?

A. So if overfishing had -- had been a cause of the fishery collapse, we would have seen an increase in the harvest rate prior to the collapse. We saw a consistent harvest rate, a harvest rate that had been taking place from the oyster resource when it was very healthy when there were lots of oysters on the bar. So we know from the model that that harvest rate is a totally sustainable harvest rate.

As a matter of fact, if you look at the biology of the oyster, because you're harvesting oysters that are larger than 3 inches, it's very difficult to find a harvest rate that would lead to a fishery collapse because oysters reproduce at a much smaller size. And as long as you harvest -- generally speaking as long as you

1732

harvest your resource after it's reproduced, it's almost impossible to overharvest it.

So the harvest rate we estimated was consistent with the harvest rates that we had in the past when the oyster reefs were very healthy, and it didn't change leading up to the 2012 period.

Q. Thank you. Dr. White, I have no further questions.

SPECIAL MASTER LANCASTER: Counsel?

MR. ECHOLS: I have no questions, your Honor.

SPECIAL MASTER LANCASTER: Dr. White, as your counsel has probably already explained to you, I'm the least informed of anybody in this room. So if my question doesn't make sense, please feel free to correct me.

But am I correct in summarizing your testimony to say that high salinity caused increased predation and that it had nothing to do with overharvesting which caused the collapse in the bay in 2012?

THE WITNESS: That's correct, your Honor. Not only increases in predation, but the high salinity led to higher incidence of

1733

disease in the model; and it also led to a decrease in the -- what we call the recruitment, essentially the number of baby oysters that are settling on the reefs.

Those three factors are all affected by salinity. The high salinity led to poor consequences for the oysters in all three cases. And, yes, that and not harvest led to the decline and the collapse.

SPECIAL MASTER LANCASTER: And we were handed Joint Exhibit 62, the 2012 Revision of the Gulf State Marine Fisheries Commission on the Oyster Fishery in the Gulf of Mexico. Are you familiar with this document?

THE WITNESS: I have reviewed it. I have not read it, you know, this past week; but I'm familiar with it, yes.

SPECIAL MASTER LANCASTER: And did you use any of the information in it in coming to your conclusion?

THE WITNESS: No, your Honor. I -- the conclusion I drew about the levels of overharvest and the effect of salinity was not drawn from reading other contemporaneous sources. It was drawn from the analysis I

1734

conducted of those fishery-independent data, the DACS data. So the analysis and my conclusions are based entirely on my -- on my analysis of the data.

SPECIAL MASTER LANCASTER: On your model?

THE WITNESS: That's correct.

SPECIAL MASTER LANCASTER: And similarly with GX-568, which we were handed today --

THE WITNESS: Yes.

SPECIAL MASTER LANCASTER: -- did you use that in coming to your conclusions?

THE WITNESS: Again, I looked at it; and I considered all of the various reports that were generated around the time. And as, I think, Dr. Kimbro explained, when he and I were planning our research program, we were using reports like that to generate our hypotheses. We thought maybe it was overharvest; maybe it was an effect of flow, based on these other suggestions in the reports.

But the actual test we did was to use the model to analyze the data. So that was the basis for the conclusion.

1735

SPECIAL MASTER LANCASTER: Counsel?

MR. ECHOLS: No, your Honor. No questions.

MR. LEOPOLD: No questions, your Honor.

SPECIAL MASTER LANCASTER: You're off the hook.

THE WITNESS: Thank you very much.

MR. PRIMIS: Your Honor, on the Georgia side, we are switching teams and documents. So can we just have a minute for the new witness?

SPECIAL MASTER LANCASTER: Take your time.

MR. PRIMIS: Thank you.

Your Honor, if I may, I just wanted to introduce the two new members of our team who have not been at counsel table for cross-examinations yet. The first is Karen DeSantis will be conducting the examination.

MS. DeSANTIS: Good morning, your Honor.

MR. PRIMIS: And she's assisted by our colleague, Emily Merki.

MS. MERKI: Good morning, your Honor.

MR. QURESHI: Your Honor, the State of Florida will call Dr. Marcia Greenblatt.

1736

She's a water resources engineer with Integral Consulting.

She will be in here momentarily. She went to the -- she's not in the courtroom right now.

But in the meantime, may I just pass out the prefiled direct?

SPECIAL MASTER LANCASTER: Please do.

MS. DeSANTIS: And, your Honor, is it appropriate for us to go ahead and --

SPECIAL MASTER LANCASTER: I'm sorry. Would you speak into the microphone.

MS. DeSANTIS: Is it appropriate for us to go ahead and distribute the binders that we'll be using, to conserve time?

SPECIAL MASTER LANCASTER: Certainly.

THE CLERK: Please raise your right hand.

Do you solemnly swear that the testimony you shall give in the cause now in hearing shall be the truth, the whole truth, and nothing but the truth, so help you God?

THE WITNESS: I do.

THE CLERK: Please be seated.

Pull yourself right up to the microphone

1737

and please state your name and spell your last name.

THE WITNESS: My name is Marcia Greenblatt, M A R C I A, G R E E N B L A T T.

DIRECT EXAMINATION

BY MR. QURESHI:

Q. Dr. Greenblatt, do you recognize the document that's been placed in front of you?

A. I do.

Q. What is it?

A. It's my prefiled direct testimony.

Q. And, Dr. Greenblatt, do you adopt this in sum and substance as the testimony that you prepared in this --

A. I --

Q. -- the testimony you prepared in this matter?

A. I do.

Q. Thank you.

MR. QURESHI: Your Honor, I would like to provide Dr. Greenblatt with her reading glasses.

THE WITNESS: Thank you.

MS. DeSANTIS: Good morning again, your Honor.

SPECIAL MASTER LANCASTER: Good morning,

1738

counsel.

MS. DeSANTIS: Your Honor, I do have a microphone on in the event that I should move away from the podium to assist the Court in hearing what I'm saying.

CROSS-EXAMINATION

BY MS. DeSANTIS:

Q. Good morning, Dr. Greenblatt.

A. Good morning.

Q. Dr. Greenblatt, I want to start by outlining for the Court what you did in this case. You were asked to provide opinions regarding salinity patterns in the Apalachicola Bay. Correct?

A. That's correct.

Q. Okay. You evaluated flow patterns in salinity in the bay for various streamflow scenarios. Correct?

A. That's correct.

Q. And the scenarios that you used were developed by Dr. Hornberger, another one of Florida's experts in the case. Correct?

A. That's correct.

Q. You did hydrodynamic modeling to assess what salinity in the bay would look like under these different scenarios. Correct?

1739

A. That is correct.

Q. And you found that reduced freshwater inflows into the bay increased salinity levels in the bay. Correct?

A. That is correct.

Q. All right. You were also asked to assess the impact of upstream withdrawals on salinity levels in the bay. Correct?

A. I indirectly assessed the impact of upstream withdrawals.

Q. All right.

MS. DeSANTIS: Let's put up slide 1 and slide 2, please.

Slide 2.

BY MS. DeSANTIS:

Q. So, doctor, you were indirectly asked to assess the impact of upstream withdrawals. Correct?

A. I was asked to assess the scenario provided by Dr. Hornberger, and he assessed the impact of upstream withdrawals.

Q. All right. And you maintained that Georgia's consumptive use of water caused reduced inflows resulting in increased salinity in the bay. Correct?

A. Based on the work of Dr. Hornberger.

1740

Q. And also Dr. Flewelling, correct?

A. And Dr. Flewelling.

Q. Because Dr. Flewelling is the expert who analyzed upstream consumption. Correct?

A. That is correct.

Q. And finally, doctor, you were asked to investigate the relationship between sea level and salinity. Correct?

A. Correct.

Q. All right. And you developed some opinions as to whether or not projected sea level rise will affect salinity in the bay. Right?

A. I developed those opinions based on their data-based opinions. I didn't do any modeling projections.

Q. All right. And I don't want to spend a lot of time on your sea level rise opinion; but with respect to sea level rise, you didn't do any hydrodynamic modeling with respect to sea level rise. Correct?

A. Correct.

Q. And you have not actually done any testifying work as an expert on sea level rise. Correct?

A. That's correct.

Q. And you're not testifying today as an expert on

1741

sea level rise?

A. That's correct.

Q. And you're not an expert on sea level rise; is that correct?

A. That's correct.

Q. All right. Let's move on to your work regarding the salinity patterns in the bay and really look at the first two projects on the slide that we're showing, the opinions regarding salinity patterns in the bay and the assessment of upstream consumptive use that you did indirectly because you were relying on the work of other experts. Correct?

A. That's correct.

Q. All right. Dr. Hornberger provided you with three different water consumption scenarios that you used in your hydrodynamic model. Correct?

A. Correct.

Q. And you ran these scenarios for the years 2007 to 2012. Right?

A. Correct.

Q. And you ran a no withdrawal scenario. Correct?

A. Yes.

Q. You ran this scenario to understand how salinity in the bay would change if there was no

1742

consumptive use of any water at all in Georgia. Correct?
A. That's correct. It provides a bounding estimate of what salinity would look like in the absence of withdrawals.
Q. All right. You also ran a future scenario. Right?
A. Yes.
Q. And this scenario took into account what other Florida experts projected Georgia's water use to be in the year 2050 -- 2,000-five-zero -- correct?
A. That's correct.
Q. And you ran a remedy scenario that was provided to you by Dr. Hornberger as well; did you not?
A. I did.
Q. And in that scenario, you evaluated how certain reductions in Georgia's consumptive use would affect salinity levels in the bay. Right?
A. Correct.
Q. All right. And for your work on all of these water consumption scenarios you relied on the work of other Florida experts regarding the quantification of upstream withdrawals. Correct?
A. That's correct.

1743

Q. And you relied on other Florida experts regarding the effect of these upstream withdrawals on streamflow. Right?
A. Correct.
Q. Dr. Flewelling, who is one of Florida's experts, provided information to Dr. Hornberger. Correct?
A. Yes.
Q. He provided information to Dr. Hornberger about Georgia's consumptive use. Correct?
A. That's correct.
Q. And Dr. Hornberger provided information to you to use in modeling in your scenarios. Correct?
A. Correct.
Q. All right. And so you relied on Dr. Flewelling's consumptive use data indirectly because Dr. Hornberger relied on it. Right?
A. That's correct.
Q. And you have no basis other than Dr. Flewelling's analysis and conclusions to support your claim that upstream water use by Georgia has substantially increased since 1970. Right?
A. I didn't do an independent evaluation, but I did review the work that was performed by Dr. Flewelling.
Q. But you didn't independently evaluate any of

1744

Dr. Flewelling's work. Correct?
A. No.
Q. You didn't evaluate any of Dr. Flewelling's analysis. Correct?
A. I reviewed his work.
Q. Did you review his models?
A. I didn't review the details of the models. I reviewed his report.
Q. And you have not actually calculated the impact that any changes to Georgia's consumptive use might have on streamflow in the ACF Basin. Right?
A. No, I didn't do that evaluation.
Q. Let's turn to your scenarios, doctor. And I would like to look at your no withdrawal scenario first. And under this no withdrawal scenario, your model compared bay salinity levels under Dr. Hornberger's no withdrawal scenario to salinity levels under Georgia's simulated water use in the years 2007 to 2012. Right?
A. I'm sorry. Can you repeat the question?
Q. Yes. Under your no withdrawal scenario, you were comparing what you modeled to be results from Dr. Hornberger's no withdrawal scenario compared to salinity levels in the bay that you simulated

1745

for Georgia's consumptive use in years 2007 to 2012. Correct?
A. I compared the no withdrawal scenario to the existing conditions or the observed conditions in the bay.
Q. All right. And these existing or observed conditions were conditions that you simulated through your hydrodynamic model; is that correct?
A. That's correct.
Q. All right. And these comparisons that you did between the no withdrawal scenario and Georgia's consumptive use that you simulated are shown in figures that you have attached as an appendix to your written direct testimony and also as an attachment to your expert report for this matter. Right?
A. Yes.
Q. All right. And under the no withdrawal scenario, you found that if nobody used any water at all, the bay would be less saline. Right?
A. That's correct.
Q. And you found that if nobody in Georgia used any water at all, the bay would be less saline. Correct?
A. That's what the no withdrawal scenario

represents.

Q. And you're not suggesting, are you, doctor, that as an outcome in this case, that Georgia should not use any water?

A. No. That wasn't the purpose of that scenario.

Q. So this was just a scenario you simulated to see what would happen to salinity in the bay if nobody in Georgia ever used any water. Right?

A. That's correct.

Q. You wanted to see what the maximum change would be. Right?

A. That's correct.

Q. And in your written direct testimony in paragraph 4 -- and we can put that up on the screen -- you actually identified that maximum change in salinity across all your scenarios. Right?

A. That's correct.

Q. And you maintained that Georgia's water consumption has a total impact on salinity in the bay of up to 8 parts per thousand. Right?

A. That's what the results of the model were; correct.

Q. And you maintained that the largest impact on salinity is in east bay. Right?

A. That's generally what I saw, yes.

Q. All right. Now, 8 parts per thousand, parts per thousand is how salinity levels are measured. Right?

A. Yes.

Q. And salinity is the measure of salt dissolved in water. Correct?

A. Correct.

Q. And 8 ppt means that in every kilogram of water, 8 grams are salt. Right?

A. Correct.

Q. And that means that out of a thousand grams of water, 8 grams are salt. Correct?

A. Correct.

Q. And to put this in context, these salinity levels are being measured in a bay where salinity levels range from zero ppt near the source of fresh water inflow. Right?

A. Yes.

Q. And salinity levels range up to 35 ppt near the Gulf of Mexico. Correct?

A. That's correct.

Q. And that's because the Gulf of Mexico is saltwater. Right?

A. Correct.

Q. All right. And the highest change that you found between salinity levels resulting from Georgia's water use and a scenario in which nobody used any water at all was 8 ppt. Right?

A. That's correct.

Q. All right. And the only modelled results that include changes in salinity as high as 8 ppt came from the no withdrawal scenario. Correct?

A. That's correct.

Q. And it's true, isn't it, that these changes of up to 8 ppt were not seen throughout the entire bay?

A. That's correct.

Q. All right. Dr. Greenblatt, in your written direct you include an attachment 2 which has figures and tables from your expert report. Correct?

A. Yes.

Q. All right.

MS. DeSANTIS: Your Honor, may I approach with a demonstrative 3?

BY MS. DeSANTIS:

Q. And, Dr. Greenblatt, as we distribute this, I'm going to represent that I'm handing to you what is attachment 2 to your written direct testimony. The only modifications that we have made is we

have enlarged the pages for the ease of the Court and for your ease in looking at them. And we have put enlarged table numbers and pages on the chart so the Court can see them.

MS. DeSANTIS: May I distribute them, your Honor?

SPECIAL MASTER LANCASTER: Please.

BY MS. DeSANTIS:

Q. Dr. Greenblatt, if you could take a quick look at demonstrative 3, please. These figures are the figures that are contained in your expert report submitted in this case. Correct?

A. Yes.

Q. And they're also attached to your written direct testimony. Correct?

A. That's right.

Q. All right. And, Dr. Greenblatt, I want to go over a few of these figures with you. We'll put figure 3-3 on the screen to start with.

These figures -- and this is on page 25 for your reference.

These figures represent an outline or a map of the Apalachicola Bay. Right?

A. Yes.

Q. All right. And the river is shown flowing into

the bay. Correct?
A. Correct.
Q. And the river is actually shown at the top of the bay -- at the top of the figures. Correct?
A. That's correct.
Q. All right. And would you agree that figures 3-3 to 3-8 on pages 25 to 30 of your direct testimony show your comparison between simulated 2007 to 2012 bay salinity levels and your modeled no withdrawal scenario?
A. That's correct.
Q. And you're depicting the change in salinity between Georgia's simulated water use from 2007 to 2012 as estimated by Dr. Hornberger and a scenario where nobody used any water at all. Right?
A. I'm showing a change between the no withdrawal scenario, which is where nobody used any water, and the existing conditions.
Q. And the existing conditions are conditions that you simulated. Correct?
A. I simulated the salinity distribution.
Q. All right. And let's look at the scale. At the bottom of your maps, you have a scale that ranges from 1 all the way up to about 8. Correct?

A. Yes.
Q. And dark blue represents a 1 to 2 parts per thousand change in salinity. Correct?
A. Correct.
Q. And the scale goes all the way up to 7 to 8 parts per thousand change in salinity, which is shown as a yellow color. Right?
A. Yes.
Q. And white on all of these maps and figures represents a change in salinity of less than 1 ppt. Correct?
A. Correct.
Q. All right. Now, let's focus first on figure 3-3, which we have up here. And in this figure, you are comparing bay salinity under Georgia's simulated water use with salinity levels under the no withdrawal scenario from May through October of 2007. Right?
A. Correct.
Q. And you're including the months of May through October because those are the low flow months. Correct?
A. That's correct.
Q. And the colors on the map show different areas where there is a change in salinity between

Georgia's simulated water use and a scenario where Georgia is using no water at all. Right?
A. Correct.
Q. And the change in salinity between these scenarios varies across different parts of the bay. Right?
A. Yes.
Q. And if I want to see the largest changes in salinity, I look at the yellow parts of the map. Right?
A. Correct.
Q. And looking at this map, July, August, September, and October are the only months where there's a 7 to 8 ppt change in salinity. Right?
A. Correct.
Q. And those changes are shown by the yellow color. Correct?
A. Yes.
Q. And those colors are kind of hard to see, aren't they, doctor, because they're small in these maps. Right?
A. I can see them.
Q. All right. Let's see if we can point one out here. I see a small one right there in October. Correct?

A. There is one in October.
Q. All right. We're putting a box around it.
There you go.
That's the only point in September 2007 in the bay where you can see a change of up to 7 or 8 ppt in salinity. Correct?
A. That's correct.
Q. All right. And on the rest of these maps you see blue tones and purple tones. Right?
A. Correct.
Q. And the blue and the purple represent the change of salinity of between 1 and 3 ppt. Correct?
A. Some of the blues go up to 4.
Q. All right. So this lighter blue shade goes up to about 4. Right?
A. Correct.
Q. And then we see a lot of white area, too. Correct?
White represents where there is a change of less than 1 ppt in salinity. Correct?
A. In some of the months we see that.
MS. DeSANTIS: Let's go ahead and put up figures 3.4 and 3.5, which are on pages 26 and 27.

1754

BY MS. DeSANTIS:
Q. And these show salinity levels under the no withdrawal scenario from 2008 and 2009. Correct?
A. Correct.
Q. And, again, the maximum change in salinity levels in these areas was 8 ppt. Correct?
A. Yes.
Q. And these changes of 7 to 8 ppt were limited to near the mouth of the Apalachicola River and some areas at east bay. Right?
A. Generally correct.
Q. All right. There's one; that's east bay. Right?
A. Yes.
Q. And there's a little yellow one right there; that's the mouth of the river. Right?
A. Correct.
Q. All right. Is this one down here, doctor -- I can't tell. Is that yellow?
A. It looks like it's yellow.
Q. All right. If that's yellow, that's near the mouth of the river. Correct?
A. Correct.
Q. All right. Now, let's go to 3.6 on page 28. And, again, we're comparing bay salinity under the no withdrawal scenario to Georgia's simulated

1755

water use from May through October in 2010 this time. Correct?
A. Correct.
Q. And I want to point out that the first two months of the low flow season, May and June, are completely white. Right?
A. Although this is the low flow season, 2010 was not a low flow year; so the results in the patterns we see are going to be different.
Q. All right. So this low flow season of even a high flow year shows changes in salinity that were less than 1 ppt in the bay. Correct?
A. In those two months.
Q. All right. And, again, this is modeled in your scenario of how salinity would change in the bay if no one in Georgia were using any water at all. Correct?
A. That's correct.
Q. All right. And according to this map, at no point does the difference between Georgia's simulated water use and a scenario where nobody uses any water at all result in more than a 6 ppt change in salinity in any part of the bay?
MS. DeSANTIS: And, Mr. Smith, you can put back up the full figure.

1756

A. That's correct. For this year.
Q. All right. Doctor, before we turn to another year, I would like to ask Mr. Smith to put up table 3.1, which is on page 10 of your expert report.
MS. DeSANTIS: It's table 3.1 on page 10.
BY MS. DeSANTIS:
Q. All right. Doctor, in figure 3.1 on your expert report you are showing annual flows in the Apalachicola River at Sumatra. Correct?
A. Correct.
Q. And looking at 2012 on this table, you would agree that 2012 has the lowest observed annual flow at the Sumatra Gage in the period of record of Sumatra; is that correct?
A. That's correct.
MS. DeSANTIS: Now, Mr. Smith, could we please put 3.8 on page 30 of Dr. Greenblatt's attachment, please, up on the screen.
Back to the maps again.
BY MS. DeSANTIS:
Q. All right. Figure 3.8 shows your 2012 no withdrawal scenario versus Georgia use scenario. Correct?
A. That's correct.

1757

Q. And in figure 3.8, again, we're looking at a range of salinity levels in the bay. Right?
A. Correct.
Q. And in June, August, and September you're, again, seeing some changes of up to 8 ppt in certain areas of the bay. Right?
A. That's what we're seeing.
I just want to clarify here. It's important to recognize that we're looking at absolute numbers. These are the absolute changes, which is what my model predicts. But the impact on the ecosystem is a function of the change. It's not the absolute change; it's how the change affects the ecosystem.
Q. Doctor, you're not an expert on ecosystem; are you?
A. I'm not.
Q. You're a salinity modeler. Correct?
A. That's correct.
Q. All right. Let's stick to the salinity.
So you would agree that these salinity changes, to the extent that they reach the 7 to 8 ppt, are restricted to the area near the mouth of the Apalachicola River. Right?
A. They do occur near the mouth. Right.

Q. And a lot of these maps are in blue or purple. Right?
A. **That's correct.**
Q. And that represents changes in salinity of about 1 to 4 ppt. Right?
A. **Correct.**
Q. All right. And we see white areas, too. Right?
A. **I'm not sure there's white areas on this one.**
Q. There's a few. Right?
A. **Those are outside of the model domain.**
Q. Okay. There is one over here?
A. **There may be some small white areas.**
Q. There are some small white areas in this map that show changes in salinity of less than 1 ppt. Right?
A. **Correct.**
Q. All right. Move on to your future scenario. You ran simulations for an increased future withdrawal scenario. Right?
A. **Correct.**
MS. DeSANTIS: Mr. Primis is telling me this microphone is working better.
MR. PRIMIS: Does your Honor agree?
MS. DeSANTIS: Does this one work for you?

I just have to keep my head turned to the left.
All right. Is that better?
BY MS. DeSANTIS:
Q. Okay. You ran simulations for an increased future withdrawal scenario. Correct?
A. **Correct.**
Q. And, again, you used inputs from Dr. Hornberger. Right?
A. **Yes.**
Q. And Dr. Hornberger relies on Dr. Flewelling's assessment of future consumptive use. Correct?
A. **Yes.**
Q. And you have not assessed the assumptions in Dr. Flewelling's future scenario. Right?
A. **That's correct.**
Q. And you haven't assessed his assumptions regarding the percentage of increase in irrigation withdrawals in Georgia. Right?
A. **Correct.**
Q. And you didn't look into Dr. Flewelling's assumptions about future municipal and industrial water use in Georgia. Right?
A. **Correct.**
Q. And you didn't look into Dr. Flewelling's

assumptions about the increase in interbasin transfers in Georgia. Correct?
A. **Right.**
Q. And you didn't independently verify whether any of Dr. Flewelling's future scenario assumptions regarding irrigation, municipal and industrial water use, or interbasin transfers were correct. Right?
A. **I did not evaluate his work.**
Q. All right. But you do know that Dr. Flewelling's projections of future withdrawals assume a .4 percent increase in agricultural consumption. Right?
A. **I don't recall the details of his future scenario.**
Q. You don't know that they include a .4 percent increase in agricultural consumption?
A. **I don't recall the details of his future scenario.**
Q. All right. You don't know that it includes a 50 percent increase in any other consumption?
A. **I don't know the details.**
Q. You just took those assumptions and used them in your modeling. Correct?
A. **I relied on his expert evaluation in that**

scenario.
Q. All right. Let's turn to figure 3-17, which is on page 38 of demonstrative 3. And figure 3-17 compares bay salinity under the future withdrawal scenario to bay salinity under Georgia's simulated water use from May through October of 2007. Right?
A. **Yes.**
Q. And the white areas of the map again indicate where changes in bay salinity, if any occurred, were less than 1 ppt. Right?
A. **Correct.**
Q. And it appears that the entire map is white for every low flow month in 2007. Right?
A. **That's correct.**
Q. And this means that for 2007, at no point from May through October of 2007 would an increase in Georgia's consumptive use have increased salinity in the bay by more than 1 ppt?
A. **That's what we see in this year.**
Q. All right. Let's move on to figure 3-18 on page 39.
MS. DeSANTIS: And, Mr. Smith, if we could, could we please blow up the months of May, July, and August.

1762

BY MS. DeSANTIS:
Q. And in May, July, and August of 2008, an increase in Georgia's consumption up to the levels projected by Dr. Flewelling would have had an impact of less than 1 ppt. Right?
A. In those three months, that's correct.
Q. All right.
MS. DeSANTIS: Let's put figure 3-22 on the screen, which is on page 43.
BY MS. DeSANTIS:
Q. And, again, this figure compares bay salinity under the future withdrawal scenario to the scenario of Georgia's water use from May through October of 2012. Right?
A. Correct.
Q. And every map in this figure is all white. Right?
A. That's what the model shows.
Q. And the all white signifies that in all six of the low flow months of 2012, the future withdrawal scenario would not have impacted any area in the bay by more than 1 ppt. Correct?
A. That's correct.
Q. All right. Let's move on to the remedy scenario, doctor. And before we go through the maps, you

1763

maintain that the remedy scenario will make an important difference, including by reducing salinity as shown in your modeling. Right?
A. Correct.
Q. And in your direct testimony, you maintain that Georgia's consumption is causing declines in optimal salinity conditions over the oyster bars. Right?
A. That's correct.
Q. All right. You don't have knowledge as to whether changes in salinity levels in the bay under Florida's remedy would materially impact the ecology of the oyster bars. Right?
A. No. I don't opine on the ecology.
Q. And you have not analyzed the impact of Florida's remedy scenario on the oysters. Right?
A. Correct.
Q. And so far as the impact of salinity on the productivity of the oyster bars or the health of the oyster bars, that's not something you're giving opinions on. Right?
A. That's correct.
Q. Now, the remedy scenario that you modeled to simulate salinity in the bay is, again, based on data received from Dr. Hornberger. Right?

1764

A. Correct.
Q. And that represents a reduction in Georgia's upstream water use. Right?
A. Correct.
Q. That's what the remedy scenario involves, a reduction in Georgia's water use. Right?
A. Yes.
Q. Dr. Hornberger models the removal of interbasin transfers out of Georgia. Right?
A. Correct.
Q. A reduction in agricultural water use?
A. Yes.
Q. And a reduction in the evaporation from small impoundments. Correct?
A. That's my understanding.
Q. All right. And this scenario is the same remedy scenario that Dr. Allan, another one of Florida's experts, used. Correct?
A. I don't know that for sure.
Q. You don't know what Dr. Allan used?
A. No.
Q. You do know that Dr. Glibert and Dr. Kimbro used this particular remedy scenario. Correct?
A. Yes.
Q. Because they used your salinity inputs. Correct?

1765

A. Correct.
Q. All right. Now, in your direct testimony you described this remedy scenario as very conservative. Right?
A. Correct.
Q. But you didn't define this scenario anywhere in your direct testimony. Correct?
A. I did not.
Q. And you don't explain your bases for calling it a very conservative scenario. Right?
A. I didn't.
Q. All right. Let's go through this very conservative remedy scenario for the Court.
You know that Dr. Hornberger relies on Dr. Flewelling to describe the cuts to agricultural water use. Right?
A. Yes.
Q. And he relies on Dr. Flewelling to describe the cuts in small impoundment incremental evaporation. Right?
A. Yes.
Q. All right. Dr. Flewelling explains that the remedy scenario involves wiping out 50 percent of agricultural irrigation in Georgia. Correct?
A. No, that's not correct.

1766

Q. You don't understand Dr. Flewelling to be saying the remedy scenario wipes out 50 percent of irrigation in Georgia?
A. I don't believe it wipes out 50 percent in all months. It's in a subset of months.
Q. All right. Let's -- do you remember testifying in deposition in this case, Dr. Greenblatt?
A. Yes.
Q. And you were under oath?
A. Yes.
Q. And you told the truth?
A. Yes.
Q. All right.
Ms. DeSANTIS: Let's show from Dr. Greenblatt's deposition transcript 157, line 16 to 22. Mr. Smith, could you please play clip 78 to 79.
Clip 78 and 79.
(Whereupon the video was played.)
BY MS. DeSANTIS:
Q. And were you asked that question, and did you give that answer in your deposition?
A. I did.
Q. All right. And this scenario, this 50 percent reduction scenario, is the remedy that you

1767

described as very conservative. Right?
A. Correct.
Q. All right. Now, let's look -- you have not -- well, let me just ask you this first, Dr. Greenblatt. You have not investigated the impact on Georgia's economy if Georgia were to cut irrigation use by 50 percent. Right?
A. No. There are other experts in this case who have investigated that.
Q. But you haven't done it?
A. I have not done that.
Q. And you haven't investigated the effect of a 50 percent cut in evaporation from small impoundments; have you?
A. No.
Q. And you haven't investigated the costs associated with eliminating all interbasin transfers out of the ACF Basin. Right?
A. Correct.
Q. All right. Let's look at figures 3-11 to 3-16 on pages 32 to 37 of demonstrative 3.
MS. DeSANTIS: And let's put that up on the screen.
Let's put 3-11 up for starters.
BY MS. DeSANTIS:

1768

Q. Figures 3-11 to 3-16 together compare bay salinity levels under Dr. Hornberger's 50 percent cut remedy scenario with Georgia's simulated water use in 2007 to 2012. Right?
A. That's correct.
Q. All right. And in all of your figures in 3-11 to 3-16 on pages 32 to 37, the greatest difference between simulated consumptive use and the 50 percent cut scenario shows salinity levels differing at most by 2 to 3 ppt. Right?
A. That's correct.
Q. All right. Let's look at 3-11, which is up on the screen. And it's on page 32 of demonstrative 3. Figure 3-11 compares bay salinity under the 50 percent cut remedy scenario with bay salinity under Georgia's consumptive use for May through October of 2007. Right?
A. Correct.
Q. And, again, May through October represent the lowest flow months of the year. Right?
A. Typically.
Q. And as with the last scenario, the white areas of the map show areas where changes in salinity, if any occurred, would be less than 1 ppt. Right?
A. Correct.

1769

Q. And, Dr. Greenblatt, there are no months in 2007 where Florida's remedy scenario would have decreased bay salinity by more than 2 to 3 ppt. Right?
A. Correct.
Q. All right.
MS. DeSANTIS: Mr. Smith, can we please blow up June of 2007.
BY MS. DeSANTIS:
Q. And, in fact, the month of June is the only month in which Florida's 50 percent cut remedy scenario would have decreased bay salinity by more than 2 ppt. Right?
A. For this year, correct.
Q. All right. And we're showing those changes very close to the mouth of the river. Correct?
A. Correct.
Q. The rest of the bay is all white. Correct?
A. Correct.
Q. And that shows a change in salinity of less than 1 ppt. Correct?
A. That's correct.
Q. All right. Let's look at figure 3-12 on page 33 of demonstrative 3. And, again, we're comparing bay salinity under the 50 percent cut remedy

1770

scenario to Georgia's use for October -- for May through October 2008. Right?
A. Yes.
Q. All right. And the white areas of the map, again, indicate where changes, if any occurred, under Florida's proposed 50 percent cut remedy would be less than 1 ppt. Right?
A. Yes.
Q. All right.
MS. DeSANTIS: Let's blow up May of 2008.
BY MS. DeSANTIS:
Q. Are you there, doctor?
A. Yes.
Q. All right. And in May 2008, if the proposed remedy resulted in any change at all, it would have been less than 1 ppt. Correct?
A. That's correct.
Q. All right.
MS. DeSANTIS: Let's blow up August of 2008.
BY MS. DeSANTIS:
Q. The same is true for August. Correct?
A. That's correct.
Q. Florida's proposed remedy in August of 2008, if

1771

it made a difference, would result in a salinity change of less than 1 ppt. Correct?
A. That's correct.
Q. And the same is true for September 2008. Correct?
A. Correct.
Q. And the same is true for October of 2008. Correct?
A. That's correct.
Q. All right.
MS. DeSANTIS: Let's put figure 3-13 on page 34 up on the screen.
BY MS. DeSANTIS:
Q. And this shows the same comparison for May through October of 2009. Correct?
A. That's correct.
Q. And the white areas of the map indicate where changes, if any occurred, under Florida's proposed remedy scenario were less than 1 ppt. Right?
A. That's correct.
And 2009 was a high flow year so, again, you would see different patterns.
Q. And in May, June, September, and October of 2009 Florida's proposed remedy, the 50 percent cut

1772

remedy, if it made any difference in salinity levels in the bay, would make a difference of less than 1 ppt. Right?
A. That's correct.
Q. And August of 2009 was the only month in 2009 where Florida's proposed remedy would have impacted salinity more than 1 ppt in the bay. Right?
A. That's correct.
MS. DeSANTIS: Let's blow up August 2009 please, Mr. Smith.
BY MS. DeSANTIS:
Q. All right. It looks like there's a -- there's a small purple area near the mouth of the river. Right?
A. Correct.
Q. Can you see --
MS. DeSANTIS: Can the Court see that dot?
SPECIAL MASTER LANCASTER: Yes.
BY MS. DeSANTIS:
Q. All right. And that impact of more than 1 ppt was limited to near the mouth of the river. Right?
A. That's correct.

1773

Q. All right. Let's turn now to figure 3-14 on page 35 of demonstrative 3.
MS. DeSANTIS: And put that up on the screen.
BY MS. DeSANTIS:
Q. And figure 3-14, likewise, compares bay salinity under the 50 percent cut remedy scenario with salinity levels under Georgia's simulated water use for May through October 2010. Right?
A. Yes.
Q. And as shown on these maps, at no point in 2010 would Florida's remedy have decreased the salinity in the bay by more than 2 ppt. Right?
A. That's correct.
Q. All right. Let's move on to figure 3-15 on page 36 of demonstrative 3.
MS. DeSANTIS: And let's put that up on the screen as well.
BY MS. DeSANTIS:
Q. Figure 3-15 compares salinity under the remedy scenario with bay salinity under Georgia's water use as simulated by you for May through October 2011. Right?
A. Correct.
Q. And in two of these low flow months, June and

1774

July, there are some areas where the salinity difference is between 2 and 3 ppt. Right?
A. Correct.
Q. And these are small areas of impact limited to near the mouth of the river. Right?
A. That's correct.
Q. And the white areas on all these maps show where changes, if any, occurred under Florida's remedy scenario were less than 1 ppt. Right?
A. Correct.
Q. All right. And, again, doctor, these figures are showing what changes in salinity in the bay would occur if Georgia cut its agricultural water use in half. Right?
A. Essentially. But, again, not for all months.
Q. And the white areas of the map showing where changes, if any, occurred under Florida's proposed remedy scenario were less than 1 ppt. Right?
A. Correct.
Q. All right.
MS. DeSANTIS: Let's put 2012 scenario up. And that is page 37.
BY MS. DeSANTIS:
Q. All right. Doctor, we're looking at 3-16 on

1775

page 37, which shows your remedy versus Georgia's simulated use results for the year 2012. Right?
A. Correct.
Q. All right. And, doctor, you're aware that 2012 was the year of the oyster collapse. Right?
A. Yes.
Q. And in 2012, the year of the oyster collapse, if Georgia had eliminated 50 percent of its agricultural water use, the impact on salinity in the bay would be what is shown in figure 3-16. Right?
A. That's correct.
Q. And, in fact, as shown on the maps in figure 3-16, for almost all of the low flow months in 2012, the change of salinity in the bay is less than 1 ppt. Right?
A. For three of the six months.
Q. The change of less than 1 ppt is shown in the white areas on these maps. Correct?
A. That's correct.
Q. All right. And just to be clear, these are the changes in salinity in the bay that your modeling shows would result under Florida's remedy scenario. Correct?
A. That's correct.

1776

Q. And your maps in figure 3-16 show your modeled salinity changes throughout the bay. Correct?
A. That's correct.
Q. Including at Cat Point. Correct?
A. Yes.
Q. Including at Dry Bar. Correct?
A. Correct.
Q. Including at east bay Station. Correct?
A. Yes.
Q. And including at St. Vincent Sound. Correct?
A. Yes.
Q. All right. And you maintain that Cat Point and Dry Bar are the main oyster bars. Right?
A. I know they're the commonly-studied oyster bars. I don't know about main oyster bars.
Q. All right. Let's put up your direct testimony at page 13, please.
MS. DeSANTIS: Page -- Dr. Greenblatt's direct testimony at page 13.
BY MS. DeSANTIS:
Q. Doctor, you indicate here -- and I'm looking at the top of paragraph 26 -- that -- you say, average salinity has been over 25 ppt of the bay oyster bars, paren, Dry Bar --
MR. PRIMIS: You have got to slow down.

1777

BY MS. DeSANTIS:
Q. -- and Cat Point. Do you see that?
A. Yes, I see that.
Q. All right.
MS. DeSANTIS: Mr. Smith, can you please put figure 3 from Dr. Greenblatt's written direct testimony on page 13 and figure 3-16 slide -- side by side on the screen.
BY MS. DeSANTIS:
Q. Okay. Now, doctor, I am just using your figure 3 on page 13 of your written direct to help orient us to the locations of Dry Bar and Cat Point. All right?
Can you see those on the map?
A. Yes.
Q. All right. And looking at your table 3 -- looking at your figure 3 and then looking at your figure 3-16, it looks like Cat Point and Dry Bar are shown in white in the months of 2012. Right?
A. That's correct.
Q. And that means that in 2012, the year of the oyster collapse, if the remedy scenario proposed by Florida had been in place, changes in salinity at Cat Point and Dry Bar would be less than 1 ppt. Correct?

A. That's what this simulation showed.
Q. All right.
MS. DeSANTIS: I have no more questions. Thank you.
MR. QURESHI: Your Honor, I'm happy to proceed now; or would you like to take your lunch break?
SPECIAL MASTER LANCASTER: Why don't you go ahead.
MR. QURESHI: Thank you.
REDIRECT EXAMINATION
BY MR. QURESHI:
Q. Good afternoon, Dr. Greenblatt.
A. Good afternoon.
Q. I had some questions about your reliance on information provided by Dr. Hornberger and Dr. Flewelling.
A. Yes.
Q. Is that standard practice in your field?
A. It is standard practice in my field. So oftentimes, when we're looking at complex problems, there's -- it requires expertise of many different experts. And so it -- it's frequently done that one expert will do an evaluation or do a modeling study and provide

those results to another expert, as was the case in this matter.
Q. Who is Dr. Hornberger?
A. Dr. Hornberger was the hydrologist who used the analysis of Dr. Flewelling and then developed the alternative scenarios that I used in my modeling.
Q. What steps did you take to verify the information you received from the hydrologists?
A. I reviewed their reports so that I was comfortable with the data that they used and the methods that they used. And in Dr. Flewelling's report, there was some question over some of the data he used. And I reviewed some of his primary sources so that I was comfortable with the difference in the methods so that I was comfortable with the values that Dr. Flewelling used.
Dr. Hornberger then also reviewed Dr. Flewelling's work. And in addition to taking Dr. Flewelling's results, he did his own analysis. So he did a second analysis, and he was able to compare that to the analysis that Dr. Flewelling did. And he found that he got similar results.
And that's another common thing that's done

in my field where doing two different analyses by different methods, when they result in similar answers, that validates the results.
Q. Okay. And what independent steps did you take to verify the information you received from them?
A. I did a low flow analysis similar to what Dr. Hornberger did. So what -- what I did was I looked at how flows have changed over time in the Apalachicola River.
And it might be easier for me to explain this from a figure.
Q. Are you referring to a figure in your expert report?
A. I'm sorry. I think it's figure 5 in my PFD. It's a figure showing -- oh, no. I'm sorry. Figure 2, a figure showing flows.
Q. I believe it's behind tab 2 of the binder that you were provided. That's your expert report.
A. Yes. Figure 1.2 in my expert report.
So Dr. Hornberger and I both did low flow analyses, but we did it slightly differently; and we both arrived at the same conclusion, which is that low flows have become more frequent in recent years.
Q. Just give us one second.

A. Yes. I'll wait for you to get there.
Q. I believe that page it's on is not numbered, but it is -- it may be the 28th page. It's, again, figure 1-2.
A. Correct. Right.
Q. Thank you, Dr. Greenblatt.
A. So to understand how flows have changed over time, I looked at measured flows. These flows were measured at the USGS Chattahoochee Flow Gage on the Apalachicola River. This is the first gage after the river enters the State of Florida. And it encompasses the flow for most of the watershed in the Apalachicola-Chattahoochee-Flint Basin.
So I looked at daily measured flows from the period of 1970 to 2015. And in order to do my low flow analysis, I defined a value of low flow. To do this, I did a statistical evaluation that is very commonly done in my field where I identified the flow that's what we call the 10th percentile flow. So it's the flow that was exceeded 90 percent of the time. And then I proceeded to count the number of days where flow was below this value over this period of -- of record of -- in the measured data.

And what I can see from this figure is that the frequency of low flows -- and these are focused -- this graph is focused on the dry season months. Increases in recent years are in the later part of the record.

So we have more low flow days, and they occur in more years. And that conclusion, again, is similar to the conclusion that Dr. Hornberger reached.

Q. Dr. Greenblatt, you also had some questions about the changes in salinity; and you made a comment about absolute changes. What did you mean by that?

A. To look at the changes in salinity, the number on its own is not a meaningful metric for salinity. What matters is how the changes in salinity affect the ecosystem. And although I'm not an expert and I'm not offering opinions on how the change affects the ecosystem, there have been -- we have heard that from Dr. White and Dr. Kimbro that there are changes and impacts to the ecosystem based on changes in salinity.

MS. DeSANTIS: Objection, move to strike testimony. The witness is proffering testimony from other experts outside of her

area of expertise.

SPECIAL MASTER LANCASTER: You may proceed.

MR. QURESHI: Thank you, your Honor.

BY MR. QURESHI:

Q. Dr. Greenblatt, there was some discussion about sea level rise and how you evaluated sea level rise in connection with your modeling. Can you explain in more detail the relationship you determined existed between sea level rise and salinity in Apalachicola Bay.

A. Yes. I did a data-based evaluation of sea level rise and salinity -- and, again, it might be easier if we could look at a figure.

Q. It's at -- this is figure 5 of your prefiled direct.

A. Thank you.

Q. On page 17.

A. The salinities have been measured in Apalachicola Bay at several locations. And so I used the measured salinity data as well as measured data of sea level or the water depth that's been measured in Apalachicola Bay for about 50 years. And once we get our figure --

Q. This is figure 5 on page 17?

A. Yes. If we could blow up the top, I think that would be helpful.

So what we're looking at here is a plot that relates sea level to salinity. So along the horizontal axis is sea level, and we can see that it varies from minus 4 to about 10. So 14 -- about 14 centimeters. And along the vertical axis is salinity at two locations, at Cat Point and Dry Bar.

And what this graph shows is that for the 14-centimeter change in sea level, we really see no change and no consistent change or consistent pattern in the measured salinity. So based on this graph, it -- what it tells me is that there's no discernible relationship between salinity and sea level.

Q. And as a general matter, Dr. Greenblatt, can you explain the difference between sea level and sea level rise?

A. Yes. Sea level is a measured value for the water depth; and sea level rise is the rate at which -- or the rate at which that is increasing over time.

Q. If we look at another figure in your prefiled direct, in particular -- sorry. It's a figure in

your expert report relating to sea level. I would like to put that on the screen and have you explain to us what it represents.

A. This is a graph that was developed by NOAA. This is the same sea level data that I had used, but it's presented in a slightly different manner. This is monthly average sea level for the period of record, so about 50 years.

And what this graph shows is that there is a wide variation in sea level from month to month. It varies by about 20 centimeters over the period. So from one month to another month we see a wide variation in sea level. So given that sea level varies all the time, it's going up and down from month to month and year to year, and that we don't see a discernible relationship between sea level and salinity, I conclude that there's -- there isn't a discernible relationship between the two.

Q. In your discussion of sea level rise in your prefiled direct, there's a discussion of sedimentation. What is sedimentation?

A. Sedimentation is when particles such as silts and clays that are in the water fall and settle out onto the bay bottom. And sedimentation is

important in this context because what drives sedimentation is flow patterns in the bay. And something like sea level rise will affect -- will change the flow patterns in the bay.

So when the flow patterns in the bay change, sedimentation will change. And so any consideration of the impact of sea level rise on salinity would need to take into account these changes because when sedimentation happens and the depth of the bay changes or the size of the inlet changes, then flow patterns change. And that will in turn affect salinity.

Q. Okay. And --

SPECIAL MASTER LANCASTER: Sorry.

MR. QURESHI: That's fine, your Honor.

I can move on to a different topic or take a lunch break if that is an appropriate time to do so.

SPECIAL MASTER LANCASTER: Why don't you move on to your new topic.

MR. QURESHI: Okay.

BY MR. QURESHI:

Q. Dr. Greenblatt, can you explain to the Court what tools you relied upon to undertake your analysis?

A. I developed a numerical model of hydrodynamics

and salinity to undertake my analysis.

Because the Apalachicola Bay is a complex system and there's a lot of factors that affect the salinity patterns we see in the bay, these factors include the freshwater inflow, tides, wind, the shape or what we call the bathymetry of the bay. All of these things react in a complex way to affect salinity and salinity patterns. So in order to evaluate the salinity patterns for both existing conditions and, importantly, for future conditions where the only way we can evaluate it is with some sort of predictive tool, I developed a hydrodynamic model that includes these factors.

Q. And in your field of study, how common is it to use the model to evaluate changes in flow?

A. It's very common.

Q. Okay. Can you explain the type of model you used to perform this flow analysis?

A. I used a model called the Regional Ocean Modeling System. It's called a ROMS model.

So this -- I would like to think about modeling as thinking about the modeling platform and then the model application. And so the modeling platform -- I like to compare it to

making cookies. And I think of the modeling platform as the oven. And there are several modeling platforms that are accepted in my field, and all work about the same way; whereas, what goes into the model you can think of as the ingredients, the wind and the bathymetry and the data that we use. And -- and so that is the model that I used.

Q. And have you evaluated other models that were used by Georgia's experts to evaluate similar issues?

A. I did evaluate Georgia's model. And Georgia's expert developed a model that's very similar to mine. He used a different modeling platform -- so a different oven -- but it works about the same way.

And he, in fact, used modeling input that I used and ran it through his model; and he came out with the same answer. So that's another validation. That's a way to validate a model when two different modelers can use the same inputs and come out with a similar answer.

Q. And who created the model that you relied upon?

A. It was created by an engineering firm called Intera Consulting.

Q. And what steps did you take to verify the appropriateness of this model?

A. I reviewed the reports. So this model -- they developed this model prior to this matter for the Water Management District in Florida. So this model was available to me as a potential tool when I was retained on this matter.

So I reviewed the reports written about this model. I had discussions with the modelers that developed it. And I actually went and visited with them and sat with them. And I had one of my colleagues sit with the modeler and go through the input file. So I have a high degree of confidence in this model as a tool to support my opinions.

Q. Okay. I would like to move on now to your modeling results and, first, ask you to describe the relationship between flow and salinity in Apalachicola Bay.

A. So what my modeling shows is as fresh water increases, salinities decline in the bay. So that's what it shows generally. And then specifically I looked at how that decline varies in different flow scenarios at different locations and at different times in the bay.

1790

Q. Okay. And there was reference in your cross-examination about that you're characterizing as the remedy scenario as a very conservative scenario. Why did you call it a very conservative scenario?

A. It's my understanding that since that scenario was developed for the modeling that I submitted in my expert report last winter, that there's been additional valuations of remedy scenarios and that there's other scenarios that may result in a greater -- other scenarios that could be done, I think, for the -- I don't know the details of them, but that could result in greater reduction, which would be more freshwater inflow, which would result in lower salinities or larger changes from the existing conditions.

Q. You mentioned Dr. Flewelling's work and your reliance on it. Did you evaluate other sources of information that consider the amount of water being used by Georgia compared to the amount that Dr. Flewelling computed was being used by Georgia?

A. I did. There are several reports that were developed by USGS that estimate the -- among other things, the agricultural consumptive use.

1791

And so Dr. Flewelling, in developing his evaluations, he did review these reports; but his -- his consumptive use -- agricultural consumptive use differs from these reports for a couple of reasons. One, there's two factors -- general factors that go into the development of consumptive agricultural use. One is the irrigated acres and one is irrigated depth.

And so what Dr. Flewelling found in reviewing this work and all of the available data that he reviewed is that the irrigated acres were -- were underestimated in some of these reports. And he relied on aerial photos to get the most updated estimates of irrigated acres. His irrigation depths also differ from what's done in these reports for two reasons. For one, he relies on some metering data which became available in the late 2000's. This is data that measures water he found, agricultural water. So he used these data to back-calculate irrigation depths for years prior to that data being available. He also calculated crop-specific irrigation depths. So that's why his numbers differ and are a more thorough analysis.

The USGS reports also rely on the data that

1792

was reported to them by Georgia. They didn't do an independent analysis of these data.

Q. In addition to evaluating the influence of Apalachicola River flow on the salinity in the bay, did you consider any other watersheds that might have an impact on salinity in the bay?

A. There is a small watershed called Tate's Hell that's located in -- adjacent to east bay. And I did consider the impacts of fresh water and flows that would come from this watershed. And in evaluating the relative amount of freshwater flow from these watersheds to the Apalachicola River, I found that it was very small, on the order of 1 to 5 percent.

And I was able to do that evaluation both based on model flows in these watersheds, so I compared the flows that were in the model coming out of the creeks in this watershed to the flows in Apalachicola River. And they were on the order of a few percent.

I also looked at the watershed area. So it's very common in my field to use watershed area as a surrogate for flow when we don't have measured flows. So the watershed area of the creeks in Tate's Hell that -- that provide some fresh water

1793

are about 1 percent or 2 percent of the total watershed area in Apalachicola Bay.

And finally, although I didn't do a sensitivity analysis myself on the flows in Apalachicola -- in Tate's Hell, Georgia's expert, Dr. McAnally, did do an evaluation of the impacts of this freshwater inflow. And what he found is that for a change of 30 percent in these flows in these small watersheds in Tate's Hell resulted in a change in simulated salinity of less than 1 percent. So they had very little impact on salinity in the bay.

Q. Okay. Dr. Greenblatt, a few more topics to cover. And the next one I would like to move on to is the testing you did to confirm that your model matches actual data.

Are you familiar with the concept of an uncertainty analysis?

A. I am familiar with that concept.

Q. What is it?

A. An uncertainty analysis is a means of looking at uncertainty in all of the parameters that go into your model and then understanding how that uncertainty would affect your results. It also provides a way to put uncertainty bounds on your

modeled predicted estimates. It doesn't change your estimates; it just puts bounds on those estimates.

Q. And are there other ways to put bounds on your estimates or to evaluate how well your model fits actual data?

A. Yes. Typically what's done in a model is to do what I call goodness of fit statistics. So you run a series of statistical tests to look at how well your model simulations match measured data. And I -- I did run those tests and -- including a statistical test of error.

And to understand how my results compared, I -- I looked at -- I used a document developed by the Army Corps of Engineers. This was not for Apalachicola Bay, but for a project in Louisiana. And although there's no guidance values, there were recommended values in that document on acceptable error statistics. And my error statistics were well within that range that was cited in that document.

Q. How many different testing stations or nodes did you evaluate in reaching your conclusions?

A. Well, the model is -- the original model that was developed by Intera calculated the data that was

collected at 37 locations throughout the bay. So that's a significant dataset for model calibration. So to -- in the -- then the calibration is the process of comparing the metrix data to the modeled predictions and making any adjustments that are necessary in the model in order to have the best fit. So the modeled predictions were compared to measured values of salinity and water level and velocity at these 37 locations, and then the statistics were performed to test the goodness of fit.

Q. Dr. Greenblatt, if we could turn to your prefiled direct testimony for a moment, in particular on page 15. I would like to discuss with you paragraph 29.

I would like you to read that to yourself and then explain to us what you mean by the last sentence in paragraph 29.

A. So this -- this paragraph is providing a general summary of what I found in my modeled results. And the last sentence -- what that means is that if I had a different remedy scenario that resulted in more freshwater inflow, then I would see lower salinities in Apalachicola Bay in my modeling. To the extent of how they would

change, I wouldn't know without running the model. But that's what we would see. With increased freshwater inflows, you would see lower salinity.

Q. The exact amounts you would need to compute in your model, but the general relationship is established?

A. That's correct.

Q. Okay. We talked when we were looking through the various remedy scenarios that were in that -- the handout that was provided, can you explain generally why the amounts vary according to months?

A. The amounts will vary according to months based on -- based on the flow patterns. So both the existing conditions and the remedy or the future scenario, depending on what we're comparing it to, you're going to see different patterns. For each year and each month there's going to be different flows in that month.

And the model looks at time-varying flows. So we had flows -- so even though we have a low flow month, there may be a period in that month where flows are higher. And then what I presented is an average for each month.

Q. If we could please turn to page 38.

SPECIAL MASTER LANCASTER: Let's take a noon recess, counsel.

MR. QURESHI: Thank you, your Honor.

SPECIAL MASTER LANCASTER: Sorry.

(Time Noted: 11:58 a.m.)

(Recess Called)

(Time Noted: 1:05 p.m.)

SPECIAL MASTER LANCASTER: I hope you haven't been standing there waiting since we left.

MR. QURESHI: No, your Honor.

Before I begin, I would like to introduce my colleague --

SPECIAL MASTER LANCASTER: Please.

MR. QURESHI: -- Stijn van Osch.

MR. OSCH: Good afternoon, your Honor.

BY MR. QURESHI:

Q. Dr. Greenblatt, before we broke, we were referring to the charts you were shown during your cross-examination. Do you recall that?

A. I do.

Q. What do these charts tell us about the absolute values of salinity at any particular point in time?

A. These charts show us the results of the modeled predictions looking at differences in salinity between the various scenarios that I ran in my model. So at any point in time they show a monthly average value of the salinity difference for each of the months for each of the years.

Q. But the particular salinity that would exist at a specific location in the bay is not depicted on these charts?

A. Not the particular salinity at a particular point in time. These are monthly average values.

Q. And, doctor, we would -- can you remind us who are the ecologists you worked with in evaluating the impact salinity changes would have?

A. The ecologists are Dr. Kimbro and Dr. White and Dr. Glibert.

Q. In addition to salinity, your testimony and expert report also discussed residence time. What is residence time?

A. Residence time is the time a particle remains in a certain water body. So the longer the residence time, the longer a particle remains in there. And typically, if flows are lower, residence times are higher.

Q. What impact would persistent low flows have on

residence time and salinity?

A. Persistent low flows would increase residence time; and they would reduce salinity -- I'm sorry, increase -- low flows would be to increased salinity.

Q. Okay. And what impact would persistent low flows have on residence time?

A. They would lead to longer residence times.

Q. Okay. Counsel for Georgia questioned you about the remedy scenario and suggested it involved a 50 percent cut in all agriculture. Do you understand that the remedy scenario actually involves cuts in water use at specific points of time in the year and only for specific crops?

A. I understood that in general. I don't know the details of the remedy scenario, but I know it's not a straight 50 percent cut.

Q. Okay. Thank you, Dr. Greenblatt.

SPECIAL MASTER LANCASTER: Counsel?

MS. DeSANTIS: No further questions, your Honor.

SPECIAL MASTER LANCASTER: Dr. Greenblatt, am I correct in understanding that your oven model, as you called it, based upon the information that you had from the other

experts causes you to conclude that decreased flows in the bay cause higher salinity?

THE WITNESS: Decreased flows in the river that come into the bay --

SPECIAL MASTER LANCASTER: Yes.

THE WITNESS: -- do lead to higher salinities; that's correct. That's what the model shows.

SPECIAL MASTER LANCASTER: Is that a correct summary of your testimony?

THE WITNESS: Yes.

SPECIAL MASTER LANCASTER: Thank you. Any other questions, counsel?

MR. QURESHI: No, your Honor.

MS. DeSANTIS: No, your Honor.

SPECIAL MASTER LANCASTER: Thank you.

THE WITNESS: You're welcome.

MS. WINE: Florida is calling our next witness, Mr. Tommy Ward.

Mr. Ward is a third-generation oyster dealer. He and his family have owned and managed the largest privately-leased oyster bars in Apalachicola Bay for over 60 years.

THE CLERK: Please raise your right hand.

Do you solemnly swear that the testimony you shall give in the cause now in hearing shall be the truth, the whole truth, and nothing but the truth, so help you God?

THE WITNESS: I do.

THE CLERK: Please be seated.

Pull yourself right up to the microphone and please state your name and spell your last name.

THE WITNESS: My name is Thomas Lee Ward. T H -- T H O M A S, L E E, W A R D.

DIRECT EXAMINATION

BY MS. WINE:

Q. Good afternoon, Mr. Ward.

A. Good day.

MS. WINE: Your Honor, may I approach the witness to provide him with his testimony?

SPECIAL MASTER LANCASTER: Please.

A. Thank you.

Q. Mr. Ward, I have just handed you your prefiled direct testimony in this matter. Do you recognize that document?

A. Yes, ma'am.

Q. And do you adopt it as your own, sir?

1802

A. Yes, ma'am.

MS. WINE: Your Honor, Georgia's counsel has told us that they intended -- they intend not to cross Mr. Ward. However, Mr. Ward wanted to be here today. He feels strongly about this matter. He's prepared to testify. And he's certainly available to answer any questions that your Honor may have about his testimony if Georgia so chooses not to cross him today.

SPECIAL MASTER LANCASTER: Thank you.

MR. ALLEN: Good afternoon, your Honor.

SPECIAL MASTER LANCASTER: Good afternoon.

MR. ALLEN: As Ms. Wine indicated, we have no cross-examination of Mr. Ward.

SPECIAL MASTER LANCASTER: Ms. Wine?

MS. WINE: Your Honor, if you would permit me to ask some questions, we're certainly prepared to do so. We weren't sure if you would allow that given that Georgia chose not to cross Mr. Ward.

And as I said, he's certainly here prepared to testify today and happy to answer any questions that you allow me to ask him or that you want to pose to him yourself.

1803

SPECIAL MASTER LANCASTER: You may proceed.

MS. WINE: Thank you, sir.

BY MS. WINE:

Q. Good afternoon again, Mr. Ward.

A. Good day.

Q. Mr. Ward, could you tell the Court how long you have run your business in Apalachicola Bay?

A. I have run it for about 30 years.

Q. And did your family run the business prior to you taking it over?

A. Yes, ma'am.

Q. And what is that business?

A. We're in the seafood business, oysters, shrimp business.

Q. And as it relates to oysters, what is your business?

A. I manage the oyster house and the oyster leases which we hold.

Q. And you're an oyster dealer; is that correct, sir?

A. Yes, ma'am.

Q. You have experience as well in the past being an oyster fishermen as well; is that correct?

A. Correct.

1804

Q. And, sir, how long has your family owned and managed the private leases that it holds in Apalachicola Bay?

A. About 60 years, you know, when my dad got it. And on my mother's side, I would say from the early 1920's, '30's.

Q. And, sir, we have only heard a little bit about the private oyster leases or the oyster bars in the bay so far. Could you please explain to the Court what those private leases are.

A. It's where you take barren bottom, and you make it productive into oyster beds, you know, if the State permits you to do that. We have perpetual leases, which the State does not give out perpetual leases anymore in Apalachicola Bay.

Q. And, sir, who is allowed to fish on your private leases?

A. Only people that work for us.

Q. And so it's not open to oyster harvesting to the public?

A. It's not open to the public, no, ma'am.

Q. Okay. And, sir, I'm going to pull up a map of Apalachicola Bay.

MS. WINE: If Mr. Walton could do that.

BY MS. WINE:

1805

Q. And, sir, it might be easier if the Court would allow you to walk over to the map. And I would love for you to point out where your leases are in Apalachicola Bay.

MS. WINE: Would that be okay, your Honor?

SPECIAL MASTER LANCASTER: Yes, but keep your voice up because this nice young lady has to record what you're saying.

THE WITNESS: Yes, sir.

A. The oldest lease we have is lease 525. We have had it since the early '20's, '30's. And this is in what we call Big Bayou up in St. Vincent Sound or in Saint Vincent Island. And then over to the northeast -- I mean, northwest we have another lease which is called -- is lease 609 that we also -- that is the newest lease. We acquired it in 1964.

Q. Thank you, sir.

Sir, how big are your leases in terms of total acres?

A. Lease 609 is 88.4 acres; and lease 525, which is in Big Bayou, is 173 acres, I believe, ma'am.

Q. So a little more than 250 acres total?

A. Yes, ma'am.

1806

Q. And, sir, have these oyster bars and these leases historically been productive?
A. Yes, ma'am.
Q. And can you give us a sense of the productivity of your oyster bars that are on these leases?
A. Well, we have always been able to harvest oysters pretty much year-round. You know, you have seasonal oyster harvesting areas. Sometimes you're planning and, you know, waiting for spat set, so you may not harvest for two or three, four, five months at a time because you don't want to interrupt the spat set you have of the juvenile oysters so you don't kill them when you're, you know, harvesting them. So, you know, it just depends.
Q. Prior -- prior to 2011 and 2012, other than when there's been an event like a hurricane, have your leases historically been consistently productive?
A. Yes, ma'am.
Q. And what happened to them in the 2011-2012 time period?
A. They was decimated. They're completely dead at this time.
Q. And -- I know this is difficult for you, sir. What -- do you need a minute?

1807

A. Okay. I'm ready.
Q. What did you see happen on these oyster bars during 2011 and 2012?
A. I seen the predators come in and start killing off the oysters.
Q. And what kind of predators did you see on your bars?
A. I'm referring to conchs. You got the southern conch and the crown conch.
Q. Is another name for a conch an oyster drill?
A. Yes, ma'am. That would be the southern conch.
Q. And, sir, what is the severity or magnitude of the conchs that you started to observe on your bars?
A. Well, you know, at the time we was probably producing 50, 60 bags a day without a chemical harvesting boat. And it got to where every couple days it was falling off five to 10 bags of oysters. And the increase of the conchs from, you know, where you may get 15 or 20 pounds, it was getting, you know, every day, 60, you know, 120. And at the end, we was catching, you know, maybe 500 pound of conchs and maybe 60 to 80 pounds of oysters where we was getting 50 to 60 -- 60 pound bags of oysters and 25 pound bags

1808

of conchs.
Q. So by the end, for every 50 to 60 pounds of oysters, how many approximately pounds of conchs were you getting?
A. I would four to 500 pounds.
Q. Four to 500 pounds of conchs?
A. Yes, ma'am.
Q. And this is in the 2012 time period?
A. Yes, ma'am. It completely annihilated these beds.
Q. And, sir, what have you done on your private leases to help the bars recover since 2012?
A. Well, I have -- I have tried planting; and, you know, we tried to diversify and grow oysters in cages.
A perpetual lease, you can only use the bottom. You cannot use the upper water column to grow oysters. So we put them in cages. And the predators would eat the oysters through the cages.
Q. So just so we understand, after the crash, you tried to harvest oysters by putting the oysters in cages or baskets, as I think you described it in your prefiled testimony?
A. Yes, ma'am.

1809

Q. And what happened to the oysters that were in those cages or baskets?
A. The predators would -- the oyster drills, conchs, however your Honor wants it worded, it would -- it would go through the holes in the baskets and eat -- and eat the oysters. You know, drill into it and eat the oyster.
Q. And I think you also mentioned planting. By that do you -- are you talking about planting shell?
A. Yes, ma'am.
Q. So reshelling your leases -- your leased bars?
A. I reshelled my leases extensively, and it did no good.
Q. So extensively since the crash in 2012?
A. Yes, ma'am. And before.
Q. Okay. And in connection with the reshelling, you also -- I don't know if this is the right word, planted or spread spat on those shells?
A. Yes. We put, you know, spat out; and they would not live.
And, you know, mainly we would like to catch a wild spat set, is what I call it, you know, where you catch the organism floating through the water, you know, on shell. And if you would get a small spat set, the -- the conchs would eat

1810

them, you know, before they got half an inch.
Q. So none of that reshelling and spreading of spat has allowed your bars to recover since 2012?
A. No, ma'am. My bars have not recovered.
Q. And, sir, has anybody been harvesting on your bars since the crash in 2012?
A. Not really. We -- you know, we test our bars to see if we're getting any recovery whatsoever, but not to the extent I would say we was harvesting oysters off of them, you know.
I think in 2015 we may have got 100 bags of oysters off of it to where --
Q. Okay. And other than that limited harvesting and testing, has anybody been harvesting on your leased bars?
A. No, ma'am.
Q. Sir, when you go out on your leases now in 2016, what do you see?
A. Oh, I see decimation, dead shell to where, you know, when -- when the crash happened, you would have a full oyster, you know, top and bottom shell. And after the conchs eat this, you will have an empty shell.
And, also, it seems like a lot of shell are deteriorating from, you know, I assume, the acid

1811

or whatever that the conch drills into the shell.
Q. And, sir, are you still seeing conchs when you go out onto your private bars?
A. If there's any live oysters, yes, ma'am.
Q. And, sir, how has the -- well, let me ask you this. What is your view of why this has happened in the bay based on all of your years of experience harvesting oysters in the bay?
A. Lack of fresh water, high salinity.
Q. And, sir, how has the lack of fresh water and its impact on the bay impacted your family and its business?
A. Well, it's just about put me out of business. I'm down probably 95 percent in production over the whole bay. I don't only harvest oysters off of private beds, but we also buy from oyster fishermen that work in Apalachicola Bay. And I used to have 30 or 40 oyster fishermen. At this time I have zero.
Q. And, sir, how has this impacted the community of the Apalachicola Bay and the oystermen within that community?
A. Well, this affected the whole economy because the fishermen, you know, not only can't make a living, but they're not able to go to the grocery

1812

store, buy groceries for their family, gas. You know, it don't just affect the oyster dealer itself. It affects the community, the other businesses which are in the community that buy other goods to be able to sustain and live.
Q. Thank you, sir. And thank you for being here today.
MS. WINE: Thank you, your Honor.
A. Thank you.
MR. ALLEN: Your Honor, I do have few questions.
SPECIAL MASTER LANCASTER: Sure.
CROSS-EXAMINATION
BY MR. ALLEN:
Q. Good afternoon, Mr. Ward.
A. Good day.
Q. My name is Winn Allen. I'm counsel for the State of Georgia. It's a pleasure to meet you, sir.
A. Nice to meet you.
Q. Sir, if I understand things correctly, you are the former president of the Apalachicola Bay Oyster Dealers Association. Correct?
A. That is correct.
Q. Okay. I want to hand you a document, sir, that we got from the Oyster Dealers' files. Okay?

1813

A. Okay.
MR. ALLEN: Your Honor, can I approach?
SPECIAL MASTER LANCASTER: Please.
BY MR. ALLEN:
Q. Mr. Ward, this is a letter dated July 28, 2010. It was produced to us from the Apalachicola Bay Oyster Dealers. It's from a gentleman named Mike Voisin. Do you know who --
A. Voisin.
Q. Voisin. So I take it you know Mr. Voisin?
A. Mr. Voisin is deceased now, sir.
Q. Okay. All right. Did you know him when he was alive, sir?
A. Yes, sir. Very well.
Q. Take a second just to review the letter for me silently to yourself.
A. Okay.
Q. And just for the record, the letter is GX-1322.
Now, Mr. Ward, in July of 2010, you shared the same feeling as Mr. Voisin --
A. Voisin.
Q. Voisin, I apologize, sir.
In July of 2010, you shared the same feelings as Mr. Voisin that undersized oysters were being put in the marketplace; is that correct?

1814

A. That is correct.
Q. And it was your understanding -- just so we're clear, it was your understanding that grossly undersized oysters from Apalachicola Bay were being supplied to the market in 2010. Correct?
A. Correct.
Q. And, sir, you understand it's the government of the State of Florida who is responsible for ensuring that people are not violating the law. Correct?
A. That's correct.
Q. And you understand it's the State of Florida who has responsibility for enforcing regulations on harvesting limits and harvesting sizes in Apalachicola Bay. Correct?
A. Yes, sir.
Q. Let's jump forward in time to September of 2014. Okay, sir?
A. Okay.
Q. In September of 2014, it's correct, sir, you wrote a letter to Nick Wiley requesting that Florida close Apalachicola Bay for the remainder of the winter harvesting season. Correct?
A. That may be correct. Yes, sir.
Q. You -- do you think --

1815

A. Yes.
Q. Yes, okay. And Nick Wiley is the director of FWC. Correct?
A. That's correct.
Q. And the State of Florida did not, in fact, close Apalachicola Bay for the remainder of the 2014-2015 winter season --
A. No, sir.
Q. -- correct?
No, sir; they did not do that?
A. They did not close it.
Q. Okay. We'll try not to talk over each other.
A. I apologize.
Q. No, no, no.
And, sir, you thought it was a big mistake for Florida not to close the bay in the 2014-2015 winter season. Correct?
A. Yeah.
Q. And in the fall of 2014, sir, you were of the view that damage was being done every day that Florida left the bay open. Correct?
A. Well, let's look at it from a business standpoint. You're putting -- you know, I believe in putting a premium quality product out on the market. And if you're not putting a --

1816

you know, we have worked long and hard to make Apalachicola world famous oysters. And we like to put a premium product on the market. And that's what I do in my business. And if -- if -- if you go buy a bag of oysters to take home to your family to eat, or you and your buddies are watching a football game, and you sit down and are eating that bag of oysters, and half of that bag is a quality product that you can eat, and half or a quarter of that bag is not quality; and you throw it away, then you feel like you got gypped, you know.
I look at it from an economic standpoint. I wasn't looking at it as if it was going to decimate the bay. I believed in putting a quality premium product on the market. And I believe that's what we tried to do with Apalachicola Bay product.
Q. I very much appreciate that, sir.
My question was in the fall of 2014 you were of the view, were you not, that damage was being done every day that Florida left the bay open. Correct?
A. Yeah.
Q. You were also of the view in the fall of 2014

1817

that there was a lack of enforcement by the State of Florida with respect to undersized oysters. Correct, sir?
A. They was harvesting juvenile oysters, yes, sir.
Q. Okay. And you were of the view in October 2014 that Florida's inaction to protect the oysters in Apalachicola Bay was causing harm to the bay. Correct, sir?
A. It wasn't helping it, but it wasn't killing it.
Q. I'll ask it again, sir. You were of the view in October of 2014 that Florida's inaction to protect the bay was causing harm to the bay. Correct?
A. Do you have the letter that I could read that, please?
Q. I'm not reading it from a letter, sir.
A. You're not reading it from a letter?
Q. No, sir; I'm not.
A. Then, you know, I'm under the assumption that the -- you know, like I said, again, I was looking at it from a business standpoint.
Q. I appreciate that, sir.
A. Okay.
Q. I'll just ask it one more time.
A. That's going to be my answer to you.

1818

Q. I understand. One more time.
In October of 2014, sir, you were of the view that Florida's inaction to protect oysters in Apalachicola Bay was causing harm to the bay. Right, sir?
A. Okay. If that's the way you want to look at it.
Q. No, sir. I'm not asking for -- I'm not trying to testify for you. I'm just asking for your testimony here in court.
A. It wasn't helping it; but I don't think it was, you know -- like I say again, my main concern was from a, you know, economical standpoint of it.
Q. Okay. Sir, you remember giving a deposition in this case. Right?
A. Yes, sir.
Q. Okay.
MR. ALLEN: Your Honor, may I approach the witness briefly?
Thank you.
BY MR. ALLEN:
Q. Sir, here is your deposition transcript.
A. Okay.
SPECIAL MASTER LANCASTER: Thank you.
BY MR. ALLEN:
Q. And, Mr. Ward, if you would turn with me to page

1819

109, please.
A. Okay.
Q. And you're with me on page 109, sir?
A. Yes.
Q. And do you see line 1 that says, question, was it; do you see that?
A. Page 106 -- okay.
Q. Do you see page 109, line 1, sir?
A. Yes, sir.
Q. Okay. And, sir, were you asked this question; and did you give this answer during your deposition.
Question. Was it the Oyster Dealers' view -- the Oyster Dealers Association view at the time that Florida's inaction to protect oysters in Apalachicola Bay was causing harm to the bay?
And there's an objection or two and then an answer.
Yes. Yeah. You know, maybe -- that's more personal than maybe the whole Dealers Association, but I'm going to say yes.
Sir, were you asked that question and did you give that answer during your deposition?
A. Yes, sir.
Q. Thank you, sir.

1820

MR. ALLEN: I have no further questions.
REDIRECT EXAMINATION
BY MS. WINE:
Q. Just briefly, sir.
I believe you just testified that your bars have effectively been closed to harvesting since the crash in 2012. Is that correct?
A. Yes, ma'am.
Q. And, sir, in retrospect, sitting here in 2016 looking at everything that's happened in the bay, do you think a closure of the bay in 2014 would have done anything to help this bay recover?
A. No, ma'am.
Q. And why is that your view?
A. Because I have closed my beds. I planted -- replanted shells on my beds. You know, I tried to diversify to grow oysters. And I have grown oysters for 30 years, and I have put a premium product on the market. And I have not been able to grow no oysters. They do not survive.
Q. Thank you, sir.
MR. ALLEN: No further questions, your Honor.
SPECIAL MASTER LANCASTER: Mr. Ward?
THE WITNESS: Yes, you Honor.

1821

SPECIAL MASTER LANCASTER: Has the water quality in the bay improved since 2012?
THE WITNESS: No, sir.
SPECIAL MASTER LANCASTER: How much harvesting occurred on your leases in 2011 and 2012?
THE WITNESS: May I look --
SPECIAL MASTER LANCASTER: Sure.
THE WITNESS: -- right here, sir?
2011, off of lease 525 we harvested 1,878 bags and 59 pounds. And off of lease 609, we harvested 3,953 bags and 5 pounds.
And when I refer to bags, sir, that would be a 60 pound.
SPECIAL MASTER LANCASTER: Was that consistent with your prior harvesting level?
THE WITNESS: Yes, pretty much. You know, some years it would be a little better. It depends on, you know, how many recruitments you get during a year's time and how fast they grow.
SPECIAL MASTER LANCASTER: Counsel?
MR. ALLEN: Nothing from Georgia, your Honor.
MS. WINE: Nothing further, your Honor.

1822

SPECIAL MASTER LANCASTER: Thank you very much, Mr. Ward.
THE WITNESS: Yes, sir. My pleasure. Thank you.
MS. WINE: Your Honor, Florida would like to call its next witness, Dr. Patricia Glibert. Dr. Glibert is an estuarine ecologist who is here to testify about the impact of freshwater flow on the ecology of the Apalachicola Bay.
Your Honor -- sorry. I jumped the gun.
THE CLERK: Please raise your right hand.
Do you solemnly swear that the testimony you shall give in the cause now in hearing shall be the truth, the whole truth, and nothing but the truth, so help you God?
THE WITNESS: I do.
THE CLERK: Please be seated.
Pull yourself right up to the microphone and please state your name and spell your last name.
THE WITNESS: My name is Patricia Marguerite Glibert, P A T R I C I A, M A R G U E R I T E, G L I B E R T.

1823

DIRECT EXAMINATION
BY MS. WINE:
Q. Good afternoon, Dr. Glibert.
A. Good afternoon.
MS. WINE: Your Honor, may I approach the witness to hand her her prefiled testimony?
SPECIAL MASTER LANCASTER: Please.
BY MS. WINE:
Q. Dr. Glibert, I have handed you your prefiled testimony in this case. Do you recognize that document?
A. I do.
Q. And do you adopt it as your testimony in this case?
A. I do.
Q. Thank you.
MS. DeSANTIS: Good afternoon, your Honor.
SPECIAL MASTER LANCASTER: Good afternoon.
CROSS-EXAMINATION
BY MS. DeSANTIS:
Q. Good afternoon, Dr. Glibert. We have met before.
A. Good afternoon.

1824

MS. DeSANTIS: We're going to distribute the document binders for the examination, if that's acceptable to the Court.
BY MS. DeSANTIS:
Q. Dr. Glibert, are you ready to proceed?
A. Yes, I am.
Q. Dr. Glibert, you have not done any analysis that would permit you to identify minimal flows into Apalachicola Bay that would be required for the ecosystem in the bay not to be in peril. Correct?
A. That's correct.
Q. And you have not identified minimal flows because of the complexity of the interaction of flows and the broader ecology of the bay. Correct?
A. That's correct. I identified a number of relationships between flow and water quality parameters and the composition of the lower food web; but I was not identified -- I did not identify minimal flows.
Q. All right. You have not identified a numerical value for minimal flows that would be required for the bay not to be in peril. Correct?
A. However -- yes, that's correct. However --
Q. We'll talk about your other work as we move

1825

forward.
A. Sure.
Q. And I would like for the Court -- in order for the Court to more readily understand this cross-examination, Dr. Glibert, I do want to go over a brief background of the work that you were asked to do and the work that you did for this matter.
A. Sure.
Q. Your task in this case was to look at changes in the Apalachicola Bay food web. Correct?
A. My task in this case was to examine the relationships between flows and the broader ecology focusing on the water quality parameters and the organisms that comprise the lower food web.
Q. And you were asked to look at the Apalachicola Bay estuary particularly from the perspective of the lower food web; is that correct?
A. That's correct.
MS. DeSANTIS: If I may, your Honor, I would like to publish a demonstrative that might assist the Court in understanding the food web of the bay. Is that acceptable?
SPECIAL MASTER LANCASTER: Sure.
MS. DeSANTIS: Please, let's publish

1826

demonstrative 1 on the screen.
BY MS. DeSANTIS:
Q. Now, Dr. Glibert, would you agree --
MS. WINE: Counsel, do you have copies of the demonstrative?
MS. DeSANTIS: I don't know that we brought -- this is it for demonstrative 1. I don't think that we brought hard copies.
BY MS. DeSANTIS:
Q. Dr. Glibert, would you agree that demonstrative 1 shows the very basic structure of a food web in areas such as Apalachicola Bay?
A. It's probably a minimalistic representation of a food web in an estuary. It shows that the base of the food web is comprised of the primary producers, the phytoplankton, the algae, and the SAV, which we should define as the submersed aquatic vegetation, the bay grasses. They are -- they form the base of the food web on which the zooplankton, oysters, fish, shellfish ultimately depend.
Q. And that's all we're trying to do here, Dr. Glibert, is show something very basic to assist the Court as we talk about SAV, phytoplankton, zooplankton, and the upper food

1827

web.
A. Sure.
Q. Is that fair?
A. Sure.
Q. Now, phytoplankton or algae are at the base of food web. Correct?
A. Phytoplankton are the microscopic algae that float in the water. And they are the primary producers; that is, they grow based on light photosynthesis. They're the microscopic plants. And, ultimately, it's their production that forms all of the food or virtually all of the food that supports the upper levels.
Q. And phytoplankton and algae are terms that can be used interchangeably. Correct?
A. For this purpose, yes. There are some technical differences, but for this purpose we can use those terms interchangeably.
Q. So for this purpose today, we can talk about either phytoplankton or algae as being the base of the food web --
A. Right.
Q. -- interchangeably. Correct?
A. Right. There are some algae that are not phytoplankton.

1828

Q. But for today --
A. Yes.
Q. -- phytoplankton, algae, interchangeable terms. Correct?
A. Sure.
Q. And SAV, which you have said is submerged aquatic vegetation, is also at the base of the food web. Correct?
A. Yes, because it is a plant. And it is a plant that grows underwater. It's a grass. And there are many species of these SAV that grow underwater. And because they are plants, they are grazed by organisms that eat that plant material. And they serve as structure and habitat for many other organisms.
Q. All right. So SAV at the base of the food web provides food for some organisms. Correct?
A. Absolutely.
Q. And SAV at the base of the food web also provides habitat for some organisms?
A. Absolutely.
Q. All right. Then if we look at demonstrative 1, you see zooplankton in the middle of the paper. Correct?
A. Yes.

1829

Q. All right. And these are tiny microscopic animals in the middle of the food web. Correct?
A. Yes. And there are many different types of species that are zooplankton.
Q. And at the top of the food web, you will see that we have fish and shellfish. Correct?
A. Yes.
Q. And you have actually called fish, shellfish, upper level of the food web higher trophic levels of the food web. Correct?
A. Yes.
Q. All right. Fish and shellfish eat zooplankton. Correct?
A. It certainly depends on the fish species because many fish eat other fish, so not all fish eat zooplankton.
Q. All right. But some fish eat zooplankton. Correct?
A. Some fish eat zooplankton.
Q. And some shellfish eat zooplankton?
A. And some shellfish depend on many other food sources as well.
Q. And some fish also eat algae. Correct?
A. Some eat algae.
Q. And that's why we have shown an arrow from algae

1830

up to fish. Right?
A. Yes.
Q. All right. And some shellfish also eat algae. Right?
And that's, again, what we have shown, an arrow going up to the upper level. Correct?
A. Yes.
Q. All right. In this matter, you maintain that reduced freshwater flow into the Apalachicola Bay has impacted the base of the food web. Right?
A. Yes.
Q. And you have documented a change in the composition of algae in low flow years. Correct?
A. I have documented a compositional change, as have others who have also investigated the same data that I have.
Q. And so you're maintaining that low flows have affected the mix or the composition of algae at the base the food web. Right?
A. The change in flow affects the composition of the base of the food web because of the change in salinity and the change in delivery of the important nutrients on which these algae grow.
Q. And you maintain that this change in algae at the base of the food web has affected higher levels

1831

of the food web. Right?
A. Indeed, because changes in the various species of the algae affect upper trophic levels for a number of reasons.
Q. And you maintain, for example, that changes in algae at the base of the food web have affected zooplankton. Right?
A. Different species of zooplankton are affected by their food source. And as the composition of the very base of the food web changes, those species that graze on the algae or phytoplankton change, different types of zooplankton may be favored or disfavored.
Q. And you actually maintain that these changes at the base of the food web have ramifications all the way up the food web to the top, fish; right?
A. This is basic estuarine science, yes.
Q. All right. Now, before we move up the food web, I want the Court to understand the context for your conclusions that reduced flow causes changes at the base of the food web. You attribute these changes in algae at the base of the food web to Georgia's upstream consumptive use. Right?
A. I attribute the changes at the base of the food web to changes in the fundamental water quality

1832

changes that occur that are associated with changes in flow. And I have used various remedy scenarios to determine how much of that flow differential is due to upstream consumption.
Q. But you're blaming Georgia for the changes in flow that are changing the base of the web food. Right?
A. I have used various scenarios to identify the contribution of upstream consumption to the changes that we see in flow and, therefore, the effects that that has on water quality.
Q. But you, yourself, then, Dr. Glibert, are not directly attributing reduced flow to consumption by Georgia; am I right?
A. The various scenarios that I have examined do, indeed, show that there is a significant percentage of flow reduction that is attributable to Georgia that in turn has impacts on the water quality that in turn has impacts on the phytoplankton community.
Q. It's true, isn't it, doctor, that there are factors other than Georgia's consumptive use that can affect flow into the bay?
A. Yes.
Q. And precipitation influences flow into the bay.

1833

Correct?
A. Yes.
Q. Meteorological conditions like storms or hurricanes can affect flow into the bay. Correct?
A. Yes.
Q. And drought can influence flow into Apalachicola Bay. Right?
A. Yes. And it is during those drought periods when upstream consumption exacerbates the low flow conditions in the bay.
Q. And, doctor, you didn't examine whether operations by the Army Corps of Engineers affects flow into the bay; did you?
A. No, I did not.
Q. Doctor, I would like to talk about zooplankton, again, on demonstrative 1 in the middle of the food web. Zooplankton, as we discussed, some types of zooplankton feed on algae. Right?
A. Yes.
Q. And you would agree that grazers like zooplankton can eat different kinds of algae. Right?
A. There are food preferences by different types of zooplankton. So not all zooplankton eat all algae.

1834

Q. You would agree that even when there are changes in the types of algae present at the base of the food web, the integrity of the food web can still be maintained. Right?
A. I don't understand your question.
Q. Even when there are changes at the base of the food web in terms of the composition or the mix of algae, a food web still exists in the bay. Correct?
A. There can be a substantially changed food web, which can, indeed, be harmed to the species that we are concerned about.
Q. But a food web still exists. Correct?
A. There has been no opinion expressed here that the bay becomes sterile.
Q. All right. For the purposes of your testimony here today, you're not testifying that there isn't a food web in Apalachicola Bay. Right?
A. The food web that emerges under low flow conditions is a food web that is consistent with the food web that is more like the Gulf of Mexico as opposed to the estuarine food web that has classically maintained the productivity in Apalachicola Bay.
Q. But there is a food web in the bay. Correct?

1835

A. Again --
Q. There is a food web in the bay?
A. Again, the bay does not go sterile.
Q. All right. You, yourself, have not assessed whether or not any changes in the algae community have affected zooplankton in the bay. Correct?
A. That's not correct.
Q. Doctor, you gave a deposition in this case. Correct?
A. Uh-huh.
Q. And in your deposition you were under oath. Correct?
A. Yes.
Q. And you told the truth. Correct?
A. Yes.
Q. All right. I would like to refer you and the Court, please, to your deposition transcript, which is tab 3 in your binder, page 46, line 19, to page 47, line 5.
MS. DeSANTIS: And, Mr. Smith, will you queue up clip 8 for us, please.
(Whereupon the video was played.)
BY MS. DeSANTIS:
Q. Did you give that testimony at your deposition, doctor?

1836

A. I did. However, the question you just asked me about any zooplankton is different from the question that you asked me during my deposition. And we spoke extensively in my deposition about microzooplankton grazers, which at the time of my deposition I used the term mixotrophs, which are the kind of zooplankton that we call the Venus flytraps of the microbial world. They can be the microzooplankton that can be plants at some points in time, but they can also eat other organisms. We spoke extensively about that during my deposition.
Q. Doctor, the data on zooplankton in Apalachicola Bay, as you testified in that deposition clip, is very minimal. Correct?
A. We were talking in that clip -- specifically in the lines just above we were talking about the work on acartia tonsa, which is a macrozooplankton species. There are data on acartia tonsa. However, the data that are available on acartia tonsa are only available as syntheses. We do not have access to raw data on acartia tonsa. This particular clip was about acartia tonsa.
And your question earlier was about did I do

1837

anything on any zooplankton. So I do believe that analyses on microzooplankton was part of a discussion that we had in my deposition.
Q. Doctor, let's approach it this way. You have no direct evidence that the zooplankton community in Apalachicola Bay has changed; do you?
A. I do have evidence that the microzooplankton community has changed.
Q. Doctor, again, in your deposition in this case you were under oath. Correct?
A. Yes.
Q. And you told the truth. Correct?
A. Yes.
Q. And I would like to refer you, again, to tab 3, your deposition transcript.
A. Yes.
Q. Page 53, line 19, to page 54, line 5.
MS. DeSANTIS: And I would like to ask Mr. Smith to queue up clip 11, please.
(Whereupon the video was played.)
BY MS. DeSANTIS:
Q. And were you asked that question, and did you give that answer in your deposition?
A. Yes. And, again, in the deposition in that conversation we were talking about acartia tonsa.

1838

And that's different than the conversations we had about microzooplankton.

Q. With respect to oysters, oysters, like zooplankton, are a type of grazer. Right?

A. Yes. They eat food.

Q. And you are not an oyster biologist, are you, doctor?

A. I'm not an oyster biologist; that's correct.

Q. And you're not an expert on stressors that affect the oyster population. Correct?

A. I have published a number of papers on stressors to oysters, particularly harmful algal bloom species.

Q. But back to my question, you're not an expert on stressors that affect oyster populations. Correct?

A. I am an expert in the particular area of harmful algal bloom stressors on oysters.

Q. Are you saying you are an expert on stressors that affect oyster populations?

A. I'm not an expert in all stressors of oysters. But I have considerable expertise in stressors of harmful algae on oysters.

Q. When you considered changes in the upper levels of the food web, you primarily considered

1839

oysters. Right?

A. I primarily considered oysters. However, I used general principles to understand that the other components of the upper food web would also respond --

Q. And you --

A. -- to changes.

Q. -- used general principles to link changes at the base of the food web to changes at the upper levels of the food web. Correct?

A. That's correct.

Q. All right. And we'll go into those general principles later, doctor.

A. Sure.

Q. For now, I want to focus on oysters for a minute.

A. Sure.

Q. You would agree that the specific relationship between low flow, any decline in oysters, and algae is not well documented for Apalachicola Bay. Right?

A. I would agree it's not well documented for Apalachicola Bay.

Q. You have not actually sampled or experimented on any oysters that you have procured from Apalachicola Bay to determine whether or not

1840

these oysters are eating a certain kind of algae. Right?

A. That is correct. However, it's the exact same oyster species that I have done considerable experiments with.

Q. But my question was you haven't actually taken oysters from the bay and conducted any experiments on them to see what they're eating. Right?

A. That's correct.

Q. All right. Now, you have used before, doctor, when we have met, the term in situ. Correct?

A. Yes.

Q. All right. And that means on site. Correct?

A. Right.

Q. Yes?

A. Yes.

Q. All right. So, for example, in situ sampling with respect to the Apalachicola Bay would refer to sampling done at the bay as opposed to off site. Right?

A. That's correct.

Q. All right. And you actually have no in situ data that oysters in Apalachicola Bay were impacted by impaired food availability. Correct?

1841

A. There's considerable in situ data collected by the broader monitoring programs ongoing in Apalachicola Bay. And it is that in situ data from phytoplankton and oysters that I related.

Q. You do not have any in situ data using experiments on oysters procured from the bay that impaired food availability was affecting those oysters. Right?

A. That's correct.

Q. Did you say that is correct?

A. That's correct.

Q. All right. Now, factors besides changes in the algae community can affect oyster abundance in the bay. Right?

A. Yes.

Q. You have not examined how harvesting practices, for example, have affected the abundance of oysters in the bay?

A. That is correct.

Q. And you didn't consider how fisheries management practices have affected the abundance of oysters in the bay. Right?

A. That is correct.

Q. And you didn't consider how storm surge or hurricanes have affected the abundance of oysters

1842

in the bay. Right?
A. That is correct.
Q. And you don't know whether agencies under the Florida Department of Environmental Protection still have the authority to close areas of Apalachicola Bay to commercial harvesting; do you?
A. That's -- no, I don't.
Q. All right. And you don't know if any management actions have been taken to restore the oyster reefs after the 2011-2012 collapse of oysters; do you?
A. No.
Q. You would agree, would you not, that oysters in Apalachicola Bay have the ability to regrow and recuperate. Right?
A. If provided the right environmental conditions.
Q. But you didn't look at the ability of oysters to recover or to recuperate in the bay. Right?
That wasn't part of your work?
A. That's correct.
Q. Now, doctor, you have maintained in your written direct testimony that you expect Georgia's consumptive use of water to have an effect on fish. Right?

1843

A. The effect on fish that I expect is based on general ecological principles and my understanding of the changes in water quality and the changes at the base of the food web.
Q. And you're, again, mentioning, doctor, these ecological principles. Right?
A. That is correct.
Q. And we will get to your ecological principles in this exam. I promise you we'll get there.
For now, focusing on the fish, fish are at the upper level of the food web. Right?
A. Yes.
Q. Okay. And in your written testimony and your expert report in this matter, you maintain that changes at the base of the food web have affected the fish. Right?
A. Again, applying general understanding of how the base of the food web has repercussions throughout the entire system.
Q. All right. In your expert report, you refer to a Dr. Jenkins. Correct?
A. Yes.
Q. And your expert report indicates that Dr. Jenkins's expert report provides the detailed analysis of changes in the food web. Correct?

1844

A. Dr. Jenkins's report was one of the materials on which I relied. However, I was also familiar with the broader literature that is available on changes in the upper food web; and I also looked at that.
Q. And in your deposition, you indicated that this Dr. Jenkins, on whom you relied in part, he analyzed changes in the upper level of the food web. Right?
A. Yes, he did.
Q. You indicated that the analysis of fish is housed in Dr. Jenkins's expert report. Correct?
A. Yes.
Q. And Dr. Jenkins was one of Florida's experts in this matter. Right?
A. Yes.
Q. And he submitted an expert report, as you have acknowledged in your expert report. Right?
A. Correct.
Q. And in addition to submitting an expert report, Dr. Jenkins gave a deposition in this matter; didn't he?
A. Yes.
Q. And, in fact, in the course of your deposition, I showed you portions of Dr. Jenkins's deposition

1845

transcript?
A. Yes.
Q. You remember that?
A. Yes.
Q. In your expert report we actually counted -- I believe you mentioned Dr. Jenkins's name more than 20 times. Does that sound about right to you?
A. I don't know.
Q. All right. Sound approximately right?
A. I know I cited him.
Q. All right. And you cited him repeatedly. Right?
A. Yes. I cited him more than once --
Q. All right.
A. -- for sure.
Q. You relied on the work of Dr. Jenkins in part to link changes in the phytoplankton community that impacted higher levels of the food web. Right?
A. In a general sense. However, I also relied on the broader literature to understand. But I was focused on the changes at the lower food web.
Q. And you relied on Dr. Jenkins for your opinions on overall fish ecology. Right?
A. I relied on a number of sources for my opinions on overall fish ecology.

1846

Q. But you relied on Dr. Jenkins in part for your opinions on overall fish ecology?
A. Yes.
Q. All right. And in his deposition, Dr. Jenkins was asked about his opinions on fish ecology. And I want you to now review with me some deposition testimony from Dr. Jenkins regarding fish ecology and then ask you some questions about his testimony regarding fish ecology.
MS. DeSANTIS: And we actually have Dr. Jenkins's deposition transcript ready to hand up to the Court, to Dr. Glibert, and to distribute.
You can go ahead and --
BY MS. DeSANTIS:
Q. All right. Dr. Glibert, I would like to ask you and ask the Court to please turn to Dr. Jenkins's transcript beginning at page 65, line 18.
MS. DeSANTIS: And I'm going to be asking Mr. Smith to queue up the first clip, which runs from 65, line 18, to page 70, line 21. And we'll just play that on the screen for the Court.
(Whereupon the video was played.)
BY MS. DeSANTIS:

1847

Q. Dr. Glibert, Dr. Jenkins in that testimony talks about the nursery function of east bay. Correct?
A. He does.
Q. And you, yourself, in your testimony have also talked about the function of east bay. Correct?
A. I do. As does much of the literature.
Q. And Dr. Jenkins, in this testimony clip, identifies the blue crab as a species that may be affected in the east bay. Correct?
A. He does.
Q. He does not identify any fish that have been affected in this clip by reduced salinity in the bay. Correct?
A. He does not identify fish in that clip.
I think it's worth, just for the purpose of the Court identifying east bay as that upper northern freshwater area in the bay because it hasn't been identified here yet.
Q. Yes. And I believe the Court is familiar with the region of east bay from some maps that have previously been used in court, including with Dr. Greenblatt today.
MS. DeSANTIS: Is that right, your Honor?
SPECIAL MASTER LANCASTER: That's

1848

correct.
A. I want to just make sure that --
Q. And --
A. But the nursery function --
Q. We'll talk about the nursery function in your view. But I just wanted to review that clip with you.
Now, we have one much shorter clip that I would like to show, so as not to take too much time from the Court, and then I would like to ask you a couple of questions --
A. Sure.
Q. -- about that clip as well.
If I could refer you and the Court, please, to page 90, line 9 of Dr. Jenkins's deposition transcript to page 92, line 1.
MS. DeSANTIS: And ask Mr. Smith to please queue that up for us.
(Whereupon the video was played.)
BY MS. DeSANTIS:
Q. Now, Dr. Glibert, in this particular video clip, Dr. Jenkins used the word change. Correct?
A. He did.
Q. He did not characterize changes in fish composition or abundance as harm. Correct?

1849

A. He did not.
Q. And it was outside of the scope of your work to analyze the fish data. Correct?
A. That's right.
Q. And it was outside of the scope of your work to examine individual fish species. Correct?
A. That's correct. I did not take that narrow perspective.
Q. And you have not fully analyzed, independent from Dr. Jenkins, the abundance of any fish species in Apalachicola Bay. Right?
A. Well, I'm aware of literature reports that relate abundance of certain types of species to flow. And so I -- I'm familiar with that literature.
Q. You don't have any data or information specific to Apalachicola Bay that you have analyzed indicating that there was a change in fish abundance in the bay. Right?
A. Not that I have analyzed, but that I have read and I'm familiar with.
Q. And you have not analyzed that data. Right?
That was outside the scope of your work?
A. Right. I'm familiar with it through the literature.
Q. Right. You have not explored the relationship

1850

between changes in the algae community and impact on individual fish species. Right?

A. I did not take that narrow perspective other than the work that we have talked about and would likely talk about with respect to oysters.

Q. And so you have not analyzed the impact of changes in the algae community on blue crab, for example; have you?

A. I have not.

Q. And you have not analyzed the impact of changes in the algae community on white shrimp. Right?

A. That's correct.

Q. And you have not analyzed the impact of any changes in the algae community on any particular species of fish in the bay. Right?

A. That's correct. Although I'm aware of some of the literature on that.

Q. And you have not evaluated yourself any in situ data from Apalachicola Bay showing harm to fish?

A. I'm familiar with the analyses of Dr. Livingston, for example, which is based on in situ data. But it's not data that I myself examined.

Q. All right. And you have no information or data that food availability for white shrimp is impaired in Apalachicola Bay. Right?

1851

A. However, Dr. Livingston shows that under low flow conditions, white shrimp can -- white shrimp populations can decline by upwards of 90 percent.

Q. Doctor, again, in this case you gave a deposition. Correct?

A. Uh-huh.

Q. And you told the truth?

A. Yes.

Q. You were under oath. Correct?

A. Yes.

Q. All right. I would like to refer you and the Court to your deposition transcript page 73, line 13, to page 73, line 18.

A. Uh-huh.

Q. And ask Mr. -- and this is tab 3 in the binder.

A. Uh-huh.

MS. DeSANTIS: And ask Mr. Smith please to play clip 25.

(Whereupon the video was played.)

BY MS. DeSANTIS:

Q. Were you asked that question, and did you give that answer in deposition?

A. Yes, I did.

And the very next question goes on to say other than literature, I did not investigate that directly.

1852

Q. All right. With respect to salinity preference ranges for species in the upper food web in Apalachicola Bay, you didn't do any analysis on that; did you?

A. That's correct.

Q. Okay. You don't have data or information indicating that any fish species in Apalachicola Bay has been negatively impacted by impaired food availability. Right?

A. I did not investigate fish species directly.

Q. You have identified east bay as a nursery region for species in the bay. Correct?

A. I have, and many others have also identified it as such, yes.

Q. But you did not do any assessment of the species that use east bay as a nursery. Correct?

A. That's well documented in the literature, so I didn't have to.

Q. You, yourself, didn't do any --

A. No.

Q. -- independent analysis of which species use east bay as a nursery. Correct?

A. Other than being familiar with the literature, correct.

1853

Q. You were focused primarily on the food web. Right?

A. Particularly the lower food web, yes, and relation to water quality.

Q. Okay. Now, doctor, you referred a couple of times in your testimony here in court to principles that you have used to link changes at the base of the food web to changes in the upper food web. Right?

A. That is correct.

Q. All right. And, doctor, I would like to list these principles out for the Court.

I promised you we would get here. All right?

A. Sure.

Q. So, first, you relied on basic ecology. Correct?

Let's just make a list of these.

Is that right; you relied on basic ecology?

A. Sure.

Q. You also relied on basic nutrition. Right?

A. With respect to aquatic biology, yes. Uh-huh.

Q. You relied on trophodynamics. Correct?

A. Yes. Which is the study of interactions of species and how they relate in and among the food web.

Q. You relied on ecological stoichiometry. Correct?

1854

A. Yes. Which is -- just so I can explain it, it's the study of how nutrient content in different supply levels or in different organisms affect the nutrition of the next level.
Q. And you relied on biogeochemistry. Correct?
A. Yes. Which is the cycling and fluxes of all of the elements in the recycling processes within an aquatic system.
Q. And you relied on bio-oceanography. Correct?
A. Biological oceanography.
Q. Biological oceanography. Well, then we have mistyped it.
Somebody fixed that.
Okay. Biological oceanography. Correct?
A. Yes. The study of all the aquatic organisms in a marine environment, yes.
Q. All right. And you relied on estuarine dynamics. Correct?
A. True.
Q. And these are the principles on which you relied, based your opinion that changes at the base of the food web can have effect on the upper food web. Right?
A. Well, these are some of the fundamental concepts -- the understanding of some of the

1855

fundamental processes and dynamics that go on within an estuary and within organisms that live within that estuary.
Q. All right. Now, doctor -- and we're almost at the time where I may suggest to the Court we take a break; but I have just a couple more questions before it's a good time if the Court would like to break.
You did not examine the historical hydrological regime; did you?
A. I did not carry out a long-term hydrologic analysis; that is correct.
Q. And the ecology of an estuary depends on the historical hydrological regime under which it has evolved. Correct?
A. Well, the historic hydrological regime will determine the type of an estuary that emerges. So whether it's a river-dominated estuary with a high flow of river input or a -- at the other extreme, a coastal lagoon which does not have a lot of inflow of river sources and the water has a much longer residence time. So it's that long-term hydrological regime that sets the trajectory for what kind of estuary will ultimately emerge.

1856

Q. But you have not presented any analysis of that long-term --
A. That's right.
Q. -- hydrological regime?
A. That's correct.
Q. But you recognize the importance of it. Correct?
A. That's correct.
Q. And you didn't examine any meteorological records concerning Apalachicola River and Bay. Correct?
A. No. Although I did look at some of the precipitation data, but not in a long-term analysis.
Q. All right. So you didn't do a long-term analysis of any meteorological records concerning the Apalachicola River and Bay. Right?
A. Right.
Q. And you didn't examine any sediment or geological records pertaining to the hydrological history of the river and the bay. Right?
A. That's correct.
Q. That is correct?
A. That's correct.
Q. And you didn't do any or examine any records of tree ring analysis in the Apalachicola River and Bay. Correct?

1857

A. That's correct.
Q. And any information regarding historical precipitation patterns in the Apalachicola River and Bay was outside the scope of what you looked at here. Right?
A. Right. Although I'm aware that that has been looked at and published, for example, by Dr. Livingston. And I reviewed some of that work.
Q. And decreases in precipitation can affect the length of low flow periods. Right?
A. Yes.
Q. And decreases in precipitation can affect the severity of low flow periods. Right?
A. Yes.
Q. All right.
MS. DeSANTIS: Your Honor, if you would like to break, this is actually an appropriate time to break in the course of my examination; but it is certainly up to the Court.
SPECIAL MASTER LANCASTER: Thank you.
While I think of it, counsel, the first demonstrative screen thing you showed that had all the arrows --
MS. DeSANTIS: The food web?

1858

SPECIAL MASTER LANCASTER: Yes. Would you tomorrow bring us hard copies of that?

MS. DeSANTIS: We certainly will, your Honor. We may even be able to get those this afternoon.

SPECIAL MASTER LANCASTER: Thank you. We'll be in recess.

(Time Noted: 2:32 p.m.)

(Recess Called)

(Time Noted: 2:42 p.m.)

SPECIAL MASTER LANCASTER: Counsel, for your planning purposes, I have an unexpected conflict; and we will recess at 4:00 today.

BY MS. DeSANTIS:

Q. Dr. Glibert, in your expert report submitted in this matter, you evaluated some different flow conditions using scenarios that were provided to you by Dr. Hornberger. Am I right?

A. That is correct.

Q. And Dr. Hornberger is another one of Florida's experts. Correct?

A. Yes.

Q. And Dr. Hornberger gave those scenarios to Dr. Greenblatt, and she translated them into flows. Right?

1859

A. She actually -- I think I perhaps may have misspoken in my deposition. She simply translated those into an Excel spread sheet which allowed me to use them in my Excel spread sheets. So they were not her scenarios; rather, she was the pass-through in order to get it in the format that I could use.

Q. All right. And you estimated how different water quality parameters in the bay would change under these different scenarios. Right?

A. Yes.

Q. And in one of these scenarios you compare observed flows at the Sumatra Gage to Dr. Hornberger and Dr. Greenblatt's remedy scenario; is that right?

A. Dr. Hornberger's scenario, yes.

Q. That's Dr. Hornberger's remedy scenario. Right?

So you compared observed flows at Sumatra Gage to Dr. Hornberger's remedy scenario. Right?

A. Yes.

Q. And is that --

A. Well, I took those flows and compared those flows to the parameters -- water quality parameters, biological parameters that I was interested in. I didn't specifically manipulate the flow data

1860

independent of the comparison of the flow data to those water quality parameters.

Q. All right. And the remedy scenario that you used as part of your analysis, you described that in your written direct testimony as a very conservative scenario with reduced Georgia consumption of water. Right?

A. I do.

Q. And you don't explain the basis in your written direct testimony for characterizing that remedy scenario as very conservative. Do you?

A. I do not.

Q. And you're not a hydrologist. Correct?

A. I am not.

Q. And you're not an economist. Correct?

A. No.

Q. And it's not within the scope of your work to know that Dr. Hornberger's remedy scenario included a 50 percent reduction in agricultural water use in the Georgia portion of the ACF Basin. Right?

A. For the purpose of my report as a biologist, I'm interested in the flows that are entering the bay. And I understand that there are a series of scenarios and there have been scenarios that have

1861

been developed since my original report, and this was one of the more conservative ones. I understand there are a range of other scenarios that have been developed.

Q. But you, yourself, don't have the basis to characterize that remedy scenario as very conservative. Right?

A. Other than what I'm aware of that there are some scenarios that do allow for more water flow for the same investment.

Q. And you have not done any --

A. But I have not done that analysis.

Q. You have not done any analysis with respect to any new scenarios that Florida has proposed for remedy. Correct?

A. No. No. The scenarios in my testimony are the same scenarios used in my report.

Q. All right. And you -- you used Dr. Hornberger's remedy scenario, which included a 50 percent reduction in agricultural water use in the Georgia portion of the ACF Basin. Right?

A. I will leave the assumption of his scenarios for him to explain.

Q. So you didn't know that Dr. Hornberger's remedy scenario involved a 50 percent cut in

1862

agricultural use in water in Georgia?
MS. WINE: Objection. I'm just going to note, again, counsel is mischaracterizing that report.
BY MS. DeSANTIS:
Q. Did you know that Dr. Hornberger's remedy scenario involved a 50 percent cut in agricultural water use in Georgia?
A. I know that there were a number of assumptions that go into these scenarios, and I'll leave it to him to describe his assumptions.
Q. So you didn't actually examine the assumptions that went into Dr. Hornberger's remedy scenario. Right?
A. That's right.
Q. All right. You simply used what he provided to you; is that right?
A. That's correct.
Q. All right. It's true, is it not, Dr. Glibert, that estuaries are dynamic systems?
A. Estuaries are dynamic systems. And the extent to which they are dynamic depends on what type of estuary they may be.
Q. And you discussed in your written direct testimony -- I'm sorry, in your expert report, a

1863

tipping point. Correct?
A. Yes.
Q. And you defined tipping point as a state in which an ecological threshold has been passed and the system's resilience is exceeded, and a new state becomes established. Correct?
A. Correct.
Q. And in your expert -- in your expert report you maintain that a tipping point can be reached during low flow years. Correct?
A. That's correct.
Q. And you also maintain that during the years when there were not low flows, the ecology of the bay did not reach a tipping point. Correct?
A. Historically when low flows have occurred, the system has recovered.
Q. And, in fact, in high flow years, the estuary functions as a highly productive ecosystem. Correct?
A. Classically, that is how it has performed.
Q. Pardon?
A. Classically, that is how it has performed, yes.
Q. And classically, that is how the Apalachicola Bay has performed. Correct?
A. Yes. It is a productive estuary and has been

1864

historically.
Q. And you maintain that a tipping point was reached in 2011 and 2012 based on change at the base of the food web. Correct?
A. Correct.
Q. And 2011 and 2012 were low flow years. Right?
A. Yes.
Q. And you didn't identify any period prior to 2011 and 2012 when the Apalachicola Bay estuary did not recover from stresses at the base of the food web. Correct?
A. That is correct.
Q. And the ecosystem in the bay does have the ability to rebound once favorable conditions are restored. Correct?
A. It depends on the extent to which the unfavorable conditions have been prolonged and the extent of harm to the system. The greater the extent of harm, the longer it may take and the more difficult it may be for the system to ultimately return to its original state.
Q. But, again, doctor, you have not identified any period prior to 2011 and 2012 when the estuary in Apalachicola Bay has not recovered from stresses at the bay of the food web. Right?

1865

A. That's right. 2011 and 2012 were the driest years.
Q. Right. You haven't identified any period when the Apalachicola Bay hasn't been able to recover from stresses at the base of food web. Right?
A. That's correct.
Q. And you are not going to provide a specific flow number that needs to be attained -- a specific number -- so that the ecology of the bay is not in peril. Right?
A. That's correct.
MS. DeSANTIS: I have no more questions.
SPECIAL MASTER LANCASTER: Thank you.
REDIRECT EXAMINATION
BY MS. WINE:
Q. Good afternoon, Dr. Glibert.
A. Good afternoon.
Q. Dr. Glibert, the bulk of your testimony and opinions relate to the lower food web; is that correct?
A. That is correct.
Q. And can impacts from low flow on the lower food web constitute harm to the bay?
A. Absolutely. It can constitute harm to the bay. And it can constitute harm to the bay in a number

1866

of very specific ways. First, it can change the abundance of these primary producers. It can change the species composition of these primary producers. The harm that we specifically saw was a change in the size of these primary producers and in the species composition, leading to some that are less nutritious than others.

Q. And you did an analysis looking at the relationship between freshwater flow and water quality; is that correct?

A. That's correct.

Q. And what did that analysis show?

A. The analysis showed that reductions in freshwater flow changed water quality in a number of substantial ways, which in turn altered the quantity and quality of nutrients. They are the nitrogen and phosphorus, the fertilizers, as it were, that support the base of the food web and changed other important water quality parameters that have ultimate harm for species.

Q. And how did the relationships that you found between low flow and these parameters that you just mentioned relate back to your overall opinions regarding Apalachicola Bay?

A. The reductions in freshwater flow, particularly

1867

when these low flow conditions -- natural low flow conditions are exacerbated by upstream extractions by Georgia, lead to impaired water quality and an impaired lower food web, which in turn has repercussions for the upper food web.

Q. Now, you talk about productivity in your prefiled direct testimony. Do you recall that?

A. Yes, I do.

Q. And what do you mean by productivity?

A. Productivity is a term that we use to mean the sum total of the production of all the organisms in a system, in an estuary.

Q. And is productivity the same throughout a bay like Apalachicola Bay?

A. In a dynamic system such as an estuary, there are indeed going to be regions of the bay which are going to have different productivity, different species, different water quality. And it's going to be very different from the northern bay region, east bay region, to the lower bay.

So, yes, indeed, there are many different zones of the bay that have different types of productivity.

Q. And what are the differences you see in productivity as between the east bay and other

1868

areas of Apalachicola Bay?

A. As we talked earlier, that east bay region is considered the primary nursery area for juvenile fish, for white shrimp, for crabs. And as such, it is considered a highly productive area. And it is most impacted when freshwater flows are reduced. And the reduction in the nursery function of that east bay area has impacts that have repercussions for years to come because the life cycle of many of these organisms is over the course of many years.

Q. How do changes in salinity impact the ecology of Apalachicola Bay?

A. As freshwater flow decreases, salinity increases because that salt intrudes from the Gulf of Mexico; and, in terms of productivity for the estuary, the organisms that depend primarily on that freshwater zone, their habitat shrinks. And they begin to have increased stressors from exposure to salt that they would not normally experience.

Q. And is the impact of salinity that you just noted particularly important in the east bay area of Apalachicola Bay?

A. Because east bay is the fresher region, and under

1869

normal conditions its salinity will range from zero to about 4 or 5 parts per thousand -- parts of salt per parts of water -- the Gulf of Mexico has a salinity of 30. The organisms, for example, some of the submerged grasses that live in that east bay area and form the nursery function for juvenile fish, they can tolerate salinities of only about 5, 6, or 7. In general estuarine science, we know that these freshwater organisms begin to experience stress when salinity reaches about 7.

So any intrusion of salinity imposes stress on these species, and this causes metabolic stress for these organisms. And many of them are not able to live in that east bay area any longer.

Q. Georgia's counsel asked you about salinity changes with respect to Dr. Greenblatt's modeling --

A. Yes.

Q. -- of the remedy scenario. Do you recall that?

A. Yes.

Q. And in your opinion, what impact would those salinity changes have on the health of the Apalachicola Bay ecosystem if the remedy scenario

1870

were imposed?
A. In east bay, the remedy scenario would be particularly effective because when the normal salinity is only in a range of zero to about 5 parts per thousand, an improvement in salinity of just a couple of parts per thousand may reduce that salt stress by 20, 30 percent. Moreover, the improvement in water flow can lead to improvement in other water quality parameters such as dissolved oxygen stress or temperature stress. So there are many improvements if we impose the remedy scenario.
Q. And you just mentioned dissolved oxygen. Could you explain to the Court what dissolved oxygen is and its importance to your opinions.
A. Dissolved oxygen is very -- is a very important measure of water quality. Just as you have dissolved oxygen in your blood, there is dissolved oxygen in seawater. And organisms need this for respiration. And under conditions of low flow when the phytoplankton community accumulates because the residence time becomes very long and the organisms just stay in place, many of them are not grazed by the zooplankton we were just talking about. And they fall to the

1871

bottom. They die and they decay. And in the rotting of that material, dissolved oxygen is consumed. When dissolved oxygen is no longer available, all organisms suffer stress.
Q. And your analysis and work in this case found a correlation between dissolved oxygen and low flow, as you just described. Correct?
A. That is correct.
Q. It was mentioned -- I'm sorry?
A. I should say there are significantly more episodes of low dissolved oxygen under low flow.
Q. It was mentioned in your testimony -- there was discussion of harmful algae blooms. Do you recall that?
A. Yes.
Q. And what are harmful algae blooms?
A. Harmful algae are those algae that can intoxicate seafood with toxins. For example, in Maine when mussel beds are closed, they're closed because of the toxin that is ingested by the mussels from the local harmful algal bloom species here in Maine. They can also cause fish kills. They cause many disruptions to ecosystems. And they're particularly harmful to some of the very fragile life stages of fish and shellfish.

1872

Q. And did your work in this case find a correlation between harmful algae blooms and low flow?
A. There are quite a number of species of harmful algae in Apalachicola Bay. Many of the species that are now found more frequently are species that are associated with higher salinity. So as salinity increases with low flow, the risk of these harmful algal blooms occurring increases.
Q. And what does that mean in particular for an estuary like Apalachicola Bay?
A. Well, when they're -- Apalachicola Bay has a number of these species. The presence of these species has a number of specific impacts that may relate to oysters, one of which is there is a specific type of harmful algal bloom species that when oysters are in the presence of this species, they don't spawn. They don't reproduce. There is another harmful algal bloom species that causes harm to the larvae. And the delicate membranes of the larvae are attacked, and the larvae do not survive.
So recruitment failure can occur when reproduction of oysters occurs in the presence of these harmful algal bloom species.
Q. Now, counsel asked you about the relationship

1873

between low flows and algae and oysters. Do you recall that?
A. Yes.
Q. And she noted that there's not a lot of evidence -- well-documented evidence from Apalachicola Bay itself regarding this relationship. Correct?
A. I have documented that relationship.
Q. Yes. And she was saying that you had not done any in situ work in Apalachicola Bay. Correct?
A. The -- I have not done experiments in Apalachicola Bay; but the data comes from Apalachicola Bay.
Q. Right. And I wanted to clarify why you're confident in your opinion about this relationship between low flows and algae and oysters based on the work that you have done.
A. I have done a considerable amount of experiments on algae and oysters. I also worked in a laboratory where on the floor below we housed the largest oyster hatchery in the East Coast. We produced a billion spat on shell every year for Chesapeake restoration. So we have considerable understanding of the eastern oyster, the same oyster, and its nutritional needs, especially at

1874

these early life stages.

And, therefore, understanding that there has been a shift in the phytoplankton community composition over time -- and that data comes from a number of Ph.D. theses -- and analyses correlations with flow, we know the species composition of algae have changed. They have changed in size, so the oysters no longer can efficiently filter them. And they have changed to a phytoplankton species that do not provide the full complement of nutrition that's necessary for oysters to go through that reproductive phase in these very early days.

Q. And is there any reason to believe that the relationship between low flows and algae and then algae to oysters is different in Apalachicola Bay?

A. There's absolutely no reason to believe that there's a unique response by the eastern oyster in Apalachicola Bay. The nutritional needs of oysters have been well studied in not only our hatchery, but in hatcheries and in experiments worldwide. There's a vast literature that has reported that these oysters can feed only on certain types of food; and they can -- that they

1875

have certain nutritional needs, and they only get that from certain types of foods.

Q. And how does your opinion regarding low flows and algae and oysters relate to the opinions that Dr. Kimbro provided in this case?

A. Dr. Kimbro spoke about the increased predators that arrive under conditions of increased salinity. My opinions in no way are contradictory. My opinions add to his opinions by showing that the oysters are stressed by the predators that eat them; but they are also stressed under these low conditions by the fact that they're not getting adequate nutrition, and they are not able to reproduce at a high rate because they're not getting the right nutrition both as an adult and as young larvae. So multiple stressors both from the top and the bottom.

Q. Now, Georgia's counsel asked you some questions about your evaluation of the upper food web as well.

A. Yes.

Q. And I would like to just step back and first ask you what is the relationship between your evaluation of the lower food web and then the

1876

larger species in the upper food web of the bay?

A. The lower food web is the foundation on which the upper food web depends. I term -- the term I use is that the lower food web is the bridge to the upper food web. Dr. Livingston in his writings says the lower food web is inextricably linked to the upper food web. The upper food web depends on all of the nutrition, the amount, quantity, quality of food that is available. The -- it depends on the timing of that food. It depends on the amount. And it depends on the -- what kind of food they can eat. So there are many, many changes that occur in upper food webs when the diet that is available at the lower food web changes.

Q. In addition to reviewing the report of Dr. Jenkins, what work or analysis did you do to form your opinions regarding the linkage between your evaluation of the lower food web and the impacts on the upper food web?

A. There were several approaches that I took. First, my general understanding of principles, as we spoke earlier, of food webs of ecological stoichiometry, which is a term that refers to the nutrition at one level of the food web and how it

1877

advances to the next. I understand that different life cycles of organisms depend on different types of food at different phases of their life. And I also reviewed a considerable amount of the literature to understand that these effects do, indeed -- have, indeed, been seen by others with regard to changes and flow in the upper food web.

Q. And are these studies in literature that you reviewed consistent with the general principles of nutritional science that you have mentioned today?

A. Yes. Absolutely.

Q. In what way?

A. When we change the amount and the quality and the timing of food available, we change the success of the next generation.

MS. WINE: Your Honor, if you would, I would like to hand up a few documents that I'm going to ask the witness about.

BY MS. WINE:

Q. Dr. Glibert, I have handed you a few exhibits that we have discussed in court over the past few days. I would like to first ask you about Exhibit GX-0568, which is titled Apalachicola Bay

Oyster Situation Report. Do you have that?
A. Yes, I do.
Q. And, Dr. Glibert, are you familiar with this report?
A. Yes. This report came to my attention about a year ago.
Q. And you have reviewed it?
A. Yes.
Q. And is this report consistent with the conclusions and opinions that you have reached in this case?
A. The particular focus that I was paying attention to in this report is the section -- I don't see page numbers on this -- that refers to nutrient inputs to the bay. And the initial conclusion that they cite is, indeed, consistent with the overall principle that I was applying in this case.
Q. And apart from the overall conclusion being consistent, is the study and the analysis that they performed in this article consistent with the study and the analysis that you did?
A. The initial statement that this report provides is that the Apalachicola Bay is the major source of nutrients to the bay. It fuels the food web

that supports oyster, shrimp, fish and other marine organisms. When flows decline, so do inputs of nutrients. And this phenomenon lasts for a long period of time. The abundance of all the organisms mentioned above may decline.
I completely agree with that statement. What took me very much by surprise when I was reviewing this document is the very next sentence goes on to say, there are no continuous measurements of nutrient input to the bay.
And I was quite surprised by this because there are thousands of records of nutrients that have been measured in Apalachicola Bay for the past decade and a half on a monthly basis. They seemed completely unaware of that data. They also seemed completely unaware of the vast literature that has described nutrients to the bay.
So they then tried to carry out an analysis to look at this connection between nutrients and flows, and they resorted to a very limited dataset that was available from the Northwest Florida Water Management District conducted in the early 2000's. They extrapolate that data through a model to 2011 and 2012.

But what is quite surprising to me is that this limited dataset was from the Jim Woodruff Dam. So they had very limited data. It was from a site 100 miles away from that which was in the bay.
And they conclude that they have difficulty linking water quality to the oyster population responses. And it was simply because they failed to look at the available data. They failed to look at the right data. And they failed to make the connection, the very connections that I was able to make because I had access to all of this publicly-available data.
Q. And what is that in general terms? What is that available and right data that you looked at in doing your analysis?
A. In my analysis I primarily depended on the monitoring data from the Apalachicola National Estuarine Research Program -- we can brief it ANERR.
Apalachicola Bay is one of the best-monitored estuaries in the country. It rivals Chesapeake Bay and San Francisco Bay as the best data on water quality and long-term records. This dataset has thousands of records of each of the

water quality parameters.
In addition to that dataset, I depended on Florida Fish and Wildlife's harmful algal bloom dataset which has tens of thousands of records of phytoplankton community. I depended on a number of theses that have excellent phytoplankton identification. I depending on the ANERR data on dissolved oxygen, a dataset that has hundreds of thousands of data records. So it was quite surprising to me that in this report they were unaware of this extensive dataset.
Q. And now, if you could take the other two exhibits that I handed you. They are marked GX-789 and FX-866. They are two articles on which Bill Pine is at least one of the authors. Do you see that?
A. Yes, I see.
Q. And are you familiar with these articles?
A. Yes, I am.
Q. And have you reviewed these articles?
A. Again, these articles came to my attention last year several months after I had started my investigation here.
Q. And are these articles consistent with your findings and opinions in this matter?
A. Both of these articles draw the conclusion that

there was a reduction in recruitment that affected the oyster fishery in Apalachicola Bay. And with respect to that specific part of the conclusion, I agree, because that was the initial hypothesis based on my knowledge of the nutritional requirements of the early life stages of oysters.

What surprised me very much in reading both of these papers is that they seemed to be completely unaware of the vast literature and/or data that relates to recruitment and nutrition and the lower food web. They simply leap from the idea that there's a loss of recruitment to the idea that this relates to shelling when, in fact, they failed to realize that young oysters have a several-week period of time before they actually settle on shell. And it's that larval phase, that phase when they go from embryo to larvae, that food -- critical food is absolutely essential to the success of the larvae. They don't even make it to the -- to the spat stage if they are stressed with poor quality food. And poor quality food can come both in the food that they are taking in directly as these young larvae; poor quality food can also come from the

mothers that are stressed because the nutrition that gets into the egg is inadequate for their survival.

It just surprised me that none of these topics were in any way considered, given the fact that these are phenomena that are well known throughout the literature.

Q. Now, Dr. Glibert, in your prefiled direct testimony in paragraph 93, you state, if Georgia -- I'll wait for Mr. Walton to get there. It's paragraph 93.

You have the opinion if Georgia consumption is not curbed, the ecology and the food web of the bay will continue to see declines in productivity and will likely be harmed permanently. Why is that your opinion here?

A. It's my opinion that it will be very difficult for the system to recover if consumption is not curbed because each of the water quality parameters, whether it's salinity, dissolved oxygen, temperature, are negatively affected, each of these causes stressors to organisms. The nursery function of the east bay will not recover. Without the recovery of the east bay nursery function, the upper food web will not

recover. We know that the plankton species composition will not recover without a curb on Georgia consumption; and consequently, the system will not revert to its previously productive condition.

Q. And in your opinion, what will happen to Apalachicola Bay if there were a remedy capping Georgia's consumption?

A. It's my opinion that -- and this is based on multiple analyses in which I have a great deal of confidence, that as flows are restored, there are not only positive effects on individual water quality parameters, but they, in fact, start to create positive reinforcing feed-backs. And the system will begin to not only recover, but that recovery can be accelerated.

For example, if the stress from salinity is removed as well as the stress from low dissolved oxygen and there's a little bit better temperature regime combined with improved nutrients, we begin to re-establish the submerged aquatic vegetation that may have declined that, in turn, begins to create a positive environment for that nursery area. We begin to see oysters starting to recover because their food is of

higher quality. And so one by one we begin to see positive reinforcing feed-backs. Those oysters that become re-established will begin to filter the water, keeping the water at a higher quality. They will begin also to create their own shell, which will, again, create more substrate for the next generation.

Q. Thank you, Dr. Glibert.

SPECIAL MASTER LANCASTER: Any recross?

MS. DeSANTIS: Very brief recross, your Honor.

RECROSS-EXAMINATION

BY MS. DeSANTIS:

Q. Doctor, counsel for the State of Florida questioned you about the effect of harmful algal blooms on oysters. Right?

A. Yes.

Q. And you based your conclusions regarding the effects of harmful algal blooms on oysters on laboratory studies. Right?

A. And on literature studies.

Q. All right. And the laboratory studies do not pertain specifically to oysters procured from Apalachicola Bay. Correct?

A. They pertain to the exact same species of oyster

and the exact same species of harmful algae.
Q. Yet, the laboratories themselves were not conducted on oysters that were procured from Apalachicola Bay. Correct?
A. That is correct. But we have no reason to believe that Apalachicola Bay oysters would behave physiologically any different.
Q. Doctor, my question was simply those oysters that were experimented on were not procured from Apalachicola Bay. Correct?
A. That's correct.
Q. All right. Doctor, you have maintained that the relationship between algae and flow is complex. Right?
A. Yes.
Q. And, in fact, you have noted that the EPA has encouraged caution in any effort to establish a direct causal link between a decrease in flow and an increase in the abundance of phytoplankton. Correct?
A. Can you please repeat that.
Q. Yes. The EPA -- you have noted that the EPA has encouraged caution in any effort to establish a direct causal link between a decrease in flow and an increase in the abundance of phytoplankton.

Correct?
A. There's caution urged there because flow delivers the nutrients that support the phytoplankton, and it depends on the amount of flow and the constituents coming with that flow.
Q. But the EPA has encouraged caution in an effort to establish a direct causal link between a decrease in flow and an increase in the abundance of phytoplankton. Right?
A. Yes.
Q. Okay.
MS. DeSANTIS: I have no more questions.
SPECIAL MASTER LANCASTER: Anything?
MS. WINE: I have nothing further.
SPECIAL MASTER LANCASTER: Doctor, counsel should have told you that I'm a very simple-minded person. If they haven't, I'm about to prove it.
What is an estuarine ecologist?
THE WITNESS: Somebody who studies the ecology of estuaries.
SPECIAL MASTER LANCASTER: Okay. And what estuaries were you testifying about here?
THE WITNESS: Apalachicola Bay.

SPECIAL MASTER LANCASTER: So I should understand that Apalachicola Bay is an estuary?
THE WITNESS: Yes. An estuary is an embayment where freshwater and saltwater mix.
SPECIAL MASTER LANCASTER: Thank you for that.
You were, as I understand it, not asked to testify as to the cause of the low flows; is that correct?
THE WITNESS: That's correct.
SPECIAL MASTER LANCASTER: Counsel?
MS. WINE: Nothing further, your Honor.
MS. DeSANTIS: Nothing further, your Honor.
SPECIAL MASTER LANCASTER: Thank you.
MR. PERRY: Your Honor, we're prepared, if we can have just a couple minutes, to call another witness.
SPECIAL MASTER LANCASTER: Sure.
MR. PERRY: But we're also prepared to do so tomorrow morning.
We expect that Dr. Hornberger, our next witness, will take quite a bit of time from Georgia. So we're prepared to go either way,

now or tomorrow.
SPECIAL MASTER LANCASTER: I had planned to recess at 4:00. If this is acceptable to counsel, we'll recess now.
MR. PERRY: Yes, your Honor.
MR. PRIMIS: That's fine, your Honor.
SPECIAL MASTER LANCASTER: Let me just say one more thing. I told you that I have committed to stick to this job to the end and write a report. And then I'm going to go to my home in Nova Scotia. If you want to know the address and how to get there, just ask Josh.
We'll stand in recess.
(Time Noted: 3:30 p.m.)
(Proceeding adjourned to Thursday, November 10, 2016, at 9:00 a.m.)
(End of day)
- - - - - -

CERTIFICATE

I, Claudette G. Mason, a Notary Public in and for the State of Maine, hereby certify that the foregoing pages are a correct transcript of my stenographic notes of the Proceedings.

I further certify that I am a disinterested person in the event or outcome of the above-named cause of action.

IN WITNESS WHEREOF, I subscribe my hand this 6th day of December, 2016.

/s/ Claudette G. Mason
Claudette G. Mason, RMR, CRR
Court Reporter.

My Commission Expires
June 9, 2019.

THE REPORTING GROUP
Mason & Lockhart

B

E

G

M

O

P

Q