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UNITED STATES ATOMIC ENERGY COMMISSION

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IN THE MATTER OF:

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

Docket No. 50-247

(Indian Point Station, Unit No. 2)

Place -

Date - Washington, D. C.

15 January 1973

Pages 8465 - 8692

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UNITED STATES OF AMERICA

ATOMIC ENERGY COMMISSION

In the matter of: CONSOLIDATED EDISON COMPANY OF NEW YORK, INC. (Indian Point Station, Unit No. 2)	Docket No. 50-247

Room 532
Sixth and Pennsylvania Avenue, N. W.
Washington, D. C.

Monday, 15 January 1973

The above-entitled matter came on for further hearing, pursuant to adjournment, at 9 a.m.

SAMUEL W. JENSCH, Esq., Chairman, Atomic Safety and Licensing Board.

DR. JOHN C. GEYER, Member.

MR. R. B. BRIGGS, Member.

APPEARANCES:

(As heretofore noted.)

ht

C O N T E N T S

WITNESS	DIRECT	CROSS	REDIRECT	RECROSS
John R. Clark		8470		

P R O C E E D I N G S

CHAIRMAN JENSCH: Come to order, please.

Whereupon,

JOHN R. CLARK

resumed the stand as a witness on behalf of the Intervenor, and having been previously duly sworn, was furhter examined and testified as follows:

CHAIRMAN JENSCH: Mr. Clark has resumed the stand. Is Applicant ready to proceed?

MR. TROSTEN: Yes, M r. Chairman.

MR. MACBETH: Mr. Chairman, at the close of the hearing on Friday, Mr. Briggs had put one or two questions to Mr. Clark about the relation of spawning in the Hudson to the Atlantic Fishery.

Over the weekend Mr. Clark has gone back and reviewed that problem, and has an answer of some length to Mr. Brigg's question, which he is prepared to give.

On the other hand, I see that Mr. Briggs has not arrived yet, so perhaps it would be better to defer that.

CHAIRMAN JENSCH: Yes, I think it would.

Mr. Briggs may be a little late today from his plane arrangements. If we could go ahead with other matters --

MR. MACBETH: Certainly.

I just wanted the Board to be aware that he is prepared to do that.

1 CHAIRMAN JENSCH: Thank you.

2 MR. TROSTEN: Mr. Macbeth, before proceeding with
3 further cross-examination, I wonder if you could tell me of the
4 availability of these open items from the 10th, 11th and 12th.
5 Do you have any items that Mr. Clark would
6 care to give for the record now? Then we can proceed to
7 questioning on them?

8 MR. MACBETH: As you know, I have only had a
9 few minutes with Mr. Clark.

10 He has in front of him now, a list of the items
11 and responses to them. I think we would find this easier
12 if you and I took it up at the break. We are doing our best
13 but no one else has been able to provide this kind of
14 items within a day or two, and we have some, but not all.

15 I would prefer not to take up the time on the
16 record, if I could, by reading over this list and working out
17 the details with you. But I would be happy to take it up
18 during the greak.

19 It looks as if we have,maybe of the 12, we went
20 over, something like 5 or 6 now, and we are doing our best
21 to find the rest. This kind of document search takes some
22 time.

MR. TROSTEN: All right.

I think what we ought to do is go over this during break, because I think with regard to the matters that are

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simply furnishing references or lists of papers, that could be deferred.

What I am particularly anxious, though, while Mr. Clark is on the stand, would be to get the answers to certain questions so that we can conclude his cross-examination now and not have to go back to this at another time.

CHAIRMAN JENSCH: Would you prefer to take a few minutes now, 15 or 20 minutes, and then proceed after you have had consultation?

MR. TROSTEN: That might be a good idea, Mr. Chairman.

CHAIRMAN JENSCH: Very well.

Let us recess to reconvene in this room at 9:25.

(Recess.)

CHAIRMAN JENSCH: Please come to order.

Are we ready to proceed further with the interrogation of Mr. Clark?

MR. TROSTEN: Yes.

Mr. Chairman, I thought it would be useful if we could just run down the list of open items from the hearing session for January 10. I have discussed this with counsel for HRFA.

Mr. Clark has many of the answers to these questions and he will provide them for the record and for everyone's analysis right now.

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CHAIRMAN JENSCH: Can you restate the question, so we will have it in one place?

MR. TROSTEN: Yes, I will run down them item by item and Mr. Clark can answer them as we go along.

CROSS-EXAMINATION (Continued)

BY MR. TROSTEN:

Q. The first one was an inquiry referred to on page 7840 in which I asked Mr. Clark for a list of papers he has published on the subject of the factors which control fish populations?

A. On that item I have, I think, supplied three for the record and I assumed that was enough to satisfy the request, and Mr. Trosten has agreed.

CHAIRMAN JENSCH: Are you going to enumerate those for the record?

MR. TROSTEN: They are in the record, Mr. Chairman.

CHAIRMAN JENSCH: All right.

BY MR. TROSTEN:

Q. On transcript 7842, I asked Mr. Clark to provide me with a copy of the first volume of Studies of the Estuarine Dependence of Marine Fishes, which he has done.

On transcript 7897, I asked Mr. Clark to respond to the following questions:

"Have the studies of Merriman and others" -- that he listed on that page or preceding pages --

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-- "which relate to the Connecticut and Delaware River shown that adverse effects have occurred with respect to those fishes listed in Table 1 as a result of power plant operations?"

A. I was not able to have access to the transcript over the weekend, so that I cannot provide the answer to that at this time.

Q. On transcript page 7902, I asked Mr. Clark to make available to me a copy of the Dolphin ~~crew's~~ Cruise report.

He has made this one-page document, one-page report available to me. I am going to reproduce it and will question Mr. Clark later with respect to it.

On transcript page 7917, I asked Mr. Clark to submit his calculations to support his conclusions that fish will be swept back and forth in front of the plant 20 to 30 times.

This conclusion is expressed in his July 14 testimony.

A. We do not have the precise behavioral information to give an exact calculation. But I have made some rough approximations.

With a net fresh water outflow of 12,000 cfs, the discharge of the river averages about 10 percent of the total river flow of about 100,000 cfs above the brackish area. This percentage is less below the fresh water area and getting into the brackish water area where the fresh water

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outflow is augmented by the salinity induced current to perhaps 20,000 cubic feet per second, according to Dr. Lawler's reports, and therefore the net discharge may reach 20 percent of the river flow.

The Staff's model as reported in the Final Environmental Statement shows that the suspended stages recycle upstream with the bottom flow. At 20 percent of the river flow being discharged, each larvae would get 5 passes in front of the plant by virtue of tidal action and with an approximate 4 to 6 recyclings by transferring between the bottom currents moving upstream and the surface currents moving downstream. Each larvae then would have 20 to 30 passes in front of the plant.

Q. Now, Mr. Clark, let me ask you just some preliminary questions about this calculation.

We will return to it later when I have had an opportunity to scrutenize it more closely.

Is this a calculation which you haveperformed as of the time you prepared your July 14 testimony? Is this what underlay your statement in there that they will pass in front of the plants 10 to 20 times?

A. Yes.

I did a rather involved analysis back in the spring using the data on vertical distribution of larvae which indicated that at any time off Indian Points, on a net

1 basis, the probability was .6 that any larvae would be going
2 upstream and from that basis then I could go ahead and make
3 some conjecture about the number of times that the fish
4 would recycle.
5 They can only go upstream with the salinity-induced
6 currents to the point where the salinity-induced currents breaks
7 down. This depends upon the season, the river outflow and so
8 forth. But it might occur in the area of the Bear Mountain
9 Bridge.
10 Under those circumstances, the fish would be able
11 to go upstream no farther than the Bear Mountain Bridge and
12 then would have to return downstream in the surface water
13 currents to a certain extent, and then begin the recycling
14 again.
15 Q. I do not see in your October 30 testimony, any
16 references to this recycling of larvae in the vicinity of
17 the plant.
18 Is this calculation a part of your estimation of
19 removals?
20 Is it reflected in your estimation of removals in
21 some fashion?
22 A. No.
23 Q. All right.
24 May we go to the next one, please, which is -- I
25 will read it:

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On transcript page 7921, I asked Mr. Clark for calculations, whether in final form or not, using Hudson River striped bass data which would show that the Lovett and ~~Danskammera~~ Danskammer plant s will, of course, heighten the effects. I was referring to a paragraph that appeared on page 6 of Mr. Clark's testimony.

A. Lovett and ~~Danskammera~~ Danskammer will heighten the effects only above natural levels.

At present, the effects of those plants on the populations in the river are already included in the data base, because assuming that the effects from those two plants had already reached an equilibrium level before the Carlson-McCann data that I used were taken. Therefore, they would not be in addition to the levels shown by Carlson-McCann and therefore I did not calculate those effects.

I did calculate the effects of Roseton and Bowline.

Q. Let me ask you about that.

Do I understand from your response that the effects of Indian Point 1 are also included in the data base of Carlson and McCann and also in the data base used by you?

A. For the years in which the plant was operating.

Q. From the fall of '62 until '68? 1968 when -- the summer of '68 when Carlson-McCann did their last study?

A. Some of the effects would be there. But there would not have been the opportunities to reach equilibrium level.

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Q. What do you mean by the last phrase?

Let's be sure we are talking about the same thing. Carlson-McCann studied the river in 1966, 1967 and they studied the river also in the summer of 1968 up through at least August as I recall it, of 1968.

Indian Point 2 began operations in October of 1962 -- excuse me. Indian Point 1 began operations in October of 1962. You mentioned a moment ago, I believe,that there had not been an opportunity for the plant to reach equilibrium.

Would you explain what you mean by that?

A. Well, we have these two levels of effects, the immediate effect of the kill of larvae in the plant as a sort of first-order effect. Then there is a positive feedback loop established with the reduction in breeding population, which reduces the larvae even further and so on.

And we expect then on a longer-term basis to reach some equilibrium level lower than what would occur at the instance of kill in the plant.

Q. So it is the possible secondary effect of what you refer to as a positive feedback loop, which there has not yet been time to feel?

A. There would not have been, no.

Q. But the impact on the river populations, if any, of both entrainments and impingement at Indian Point 1 would havebeen felt, since the plant was operating from October of

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1962 through and including the period of the summer of 1968?

A. Yes.

MR. MACBETH: Mr. Trosten, may we have it clear when you say the plant was operating through that period, you mean it was operating from time to time through that period?

MR. TROSTEN: Yes.

MR. MACBETH: So there may well have been extensive periods in there when the plant was not operating, isn't that so?

MR. TROSTEN: There may have been. The record could be scrutinized.

In fact, the fish protection record would probably show when the plant was actually not operating.

But during the period of 1966, '67, for example, the period Mr. Clark uses for the base for his calculation of impingements, the plant was operating and it was operating in '63, '65 and so on.

THE WITNESS: I can add one more thing to that, and that is with the flow rate of the small plant, Indian Point 1, it is very likely that its effects would be below 15 percent. I am not positive of this, but my recollection is that its effect, singly, operating on the river, might be 15 percent or less, of the population.

And that is not significant enough an amount to

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1 enable one to measure that amount of variation against the
2 backgrounds of error in the data. So that it is not a matter
3 of great importance in my calculations.
4 BY MR. TROSTEN:
5 Q. Well, you say it is not a matter of great
6 importance. You arrived, for example, at the impingement esti-
7 mate for Indian Point Units 1 and 2 by multiplying the
8 impingement which you believe occurred in 1966 and 1967 by
9 five?
10 A. Yes.
11 Q. In that sense, you reflected very clearly in your
12 estimate, the amount of impingement which you believe
13 occurred in 1966 and 1967 at Indian Point 1?
14 A. I was thinking of entrainments when we were
15 talking.
16 Q. Now, with regard to --
17 CHAIRMAN JENSCH: Is there some further comment you
18 want to give to that?
19 You said you were thinking of entrainments, not
20 impingements. Does that affect your answer?
21 THE WITNESS: When I was thinking of the error
22 of estimate involved in this, simply pointing out that the
mount of error would encompass that degree of change, at that
I was thinking of entrainment, not thinking about the
ngement.

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Now, if we are thinking about impingements, I have to kind of rethink it. I am not just sure what the point of your question is, so I don't know what to think about, except that the plant was on -- off and on during those years

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BY MR. TROSTEN:

Q. One thing we have established is that Indian Point 1 was ~~opening~~ operating, ~~to~~ the extent the record shows it did ~~open~~ operating, during that period of time?

A. Yes.

Q. Do you happen to know offhand -- if you don't, we can check it out -- what the combined pumping capacity of the Lovett and ~~Danskammera~~ Danskammer Plants?

A. No.

Q. Now, with regard to Lovett and Danskammera, you mentioned a moment ago that these were included within the data base for 1966 and 1967. We are still left, however, Mr. Clark, with the statement that these would heighten the effects. Now, I'm unclear now what you mean by this. You have indicated that you have not performed any calculations with regard to the Lovett and ~~Danskammera~~ Danskammer plants. Is that correct?

A. Yes.

Q. As to the effect of these plants, either with regard to impingements or as to the effect of these plants with regard to entrainments. Is that correct?

A. Yes.

Q. Now, I'm confused now, because you have said that they will heighten the effects, but also you have said these are included within the data base that you used for your

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calculations of mortality or percent removals. And they are also included, incidentally, in the period of time, 1966-67 that you used to calculate the Indian Point 1 kill. That is perhaps irrelevant. But they were opening during that period of time.

Now, I really don't understand what it means when you say they will heighten the effects.

A. There were no power plants ~~opening~~ operating on the river, and you put Indian Point Numbers 1 and 2 on line and start them ~~opening~~ operation, they would have a certain amount of adverse effect.

Added on to that would be additional adverse effects from any other power plants opening on the river. And that is what I mean by "heightening" the effects.

Q. You mean if there were no power plants ~~openi~~ operating on the river, and you started up Indian Point 2, and then you started up Lovett and ~~Danskammera~~ Danskammer, in that sense, they would heighten the effects. Is that what you mean?

A. Yes.

Q. I understand that. Would you not agree, however, that since Lovett and ~~Danskammera~~ Danskammer and Indian Point 1, we are ~~opening~~ operating at the time the Carlson-McCann data were collected, that it would be appropriate to consider them just sort of part of the environment, if you will, in the sense that everything else that existed at that time was part of the

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1 environment, so that Lovett and ~~Danskammera~~ Danskammer and Indian Point
2 1 would not heighten any effects, they are just reflected
3 in what the environment is or was in 1966 and 1967, and what
4 it is now?
5 A. Is this in reference to the previous statement?
6 Because I didn't say that Indian Point 1 would heighten
7 the effects. That was Roseton and Bowline and Lovett and
8 ~~Danskammera~~ Danskammer.
9 Q. I realize that. But Indian Point 1 was ~~opening~~ operating
10 during a period of time that the Lovett and ~~Danskammera~~ Danskammer
11 plants were ~~opening~~ operating.
12 A. Right. Indian Point 2 is the only new plant
13 on line taht we have been discussing, other than Roseton and
14 Bowline.
15 Q. But would you respond to my question, however?
16 Would you not agree that it would be appropriate to consider
17 that the Lovett and ~~Danskammera~~ Danskammer plants and the Indian Point
18 Plant should be considered just part of the general environ-
19 ment in which your studies and calculations were made and
20 which exists now, so that an appropriate way of looking at
21 this would be to look at the effect of the Indian Point 2
22 plant, which may start up?
23 A. I was going on the assumption we had a general
24 agreement here that we were going to talk about Indian Point
25 Number 1 and 2 together.

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Q. But I'm trying to explore this in relation to what you have said here, and what you testified to this morning.

A. No, my answer to your question is no, I would not consider them part of the general environment. It is just not my way of thinking about environment.

Q. Well, I understand what you have said, but is it not true that the Lovett and ~~Danskammera~~ Danskammer operating plants were ~~opening~~ in 1966 and 1967?

A. Yes.

Q. And Indian Point 1 was opening in 1966 and 1967?

A. Yes.

Q. So the impact of those plants was being felt during that period of time and it has been felt from that period of time up until the present time?

A. Yes.

Q. Would you agree with that?

A. Yes.

Q. All right. Let's go on to the next one. On transcript Page 7937, I asked if you would supply the ~~datat~~ data references for the repulsion of marine forms by the 100 parts per million of chlorine. I believe you indicated you are going to check the record on that?

A. No, I can do better than that. I can state it was Sprague and Drury from my notes. And if, when I'm able to

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check that in the original publication, and there is any difference, if it is different, I will let you know. So, we can cross that one off.

Q. On transcript Page 7970, I asked Mr. Clark -- excuse me, Miss Reporter, would you be arranging that we can have copies of Mr. Clark's responses to my questions as soon as practicable today, instead of waiting until tonight, this set of questions I'm asking him now, as to the open items from January 10th.

You asked you on transcript Page 7970 if I would review the Kerr Study of 1953 of entrainments of striped bass at the Contra Costa plant, and see if you disagreed with my characterization of that. I believe you want further time to analyze that study.

A. I didn't have a chance to read the transcript on that.

Q. All right. Now, I believe you also indicated that you were going to review the later testimony and data on zooplankton and phytoplankton on Page 7970 to see the extent to which this compared with your earlier testimony. We will go back and check that page and see if it indicates that.

A. Oh, yes, all right. Fine.

Q. Transcript Page 7996, I asked if you would give me the source of data for your statement that Hudson River

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temperatures reached 68 degrees Fahrenheit in June, I guess it was.

A. Yes, that information is from the Carlson and McCann report, Figure 4.

Q. Would you find that for me, please, Mr. Clark?

A. It is on Page 9.

Q. Of the first volume of the report.

A. Right.

Q. All right, thank you very much. Now, this, by the way, the Figure is entitled "Hudson River Water Temperatures Measured at Poughkeepsie." Is that right?

A. Yes.

Q. All right. And you were relying upon that for your conclusion with regard to the Hudson River water temperatures at Indian Point?

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A. Also a figure which --

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CHAIRMAN JENSCH: The question was, did you rely upon that data.

THE WITNESS: I am sorry. Yes, partly, but in addition to the temperature data furnished by Dr. Lawler, which I have a xeroxed copy here, but I don't have it identified as to page, but it appears to go figure four of something. Anyway, that is from the environmental supplements to it, whatever you call it. The big blue book.

BY MR. TROSTEN:

Q So you recall this as a document that was prepared by Con. Edison, entitled "Figure Four, Equilibrium Surface Temperature, River Ambients Temperature, Hudson River Near Indian Point."

We will look for this later.

A Yes. It is in the supplements to the environmental report.

Q In the supplements to the environmental report?

A Dr. Lawler's.

Q All right. We will look into that later.

A Those two taken together are the basis.

Q Right. Now on transcript page 7998 I asked if you would review later testimony and then respond to my question concerning your conclusion that gammarus will be harmed by entrainments at Indian Point 2.

A I have not had a chance to review that yet.

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Q The next question was the one on transcript page 8000 where I asked you to provide data which indicate that zooplankton or phytoplankton populations will be harmed as a result of entrainments at Indian Point unit 2.

A The information, the source of information to answer both of those questions appears on pages 538 and 539 of the final environmental statement related to operation of Shoreham nuclear power station. September 1972.

Q Now, this was a study by the Atomic Energy Commission regulatory staff of another power plant, the Shoreham plant, is that correct?

A Yes, that is correct.

Q And you were relying on this study by the AEC staff with regard to your conclusion that other zooplankton than gammarus and phytoplankton will be harmed by entrainments at Indian Point 2.

A They have reviewed the literature and come up with certain conclusions.

Q Now --

CHAIRMAN JENSCH: I think the question was, did you rely upon that, these ultimate studies? I think Applicant's counsel asked you, did you rely upon those studies that the staff had undertaken.

THE WITNESS: Partly.

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BY MR. TROSTEN:

Q Did you rely on some other study partly?

A I have just generally gone through the literature on this. Some of Michersky's work, some of the material since that time, scattered here and there, where people have reviewed the subject and have gotten the general impression that this is part of the impact effect from plants operating in estuarine situations where there are these forms of micro crustaceans, with Delta Ts and operating conditions such as we have at Indian Point.

Q Could you give me the specific references that you relied upon? I really need them if I am going to be able to cross-examine your conclusion. You have given me this, I will look at that. But the other references you relied upon.

For example, could you give me the specific references to Michersky or anything else you relied on?

A Yes, I can supply a number of additional references.

Q Would you do that, because it is necessary for me to see exactly what you relied upon so I can cross-examine your conclusion.

Now, regard to the staff's study of the Shoreham plant, there is a statement in here that I find sort of interesting. "The dependence of mortality" -- I am reading from page 5-39 of the Shoreham statement -- "The dependence of mortality of acquatic organisms upon both time and temperature

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is well understood. The Sandy Hook group also studied the Oyster Creek nuclear plants on Barnegat Bay, New Jersey, but data from that plant are even less applicable to Shoreham, since the temperature rise was 10 degrees F."

Does that statement indicate to you, Mr. Clark, that it is very important to study the exact operating conditions of the ~~paint~~ plant with regard to temperature and by inference, other operating conditions before you can derive a conclusion whether particular data are applicable to that plant as far as mortality to plankton populations are concerned?

Would you like the question read?

A Yes.

(The reporter read the question as requested.)

CHAIRMAN JENSCH: I wonder if you could read that Shoreham statement again? I didn't quite get the Delta T situation.

MR. TROSTEN: I picked a statement out of the staff's report which reads as follows: "The dependence of mortality of acquatic organisms upon time and temperature is well understood. The Sandy Hook group also studied the Oyster Creek nuclear plant on Barnegat Bay, New Jersey, but data from that plant are even less applicable to Shoreham, since the temperature rise was 10 degrees F."

CHAIRMAN JENSCH: Does that sentence mean because the temperature rise was 10 degrees and therefore -- what is

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the Delta T gain on Indian Point 2?

MR. TROSTEN: Fourteen point five degrees F., Mr. Chairman.

CHAIRMAN JENSCH: Thank you.

DR. GEYER: On Shoreham?

MR. TROSTEN: The Delta T on the Shoreham plant, let's see.

THE WITNESS: Nineteen point seven, I believe.

MR. TROSTEN: I will accept that as being accurate, 19.7.

CHAIRMAN JENSCH: I don't want to get into a discussion of what they did in Shoreham, but just for general information, is that statement in Shoreham imply the lower the Delta T, the less the effect of the entrainments, but the higher the Delta T, the greater the effect on entrainments?

MR. TROSTEN: I believe the answer to that question, to your question is yes, Mr. Chairman. I was asking a somewhat broader question than that. The statement -- the Delta T is 19.7 degrees at Shoreham.

CHAIRMAN JENSCH: And 10 degrees at --

MR. TROSTEN: It appears, according to this report, Mr. Chairman, the Delta T at Oyster Creek is 10 degrees, right.

MR. MACBETH: Could Mr. Trosten be any more precise about the other conditions in his inference? This clearly doesn't apply to temperature, this statement, but it is a little

kar 6 1 unclear to me that the authors were inferring too much more
2 about other conditions.
3 MR. TROSTEN: For the moment, let's confine it to
4 Delta T.
5 BY MR. TROSTEN:
6 Q Does that statement by the staff, Mr. Clark, imply
7 to you that it is very important in relating data from one
8 plant to another plant to be sure that the Delta T in the two
9 plants are similar?
10 Let me expand upon the question somewhat. When you
11 are considering the impact of entrainments on organisms that
12 are actually entrained in the plant?
13 A Yes.
14 Q By inference, does that statement indicate to you
15 that it is also very important to consider other operating
16 conditions in the two plants such as time at which the organisms
17 are exposed to the temperature and pressure changes when
18 comparing the two plants?
19 A You are asking is it important?
20 Q Does that statement indicate to you that it is
21 important to consider these differences?
22 A Yes.
23 Q Now, you have indicated that you relied upon the
24 Shoreham study partly for your conclusion that zooplankton or
25 phytoplankton populations will be harmed at entrainments.

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A Would you please refer me back to the part of my text where I said that? I can't seem to find it.

Q I will have to look at page 8000 of the transcript and see.

MR. TROSTEN: Mr. Chairman, I am looking for the portion of Mr. Clark's testimony that dealt with the harm that would occur to zooplankton and phytoplankton.

THE WITNESS: It is my impression, Mr. Trosten, that I didn't give any numbers of quantative values or make any calculations, and it was a rather general statement about effects on the food chain.

Therefore, your questions relating back to the desirability of various kinds of data and the comparability of various plants and so forth is really not a very pertinent question.

BY MR. TROSTEN:

Q On the contrary, I think it is quite pertinent, because I will refer you now to the particular sentence and paragraph in your July 14th testimony.

A All right.

Q It is on page 13, you were referring to trophic effects of operation of the Indian Point plants. You say "Unfortunately, the loss will be greatest for certain zooplankton species that make up the primary diets of juvenile striped bass, white perch and other Hudson River fish. These zooplankton have a long generative interval, reproducing only two or three cycles per year. These include the major items in striped bass and white perch juvenile diets, Gammarus and Neomysis.

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"Once killed, replacements of these species requires considerable time. It is not virtually instantaneous as it is for smaller simpler plankton forms."

Do I understand you correctly to have been saying in your July 14th testifmony that there would be substantial losses in terms of the populations of zooplankton species, particularly Gammarus and Neomysis, as a result of entrainment in the Indian Point plants?

A Yes.

CHAIRMAN JENSCH: What does this sentence preceding that paragraph you read mean? "A high proportion of many species will be killed during the summer when the maximum adverse effects are present and the synergy is at its highest."

I am trying to get an understanding of your language "a high proportion of species." I think the question was would there be substantial -- you mean one and the same; do you?

Do you mean one and the same in answer to the question as to what you expressed on page 13 of the July 14th testimony?

THE WITNESS: I am sorry; I'm having difficulty following you.

CHAIRMAN JENSCH: The preceding sentence to the paragraph he read.

THE WITNESS: Yes, sir.

CHAIRMAN JENSCH: Where you say "a high proportion

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of many species will be killed outright." I think the last previous question to you was something about would a substantial number be killed.

THE WITNESS: Yes.

CHAIRMAN JENSCH: Do you mean one and the same?

THE WITNESS: Yes, sir.

CHAIRMAN JENSCH: Thank you.

BY MR. TROSTEN:

Q Now, returning to my question, I asked you whether it is correct that you were relying in part, at least you said, on the Shoreham Study in making this statement that "a high proportion of many species will be killed."

Is it not correct that the Shoreham Study shows a delta T of substantially higher, 19.7 degrees, versus 14.5 degrees?

A I am sorry, I probably didn't answer appropriately. On general zooplankton, as separate from the Gammarus and Neomysis issue, Neomysis and Gammarus was covered in the preliminary environmental statement by the AEC Staff, and I relied upon their statements in there, as I remember it, for the main conclusion that these two critters would be involved with Indian Point.

CHAIRMAN JENSCH: That is the preliminary statement applicable to Indian Point No. 2; is that correct?

THE WITNESS: Yes, sir. The draft environmental

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statement.

BY MR. TROSTEN:

Q Let us go on to another aspect of this.

CHAIRMAN JENSCH: Just one thing about the studies for Shoreham. These are the projections. The plant has not yet been authorized.

MR. TROSTEN: That is correct.

CHAIRMAN JENSCH: I expect until they get into actual operation, the delta T on Shoreham will still be estimates and projections.

MR. MACBETH: Could I clarify something? It is my memory, without that they involve, you know, a discussion of the literature, so that the pages in the Shoreham Study are similarly a discussion of Oyster Creek, a discussion of other plants and other delta Ts and their effect on zooplankton.

So it is not simply a detailed study of Shoreham alone, but a discussion of the problem with examples from other plants. And the witness was, as I understand it, relying on that discussion, the references to the literature. Is that correct, Mr. Clark?

THE WITNESS: Yes in this way: if you review some plankton kill data for a plant with a 10 degree delta T in the wintertime, and find a kill of, say, 10 percent, which is in the range of this, then you can be fairly certain from what we know that that is the floor down there. That in the

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summer, with much higher temperatures, at a higher delta T, the effects would be considerably worse.

So that the most conservative estimate of the damage would be what would happen in the wintertime with the low delta T.

CHAIRMAN JENSCH: Are you implying by your statements that this is common knowledge, that -- you used the term "the microcrustaceans" going to be killed with a delta T 10 degrees or higher.

Does everybody kind of accept that as general information; is that correct?

THE WITNESS: Yes, sir, to some degree.

MR. MACBETH: What does the "to some degree" mean? Whether people accept it or some of them will be killed?

THE WITNESS: That some will be killed. It is a question of proportion.

CHAIRMAN JENSCH: Thank you.

BY MR. TROSTEN:

Q Just one final question on this, Mr. Clark.

Do you not agree that the fact that some zooplankton will be killed in going through the plant is not the critical point in determining the ecological effect on the populations in the river; it has to do with the populations, the effect of the mortality of these individuals in the plant upon the overall populations of these individuals in the river.

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Do you not agree that that is the critical question?

A That is the critical question, yes, sir.

end 4

Q Thank you.

Now with regard to transcript page 8010 I asked you to provide me with the data on commercial fishing which you indicate support your contention that Indian Point is one of the greatest overwintering areas on the northeastern coast, including any comparative data. I think it would be well if we looked back at the page itself. I think that my precise question was this: "Mr. Clark, before we move on to the next subject, which I would like to cover with you, which would be impingement, when you provide us with the data on the cruise of the research vessel, Dolphin, would you please also provide us with the data on commercial fishing which you indicate support your contention that the Indian Point area is one of the greatest overwintering areas on the northeast coast, including any comparative data which you are relying on for that statement?"

A Yes. On page v-59 of the Final Environmental Statement for Indian Point 2, there is a graph chart which shows the catch in the Hudson in hundreds of pounds of striped bass showing that the catch in the Hudson has exceeded a million pounds in certain years. Those are the statistics that indicate that the Hudson is a great wintering area for striped bas, because the catches are taken, these fish are caught primarily during the upstream migration to the wintering areas in the fall and the downstream migration from wintering

1 spawning areas in the spring.

2 Now if you look further at these statistics,

3 you will find no river in the northeast wherein there are

4 catches of striped bass anywhere near this amount. The nearest

5 place to the south would be the Delaware or Chesapeake areas.

6 But in the northeast only in the Hudson.

7 Q Mr. Clark, what percentage of this catch in the

8 Hudson shown on the vertical axis here on figure 5-14, page

9 v-59, was caught in the wintertime? Do you know that?

10 A No, I do not. I know that it would be very small

11 because they are not able to fish in the river when there is

12 ice on the river and because recently there has been a

13 prohibition on the operation of nets, as I remember, from some-

14 where around the 15th of November until the 1st of March,

15 if I am right.

16 Q Now there are indeed then no fishing statistics

17 in the Hudson River from the beginning of December to, say,

18 the 1st of March, perhaps the 15th of March, because of the

19 prohibition on fishing in the Hudson River at that time.

20 Is that correct?

21 A No current statistics. There are statistics

22 from the time before this happened and before there was

23 commerce on the river going way back when the fishermen could

24 get onto the ice and cut holes and put nets in. They did that

25 all winter long.

1 Q When did the prohibition -- I believe you mentioned --
2 we can go back and check the transcript on this -- when you
3 were discussing the gill netting under the ice, which you
4 just started to refer to again, I believe you indicated the
5 data from that type of fishing effort was the basis for your
6 statement that the Hudson was one of the greatest overwintering
7 areas.
8 Now it is illegal now to engage in that kind of
9 fishing; isn't that correct?
10 A Yes, to the best of my knowledge, it is illegal.
11 Q Do you know when that --
12 CHAIRMAN JENSCH: Wait a minute.
13 Did you finish the answer?
14 THE WITNESS: Yes, to the best of my knowledge,
15 it is illegal.
16 BY M R. TROSTEN:
17 Q Do you know when that prohibition against fishing
18 under the ice, the gill net fishing under the ice that you
19 were describing went into effect?
20 A I do not.
21 Q What are these data that you were relying upon
22 then that were taken and collected prior to the prohibition
23 of this type of fishing?
24 A The data that reinforce a general conclusion. I
25 think you would find we all agree that fish are migrating up

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1 into the Hudson in the fall, they spend the winter there,
2 spawn and leave the river. And if you catch fish on their
3 way up or catach fish on their way down, this indicates
4 something about the relative size of that population that
5 are going up there to winter.
6 Now I will read you something which will reinforce
7 this. This is from Benson J. Lossing, "The Hudson, from the
8 Wilderness to the Sea." The publisher is Virtue and Yorston,
9 New York, page 278: "These fishermen often find their calling
10 almost as profitable in winter as in April and May, when
11 they draw 'schools' of shad from the deep. They generally
12 have a 'catch' twice a day when the tide is 'slack,' their
13 nets being filled when it is ebbing or flowing. They cut
14 fissures in the ice, at right angles with the direction of the
15 tidal currents, eight or ten yeards in length, and about two
16 feet in width, into which they drop their nets, sink them
17 with weights, and stretching them to the utmost length,
18 suspend them by sticks that lie across the fissure. Baskets,
19 boxes on hand-sledge and sometimes sledges drawn by a horse,
20 are used in carrying the 'catch' to land. Lower down the river,
21 in the vicinity of the Palisades, when the strength of the
22 ice will allow this kind of fishing, bass weighing from
23 thirty to forty pounds each are frequently caught. These
24 winter fisheries extend from the Donder Berg to Piermont, a
25 distance of about twenty-five miles."

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1 Q What are you reading from?

2 A Benson J. Lossing, "The Hudson, from the Wilderness

3 to the Sea."

4 Q What period of time is he describing?

5 A Way back.

6 Q When?

7 A Last century.

8 Q Is that something that occurred in the 19th

9 century that you relied upon for your statement that the

10 Indian Point area is the greatest overwintering area in the

11 northeastern coast, one of the greatest overwintering areas

12 on the northeast coast?

13 A No, it is just part of the story.

14 Q What is the other part of the story? Where are

15 the statistics on which you relied that indicate this is one

16 of the greatest overwintering areas on the northeast coast?

17 Where are the comparative statistics from other rivers,

18 or indeed where are the statistics from the Hudson River that

19 indicate this?

20 A I have explained that the best I can. I have also

21 cited the Dolphin. We went up there on the ship, broke

22 through the ice, put down nets and caught striped bass, lots

23 of them.

24 Q You are referring to the three-day cruise, March

25 6 to 8 on the Dolphin?

A Right.

Q The data from which are reported on this page I have; right?

A Right.

Q When striped bass go up into the Hudson River and overwinter, could they overwinter over a long stretch of the river?

A Yes.

Q Now you have not performed a cruise on another river inthe wintertime similar to the cruise that you performed on the research vessel Dolphin in March '68, have you, Mr. Clark?

A No, I have not.

Q Is it possible that if you were to --

MR. TROSTEN: Strike that question.

I believe, Mr. Chairman, that concludes the listing of questions that I asked Mr. Clark on January 10. We can go back to the normal order now.

CHAIRMAN JENSCH: Very well. Proceed.

I wonder if we could clarify that last question. I think Applicant's counsel said could they overwinter in a long stretch of the river. I wonder if Applicant's counsel would define the location and length that he had in mind in his question.

MR. TROSTEN: Yes. I would say 20 to 25 miles,

1 Mr. Chairman.

2 CHAIRMAN JENSCH: Starting where?

3 MR. TROSTEN: I would say somewhat north of

4 Indian Point, and extending downward in the neighborhood of

5 20 or 25 miles. That would be my rough definition of it.

6 CHAIRMAN JENSCH: Very well.

7 BY MR. TROSTEN:

8 Q Does that comport with your understanding?

9 A No. From our trawling in that area I would think

10 that you don't find them as far as -- let's see, 25 from 42

11 is river mile 17. Is that right? You would say then from

12 river mile 42 to river mile 17?

13 Q Say, from river mile -- well, from river mile

14 20 to river mile 45. These are very rough numbers, Mr.

15 Chairman, but I am talking about a stretch of river about 20

16 to 25 miles somewhat north of Indian Point, extending

17 downward some 20 or 25 miles.

18 THE WITNESS: I think from our trawling around up

19 there, they are more abundant from the Tappan Zee on up to

20 Indian Point. How much farther from that, I don't know.

21 BY MR. TROSTEN:

22 Q How far south of the Tappan Zee did you trawl?

23 A I would have to check that. I don't remember the

24 exact locations down there.

25 CHAIRMAN JENSCH: Thank you. Will you proceed?

1mil

BY MR. TROSTEN:

Q Mr. Clark, I had intended to go directly into the questions that Mr. Briggs asked, but since he is not here now, I think the best thing to do would be to try to conclude the questioning on impingement and get that out of the way and return to Mr. Briggs' question later.

CHAIRMAN JENSCH: Do you want to take a few minutes' recess?

MR. TROSTEN: Yes.

CHAIRMAN JENSCH: At this time, let us recess, to reconvene at 10:30.

(Recess.)

CHAIRMAN JENSCH: Please come to order.

BY MR. TROSTEN:

Q Mr. Clark --

CHAIRMAN JENSCH: Excuse me just a moment. I think some of our participants aren't here.

Very well, Applicant's counsel, will you proceed.

MR. TROSTEN: Thank you.

BY MR. TROSTEN:

Q Mr. Clark, do you agree that there may be significant numbers of Chesapeake Bay fish which enter the Hudson River to over winter?

MR. MACBETH: I could interject a moment? I have a feeling we are getting into the area that is covered by the

2mil

answer to Mr. Briggs' question. Do you feel that, Mr. Clark? It just seems to me that if that is so, it might be simpler to have a rather extended answer that Mr. Clark has prepared stated. I just think it would tend to focus the future questioning. I thought we were going to move away from that to impingement or some other topic, so we could put this question in when Mr. Briggs is here.

MR. TROSTEN: Right. Would you rather wait?

MR. MACBETH: That seems to be more sensible.

MR. TROSTEN: Fine. Would you defer the answer to my question, then, until Mr. Briggs is here.

THE WITNESS: Certainly.

BY MR. TROSTEN:

Q Mr. Clark, I would like to question you now with regard to the general condition of the fish which are impinged at Indian Point. I would like to explore your views as to the general physical condition of these fish at the time that they are impinged at the plant. Do you believe that a 40 percent reduction in flow rate would reduce the number of fish impinged at the intake screens at Indian Point?

A Yes.

CHAIRMAN JENSCH: Could you give the reduction from what? Or doesn't it make any difference? I don't know. If you go from 100 down to 60, or whether you go from 60 to 20, does it make a difference? I don't know.

3mil

MR. TROSTEN: Let me ask it generally first.

THE WITNESS: Yes.

BY MR. TROSTEN:

Q You agree that a reduction from 140,000 to 84,000 would reduce the number of fish impinged at the intake screens at Indian Point 2?

A Yes.

Q Is this because more fish would be able to escape the flow?

A No.

Q In your opinion, what would be the reason that the reduction in flow would cause a reduction in the number of fish impinged?

A The reduction in the volume of water moving into the plant and the reduction of the flow through the screens themselves.

Q Does that mean that you are assuming that the number of fish impinged is simply directly related to the volume of water that is screened through the plant?

A To the best of my knowledge, that would be the situation. That is the best I have been able to interpret from the data I have had to look at.

Q Does that imply that you view the fish which are being impinged as not having any motive ability? In other words, it sounds as if you are treating them as if they were

4mil

1 planktonic.

2 A No.

3 Q Well, if it doesn't imply that, how are you able

4 to draw the conclusion that the number of fish impinged is

5 simply related to the volume of water that is withdrawn

6 into the plant?

7 A There is some evidence collected by Con Edison

8 showing that if you reduce the volume of flow, you reduce

9 the number of fish impinged. And I haven't attempted to go

10 beyond that. I haven't attempted to analyze the situation

11 to any greater depth than that. It is just simply if you

12 pump "X" thousand gallons, you get one result, and if you

13 pump less, you get another. It is related to the volume of

14 the flow. I don't think, or at least I don't know of any

15 studies which tell us what it is about the volume of flow,

16 whether it is associated or what property it is about the

17 volume of flow that would cause the reduction in fish.

18 Q Now it is correct, isn't it, Mr. Clark, that as

19 you reduce flow, you reduce velocity? The two go hand in hand

20 isn't that correct?

21 A Yes.

22 MR. MACBETH: Excuse me. Is that necessarily true?

23 I mean for instance, one could simply turn off one of the

24 pumps entirely, so that less flow, less volume of water would

25 be going through the plant, but the same velocity through the

5mil 1 particular screens would be maintained.

2 MR. TROSTEN: I think in consulting with Mr.

3 ~~Aleuvas~~ alevras, he advises me the question should more properly be

4 phrased with relation to flow per day. In other words, if

5 you reduce the volume of water coming into the bay, does that

6 not mean that you are correspondingly reducing the volume of

7 water going through the screens in that bay. So I should

8 ask Mr. Clark the question in that context. I think that will

9 respond to your question, Mr. Macbeth.

10 CHAIRMAN JENSCH: Is that engineering situation

11 within his province? I don't understand it. Could you give

12 me a diagram on the board? As I understood Hudson River

13 counsel a minute ago, he said if you cut off one pump, it may

14 not affect the velocity in another pump.

15 MR. TROSTEN: I think this is kind of an important

16 point and I will put up a diagram of the intake screens and

17 ask Mr. ~~Aleuvas~~ alevras to explain this. Would that be satisfactory?

18 CHAIRMAN JENSCH: Yes, I think it would be very

19 helpful.

20 MR. ~~ALEUVAS~~ alevras: This is a cross-section through one

21 of the intake bays at Indian Point 1. I will point out some

22 features to orient you. This is the wharf here, the pilings

23 that support the wharf are not shown. It is directly in

24 front of the intake structure in the river. This is the fixed

25 screen in front of the intake opening. The water is moving

6mil

in this direction, it passes through a bar rack, then through the traveling screen and into the main circulating water pump. When water is being withdrawn, each pump at Unit 1 and the pumps at Unit 2 draw through isolated either pairs of bays or individual bays, each bay is isolated from the bay alongside it by concrete walls. So that the flow through each screen is controlled by an individual pump. If you reduce the volume of water which this pump withdraws, it reduces the volume of water coming through this fixed screen, regardless of what the pump alongside in another ~~by~~ bay ~~may~~ be doing. So that if we reduce the flow in this pump from 140,000 down to 84,000 gallons per minute, a 40 percent reduction, we reduce the volume of water coming through this opening by 40 percent also.

Since the size of the opening is fixed, the velocity of water through that opening is also correspondingly reduced. It is possible, since there are two main circulating water pumps at Unit 1, it is possible to cut off one pump completely, thereby reducing the total flow to the plant in half, without changing the velocity through an individual bay or individual screen. In this question we are considering the situation where either one or both of the main circulating pumps has the flow reduced, and therefore, by reducing the flow through a corresponding opening of that pump.

CHAIRMAN JENSCH: That is a subject that more

7mil 1 detailed examination by me -- I would appreciate it. Do you
2 have a pump for each bay, or is there some common pooling
3 of water after it has come through the separate bays?
4 MR. ~~ALEUVAS:~~ Alevras At Unit No. 1 there are two main
5 circulating pumps. Each pump pulls through a pair of bays.
6 Those bays are separate from the fixed screens back to the
7 traveling screens. Behind the traveling screens, it becomes
8 a common well that the pump withdraws from. When the pump is
9 withdrawing -- I am sorry. It becomes a common well for each
10 one of the main pumps. So that when one pump is one, it can
11 only pull the water through the two bays frequently in front
12 of it, it cannot pull through the other pair of bays where the
13 other pump might be located, but not operating. So each pump
14 influences its own fixed screen and screen in front of it and
15 does not influence the bay alongside.
16 CHAIRMAN JENSCH: That common well applies to one
17 pump and the other pump has its common well.
18 MR. ~~ALEUVAS~~ Alevras: That is right.
19 DR. GEYER: When you reduce flow, do you cut down
20 on the discharge of the pump or turn it off?
21 MR. ~~ALEUVAS~~ Alevras: After the water is pumped into the
22 plant on the downstream side of the condensers below the
23 water box, there is a butterfly valve. By partially closing
24 this valve, it withdraws less water from the bay, therefore,
25 by withdrawing less water through the screen. That can be

8mil

done independently for each pump.

DR. GEYER: What is the usual practice?

MR. ~~ALEUVAS~~ Alevras: The usual practice when we are operating the plant at reduced flow, is to partially close the butterfly valve on all outlets from the condenser, thereby reducing the flow.

DR. GEYER: And don't to run the pumps?

MR. ALEUVAS: That is right.

DR. GEYER: So the velocity in front of the screens does reduce when you close the butterfly valve on the discharge from the condenser, reduce flow?

MR. ~~ALEUVAS~~ Alevras: That is right.

CHAIRMAN JENSCH: Thank you.

BY MR. TROSTEN:

Q Now, Mr. Clark, as the intake velocity is reduced in front of the screens at Indian Point 1, and the number of fish impinged, down, we will assume -- I think you have agreed as this occurs the number of fish impinged normally would go down. Is that correct?

A As the flow is reduced, we believe the number of fish impinged will be reduced.

Q Right. I am asking you to assume on the basis of this explanation by Mr. ~~Aleuvas~~ Alevras that as the flow goes down, the velocity goes down.

A Yes.

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ty 1

Q So my point is as the intake velocity is reduced, and as the number of fish impinged goes down, would you say that those fish that are still impinged, being impinged on the screen, were weaker swimmers than the fish which were not impinged?

A No.

Q Well, what reason would you assign for the fact that there are fish being impinged on the screens, a lesser number of ~~fishing~~ fish being impinged on the screens as the velocity goes down than when the velocity is higher? Why are those fish being impinged on the screens as opposed to the larger number that are being impinged when the velocity is higher?

A Let me put a sketch on the board and maybe that will clarify the situation.

(Drawing on blackboard.)

It seems very simple to me that if you have, along the edge of the river where the intake structure is located, a certain volume of water with a certain number of fish in the water, and when they are there and when you pump the plant, pump the water through the plant, you are drawing water in, and depending upon how much of this water you draw in, you may get that many fish or you may get the whole amount. It is simply a fixed density of fish in the water making your number that are drawn onto the screens directly proportional to the amount of flow you take through the plant, the number

ty 2

1 of cubic feet, with the fish that are contained therein.

2 Q Now, I take it then that the reason why you have

3 answered the question as you have is that you have not been

4 able to assign in your own mind a reason why the number of

5 fish that are impinged on the screens goes down as the flow

6 is reduced, i.e., as the velocity is reduced?

7 Is that the reason you answered the question as

8 you have?

9 A This is the answer. There is no reason to go

10 looking for a more complicated answer when this simple answer

11 seems to be all that is needed to explain why the volume and

12 the number of fish impinged are related.

13 Q Well, Mr.Clark, I thought just a few moments ago

14 when we were discussing why it was that a 40 percent reduction

15 in flow, i.e., a 40 percent reduction in velocity, would cause

16 a reduction in fish impinged on the screens that you said you

17 had not been able to go beyond the fact that this occurred in

18 your analysis, you just were not able to assign a reason to

19 this.

20 Did you just say that?

21 A Yes, and I stick with that.

22 Q But up here you are now assigning a specific reason

23 to this. You are saying that it is simply a matter of

24 sucking less fish out of the water when you reduce flow. That

25 is a specific reason.

ty 3

1 A If it is, it is. It is an explanation that you asked
2 for. This is not an analytical process. It is just --
3 Q Just a priori reasoning?
4 A Yes, just simple logic.
5 Q So you have just reasoned there are a certain
6 number of fish in the water, and when you take less water out,
7 you get less fish. Is that correct?
8 A Yes.
9 Q Now let me ask you this, Mr. Clark: Is a possible
10 alternative hypothesis to the one you have advanced that the
11 fish, that there are certain fish in the water which are
12 able to swim less fast or less strongly than other fish and
13 as you reduce the velocity of water coming through the
14 screens that these fish which are less able to swim and have
15 less endurance, shall we say, than the other fish, it is they
16 who are being impinged on the screens rather than the fish
17 which are able to swim more strongly, that is, they have more
18 endurance?
19 A Yes.
20 Q Now these fish which have less endurance than the
21 other fish, do you think they might be the weaker, the
22 physiologically weaker members of the population of the fish
23 in the area there?
24 A I don't know.
25 Q Do you think they might be?

ty 4

1 A I don't know. I have no way of answering that
2 question.
3 CHAIRMAN JENSCH: Let me inquire about your question.
4 Are you including the strain of fish and saying
5 let's knock them off? I thought the question was really
6 whether the number of fish would be killed and we didn't go
7 into questions of whether they are despondent or unhappy or
8 poor swimmers?
9 MR. TROSTEN: Actually I think, Mr. Chairman, the
10 question we ought to be addressing here is what is the effect
11 on the populations of the fish, say, of white perch or striped
12 bass in the river.
13 CHAIRMAN JENSCH: Are you saying a poor swimmer is
14 not a good fish?
15 MR. TROSTEN: No, I am saying the poor swimmer
16 might be a diseased fish, that is, a fish that is not in as
17 good physical health as the other fish, and if you were to
18 actually remove these diseased fish or fish that were not as
19 physiologically fit as the other fish, that the remaining
20 population of, say, striped bass in the river might be better,
21 looking at it from a human point of view, or even from the
22 biological point of view.
23 The population might actually be improved.
24 CHAIRMAN JENSCH: I think one of the ordinary
25 requirements in such interrogation is would you connect it

ty 5

1 up to show that the fish you have been catching or killing
2 have been analyzed and found to be diseased or poor swimmers
3 in some way, rather than speculating. Because he might come
4 back and say is he blind, can he see or hear?
5 I think we go into many speculative possibilities.
6 I think if you connect it up, give some analysis, fish-by-fish
7 analysis, I think it would be a predicate for the question.
8 Otherwise we are guessing quite a bit.
9 MR. TROSTEN: Would you accept this, subject to
10 check, Mr. Chairman?
11 CHAIRMAN JENSCH: Surely.
12 MR. TROSTEN: Thank you.
13 BY MR. TROSTEN:
14 Q Mr. Clark, would you answer my question? Do
15 you think that these fish which have less endurance are actually
16 physiologically less healthy than the other fish in the
17 population, that they might be diseased?
18 A I have no opinion.
19 Q You have no basis for forming that opinion?
20 A No.
21 Q Would you just say it -- you are a fishery biologist,
22 just as a matter of your general knowledge, do you think this
23 might be true? I recognize that you don't have data which
24 would enable you to form an absolute conclusion on this.
25 But on the basis of your expertise.

ty 6

A You are suggesting that it is already established that there is a connection between impingement probability and endurance which is not established.

Q No.

A Can we have the question read back?

(The reporter read the question as requested.)

BY MR. TROSTEN:

Q Mr. Clark, earlier in the interrogation you agreed that as the intake velocity was reduced -- I am sorry.

Earlier in the interrogation you stated that as the intake velocity is reduced, the number of fish that are still impinged on the screens, that are being impinged on the screens, would probably be weaker swimmers. Is that correct?

MR. MACBETH: I don't think that is in the transcript at all.

MR. TROSTEN: We will have to go back and find out what you said earlier.

MR. MACBETH: It is one of those possible questions where you didn't ask him what was probable. He said it was possible.

BY MR. TROSTEN:

Q Did you say that was possible?

A I accepted your hypothesis as being possible, which included that statement, I believe.

Q Thank you very much. That is exactly what I

ty 7

1 wanted to establish.

2 Now having established that possible hypothesis,

3 I am asking you the question might it be true on the basis

4 of your general expertise as a fishery biologist that

5 these fish which are being impinged on the screens are

6 physiologically weaker than the other fish in the population.

7 A Yes.

8 Q Thank you.

9 Now is it true, Mr. Clark, that in many instances

10 where one organism is fed upon by another that the predator

11 often catches and consumes the weaker individuals in the prey

12 population? At a greater rate, that is, than the healthy

13 individuals?

14 A Are you saying that weak is unhealthy?

15 Q I am saying weak could either be unhealthy or

16 it could be just not as strong, just did not have as great

17 a physical capability.

18 A I don't know.

19 Q Isn't it true, for example --

20 A About weakness.

21 MR. MACBETH: Perhaps if you broke those two, took

22 healthy as one case and lack of strength as another, we might

23 get on.

24 BY MR. TROSTEN:

25 Q Let me take a rough analogy I read about, it

ty 8

has nothing to do with fish, but this is what I am talking about. I have heard that wolves and cayotes are very useful because they take the diseased members of the animal populations, deer populations, for example, and run them down and it helps really to keep the population of the herds healthier, actually, because they are taking the weaker members. That is the sort of thing I am thinking about. So what I am asking you is this: Would you say in the case of fish that a predator which is preying on a fish population would selectively consume the weaker members of a population rather than the stronger members of ~~ten~~ ten population?

MR. MACBETH: Could we try to and get it whether by "weak" you mean "unhealthy" fish or you mean simply physically not as strong?

BY MR. TROSTEN:

Q I am starting first with physically not as strong.

A No --

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CHAIRMAN JENSCH: Have there been any studies after the predator has caught a fish to open up the predator and look at the fish inside and say now was this catch physically weak, or was he a diseased fish or blind, or anything like that, any analysis of the innards of predators of fish?

THE WITNESS: There are a number of studies and field observations to suggest that among the prey, those that are acting peculiar in their behavior, that have been wounded in some fashion and display some stress are taken by predators. But I know of nothing that says that a fish that is weaker or his stamina is down would be selected in favor of any other.

Now there is one set of experiments that comes to mind, and this was on whitefish fry, some experiments that were done whereby when these whitefish fry were stressed at one minute of high temperature such as they would get in a power plant, that this stress was recognized immediately by predators. These fry were held in two groups, one control group and one shocked group. When the one that was thermally shocked, when that group were introduced with the predators, they immediately ate them up. When the other group was put in, the predators kept swimming around in the tank and paid no attention to them. So it is an example of the stress factor being recognized by the predator.

As I recall this, the research men, the observers, couldn't see any difference at all between the fish, when

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1 they had been thermally shocked or not. They put them in the
2 tank and they all looked the same. But the predators recog-
3 nized them immediately and they attacked the ones that had been
4 thermally stressed and not the others. There is an example.
5 But it is not weakness, lack of physical strength or stamina
6 or endurance. It is some peculiar sort of behavior, that
7 in this instance was not visible to our eyes, but was
8 recognizable by the predatory fish.

9 BY MR. TROSTEN:

10 Q I understand, I think, the difficulty you are
11 having in answering my question. Take a fish which is diseased.
12 Do you think that a predator would selectively prey upon a
13 diseased fish?

14 A Yes, if he could recognize the stress nature
15 of the fish caused by the disease. If the disease was internal,
16 so that there was no recognizable behavior, then I don't, I
17 wouldn't think that he would be subject to more predation.
18 Unless it is recognizable as a behaviorial aspect or some
19 visual sign about the fish.

20 Q Now we have established that there is some
21 selectivity of predation.

22 A Definitely.

23 Q But there are perhaps some complicated factors
24 associated with this.

25 A Yes.

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Q Turning away now from natural predation and turning to the effect of the power plant upon the populations of fishes in the river, the Indian Point power plants, do you think it is possible that as the flow is reduced, i.e., as the volume is reduced through the intake screens, that the Indian Point plants would selectively remove the members of the population that are diseased?

A No.

Q Would you tell me the basis, why you feel this could not occur, in view of what we established before, that as the flow goes down, you agreed that the number of fish reduced will go down; you agree that it is possible that the fish which are being impinged on the screens as the flow goes down are the fish which have less endurance, fish which are weaker?

A Are you saying this?

Q I say you have agreed that this is the case.

A No, I have not agreed that that is the case.

MR. MACBETH: You agreed it was possible.

THE WITNESS: Oh, all right. It is possible.

BY MR.TROSTEN:

Q Now I have asked you the question -- and you have also agreed back in the testimony, Mr. Clark, that it is possible that diseased members of the population are poorer swimmers, do not swim as well as the healthy members of the

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1 population.

2 MR. MACBETH: Could you identify that in the

3 testimony? Do you remember that in the record?

4 THE WITNESS: No, I don't. If you just want to

5 say is it theoretically possible that all of these things

6 can happen, I can answer yes and we can go on. But if you

7 ask me probably, I will say no in every case.

8 BY MR. TROSTEN:

9 Q All right. You would agree it is theoretically

10 possible that the Indian Point plants are selectively

11 removing the diseased members of the population of fishes

12 in the river. Is that correct?

13 A Sure, it is possible for a codfish to swim from

14 Newfoundland and get caught in that screen, too, but not

15 probable.

16 Q Would you just answer the question?

17 A I did. I said yes.

18 Q You agree it is possible. Thank you.

19 CHAIRMAN JENSCH: Will you connect that up? Because

20 I had understood that a predator has a kind of behavioral

21 response, but I didn't understand that the same capacity was

22 shown with mechanical devices at Indian Point to detect a

23 behavioral difference among fish and reach out and take just

24 the diseased or poor swimmers. I thought it was kind of

25 an engulfment of everything in front of it.

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1 MR. TROSTEN: I am not trying to suggest that the
2 Indian Point plant selectively picks out the fish, the way
3 there is some evidence, perhaps, that a predator does. Mr.
4 Clark described some of the predator-prey experiments. But
5 I was attempting to demonstrate through this line of question-
6 ing that we believe there is evidence -- I was seeking to
7 elicit Mr. Clark's agreement to this -- that can cause one
8 to deduce that the Indian Point plants are selectively
9 removing the weaker members of the population. This is a
10 process of deduction you have to go through by analyzing
11 the behavior of fish populations, analyzing the behavior of
12 the plant, and then drawing a logical conclusion, the sort of
13 logical conclusion that Mr. Clark says he has drawn as to
14 why the number of fish goes down when you reduce the flow.
15 He has his conclusion which he has drawn, we
16 have another conclusion which we feel is a better conclusion
17 and a more justifiable one.
18 CHAIRMAN JENSCH: My question to you is, will you
19 connect up the selectivity of your mechanical devices at
20 Indian Point to show you are pulling --
21 MR. TROSTEN: In the diseased fish?
22 CHAIRMAN JENSCH: Of course, if in a collection
23 that you pick up in a basket, you find one out of 2000 has a
24 part of a fin missing or an injury or some disease internally,
25 I am wondering if you would also be able to connect up that

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1 that indicates that the mechanical devices of the intake
2 are making some selection of diseased fish, even though the
3 proportion may be one in 200,000 fish, you found one that was
4 diseased.
5 MR. TROSTEN: We will offer evidence, Mr. Chairman,
6 to connect this line of questioning up having to do with the
7 selectivity of the Indian Point intake structures.
8 CHAIRMAN JENSCH: Very well. Thank you.
9 BY MR. TROSTEN:
10 Q Mr. Clark, in terms of the probability which a
11 fish would have of surviving to maturity, would you say that a
12 fish which was diseased would have a lesser probability of
13 surviving to maturity than a fish which was not diseased?
14 A Yes.
15 Q If it were shown that fish collected -- excuse me.
16 Strike that.
17 If it were shown that fish collected at the intake
18 structure had a higher percentage of disease than the popula-
19 tion as a whole, would this indicate to you that these fish
20 that were collected at the intake structure would have a
21 lesser probability of survival than the population as a whole?
22 MR. MACBETH: Could Mr. Trosten indicate what
23 diseases he has in mind here? If this is going to be
24 connected, and if there is evidence as to particular diseases,
25 it seems it would be useful to have those diseases laid out

1 to the witness so the answer can be as pointed as possible?

2 CHAIRMAN JENSCH: Could you do that? I don't

3 know what kinds of diseases fish have, pneumonia or cancer?

4 MR. TROSTEN: Parasites, for example, Mr. Chairman.

5 CHAIRMAN JENSCH: Well, can you give us several

6 diseases, and say if one has a probability of killing a fish

7 sooner than his normal life span, that sort of thing?

8 MR. TROSTEN: Let us try. I was thinking in general

9 terms actually of any disease that would prevent a fish from

10 carrying on normal life functions. But take gill parasites,

11 as an example.

12 THE WITNESS: I have no opinion on that, Mr.

13 Trosten.

14 BY MR. TROSTEN:

15 Q All right, Mr. Clark.

16 Mr. Clark, in your analysis of the impact of the

17 removals by impingement at Indian Point 1 and 2 upon the

18 populations, did you assume that all of the fish were of equal

19 health?

20 A I didn't consciously assume that, but -- or write

21 that down, but I would say yes, I would be working within that

22 framework.

23 Q Mr. Clark, what is the fate of a fish that dies from

24 natural causes in the Hudson River? What happens to him?

25 MR. MACBETH: What is the natural cause of his

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1 death? Is it eaten by other fish, or what?

2 MR. TROSTEN: Other than being consumed by another

3 fish.

4 THE WITNESS: If a fish gets diseased and dies,

5 what will happen to it?

6 BY MR. TROSTEN:

7 Q Yes, what happens to the body of the fish?

8 MR. MACBETH: I object to this question on the

9 grounds of relevance. What relevance does it have?

10 MR. TROSTEN: The relevance, Mr. Macbeth, has to do

11 with the mode of disposing of the fish which are impinged at

12 Indian Point and the mode of disposition of fish in the

13 natural order of things which die in the Hudson River. And

14 what this contributes -- what we are talking about here, Mr.

15 Macbeth, as you know, is the overall ecological and biological

16 effect of the impingement at Indian Point. At least I certainly

17 believe that that is what you are discussing here, too. We

18 are talking about not the effect upon the individual fish that

19 dies on the screens, but the thing that the hearing is about,

20 what we are all concentrating on, is the biological impact

21 on the overall population of the impingement that occurs in

22 the river. That is the relevance of this particular question.

23 I am comparing what happens in the river and what happens at

24 Indian Point.

25 MR. MACBETH: Wait a minute. Are you asking Mr.

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1 Clark what you do with a fish that you take off the screens?

2 MR. TROSTEN: No, I am asking him what happens,

3 in his opinion, as a fishery biologist, a person who has

4 studied the Hudson River, to a fish that dies of natural

5 causes in the river other than a fish consumed by another one.

6 What happens to a fish that is diseased and dies in the

7 Hudson River in the vicinity of Indian Point, shall we say.

8 That is what I am asking.

9 CHAIRMAN JENSCH: You say a fish that is diseased

10 and dies?

11 MR. TROSTEN: A fish that dies, for example, of a

12 disease, not a fish eaten by another fish, but a fish,

13 through the natural order of things, dies in the river.

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MR. MACBETH: I still fail to see the relevance of this, whether it goes to the top of the river or the bottom of the river or decomposes. I fail to see what the relevance of this is to the inquiry before the Board. We have had an explanation from Mr. Trosten. Perhaps we could get a ruling from the Board, because despite your description that you are discussing mortality, it is true you are discussing mortality, but I don't see anything in the explanation that connects up the dead fish, or what happens to the dead fish -- that is all you are asking, what happens to them, do they go to the top or bottom, to anything else we have been talking about. I really don't think this is relevant.

I object on those grounds.

MR. TROSTEN: I think you put your finger on the various things that could happen to it. Why not let the witness answer as to what happens to the fish. I am not concerned --

MR. MACBETH: I object on the grounds of relevance.

CHAIRMAN JENSCH: I think in view of Applicant's counsel's statement that he will connect this up, we will have a chance to reevaluate the situation, because I assume he is going to show almost on an individual fish by fish analysis first whether they are diseased and then some connecting up of what does happen, from your own witnesses, to these fish,

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whether they are eaten by seagulls or whatever else. Another problem I wonder is what would be the normal life span of, A, a normal healthy fish, and, B, the life span of a certain diseased fish, and then the life span of another kind of a diseased fish. So that we would have quite a population coverage of not only normal fish, but diseased fish. I assume you will connect this all up.

MR. TROSTEN: Mr. Chairman, we have had a tremendous amount of generalized testimony in the hearing from Mr. Clark, for example, about impacts on populations, and impact on the river, and it has been testimony of the most generalized sort. And I think that in questioning a person who draws conclusion of this sweeping sort on the basis of very generalized basis, it is necessary to question on a generalized basis, because he is not relying on specific data in maybe many cases, he is relying on general reading, general feeling, and general conclusions. As far as the particular question that I am asking, the important issue before the Board is what is the ecological impact on the populations in the river as a result of the impingement at Indian Point. It isn't the question of what happens to the individual fish that is impinged on the screens. What I am seeking to establish here with this witness is to compare the ultimate fate of the fish that are impinged on the screens with the fish that die in the river to see if from an ecological point of view, the two

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1 effects might be the same. So that the result of this might
2 be that the impingements at Indian Point 2 might not be having
3 a substantially different impact than the death of fish in the
4 river itself. That is the whole reason why I am asking these
5 questions.
6 CHAIRMAN JENSCH: Well, it seems to me that a part
7 of your questioning depends so much on your previous ques-
8 tioning which doesn't rest upon probable circumstances, or
9 established facts. You have asked him questions -- well,
10 theoretically don't you think it is possible that something
11 like this could happen. He says, yes, it is possible, but
12 it is not probable. So on the basis of these, what I infer
13 are speculative possibilities, you are now asking him, now
14 that you agree you might get some diseased fish in the intake,
15 it is a possibility, compare that number of diseased fish in
16 your screens with the number of diseased fish in the river,
17 and I don't think you have comparable situations.
18 MR. TROSTEN: Mr. Chairman, let me rephrase the
19 question to Mr. Clark.
20 CHAIRMAN JENSCH: All right. The question will be
21 considered to be withdrawn. Proceed.
22 BY MR. TROSTEN:
23 Q Mr. Clark, apart from the fish which are removed
24 for study purposes at Indian Point, once they are taken off
25 the screens, what happens to the fish that are impinged which

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are dead, once they are collected off the intake screens?

MR. MACBETH: I think --

CHAIRMAN JENSCH: Could I have that question read, please.

(The reporter read the pending question.)

CHAIRMAN JENSCH: Is this the revolving screen or the outer screen?

MR. TROSTEN: The revolving screen, Mr. Chairman.

CHAIRMAN JENSCH: Have any studies been made of the fish impinged or killed on the outer screens?

MR. TROSTEN: No, sir. I am asking him what happens to the fish that are collected off the revolving screens and which are dead. What happens to them. I am asking Mr. Clark to tell me -- he knows perfectly well what happens to them. I am just asking him to say what that is.

MR. MACBETH: Some of them are brought in bags by Gene Woodbury to the hearings, things of that sort. Mr. Trosten, it is the Applicant that knows what happens to those fish; we haven't offered any testimony on that point. Until there is something in the record from the Applicant --

CHAIRMAN JENSCH: Do you have some witness here who can establish that evidence?

MR. TROSTEN: Yes. I can say what happens. The fish that are removed from these revolving screens, which are dead, are returned to the river. Isn't that true, Mr. Clark?

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THE WITNESS: I have seen pictures of piles of them on a dump someplace.

BY MR. TROSTEN:

Q I am talking about what is happening under the standard operating procedures today, Mr. Clark, and you know perfectly well what I am talking about. The fact that your counsel is objecting so furiously to this must indicate there is some reason you don't want to answer the question.

MR. MACBETH: That does not indicate that at all, Mr. Chairman. I object to this question because the Applicant knows the answer to this question; we haven't produced any evidence on this point. If Applicant wants to come forward with testimony as to what they do with the fish, we will cross-examine them and check it. I am not objecting on the grounds that the witness does not wish to answer. I think that is a totally inaccurate and uncalled-for discussion from Applicant's counsel.

MR. TROSTEN: There is evidence in the record, Mr. Macbeth, as to what happens to -- what is the disposition of these fish. If you wish --

CHAIRMAN JENSCH: Where is it in the record? That might answer the whole thing. If it is already in the record, we won't have to go through it again. Do you have a man here --

MR. TROSTEN: Yes. Mr. Aleuvas would say what

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1 happens.

2 MR. ~~ALEUVAS~~ Alevras: When we are not using the fish for

3 study purposes, the fish that are taken off the intake

4 screens, their bodies are still whole, they are intact, and

5 we take those fish out into the river and dump them into the

6 river, a safe distance from the plant, so we feel we won't

7 have them immediately recirculated back onto the screens.

8 CHAIRMAN JENSCH: This witness just said he saw

9 piles of fish in a dump. When did that happen?

10 MR. ~~ALEUVAS~~ Alevras: The original configuration of the

11 intake at Unit 1 consisted of a sluice coming from the traveling

12 screens on which the fish were picked up. This sluice led to

13 a trash basket, which is a common structure in a power plant.

14 The fish and the trash which is picked up on the traveling

15 screens piles up in a basket, and this basket is lifted

16 out periodically, put in a dump truck and disposed of at a

17 local dump. Shortly after it was released, the fish were piling

18 up in the dump, the sluice which carried the fish was

19 extended back to the river. This sluice then carried the fish

20 back to the river, rather than staying inside of the plant or

21 being disposed of at the dump. Because the sluice is close

22 to the intake screens, we don't want to release the fish

23 directly there because on flood tide they could be carried

24 right back to the screens and we would count the fish many

25 times.

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In fact, in the past we are well aware that numbers reported at the plant consisted of fish being counted several times, over and over again.

CHAIRMAN JENSCH: Do you tag them so you know that?

MR. ALEUVAS: No, but we physically observed the fish to go from the sluice directly back onto the screen. To prevent that now we simply take the fish fafther into the river, well beyond the influence of the intake, so we are not recirculating them back to the intake screens. That is the disposition of the fish.

CHAIRMAN JENSCH: All right. Upon that predicate, do you have a question?

MR. TROSTEN: Yes.

BY MR. TROSTEN:

Q You have heard Mr. ~~Aleuvas~~ Alevras testify with regard to what happens to the fish that are dead which are collected off the intake screens, i.e., they are returned to the river --

CHAIRMAN JENSCH: Let me ask the witness something on that: Do you extend the sluice way farther out into the river?

MR. ~~ALEUVAS~~ Alevras: We had been using the extended sluice until we realized we were recirculating dead fish back into the intake. We don't use that now. The sluice is still there to conduct the water away, but we are

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intercepting the fish for study purposes, and when we aren't studying them, we collect them anyway, and take them out into the river some distance away from the influence of the intake and release the fish into the river.

CHAIRMAN JENSCH: Just as a matter of numbers, how long do you run the boats out? Do you dump every hour or what?

MR. ~~ALEUVAS~~ Alevras: It would depend. Normally I would say most of the months of the year we would probably only take fish out once a week and that would be something less than a garbage can full. In the summertime, we do it every day, simply because the smell gets bad.

CHAIRMAN JENSCH: Do you have records showing the number of boat trips you made for that?

MR. ~~ALEUVAS~~ Alevras: No, we never kept track of that.

CHAIRMAN JENSCH: Do you have records showing the number of basketfuls you take out into the river.

MR. ~~ALEUVAS~~ Alevras: We only have records of the number of fish we collected at the plant. Many of these fish, a good deal of them, have gone for study purposes and therefore they weren't dumped into the river, we dispose of them as study fish as directed by the New York State Conservation Department.

CHAIRMAN JENSCH: When did the program of studying the fish start?

MR. ~~ALEUVAS~~ Alevras: Well, it was never clearly defined

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when the study started. I can't give you a specific date. Con Edison's involvement began in April, 1970.

CHAIRMAN JENSCH: You started in 1970.

MR. ~~ALEUVAS~~ Alevras: That is correct. Fish were counted prior to that, but it wasn't a, I would say a formally constituted study at the time those were being counted.

CHAIRMAN JENSCH: Well, you have records about your study of fish and how many, what the percentage is of the fish that are taken out for study compared with the number of fish dumped back into the river?

MR. ~~ALEUVAS~~ Alevras: No, we have not segregated. The method of disposition of the fish has changed over the course of the study.

CHAIRMAN JENSCH: What disposition -- first you dumped them in a dump pile someplace. And then you put others in the river. What other changes have you had?

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MR. TROSTEN: Mr. Chairman, the practice of dumping fish in the dump, which was a practice that was discontinued, as Mr. ~~Aleuvas~~ Alevras said --

CHAIRMAN JENSCH: When?

MR. TROSTEN: When was that practice discontinued, Mr. ~~Aleuvas~~ Alevras?

MR. ALEUVAS: I cannot give the exact date, but prior to 1965.

CHAIRMAN JENSCH: The reason I asked, is you said the method of dispositon of the fish had changed. What steps or what different kinds of disposition did you have of the fish?

MR. ~~ALEUVAS~~ Alevras: For a while, we were taking the fish we considered as study fish, and disposing them in the river, by putting them in weighted burlap sacks. This was to insure they didn't come back into the intake screens, the burlap would break down, and the fish would be released to the river and be decomposed.

The New York State Department did not approve of that method, and they required us to dump the fish whole, into the river with no container around them. Now, they have requested the study fish be used, all of the fish that are collected in the study, both at the plant, and in the river, all get grouped together as study fish, and now, they are going back to the dump again, because they are study fish.

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So, if we go back to opening the plants on a normal basis, and we don't have study fish, they will then go back to the river again. These are the fish we are talking about.

CHAIRMAN JENSCH: I can't help but think how the Pilgrims must roll over in their grave when they put the fish in the corn to make it grow. I don't know if it has the same effect in the river or not. But are those the only steps you have had about the -- first, the dump pile, then the burlap sacks, and now, you are dumping them whole?

Those are the only three kinds of disposition you have made? You have used the word "study fish." I take it you take a basket and scoop out of the larger basket of fish every once in awhile?

MR. TROSTEN: Mr. ~~Aleuvas~~ aleuvas, would you please describe what you mean by "study fish," what is being done with those fish, and how they are being disposed of?

MR. ~~ALEUVAS~~ aleuvas: We are presently sampling all of the fish that come off the traveling screens at Unit 1 and Unit 2, if the pumps are opening for test purposes. Every fish we check presently is considered a study fish. We are enumerating them by species, by weight, taking a substantial sample, of which we take the length and weight of individual fish.

We are also examining the fish for parasite contents, and we are doing physiological and histological studies of those fish. So that presently, all of the fish

coming off the traveling screens at the plants are considered study fish. So, at this moment, we are not taking any fish out into the river, and disposing of them. If we conclude our studies, when we do, if we are still collecting fish at that time, those fish will no longer be study fish, and they will be destined to go back into the river.

CHAIRMAN JENSCH: Dumped, without any restraints, like burlap sacks?

MR. ~~ALEUVAS~~ aleuvas: Right.

DR. GEYER: Your testimony that they were recirculated, when they were put in the discharge flume, suggest, at one time you were just putting those, not taken for study right back in the discharge flume, is that right?

MR. ~~ALEUVAS~~ aleuvas: Not the discharge flume, the sluiceway. This was prior to April 1970. When collections were being made, but it was not a formally constituted study.

DR. GEYER: But this is a way you did it at one time?

MR. ~~ALEUVAS~~ aleuvas: That is right. We realized the problem there, and in the future when we are ready to return fish to the river, we will, of course, take them a distance away from the plants so we don't recirculate them.

MR. TROSTEN: Just to further expand upon your response to the Chairman's question, Mr. Aleuvas, it is correct, is it not, that all of the fish that come off the travelling

screens now are being counted.

MR. ~~ALEUVAS:~~ Alevras That is correct.

MR. TROSTEN: Now, it is also correct, is it not, that the method of disposition of the fish into the river and the method of, or the handling of the so-called study fish, these methods are those that have been directed, and/or approved by the Department of Environmental Conservation of the State of New York?

MR. ~~ALEUVAS~~: Alevras That is correct.

MR. TROSTEN: Is it not also true that the method of disposition of fish into the river was directed by the Department of Environmental Conservation, because they felt that it would be ecologically sounder to do this, so the fish would be returned to the food chain in the river.

Is that correct?

MR. ~~ALEUV~~AS: Alevras That was their reason given for disposing of the fish the way we did.

DR. GEYER: Since the two screens, the outer one and the moving one, are the same mesh size, if the outer ones were down, you would not expect to get anything on the inner ones, would you?

MR. ~~ALEUV~~AS: Alevras This would require an explanation.

The flow, of course, is continuous in the direction toward the pumps. So, when the fish impinges on the outermost screen, he is held there by the water pressure, through the

screen. When we raise the screen to clean it, which, on a regular basis, is once daily; we do it with the main circulator still running.

The result is that as the screen is raised, because this wall here extends below the water surface, before the screen reaches the water surface, the water pressure on the screen is released, and the fish that are on the screen roll off and sink down into the water, and are carried by the intake flow into the bay.

Since most of the fish coming off the final screen are already dead, they are passive, and they are carried immediately back onto the traveling screen. They are the same mesh size, so we assume we don't lose any through the meshes from one screen to the other.

So the fish just go passively back on to the traveling screen. That screen has ledges about two inches wide, every two feet. They are lifted onto those ledges and washed off into the sluice, here, and that is our sampling points. That is how we get fish into the bay. In essence, the traveling screen at the plant, now is our sampling device. And the fixed screen is actually doing the job of filtering the debris out of the river. It is simply replacing the traveling screen, The traveling screen is now simply the pickup.

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DR. GEYER: Do you believe that is of any significant help?

MR. ~~ALEUVAS~~ Alevras: Having the fixed screen out here?

DR. GEYER: Yes, if it is the same size screen.

MR. ~~ALEUVAS~~ Alevras: Most definitely it is a help for a couple of reasons. For one, the cross-section doesn't show it as well, but this is, if you can visualize it, this is a three-sided box, concrete walls on either side, a concrete floor, and this intake opening. It has been reported in the literature on fish impingement and we have some data from the plant to suggest that if we operate without a fixed screen, we get more fish into the bay and collect more fish off the traveling screen than if we operate with the fixed screen in place. We have done comparative tests, two bays with a fixed screen, two without, to see the comparative numbers of fish.

Most definitely you get less fish when you have the fixed screen in place. The other important factor is that from a fish point of view, fish aren't very bright. You can trap them in a three-sided box and if the opening is relatively small, and if in this case all of the flow is going in the direction toward which there is a dead end, even large fish can get trapped in a space like this, and not find their way out, even those there is nothing to restrain them.

It is sort of the principle of fish trap, when you trap fish, you lead them into a small area, an area with a small

1 opening. Once they are in there, they don't find a way
2 back out. We feel we reduce the number of large fish that we
3 collect at the plant by screening this bay and removing
4 the entrapping area here.
5 A large fish, a stronger swimmer than the fish that
6 we are getting now, which are ranging two to four inches, these
7 larger fish can escape the flow approaching and going through
8 the fixed screen and not get impinged, whereas the small
9 fish that would also be entrapped, he can escape, so what we
10 have done by installing the fixed screens, at least our feeling
11 is we have eliminated the problem of entrapping large fish
12 at the plant.
13 We have also eliminated the entrapping of small
14 fish. But we have not eliminated the impinging of the
15 small fish. So we feel we have gained two things, reduced
16 the total number using the fixed screens and also reduced
17 the number of large fish, in fact, virtually eliminated it.
18 DR. GEYER: Thank you very much.
19 CHAIRMAN JENSCH: Are you sure that you get a
20 good enough count from this outer screen arrangement that you
21 raise once a day. Does shutting scrape them off? When they
22 get closer to the surface, I take it you don't have quite the in-
23 take velocity, and therefore, you get this floating; I think
24 Mr. Clark mentioned before he had seen a lot of fish
25 on the surface, so I take it they are not all pulled into the

revolving screen.

MR. ~~ALEUVAS~~ Aleuvas: That is correct. There is certainly a loss that occurs in the cleaning process of the fixed screen. I have tried to make observations in a variety of ways to determine what is the fate of a fish that is impinged on that screen, particularly dead ones, since most of them are dead, what happens when the fine screen is raised and where are the losses that could occur.

MR. TROSTEN: Before you go on, Mr. Aleuvas, you have personally been at Indian Point and observed the operation of the screens many times, is that correct?

MR. ~~ALEUVAS~~ Aleuvas: Yes, in fact I have been there and directed how the screen is raised, fast, slow, stop. I want to watch this kind of thing so I have had access to the plant and could adjust the movements of the screen to make observations. When the screen is raised, the majority of fish which are impinged on the screen are not raised out of the water physically impaled into the screen. They roll off the screen and start sinking and you can visually observe this before the screen breaks the surface of the water.

It is because of the curtain wall that breaks the water flow going through the screen here. Some percentage of the fish on any given day arephysically impaled into the mesh, they may have got their head in and gotten gilled or the fins are entangled in the mesh of the screen. Those fish

stay attached to the screen as it is raised above the water surface, there is a spray on the deck that hits the screen from behind and knocks the fish off down into the water.

CHAIRMAN JENSCH: Those are the floaters?

MR. ~~ALEUVAS~~ alevras: Those are usually the ones that float. This wharf here, the wall, the spray wash is behind the screen here, so when the fish are sprayed off, the distance is about six feet between this wall and the wharf, so the fish can't be sprayed any farther than that away from the screen and they fall down directly in front of the screen.

My observation is any fish that falls down here, he may float and not be taken into the bay when that screen washing occurs. But he does not escape the influence of the intake flow. He stays around the intake, so he is probably collected on a subsequent screen washing. This is one reason why we ran the tests for two weeks or a month at a time to smooth out the loss of fish on any given day, to account for these fish that are not taken in.

What happens to fish underwater. The clarity of the water thereis quite limited, under good conditions you can see down two feet, most of the time less than that. What happens to the fish underwater I can't say. We tried observing with an underwater TV camera and visibility is too limited and the diver has the same problem.

So, there could be a loss down here that we can't

1 observe, there is no way to see it. One thing that makes me
2 think the loss is limited is this. Since the pump draw is located
3 in the bottom of the bay, when you make a velocity profile in front
4 of the screen most of the time the flow through the screen is not
5 a uniform flow distribution, the bulk of the flow is coming
6 through the lower portion of the screen. So it is my feeling
7 that any fish that would roll off the screen at the lower part
8 of the screen perhaps as it breaks off the bottom there, I think
9 the chances of the fish escaping there are less likely than
10 when the screen is getting farther and farther up.
11 Particularly if you break the flow right at the
12 bottom when you raise the screen, you get a rush of the water
13 under the screen, because you have less resistance to the
14 flow. So I feel the fish would go in with a rush, rather than
15 getting out.
16 If they are dead and then passive, I don't see how
17 they could escape into the tidal flow of the river and get
18 away from us.
19 CHAIRMAN JENSCH: If you raise that screen and there
20 is still enough force to hold them against the screen as you
21 raise it, while the force or velocitymay be less than you get
22 near the surface of the river, do not those fish get up
23 to an area in the river where they can kind of float
24 at will, they are not going to drop like lead to the bottom,
25 are they?

MR. ~~ALEUVAS~~ Alevras: No, I have observed them to sink, you can see them peal off the screen and slowly sink down.

CHAIRMAN JENSCH: Some. What proportion?

MR. ~~ALEUVAS~~ Alevras: We never made a collection at that point to determine. I would say the vase majority sink.

CHAIRMAN JENSCH: Yet this floating on the surface, there must be quite a few that get to the surface, as I understand the testimony the other day, there is quite a few floating around the surface. How long does it take, by the way, to raise this screen?

MR. ~~ALEUVAS~~ Alevras: I have timed this over a period of several months and the average is three to five minutes from when the screen breaks off the bottom to be cleaned and placed back down again.

CHAIRMAN JENSCH: You do that once a day.

MR. ~~ALEUVAS~~ Alevras: Yes, sir, once a day.

CHAIRMAN JENSCH: Thank you.

BY MR. TROSTEN:

Q Mr. Clark, I just have two brief further questions on this subject. You have heard the testimony concerning the disposition into the river of the fish that are collected on the traveling screens. Now, what is the disposition, in your view, as a fishery biologist, of those fish that are placed back in the river that were collected on the intake screens and were put into the river dead?

A Depending on when they -- they will fall prey to something, depending on whether they float or sink. It might be crabs or sea gulls.

Q What is the disposition, in your view, as a fishery biologist, of the fish which die in the river other than those which are consumed by another fish? Is it the same fate that you have just described for these dead fish?

A Fish dying of natural cuase, what is their disposition?

Q Yes, what is their disposition. Would you say their fate would depend on whether they rose or sank or -- would it be the same fate as the fate of the other fishes that were put in the river dead after being impinged on the intake?

A Yes.

Q Thank you.

MR. TROSTEN: Mr. Chairman, I have no further questions of Mr. Clark with regard to the impingement. We can go on to another subject now.

CHAIRMAN JENSCH: There have been delays this morning --

MR. TROSTEN: Would you like to take an early lunch break and maybe Mr. Briggs would be back.

CHAIRMAN JENSCH: If that would be more convenient to your examination, we might well do that. What time would you suggest we reconvene.

MR. TROSTEN: Why don't we come back here at one o'clock and start right in. Perhaps Mr. Briggs would be here by then.

CHAIRMAN JENSCH: All right. Let us recess at this time to reconvene in this room at one o'clock.

(Whereupon, at 11:40 a.m., the hearing was recessed, to reconvene at 1 p.m., this same day.)

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AFTERNOON SESSION

(1 p.m.)

CHAIRMAN JENSCH: Please come to order.

XXXX Whereupon,

JOHN R. CLARK

resumed the stand and, having been previously duly sworn, was examined and testified further as follows:

CHAIRMAN JENSCH: With the rain and the fog outside, it is easy to understand the delay in the plane that brings Mr. Briggs here for the afternoon session.

Mr. Clark has resumed the stand.

We had some discussion this morning that Mr. Clark had some information in response to Mr. Briggs' questions.

Who will make the presentation? Hudson River Fishermen's Association or you?

MR. TROSTEN: Mr. Chairman, before we do that, I would like to ask Mr. ~~Aleuvas~~ Alevras if he has any brief amplification of his testimony this morning to make?

CHAIRMAN JENSCH: Can you focus it a little?

MR. TROSTEN: Yes, it will be focused on the matter of what occurs to the fish as the traveling screens are raised, and they come off the screens and their location here in this area here. (Indicating on chart.)

We had some discussion this morning and Mr. ~~Aleuvas~~ Alevras

has a brief amplification on his testimony with respect to that.

CHAIRMAN JENSCH: This pertains solely to the traveling screen, not the fixed screen on the outside.

MR. TROSTEN: No, it has to do with what happens when you raise the fixed screens and the fish fall off the fixed screens while the fixed screen is being raised. This is the screen right up here that is being raised. (Indicating.)

CHAIRMAN JENSCH: Proceed.

MR. ~~ALEUVAS~~ Alevras: The Chairman had a question about when the screen is raised, the fish that are left floating on the surface of the water in front of the screens. And the structures in front of the screen and the flow pattern of the water moving toward the screen has an influence on what happens to those floating fish. That small diagram doesn't show it very well. (Drawing on board.)

In front of the intake structure there is a wall supported by a series of pilings. There is a deck surface and a wall that extend down below the water surface. This is the intake opening. This is the position of the fixed screen in front of the intake opening. When the fixed screen is raised, it is raised in this direction, and there is a pipe right here that sprays water onto the screen to wash it as it is raised.

Now, the distance between the wharf and the deck

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1 surface is only six feet. So that when the fish are washed off,
2 those that don't sink immediately can only be sprayed up to
3 six feet away from the screens, in most cases they drop
4 directly down onto the water surface. And the flow toward,
5 the flow of water is all in the direction of the plant, so
6 these fish that fall back onto the surface of the water do
7 not have an opportunity to get into the tidal flow or any
8 other currents that would conduct them away from the intake
9 structure.

10 If you were to look at it from above, there are four
11 intake base, each one with a fixed screen in front of it,
12 and the wharf in front of that. The fish fall into this area
13 right here -- (Indicating.) -- which is a distance of six
14 feet between the wharf and the intake and across the structure
15 itself is a distance of about 50 feet. It is within this area
16 that the fish are falling onto the surface of the water.

17 CHAIRMAN JENSCH: You are not suggesting that that
18 wharf is a solid wall, but there is a free flow of water below
19 that wharf, however, I take it, except for the pilings
20 holding the wharf?

21 MR. ALEUVAS: That is right. The river flow is
22 in this direction underneath the wharf.

23 Now I have gone down underneath the wharf to
24 observe the screen washings to see what happens to the material
25 that comes onto the water. There is a good deal of floating

ty 4

debris in the river, logs, plastic bottles and so forth that are carried up against the screen at the surface just as the dead fish would be. I have observed through all stages of the tide that this material which collects in front of the screen in approximately this area here does not get carried away by the tide, even though the current is running pretty strong underneath the wharf, say, by the outer edge, back in here there is very little tidal current.

So the material that falls in front of the screen, including the fish washed off the screen, do not get carried away by the tide, it stays there day after day and you can observe this by seeing the same pieces of debris there for weeks at a time, they are identifiable by some mark on them perhaps.

CHAIRMAN JENSCH: Under your theory you would reach them down and scoop them out and perhaps get dead fish with them; is that it?

MR. ~~ALEUVAS~~ Alevras: I observed screen washings for several weeks straight and I have never observed a build-up of fish in the ~~rea~~ area, the fish sink down through the debris and get back into the flow onto the screen. I can't imagine the fish being able to go any other place.

We have at times when the build-up of debris got so heavy in here that there was a potential of log or branch getting into the screen slots and blocking the screens, we

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have scooped this material off the surface of the water and we never removed any significant number of fish taking the debris out. The fish sink through the debris and get back on the screen.

CHAIRMAN JENSCH: It would be interesting to see a hydrodynamic study of the flow. As I understand your statement this morning, with the pump so near the bottom of the intake structure, the force of the pump is more related to the lower level of the whole structure and it doesn't have the same effect at the surface.

So unless your fish sink like rocks, they are not likely to get within the force of that velocity of the pump; is that correct?

MR. ~~ALEUVAS~~ Alevras: I didn't mean to imply there is no flow in the upper area of the screen. When you take a velocity profile over the depth of the screen, the velocity of the water and therefore the bulk of the flow is through the lower portion of the screen. However, there is a significant flow and measurable flow through the upper portion of the screen, and that is certainly enough to hold the fish passively, a passive fish against the screen or close to the screen, because it holds large logs there for days at a time.

CHAIRMAN JENSCH: As I understood it, it takes three to five minutes to raise and lower the screen, so there is not a great deal of time involved. But I don't

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understand you. You have the velocity of water reflected in anything like a funnel, so it all comes to the lower section because you only have a small opening at the bottom of the intake structure as compared with the bottom of your pump, so I would wonder whether your surface is getting any appreciable force of the velocity. I imagine it would be worthwhile to study that with some sort of measurements, rather than "significant here," and "I don't think much there," because I don't think those terms necessarily help us understand the force.

End #13

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MR. TROSTEN: Mr. ~~Aleuvas~~ Alevras, from your personal observations, have you seen fish floating around in this area underneath the water as opposed to this six-foot area here?

MR. ~~ALEUVAS~~ Alevras: No, the fish are confined only to the area immediately in front of the screen.

MR. TROSTEN: Have you seen fish floating --

CHAIRMAN JENSCH: They never get out on either side, they just automatically stay in that area, is that correct?

MR. ~~ALEUVAS~~ Alevras: If you put a fish out here, he could be carried away by the tide. But I have never seen a fish washed off the screen, there is no way he can get out here, because the wall prevents the fish from being sprayed beyond the influence of that flow that keeps the material close to the screen.

CHAIRMAN JENSCH: Then they are flushed against that wall, they drop to the surface of the water, and some sink, some float.

MR. ~~ALEUVAS~~ Alevras: They drop, they can drop only as far six feet away from the screen and at that distance I have not seen material carried away by the tide. It is held against the screen by the flow.

CHAIRMAN JENSCH: That is one of the things we will be looking at some day when we get up there.

MR. TROSTEN: In other words, you have not seen the

material being washed down in this area here?

MR. ~~ALEUVAS~~ Alevras: No, even when the tide is running full in either direction, the mass of surface debris collected stays in contact with the screen, it doesn't drift away and come back with the return tide.

CHAIRMAN JENSCH: Your pumps are always on when you raise or lower the screen?

MR. ~~ALEUVAS~~ Alevras: Not every single time. There have been occasions when the debris load on the screen has been great enough that the pressure against the screen is so great that the screens bind in their slots. In those cases, the pump is turned off, and when it is, if there are fish impinged on the screen, they are lost to the collecting process. That is a relatively rare event. It has happened maybe three or four times in the two and a half years I have been collecting up there.

CHAIRMAN JENSCH: Thank you.

MR. TROSTEN: Mr. Chairman, I think it would be appropriate now -- thank you for the opportunity to present that -- I think it would be appropriate now if we could have Mr. Clark respond to Mr. Briggs' question that appears on transcript page 7461. I am sorry, 8461.

CROSS-EXAMINATION (Resumed)

MR. MACBETH: I forget the transcript page, but -- yes, that is the colloquy at the close of the hearing on

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1 Friday which Mr. Clark will address himself to at this time.
2 He worked on this over the weekend and has a statement that
3 I think will help to clarify this problem.
4 Mr. Clark.
5 This was the question as to the relationship
6 between striped bass spawning in the Hudson River and the
7 Atlantic fishery.
8 CHAIRMAN JENSCH: That number is 8461.
9 MR. TROSTEN: Yes, 8461. Mr. Briggs asked the
10 question.
11 CHAIRMAN JNESCH: Very well, Mr. Clark. Will you
12 proceed.
13 THE WITNESS: In response to Mr. Briggs' question,
14 I have come to a conclusion on this particular item based
15 on the following analysis: I have estimated the total number
16 of striped bass in the Hudson-influenced area of the Atlantic
17 Coast by combining sport and commercial catches for the year
18 1965 for which I have catch break-downs for individual states.
19 For this purpose I have defined the Hudson-influenced
20 area as the coast of Delaware, New Jersey, New York, and
21 Connecticut. And the estuaries and bays adjacent. The sport
22 fish catch data for these states were allocated from the data
23 in the 1965 salt water angling survey by the Sandy Hook Marine
24 Laboratory to obtain estimtes used in our paper "Migratory
25 Fish of the Hudson Estuary," published in the Second Hudson

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Ecology Symposim of 1969." The estimated pounds caught in the Hudson-influenced area were as follows:

Connecticut, 8.153 million.

New York, 9.492 million.

New Jersey, 1.534 million.

Delaware, 0.552 million.

These fish had an average weight of about 3.6 pounds in Connecticut and New York, and 2.7 pounds in New Jersey and Delaware. The total number of fish caught then was 5.69 million in those four states.

The commercial catch in pounds for 1965 from Koo was:

New York, 740,000.

New Jersey, 761,000.

Delaware, 32,000.

Using the same average weights given above for the sport catch, I estimated the commercial catch at 726,000 individual fish. The combined estimated sport and commercial catch would be 6.116 million fish from Delaware to Connecticut. The proportion of these fish that may have originated in the Hudson cannot be determined directly, but there are several ways to deduce what the proportion might have been.

The AEC Staff has reported calculations in the Final Environmental Statement for Indian Point No. 2, page Roman 12-36 and 38, from which it might be estimated that up

to 79 to 93 percent of the mid-Atlantic stock of striped bass -- those caught from New York to Delaware -- may be of Hudson origin. In my study, the seasonal movements of striped bass contingents of Long Island Sound and the New York Bight, Table 4, shows that 52 of 65 fish taken in spawning situations, that is during spring in the Hudson, or tidal rivers to the south.

Consequently, one might conclude that 80 percent of the tagged stock resorted to the Hudson to spawn. One might further conclude that 18 percent went to the Delaware and New Jersey rivers, and 2 percent to the Chesapeake, since recaptures were 16 and 1 fish respectively.

Numerically the sample is weak. Taggings were concentrated along the Connecticut, New York and New Jersey coats adjacent to the Hudson estuary. Delaware is not represented in the tagging. There are other shortcomings. Still, this agrees rather closely with the Staff opinion.

Thus, one might take this 80 percent as representing the best present measure of the Hudson contribution.

In 1967, I investigated the possible contribution of the Chesapeake to the coastal migratory striped bass stock as shown by tagging data, and found that in seven experiments there were 17,508 fish tagged in the Chesapeake with 5755 recaptures. The percentage of these recaptures that left the bay in each of the seven taggings were:

3.1, 2.5, 0.0, 0.0, 1.9, 0.6, and 0.7. This is an average output rate of 1.8 percent from Chesapeake Bay. If the standing crop of migratory age fish, two to four years old, was 10 million at the end of winter, and 1.8 percent of these left the bay during spring or summer, the total output to the Atlantic coastal stock would be 180,000 fish only.

If these all went to the Hudson-influenced sector, Delaware to Connecticut, they would make up only 3-1/2 percent of the striped bass reported caught there. Thus the Chesapeake contribution would be 3-1/2 percent to the Hudson-influenced sector.

If one were to use 80 percent as the Hudson contribution, and add this 3-1/2 percent for the Chesapeake, there would still be 16-1/2 percent from other areas. This 16-1/2 percent might be recruited mainly from Delaware Bay and south Jersey coast spawning rivers. This theory would not be inconsistent with the results from my limited tagging study recaptures from spawning situations, showing that 18 percent of the fish may spawn in New Jersey and Delaware Bay streams.

Upon considering this numerical information, which is all that is available to me, my best estimate of the proportion of the striped bass catch in 1965 in the area from Delaware to Connecticut contributed by the Hudson is 80 percent. Thus, 4.9 million fish would have been contributed by the Hudson in

1965. There are many uncertainties underlying the basis for this opinion. They include sources of error in interpreting the tagging results and in the accuracy of the striped bass catch statistics. This discussion about proportional contributions also leaves unsolved a basic paradox, namely, there do not appear to be enough young leaving all of the estuaries combined to provide enough recruits to supply the Atlantic catch north of the Chesapeake Bay, as it is reported.

For example, in 1965, the reported total catch from Delaware to Maine would be about 14 million by sport fishermen, and 700,000 by commercial fishermen. A source for this 14.7 million fish is not apparent. Present information suggests the following:

One, none, or very few, recruits come from south of the Chesapeake Bay.

Two, only a few hundred thousand come from the Chesapeake.

Three, an unknown, but probably small, number come from south Jersey and Delaware Bay.

Four, none, or very few, come from spawning areas north of the Hudson.

This leaves the Hudson as the major supplier, but the quantitative data from the Hudson do not indicate that it could supply this whole fishery of 14.7 million fish or

even the substantial proportion of it, the 80 percent. The solution to this baffling situation may be found in two sources of error.

First, are various samples and experiments that seriously underestimate the production of recruits. Insofar as the Hudson is concerned, this could arise from underestimation by the sampling gear used and underestimation of the screen kills at Indian Point.

Insofar as the sport fish catch is concerned, the survey estimates for 1965 have wider, or limits, and fishermen are believed to overestimate their catches when interviewed. That is, they exaggerate. An in-depth review of all available data with assignment of error probabilities and simulations with various sets of values might suggest an answer to the puzzle.

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DR. GEYER: One figure you gave required maybe some support, and that is the 10 million in the bay. How did they get at the total population?

THE WITNESS: My simple approximation to that is that there are something, or there were in 1965 era, about 5000 -- or excuse me, 5 million fish removed per year by sport fishermen and commercial fishermen combined. This is one of the estimates I made when I was doing my analysis in 1967 on this subject.

DR. GEYER: Is this from the bay?

THE WITNESS: From the Chesapeake Bay itself, the enclosed part. And that -- incidently this figure could also include some catches from outside of the bay on the outer Virginia and Maryland coasts. They catch a few striped bass on the ocean. But we lumped those into the Chesapeake Bay. We have been. So that if there are 5 million fish being caught and we have evidence of a fishing mortality of about 50 percent of the fish in the bay per year, that would indicate that the population size is double or perhaps about double. And that would then give you 10 million fish from the bay alone. Now this agrees with the range of estimates given by Dr. Goodyear in his answers to some questions that arose out of his testimony. He is estimating, presently, 10 million to 30 million total stock in the Chesapeake Bay system.

These fish that I am speaking of would nearly

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1 approximate Dr. Goodyear's figure. I am talking about the two-
2 to four-year-old fish and he is talking about all of the fish
3 in there beyond age one. So he would include a few older fish
4 in his estimate.
5 BY MR. TROSTEN:
6 Q You mean beyond age two?
7 A Beyond age four.
8 Q Just so we can have it all in one place, Dr.
9 Goodyear's response to the Applicant's question of the total
10 population of striped bass in Chesapeake Bay is as follows:
11 "Ten to thirty million fish two years old and over."
12 A Yes. So his estimate would include some fish of
13 five, six, seven, eight, and so on, which I hadn't intended
14 to include in mine. But they are pretty close together.
15 Anyway that is the estimate that I was working with in 1967
16 that I derived myself from this kind of logic.
17 DR. GEYER: Are only two- to four-year-olds tagged
18 in these programs?
19 THE WITNESS: No. They tag fish of larger size
20 as well, and some of smaller size, depending on the experiment.
21 My assumption here is that the recruitments to this coastal
22 migratory stock would occur sometime between age two and age
23 four. In other words, the main period of commitments of
24 a fish to go out of the bay and join this stock would come at
25 that age. And that he may already be in this migratory group

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by the time he reaches five, six, or seven, and be migrating every year in and out of the bay.

DR. GEYER: Well, it appears to me that if you doubled the estimate of the stock in the bay, that participated in the tagging program, or which you sampled by the tagging program, this would about double the percentage that the bay contributes to the stock.

THE WITNESS: Yes, it would be very sensitive to the population size you estimated. If you took Dr. Goodyear's maximum figure of 30 million, the figure would increase from 180,000 to three times that amount. So somewhere around a half million fish then --

DR. GEYER: Which would be 10 percent.

THE WITNESS: Which would come to over 10 percent.

DR. GEYER: Thank you.

MR. BRIGGS: Mr. Clark, your statement was very helpful and I would like to just be sure now that I captured an important part of it. As I understand, you say your best estimate of the Hudson contribution for 1965 is 80 percent of 6.1 million fish, or about 4.8 million fish.

THE WITNESS: Four point eight or nine, yes.

MR. BRIGGS: In line with some of the questioning that occurred last week, your estimates of the total kill by impingement on the screens in 1966 and '67 was like 326,000 striped bass from the testimony.

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THE WITNESS: Yes, sir.

MR. BRIGGS: So there is roughly a ratio of 12, I suppose, or 14 between this 4.8 million fish and the 326,000 fish that were killed, or that you estimate would have been killed in '66 and '67 from Indian Point 2 if it had been in operation. I think that answers my question.

Thank you.

THE WITNESS: You are welcome.

CHAIRMAN JENSCH: Did you have any direct evidence on this matter?

MR. MACBETH: No, not at this time.

CHAIRMAN JENSCH: Applicant may proceed.

MR. TROSTEN: Thank you.

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Mr. Chairman, there are several questions I have that relate to this subject. I would like to proceed and I would like to get back to the statement of Mr. Clark's after I have had an opportunity to analyze it and compare it with my notes, if that is all right.

CHAIRMAN JENSCH: Very well.

BY MR. TROSTEN:

Q Mr. Clark, I would like to take some numbers that you used in your most recent presentation and in the presentation that you gave us the other day and make sure that I understand them. What I would like to do is go through this with you and perhaps if you would like to come over here, it might be a little easier. What I am doing is I want to make sure I understand the underlying factors that you used in drawing up this most recent calculation and also the calculations that underlay the notes that you gave us, copies of which are before the Board now, which show the percentage of the North and Middle Atlantic states which you consider to be influenced by the Hudson.

The testimony which you have given now represents that portion of the Hudson influenced area you considered to be supplied by the Hudson River fish, so I am going one step back. Now in relation to your statement on page 4 of your testimony, where you estimate one-half of the sports catch is influenced by the Hudson, you drew a map on the

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1 blackboard and presented us with a series of figures indicating
2 how you arrived at these conclusions. And the map was a little
3 bit unclear to me, so I would like to try to reproduce it here
4 and make certain my understanding of it is correct and the
5 record is clear on this point. I have here a map of the
6 entire Eastern Seaboard, and there are two points, the
7 northern and southern terminus of which I would like to call
8 your attention to. The southern terminus I am discussing
9 is Cape Hatteras, the nothern terminus is the main New Brunswick
10 dividing line.
11 Now the first thing you did, as I recall, was you drew
12 a line at the Hudson River Harbor, the division between
13 New York and New Jersey. And you referred to the North Atlantic
14 region as the region from New Jersey Harbor to the Maine - New
15 Brunswick line. That we can consider to be the North Atlantic
16 region as it is designated in the five-year fishing survey
17 conducted in 1960 and '65 and 1970. Is that correct?
18 A Yes.
19 Q Now the southern portion of this, that is the
20 region from New York, the New York Harbor to Cape Hatteras --
21 and this includes New Jersey, Delaware Bay, Chesapeake Bay
22 and the coastal area down to Cape Hatteras -- is designated
23 as the Middle Atlantic region in these five-year surveys.
24 Is that correct?
25 A Yes.

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Q Now I am going to write the number 8.7 million up here, representing the North Atlantic region, the area from New York Harbor to the Maine - New Brunswick border. And I am going to write the number 6.4 million in the area from the New York Harbor down to Cape Hatteras. Am I correct in my understanding that these figures represent the mean number of striped bass caught in each of these two regions in the 1965 and 1970 surveys? In other words, 8.7 is the mean number of striped bass caught in the North Atlantic region for 1965 and 1970, 6.4 million is the mean number of striped bass caught in the Middle Atlantic region in 1965 and 1970?

DR. GEYER: Did you say between these years?

MR. TROSTEN: There were two survey years, Dr. Geyer, 1965 and 1970. If you look at Mr. Clark's notes, you will see there are two entries and then a mean.

DR. GEYER: I thought you used the word "between."

MR. TROSTEN: I am sorry. It is the mean of these two years. Is that correct, Mr. Clark?

THE WITNESS: Right.

BY MR. TROSTEN:

Q Now I think the next thing that you did was to further subdivide these two areas, the North Atlantic region and the Middle Atlantic region, into regions in which, in your opinion, the striped bass catch was predominantly influenced by the Hudson. And that is one area. And the other area was

4mil

one predominantly influenced by the Chesapeake Bay, is that correct?

A No. Just Hudson and the other is open.

Q Okay, just Hudson then. Now I think that you drew two lines to indicate the Hudson infuenced area. Now the first line, I believe, was at the Rhode Island border, which is essentially the eastern tip of Long Island, if you extended it southward. And the other one, as I recall it, was at the Delaware - Maryland line, as you extend it eastward.

A Yes.

Q Now I recall in different places -- I went back to the transcript and I noted the first time you discussed this you designated this Hudson influenced area as I have just done it, Rhode Island border, Delaware-Maryland line. But in another place you were discussing the Barnegot inlet as a border area. Now did you have something else in mind? I just want to make sure I am clear on this. I refer to your testimony on 8210 and 8212. You were talking about the Barnegot inlet.

MR. MACBETH: It might be easier if you tendered those pages to the witness. I don't think he has memorized all of the page numbers.

MR. TROSTEN: All right. I am simply doing this in order to make sure we are talking about the same thing.

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BY MR. TROSTEN:

Q The first time you were discussing this on transcript 8195 you mentioned, here you were referring to the dividing line as the Delaware State line.

A Right.

Q Then on transcript page 8210 you said from the Rhode Island Border west, Western Long Island Sound? That is from Barnegat Bay north to the harbor, plus the harbor area and this south shore of Long Island.

I think that is the area you were referring to, that is a bad map.

That is what is confusing me. I wasn't sure whether the southern terminus of the Hudson influenced area was the Delaware-Maryland line or was Barnegat Inlet?

A Your confusion was over the fact that when we were talking about Barnegat, we are defining what the New York bite it.

Q Then am I correct in my basic understanding that the sourthern terminus of this Hudson influenced area is the Delaware-Maryland line?

A As I drew it on the map, yes.

Q In your view, this is the proper southern terminus of the Hudson influenced area, both as you drew it on the map and as you now consider it, is that correct?

A It is arbitrary. It is drawn for political -- it is

1 drawn along the political line for the convenience of agreeing
2 with certain catch statistics and so on.
3 Q Well, is this area that I have designated here on
4 the map the area that you had in mind when you indicated
5 the Hudson influenced area?
6 A Yes, that is the area.
7 Q So you now have the coastline of the United States
8 from Cape Hatteras to the Maine-New Brunswick border divided
9 into four areas.
10 A Yes.
11 Q And you so associated a number with each region
12 which you indicated to be the mean number of striped
13 bass caught in each region.
14 A Yes.
15 Q I am goingto do this now in relation to your notes.
16 From Maine to Rhode Island, that is from the Maine-New Brunswick
17 area to the Rhode Island-Connecticut border, there is a number
18 of 3.5 million.
19 A Yes.
20 Q From Rhode Island to and including New York Harbor,
21 that is the secondary area here.
22 (Indicating.)
23 You have a number of 5.2 million.
24 A Yes.
25 Q In New Jersey, that is from this dividing line, down

to the southern terminus of the Hudson influenced area, you have a number of 2.4 million.

A Yes.

Q Finally, in the area from the Delaware-Maryland line to Cape HAtteras, you have a number of 4 million.

A Yes.

Q Now, the sum of those values in the area north, the area farthest north, the areas farthest north, is 8.7 million.

A Yes.

MR. MACBETH: Could we have that a little clearer for the record? When you say the areas farthest north, it is a little difficult to tell.

MR. TROSTEN: The two areas farthest north from the New York Harbor to the Maine border, the sum of that is 8.7 million, representing the North Atlantic striped bass catch.

THE WITNESS: Yes.

BY MR. TROSTEN:

Q And the sum of the southerly areas is 6.4 million.

A Yes.

Q Representing the Middle Atlantic catch?

A Yes.

Q Now, to arrive at the values for each of these four areas what you did, as I understand it, was you simply took the

1 number of fish listed in the salt water angling surveys for
2 the North and Middle Atlantic regions and you divided them
3 into what you felt was appropriate figures for each section.
4 Is that correct?
5 A Yes, that was a breakdown.
6 Q Right. In other words, as indicated in the second
7 footnote in this table here, "The breakdown is based upon
8 personal experience with distribution of fishing efforts."
9 A Yes.
10 Q Now, letme ask you this, Mr. Clark. Would you say
11 that the breakdown that you draw here is not based upon a
12 scientific set of statistics, but is rather based upon an
13 educated guess on your part?
14 A Yes.
15 MR. TROSTEN: Mr. Chairman, I am going to offer Mr.
16 Clark's notes in evidence. I will provide a better copy,
17 unless you prefer to do this, Mr. Macbeth.
18 MR. KARMAN: I would like a copy too.
19 MR. TROSTEN: Yes.
20 (Handing.)
21 I will have a copy typed up. I am referring
22 just to the first page of the compilation. The other pages
23 are just Mr. Clark's notes on statistics that he obtained
24 from the 1970 salt water annual survey.
25 CHAIRMAN JENSCH: Do you want to furnish enough

copies for the record?

MR. TROSTEN: I shall. I shall furnish enough copies of the first page to put it into the record.

CHAIRMAN JENSCH: Is there any objection to that request?

MR. MACBETH: I have no objection as long as it is clearly understood that these were working notes. There is no intention this be a formal presentation. I think that should be born in mind in considering the exhibit. But I have no objection to the induction.

MR. KARMAN: No objection.

CHAIRMAN JENSCH: The request of the Applicant's counsel is granted with the understanding that sufficient copies will be submitted to the reporter. The document is entitled, "Proration of Striped Bass Sport Cathces made to Allocate Catches to Areas Under the Influence of the Hudson Reproduction (catches in millions of fish)," may be included in the transcript as if read. This is a true and correct copy of your working notes, is that correct?

THE WITNESS: Yes.

CHAIRMAN JENSCH: Very well.

(THe document follows.)

Proration of striped bass sport catches made to allocate catches to areas under the influence of Hudson reproduction. (Catches in millions of fish.) */

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Mean	8.7	5.2 **/	3.5 **/	6.4	2.4 **/	4.0 **/	15.1	7.6	7.5

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	North Atlantic			Middle Atlantic			Both Areas Total		
	Tot.Area.	H.I.	Other	Tot.Area	H.I.	Other	Tot.Area.	H.I.	Other
1965	13.2	--	--	2.8	--	--	16.0	--	--
1970	4.3	--	--	9.9	--	--	14.2	--	--
Mean	8.7	5.2 **/	3.5 **/	6.4	2.4 **/	4.0 **/	15.1	7.6	7.5

*/ From ref. nos. 10 and 31, Clark, Oct. 30 Testimony.

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**/ Breakdown based upon personal experience with distribution of fishing effort.

1 DR. GEYER: I presume, Mr. Clark -- quite obviously
2 these don't include the catches in the Chesapeake Bay or in
3 the Hudson River?
4 THE WITNESS: They would include reported sport
5 fishing catches from the Hudson River itself, but not from
6 the Chesapeake Bay.
7 DR. GEYER: How about the Delaware?
8 THE WITNESS: They would include the Delaware, any
9 Delaware Bay or Bay Shore catches or Rehobeth Beach on the out-
10 side, anyplace through the state of Delaware.
11 MR. MACBETH: Dr. Geyer, is your question whether
12 the total numbers include Chesapeake Bay or whether the Hudson
13 influenced area?
14 DR. GEYER: Chesapeake Bay as defined here is in
15 the MiddleAtlantic region. Those figures for the Middle
16 Atlantic do not include Chesapeake Bay catches.
17 THE WITNESS: I shall have to clarify it. This
18 4.0 we were talking about would include the Chesapeake Bay,
19 all of the way down to North CArolina. This 2.4, the smaller
20 amount in this area, from Delaware Border to New York, which
21 I am saying is one part of the Hudson influenced area, that
22 would not include any Chesapeake Bay.
23 MR. TROSTEN: I think the answer to your question,
24 Dr. Geyer, if I understand Mr. Clark, is that the 6.4
25 representing the Middle Atlantic catch reported by the National

1 Marine Fisheries Service, does include catches in the
2 Chesapeake Bay, if I understand the points correctly.
3 MR. MACBETH: Yes, I think that is what Mr. Clark
4 said.
5 DR. GEYER: I wasn't clear. That doesn't gel with
6 this figure of 5 million.
7 THE WITNESS: This 4 million?
8 DR. GEYER: Right.
9 THE WITNESS: There are also the commercial catches
10 in the Bay, whatever they are, some 2 million fish or so.
11 Also I have to point out that these are not the same
12 figures we are looking at -- I just took 1965, because in that
13 year we had already worked out some state-by-state
14 breakdowns. Now, in these figures we have been putting
15 on here, this is an average of 1965 and '70. Now, 1965 we
16 had an entirely different distribution of the sport fish
17 catch. We had much higher catches -- let me check and make
18 sure -- in 1965 we had a very small catch in the MiddleAtlantic
19 and a high one in the North Atlantic. In 1970, for some reason,
20 it changed completely around, so that the Middle Atlantic
21 catches, sport fish catches, were much higher, so that this
22 kind of a breakdown and distribution is going to be sensitive
23 to how many are distributed in this area, and how many in that
24 area.
25 MR. TROSTEN: Actually, Dr. Geyer raises a very

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interesting question that ties in with your testimony. In 1965 is it not true that the total Middle Atlantic striped bass catch, which would be the area from New York Harbor to Cape Hatteras was 2.8 million fish. Is that right?

THE WITNESS: RIght.

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#18

BY MR. TROSTEN:

Q Now, what number were you using up there for the Chesapeake Bay catch?

A Five million, including the commercial catch, which is about -- which brings it up to that level.

Q All right. Now, let me just ask you this: Take the figure of 5.2 million for the so-called Hudson-influenced northern section, the area from New York Harbor to Rhode Island border.

A Okay.

Q How accurate would you say that number is? I mean instead of being 5.2 million, could it be 3.2 million or 1.2 million?

A Well, it could be anything from zero to 10 million. The sport fish -- the confidence levels on the sport fish collections are such that at five million fish, two standard errors would encompass the whole of the sample.

In other words, a standard error for these catch statistics is half at that level. So you have two and a half million, two standard errors would be five million, so you could go anywhere from zero to 10 million.

That information is in the, on standard errors and all, is in the publication.

Q All right --

MR. TROSTON: Mr. Chairman, I realize this is a

KF

1 little irregular, but rather than filtering the questions
2 Dr. Lawler has through me, would it be permissible if he
3 asked this informational question having to do with Mr.
4 Clark's presentation?
5 CHAIRMAN JENSCH: Any objection?
6 MR. MACBETH: No objection.
7 MR. KARMAN: No objection.
8 BY DR. LAWLER:
9 Q This is just a question to clarify in my own mind
10 the direct evidence you just read into the record a few
11 moments ago, Mr. Clark, by comparison to the statement that
12 you made on the distribution in the Middle Atlantic fishery
13 as to the amount of fish that is contributed to the Middle
14 Atlantic by the Hudson, is somewhat your own best estimate,
15 and not based on a set of data.
16 I thought you said that the sport fishery -- and I
17 suppose you were referring to the 1965 survey, was
18 allocated by the Sandy Hook Laboratory and further gave a
19 breakdown in terms of pounds of fish for Connecticut, New York,
20 New Jersey and Delaware and also gave the average weight of
21 fish for Connecticut, New Jersey, Delaware and New Jersey.
22 It would seem to me from those numbers that one could
23 compute a distribution in the areas that Mr. Trosten has
24 just delineated, Connecticut, Connecticut and New Jersey on
25 one hand, New Jersey and Delaware on the other.

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1 So, are you simply saying that with respect to
2 the mean numbers, because you don't have such allocations for
3 1970, that you really don't know how they are distributed
4 between on the one hand New Jersey and Connecticut and on
5 the other hand, New Jersey and Delaware?
6 A That is right. We had never done, attempted to
7 do or no one has attempted to do, to my knowledge, for the
8 1970 data -- it hasn't even been published yet -- what these
9 allocations might be state by state.
10 Q Am I correct in presuming that the allocation
11 obtained by Sandy Hook Marine Laboratory in 1965 is based
12 on the answers to the questionnaires in the 1965 survey?
13 A No. It is not. It is a Bureau of Census refuse,
14 or did refuse to allow us access to those state by state,
15 because their sampling validity is done by big population
16 units.
17 We didn't even get a chance to look at the
18 individual interviews that came in. They merely reported it
19 out. They would only give it to us in big hunks of coast like
20 that. They have never supplied us with anything finer, any-
21 thing state by state.
22 Q Well, that is the case -- how did the Sandy Hook
23 Laboratory allocate --
24 A Guesstimate.
25 Q So, the 1965 is also a guesstimate?

A Yes, but it is one in which we had worked it out state by state to the best of our knowledge, so we could come up with the figure of 19 million pounds in the 1969 paper.

Q What was your source of data for state by state?

A It was a product of the best kinds of estimation we could make off the top of our heads, based upon our knowledge of who fishes where and generally what they catch and whatever state fishing records there have been.

Many of the states have done canvases or somehow or other estimate their catches of fish. And we have information from party boats; we had information from the Schaeffer Fishing Contest; we had a lot of scraps of data that we got. But nowhere any coherent collection of individual state by state statistics. And we still don't for 1970. It is still the same thing.

Q The Bureau of Census is of the opinion that the state by state basis is too small a sample for any kind of allocation among this total of 15 million fish?

A They interview -- in this survey they did for us, it was part of and based on the National Unemployment Survey they do every month. They added on an extra question about fishing.

They then came back to the household later on, if they responded positively on salt water fishing and did an in-depth interview of about 45 minutes with each party. They

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flushed out about 2000 people who had done it. So, the whole thing for the nation is based upon only 2000 people. It just doesn't break down state by state. I mean you divide 2000 by 50 and you get a small number indeed.

Q There were 1566 people to be exact.

A Yes. But not that were salt water sportsmen. That said they were fishermen.

Q No --

A There weren't that many salt water fishermen. There might have been that many fisherman, fresh and salt.

Q I think that was salt water. I am not sure on that.

A Anyway the basis was such we couldn't get a finer breakdown. We wanted it state by state but we couldn't get it.

I can clarify that point for you. Completed interview records were obtained from 1566 persons, "or about 95 percent of those originally identified as salt water anglers." That is on page 2, the last full paragraph.

Q And those 1500-some-odd people corresponded to a projection of eight million people throughout the country?

A Yes.

BY MR. TROSTEN:

Q Now, we can move on, Mr. Clark.

On what basis do you estimate the commercial catch in the Chesapeake Bay?

A Well, that is from the Bureau of Commercial Fisheries statistics. Now, the National Marine Fisheries Service.

Q I see. This is entirely, an entirely separate survey than the salt water and angling surveys?

A The salt water and angling survey, they just hire people to go around on a sampling basis, like the Gallup Poll and ask them. The commercial fishing statistics is an actual recording from sales slips of transactions in fish markets.

Q Then these numbers you projected in your testimony at the outset of this session are from the National Marine Fisheries Service commercial statistics, is that right; if we turn to those for 1965 we can find those numbers?

A You will find them reported in Koo's summary from the Bureau of Commercial Fisheries.

Q Now, just a few other questions here. You are listed with Mr. David Deuel, as the author of the 1965 Salt Water Angling Survey published by the Bureau of Sports Fisheries and Wildlife, U.S. Department of Interior. Is that correct?

A Yes.

Q And you were also the author of the 1960 survey.

A Yes.

Q Mr. Deuel who worked with you on the 1965 survey,

is the author of the 1970 survey, which is about to be published, is that correct?

A Yes.

Q Now, is it correct that the 1965 Salt Water Angling Survey is an adjunct to a survey of all fishing and hunting activities in the United States, which is called The National Survey of Hunting and Fishing.

A Yes.

Q And am I correct that each of the three surveys, 1960, 1965, and 1970 surveys, are similarly adjunctions to these five-year National Surveys of Hunting and Fishing?

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A Yes.

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Q Now, am I correct in understanding that the way the 1965 saltwater angling survey was conducted was that the initial screening survey was done during the week containing the 19th of December 1965; do you remember that?

A No, I don't.

Q Do you think that -- well, all right.

MR. MACBETH: Is it in a document somewhere?

MR. TROSTEN: I am not sure. I won't press the witness' memory if he doesn't recall. We will check it.

THE WITNESS: Thank you.

BY MR. TROSTEN:

Q Is it true that the actual questionnaire given to the 1566 persons who responded and indicated that they were saltwater fishermen, required the persons who responded to this survey to recall the type of fish which they caught, the number of each species caught, and the average weight for each species during the preceding, it could have been anywhere from 12 to 14 months; is that right?

A Yes. That is not true for the 1960 survey insofar as weight is concerned, but it is true for '65, including the weights.

Q Now so you would think, based upon your earlier testimony, there would be considerable error associated with this recall process?

A Yes, that is called memory bias error.

ty 2

1 Q All right.

2 Now, Mr. Clark, you state on page 2 of your October

3 30 testimony in the last paragraph that in 1965, 15,982,000

4 pounds of striped bass were caught weighing 55,340,000 pounds

5 and that in 1970 the striped bass catch declined in number to

6 14,166,000 fish, weighing 73,106,000 pounds.

7 Do you see that there?

8 A Yes.

9 MR. MACBETH: Wouldn't it be a little more accurate

10 to read in, since you said the catch declined, although the

11 weight increased to 73 million?

12 MR. TROSTEN: Yes. All right.

13 MR. MACBETH: If you are talking about a catch,

14 talking about the number of fish, you ought to mention the

15 weight of the fish.

16 MR. TROSTEN: Would you like to read that?

17 MR. MACBETH: "In 1970 the catch of striped bass

18 declined in number caught to 14,166,000 fish, although the

19 weight increased to 73,106,000 pounds."

20 BY MR. TROSTEN:

21 Q You, then, state this trend, the catch of fewer

22 fish of a higher average weight is diagnostic of a fishery

23 wherein the production of young may have been undermined.

24 Do you see where you say that?

25 A Yes.

Q Can you tell me from your understanding of statistics, Mr. Clark, whether two data points such as the ones you present here are sufficient to indicate a trend?

A Statistically, they are not worth much.

Q Are they worth anything statistically?

A Significance, statistically, they are worth nothing.

Q Now from your knowledge of the sampling techniques that were utilized in these angling surveys, 1965 and 1960, and your general understanding of what is going on in 1970, do you think that the variation in the two samples from 1965 and 1970, represent genuine differences or might these differences be the result simply of limitations in the sampling process?

A They could very well be limitations in the sampling process.

Q One final question on this point. These saltwater angling surveys that you described each cover a period of only one year? In other words, although they are designated as five-year surveys, the 1960 survey covers 1960 and 1965 covers 1965 and 1970 covers 1970, and not intermediate years.

A Yes, it is right in the title "The 1965 Saltwater Angling Survey."

Q Excuse me. I thought they were generally referred to as five-year surveys. Is it possible, since each of these surveys covers one year, that if the survey were taken in any

ty 4

1 intermediate year it might show results substantially different
2 from the results shown during these five-year intervals?
3 A Definitely.
4 Q Now, Mr. Clark, on page 2 in the last sentence
5 where you refer to a trend toward fewer fish of a higher
6 average weight being diagnostic of a fishery wherein the
7 production of young may have been undermined, can you cite a
8 standard reference in Fishery Science which establishes that
9 such a diagnostic is reliable?
10 A Oh, I think I probably could find it in some
11 elementary textbook about fisher research someplace.
12 Q Would you do so? Let me have any reference which
13 supports this statement.
14 A Yes, I certainly will.
15 Q Now, Mr. Clark, what was the age composition of the
16 catch in 1965 as opposed to the catch in 1970?
17 A I haven't any idea at all.
18 Q If you don't have that kind of age composition data,
19 what can you determine about the year class composition of
20 the catch of 1965 and '70?
21 A If you could believe the statistics were very
22 accurate and you can accept this kind of trend as being signi-
23 ficant enough to start talking about ages, you would say they
24 were of a higher average age in 1970 than in 1965. Just
25 the average age for the whole catch group, not any kind of

breakdown, how many, three, four, five, eight, ten-year old fish there would be.

Q Now in view of the fact that there are large variations in year class strength in the striped bass, is it not possible that the 1970 catch was dominated by older and larger fish as a result of natural variations in year class strength?

A Did you ask me if it is likely or possible?

Q Is it possible.

A It is possible.

CHAIRMAN JENSCH: Does it help to complete the thought, so that we don't get into possibilities, to follow it up by is it probable?

THE WITNESS: No, I would say that it is not only probably, but necessary to get a shift to higher ages of fish, that there has to be a different year class composition. I think your question is whether this could have come about by natural causes other than by something that affected the reproduction of the fish. Usually changes in year class strength we associate with factors affecting reproduction, whatever it is that makes it high or low, we associate that with a big year class of fish, rather than something that happens to them later on.

So where it is quite obvious that it is a year class, that it is a change in the strengths of various year

1 classes as composing the fishery, the cause of that would
2 not be known. But you would suspect the change in year class
3 composition would have to do with reproduction, the number of
4 young supplied. Because the reduction in the young fish could
5 be natural or unnatural causes.
6 BY MR. TROSTEN:
7 Q Now you would say then assuming that the trends
8 you have depicted in your testimony is real, and not simply the
9 result of sampling error, that changes in age composition of
10 the catch could account simply for the two statistics that
11 you presented; is that correct?
12 A If that situation were true and described here
13 statistically, and we could accept it, it would have to be caused
14 by a difference in age composition, no other way.
15 Q Could it be caused by a change in growth rate?
16 Is that another possible way?
17 A I would have to think about that, but it sounds
18 like it could happen. I mean all of the fish growing
19 faster? It is not likely, because there is mortality offset.
20 We are talking about less fish of a greater size. And it is the
21 less fish that gets involved with what has happened back in
22 reproduction, rather than greater size alone.
23 Q Let me ask you this, Mr. Clark, as a final question
24 on this: Are you saying that this trend, if it is real, could
25 be accounted for by natural fluctuations in year class strengths?

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1 A Yes.

2 Q And therefore it is not diagnostic of anything other

3 than there are natural variations in year class strength?

4 A Let me just clarify something so we can simplify

5 this.

6 Down here at the bottom of page 2, where it says

7 that the production of young may have been undermined, this

8 could happen, this undermining could happen either by natural

9 or artificial causes. In otehr words, it could be some

10 disease, predation, or whatever imbalance which could under-

11 mine the production of young as well as an artificial cause.

12 So in any instance, whatever it is that happens to

13 those, would have the same effect.

14 Q Well, you do get natural fluctuations in year class

15 size without young being undermined, isn't that correct? You

16 mean you just have larger year classes sometimes?

17 A But as I mentioned before, we usually relate those

18 changes in year class size to the populations of young. In

19 some years there are much higher numbers of young produced

20 in the estuary than in other years. And --

21 Q I agree. But the fact that there are some years

22 that are very, very good doesn't mean in those years when they

23 aren't very good that the production of young has been under-

24 mined, does it?

25 A I guess we are into semantics. You can -- you take

some figure as the maximum capacity of the estuary to ever produce any number of young, and then look at it as what the problems are that have reduced it down to whatever its existing thing is, that is what I am thinking of. Undermined is not a good word at all to describe a natural reduction of young.

End #19

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DR. GEYER: While there is a pause, Mr. Clark, on Page 1237 in the staff's final report is a figure which has a scale of landings in 10^5 pounds. And the subtitle says this is Midland region. These figures don't look like the same order of magnitude as the ones that you are using. Why is this?

THE WITNESS: Because they only contain commercial fishing. Particularly in the last few years, since the late 50s, the sport fishing has boomed, and the commercial fishing has sort of held its own, more or less, and fallen a little bit and risen a little bit. But the order of magnitude now, if you can believe the statistics from the fishermen, is on the order of 5 to 1 or 10 to 1 in many areas, with sports fishing over commercial fishing.

DR. GEYER: Are there data that you could draw a similar figure which would include the sports fishery?

THE WITNESS: We could put it in there for 1969, '65 and 70.

DR. GEYER: It would have to be a different scale at the end of the 60s.

THE WITNESS: Yes, it would reduce it, just a factor of 5 on it, maybe or 6, or something.

DR. GEYER: Thank you.

MR. TROSTEN: At this time, I would like to turn briefly, while I notice Mr. Roisman's colleague Miss Sheldon is

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here with us, Mr. Briggs asked for documents having to do with the pressure ~~vessels~~ Vessels and I have three of them here for review by the board and the parties pursuant to the Chairman's request, which appears on the transcript Page 7434.

Now, I have the following documents which I will just indicate and mention to you briefly. One is called "Inspection Report for ~~1973,~~ 1973" Inside Diameter Reactor Vessel, Combustion ~~Energy~~ Energy Engineering Contract Number 17765." The second is called " UT Report After Hydrostatic Test." The third is called "Equipment Specification 676208," dated December 13, 1965, and an addendum to Equipments Specification 676208, Revision 1, Dated March 23, 1967, and June 17, 1968.

The third item which consists of two documents, the Equipment Specification and the Equipment Specification Addendum, contains proprietary material, Mr. Briggs, and we are prepared to make this available to Mr. Roisman and to two consultants of his who have signed agreements for nondisclosure of proprietary information.

The fourth item the Board requested is a large bulky document, "Analytical Report for Reactor Vessel, Number 2." This document was sent to Washington, but was misplaced in transit, and we hope to get another one down here today and it is not proprietary, and we can make it available to the Board.

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As per the Chairman's request, I would like to make this copy available to the board and it is available similarly to Miss Sheldon, here today, will be available all of this week as the Chairman requested, and it is here.

BY MR. TROSTEN:

Q. Mr. Clark, I would like to conclude with several questions having to do with your presentation up to this afternoon and the contribution of the Hudson River to the ~~Midland~~ mid-atlantic Fishery. Mr. Clark, supposing that the number of striped bass caught by sports fishermen in western Long Island Sound and the New York Bight, we are to increase by 500,000 fish annually over the present level, and this we are to continue for two years running -- have you got that so far?

A. Yes.

Q. Would you assume also that the number of striped bass caught by commercial fishermen in that area remained the same during this hypothetical three year period that I'm describing.

A. Excuse me, three years?

Q. Yes, the first year is the base period, the second year is the two year running period.

A. Okay.

Q. Now, would this have a long term detrimental effect on the fishery in that area?

dh4

A. Excuse me, the commercial fishing remained at some --

Q. At the same level, that is right.

A. Whatever it was?

A. Whatever it was, it remained.

Q. With the addition of these one million fish over a period of two years have a detrimental effect on the total fishery?

A. On the striped bass fishery in that area?

Q. I would think not.

Q. You would think it would not. All right. Now, this number of striped bass that I have just described, 500,000 fish annually, and these fish, in the hypothetical assumption I'm giving you, are fish that would be 16 inches fork lengths or over, is that correct, because that is the legal limit in this area -- is that thought true? I just want to make sure --

A. Excuse me, Did you say the million fish added were fish that were caught or just added to the population?

Q. No, would the reporter read the question back?

(The reporter read the question as directed.)

THE WITNESS: I'm sorry, I completely misunderstood you. I thought it's 500,000 we're adding to the population. I will have to change my answer.

dh5

BY MR. TROSTEN:

Q. Sure.

A. 500,000 were caught, and are there any other assumptions u nderlying this? Are there more or less fish in the population, or what?

Q. The only two assumptions I was giving you were that 500,000 fish, more than some basic level we are -- these are all striped bass -- were caught by sports fishermen annually, and this trend went on for two years running. And the other assumption I asked you to make was that the commercial fishing level remained exactly the same throughout the three year period.

MR. MACBETH: Do we know what the population is?

MR. TROSTEN: The population as it is today.

MR. MACBETH: And it remains the same throughout the three years.

MR. TROSTEN: Take the situation as it exists today, and just assume that starting now, that the number of sports fish that were caught by, the number of striped bass caught by sports fishermen went up by 500,000, and then it stayed there for a year and the next year it was also up by that amount.

MR. MACBETH: You make no assumption about what happens to the striped bass population?

CHAIRMAN JENSCH: I wonder how you can do that?

dh6

Suppose you had an unusually favorable spawning situation that tripled or quadrupled the available number of fish? I mean you have taken the withdrawing section only, but not the supply. So unless you know what it is -- give us a figure, when this year or last year, give us a figure of total population of bass.

BY MR. TROSTEN:

Q. Mr. Clark, can you give me a figure for total population of Hudson River striped bass that I could use for my hypothesis?

A. Use the number you wrote on the chart there. Or whatever else we have got around here.

CHAIRMAN JENSCH: Between ten and 30 million.

THE WITNESS: Use it -- excuse me?

MR. TROSTEN:

Q. Shall I use the 5.2 million in this area from New York Harbor to Rhode Island. How about that?

A. That is all right, or the 6.1 million we had for both for 1965. Either one. Whatever area you want to talk about.

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1mil

Q Shall we take the 5.2 or do you want to use the 7.4?

MR. MACBETH: Mr. Trosten, it is your hypothesis. Could you choose a number.

THE WITNESS: 5.2 is fine. I will agree with that.

BY MR. TROSTEN:

Q Mr. Clark, would you assume the population level we are starting with is 5.2 million?

A Okay.

CHAIRMAN JENSCH: And there is no change, but each year there is added, is there not, a certain number of -- if you assume 5.2 million in each of the years, and you just catch a half million more, but the next year you are back to 5.2 million?

MR. TROSTEN: I am just assuming a bass population when you start the hypothesis of 5.2 million.

CHAIRMAN JENSCH: 5.2 million and then you withdraw for three years, but you don't have any additions.

MR. TROSTEN: You withdraw fish during a three-year period and there is some add-on to the population.

CHAIRMAN JENSCH: How many, do you know?

MR. TROSTEN: I don't know, Mr. Chairman.

CHAIRMAN JENSCH: Let's pick a number. Mr. Clark, can you pick a number that -- give us a hypothetical. It doesn't make any difference, because it is hypothetical.

THE WITNESS: I think that is the trouble with the

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whole question, is there are so many underlying factors, such as the size of the fish that were caught, whether they were going to be of spawning age the next year, what detrimental really means and I find it difficult.

MR. TROSTEN: Let me see if I can clarify this, Mr. Chairman.

CHAIRMAN JENSCH: All right. Let's consider all questions under this hypothesis withdrawn and start over.

MR. TROSTEN: Yes.

CHAIRMAN JENSCH: Thank you.

MR. TROSTEN: Let me clarify for the record that the 5.2 million fish that are caught here, this doesn't represent a population, this represents a number of fish that were caught. It is a number of fish that were caught. It does not represent a standing crop.

CHAIRMAN JENSCH: Well, give us a figure for the standing crop.

BY MR. TROSTEN:

Q Mr. Clark, somehow whenever we go into this line of questions we seem to have grave difficulty coming up with all of the hypothetical considerations of add-ons and subtractions and so forth, and the difficulty in answering the question.

A Yes, that is true.

Q We have a statement on page 58 and 59 that "Even

3mil

1 operation of the once through cooling system through two
2 spawning seasons will have long-term detrimental effects
3 on the fishery through reduction of catch and breeding stock."
4 A Yes.
5 Q Now there were a series of assumptions and calcula-
6 tions and ideas that you had that enabled you to draw this
7 particular conclusion. What I want to explore with you is
8 the relative impact of an increase of sports catch of 500,000
9 fish per year; just so I can be perfectly specific, so we can
10 all see where I am heading in this, I want to contrast that
11 with the number of fish you think are going to be impinged
12 at Indian Point 2 and Indian Point 1 during the same period
13 of time. I just want to contrast these two things.
14 A All right.
15 Q Now let's go back and see if we can all get
16 together on this and then we will take the question. You
17 assumed that there is a certain number of fish in the Hudson
18 River fishery and you drew some conclusions that the impinge-
19 ment and entrainment kill was going to have a long-term
20 detrimental effect. Now assume the same circumstances as to
21 what the fish population in the Hudson River fishery, all of
22 the other factors that led you through your thinking as you
23 reflected it here. Now I am just going to ask you the question:
24 Would you, if you assumed that there are 500,000 more fish
25 caught in the western quarter of Long Island Sound, and in the

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New York bite for two years running by sports fishermen, and you assume that the commercial fishing remains exactly the same, would this cause a long-term detrimental effect on the Hudson River fishery?

A No.

CHAIRMAN JENSCH: Excuse me. Does this assume during this two- or three-year period there are no impingements? You could say what difference does it make whether you impinge 500,000 or catch 500,000, is that the question?

MR. TROSTEN: Yes.

CHAIRMAN JENSCH: You say it doesn't make any difference if the fishermen catch 500,000 more, what difference does it make if they are caught that way or on the fish screens? That is what is really --

THE WITNESS: What I said at the bottom of page 59 is the lowered fish population will be a real and irreversible loss as long as it lasts. Now these million fish caught by the fishermen out there would be a real irreversible loss to the fishermen that didn't catch them.

BY MR. TROSTEN:

Q I am not talking about the fishermen. Would it actually affect the fishery? Would it cause a long-term detrimental impact on the fishery?

CHAIRMAN JENSCH: You are using long term in the same sense --

5mil 1 MR. TROSTEN: In exactly the same sense he uses
2 it.
3 CHAIRMAN JENSCH: Very well.
4 THE WITNESS: Yes. I will answer yes to that.
5 BY MR. TROSTEN:
6 Q What are you answering yes to? I am sorry.
7 A To the fact that this would be an irreversible
8 loss, et cetera, et cetera, to the fishery. Not that it would
9 be destructive to the fishery, because then you are saying
10 people can't fish without destroying their own fishery, which
11 is not true, because there are management techniques that
12 bring them into balance. In other words, it is quite
13 apparent that if you reduce the population of fish that are
14 being fished on, you are going to reduce the breeding stock,
15 and reproductive potential of the species, and according to
16 all of the theory we have, and these have to be balanced off.
17 BY MR. TROSTEN:
18 Q Let me see if I understand you. Are you saying
19 that in this hypothesis that I gave you, where the 500,000
20 fish are caught annually by sports fishermen, that this
21 would have a long-term detrimental effect on the fishery?
22 A It would have an irreversible effect, which is
23 what I think I said over here, a real and irreversible loss
24 to the fishery, yes.
25 Q What do you mean by a real and irreversible loss so

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long as it lasts?

A I mean the fish, once the fish are gone, they are gone. You are not going to catch them again.

Q Oh, is that what that means?

A Yes.

Q In other words, just when you catch a fish, you have caught a fish?

A No, it means if something like 500,000 fish are gone out of the population, they are gone. If they are lost, they are lost. There is nothing you can do to bring those fish back.

MR. MACBETH: I would like to get something straight here. It seems to me the testimony on page 58 and 59 concerns itself with both entrainments and impingements. There is a discussion of losses and irreversible effects and so on there that has to do with those terms. Are you now asking Mr. Clark what the phrase at the end of page 59 means in terms of your hypothetical catch of 500,000 fish, or in terms of his testimony? I think he has answered you in terms of the 500,000 fish. I just want to be sure whether that is the way you are asking the question, rather than asking him what he means here. If what you are getting at is what he means here, it would be easier to come at it that way, at rather than the hypothetical.

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BY MR. TROSTEN:

Q Let me ask him what he meant when he said the effect would be the same. When you say that there is an irreversible loss as long as it lasts, and you were referring to my hypothetical --

A Yes.

Q What do you mean by that phrase, "It is irreversible as long as it lasts," when you are referring to my hypothetical?

A Oh, when the fish are killed, there is nothing you can do to restore and put them back into the population. They are irreversibly dead.

Q Okay. Does that mean, however, that the population is depressed or does it simply mean that you have caught the fish and they are gone?

A I can help you if you will refer to the final environmental statement, page V-60, V-15. That shows what happened when you apply fishing efforts to a stock, you reduce the breeding, size of the breeding stock.

Q Are you saying, Mr. Clark, that in the example that I gave you, where you increase the catch by 500,000 fish annually, that that would proceed to depress the Hudson River fishery population?

Is that what you are saying?

A It should operate just in the same fashion that the commercial fishery, if you wanted to work all of the

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1 proportions and calculations around, you should get something
2 like this display here, which shows that the more fishing
3 you do, the lower the breeding stock is.
4 Q Mr. Clark, are you relying --
5 CHAIRMAN JENSCH: Excuse me, you mentioned a few
6 moments ago that there are various management techniques to
7 correct that. What do you mean by that?
8 If they are catching more fish, depressing the
9 stock, the state will prevent the taking of such numbers or
10 limit the commercial or sport fishing, so the reproductive
11 stock will increase again? Is that what you meant by
12 management techniques?
13 THE WITNESS: Yes, that is one of the things, and
14 one way to reduce the catch is to put a size limit on, so
15 that people just can't catch the small fish, and they tend
16 not to fish for them or release them if they catch them.
17 Another way is just to have closed seasons and
18 another way is to have bag limits, but all of these are
19 aimed at reducing the size of the catch that sport fishermen
20 make and it is usually necessary when the fishing builds up
21 and builds up, as more and more people want to go fishing,
22 there get to be so many people fishing, that you no longer
23 can support everybody just doing whatever they want, whenever
24 they want, catching whatever they want.
25 CHAIRMAN JENSCH: Well, I wouldn't think the

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management technique would be applicable in the situation we discussed a moment ago, it does not make any difference whether the sport fishermen catch 500,000 more or they impinge 500,000 in the plant. There is a management technique to stop perhaps the impingement by shutting the plant down. So aren't there management techniques for corrective action also?

THE WITNESS: Yes, that would be an analogy.

MR. MACBETH: Another example would be penalties for drawing fish by taking of water, which is a subject we have discussed.

CHAIRMAN JENSCH: My thought was I am having trouble with what seems to me to be a partial hypothetical of taking the withdrawal into considering either replenishment of stock or this management technique situation he mentioned.

Excuse me, proceed.

BY MR. TROSTEN:

Q Mr. Clark, did you have in mind any other management techniques that would enable you to replenish the fishery stock if you were to increase the sports catch?

What else did you have in mind, if anything?

A In some situations they have demonstrated that it is helpful to use a hatchery to replenish the stock. That is if they suspect that breeding is the problem, rather than some habitat or food resource or something.

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This has been done. But never for striped bass. It has been done for salmon, trout. There is quite a bit of literature on attempts to introduce, attempts to improve fisheries with hatcheries and it has never worked anyplace yet where they have tried it.

MR. MACBETH: For striped bass?

THE WITNESS: For striped bass, either in California or in the Chesapeake Bay.

BY MR. TROSTEN:

Q Mr. Clark, do you think that in the situation which I have given you if the striped bass or the sports fishing for striped bass were to increase by 500,000 per year as I suggested to you, do you think that variations in natural year class strengths could restore the fishery population to its original number within a period of time?

A That is possible.

Q Now, in the situation which I have given to you, where you increased the sports catch by 500,000 fish per year for two years running, would you expect, if the fishing pressure were to be reduced back to its original level, if this 500,000 increase were to be eliminated, would you expect that the population would go back to its original level once this extra fishing pressure were removed?

A Excuse me a minute, please.

I think I made a statement on that somewhere. On

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ln5 1 page 59 I say "The total size of the fishery might possibly
2 be restored over time through a combination of natural and
3 management means."
4 That would be as true for overfishing as it would
5 for screen kills or entrainments.
6 CHAIRMAN JENSCH: Excuse me.
7 Would this be a convenient place to interrupt your
8 examination?
9 MR. TROSTEN: Yes.
10 CHAIRMAN JENSCH: Very well.
11 At this time let us recess to reconvene in this
12 room at 2:50.
13 (Recess.)
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CHAIRMAN JENSCH: Please come to order.

Applicants, are you ready to proceed?

MR. TROSTEN: Yes, I am.

BY MR. TROSTEN:

Q Mr. Clark, looking back again at your testimony on pages 58 and 59, I take it that when you use the term " a real and irreversible loss as long as it lasts," that does not mean to you that the population of the Hudson River fishery will not restore itself through natural means over a period of time. Is that correct? Once the pressure of increased mortality is lifted?

A No, I couldn't say that it would not.

Q Do you think it is probable that the population would restore itself once the fishing pressure was lifted?

MR. MACBETH: Wait a minute. If we are talking about this testimony, which doesn't have anything in it about fishing pressure, or are we talking about the entrainment and screen kills that are actually the subject of the testimony?

MR. TROSTEN: Mr. Macbeth, I think mortality is mortality. I think we just have to sort of accept this basic premise.

MR. MACBETH: I find it a little confusing when you direct the witness' attention to two pages of testimony which are about entrainment and impingement and then it turns out in the second question that you are talking about the fishing

kill. It seems a little simpler if you would make that clear in the question from the beginning.

BY MR. TROSTEN:

Q All right. Let's go back to the sports fishing hypothesis, then, if you wish, Mr. Clark. In that situation you have indicated that once the sports fishing pressure were removed, the population would restore itself through natural means.

A Yes.

Q Do you think that it is probable that the population would restore itself through natural means?

A I think that is probable.

Q Now let's go to the situation you were describing on this page, where you have what you consider to be an increased mortality imposed on a population through the operation of a power plant. Do you think it is probable that if that increased mortality were removed that the population would restore itself through natural means?

MR. MACBETH: Is this a two-year power plant or a 40-year power plant, or what kind of power plant?

MR. TROSTEN: Let's talk about the first for two years. Let's talk about something that is operating for two years.

THE WITNESS: Excuse me a minute to think about this. You have two things: one, a direct, and another, an

1 indirect effect on the reproduction.

2 CHAIRMAN JENSCH: Excuse me. I wonder if your

3 fishing loss, as I understood the previous interrogation,

4 would be a fish over 16 inches, the legal limit. Now the

5 impingement of the two, three or four-inch size fish, two to

6 four inches, does that affect the irreversible or

7 replenishable possibility?

8 MR. TROSTEN: Are you asking that of me?

9 CHAIRMAN JENSCH: Whether it is part of the hypo-

10 thetical.

11 MR. TROSTEN: I think we have to break it up this

12 way, Mr. Chairman. The fishing hypothetical dealt with legal

13 size fish, which would be 16 inches and over. Mr. Clark's

14 testimony here deals with the impingement of fish two to four

15 inches in length and also with the entrainment of fish, which

16 are of the very small sizes, less than, say, an inch and a

17 half. So that is the factual background of the discussion.

18 THE WITNESS: I think it is within the realm of

19 probability that given a sufficient period of time, the popula-

20 tion would restore itself after a short-term reduction of

21 that type.

22 BY MR. TROSTEN:

23 Q And you are referring here now to after a short-

24 term operation of a power plant for two years?

25 A Two years of a power plant.

Q Now you said that was within the realm of probability, did you not?

A Yes.

Q Now, then, as I understand the way you use the term "irreversible" on page 59 of this testimony -- do you see that word in the next to the last line?

A Yes.

Q That you do not mean this in an ecological sense, in the sense that the population would never come back, you are using it in the sense that once a fish is killed, it is killed. Is that what you mean?

A Yes.

Q Now --

CHAIRMAN JENSCH: Excuse me. May I interrupt?

MR. TROSTEN: Yes.

CHAIRMAN JENSCH: Could you extend that a little further? Suppose you operated the plant not for two years, but -- you indicated that would not prevent a recovery situation -- how about three, four, five, six, 10 or 20 years? When do you get to the point where --

MR. TROSTEN: That was my next question. I was going to ask Mr. Clark whether he would extend this for -- I will ~~you~~ explain exactly where I am going, so we can all be clear where I am heading. Let's take five years, extend it from two to five years. Where I am going to go after five years is to

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eight years. All right. You see exactly where we are heading.

BY MR. TROSTEN:

Q Let's take five years. Would you say that it is probable that after five years of operation of a power plant that the population would restore itself through natural means to its original level?

A Are you planning on running this plant at the critical times of impingement and entrainment? Is this running for 12 months of the year?

Q Without special restrictions due to the impingement or entrainment period, but taking into account reasonable downtime, you know, the plant is not going to run 12 months a year 100 percent of the time, one could come up, I think -- let's take an 80-percent plant factor, 80 percent time factor, and assume a five-year period of operation.

CHAIRMAN JENSCH: I think your question was there are times of the year -- what is it, May, June, something like that -- that the small fish are around there?

THE WITNESS: Yes.

CHAIRMAN JENSCH: If your 20 percent downtime is in the less critical time of the year or more critical time of the year, wouldn't that affect the question?

MR. TROSTEN: For purposes of simplicity, let's assume an 80-percent plant factor distributed equally

1 throughout the year.

2 THE WITNESS: You will be closed down during the time

3 of entrainment, May, June?

4 BY MR. TROSTEN:

5 Q No. I am assuming that the plant has an 80-percent

6 plant factor, that the 80-percent plant factor applies

7 throughout the year, so there is no special restriction such

8 as has been suggested by the Hudson River Fishermen's

9 Association for downtime during the spawning season.

10 A I would say that after five years, it would recover.

11 I would not be willing to say it would recover to its full

12 original condition. I don't think I would have sufficient

13 grounds to say that.

14 Q When you say it would recover after five years, do

15 you mean if you operated the plant for five years and then

16 you shut the plant down, or went to once-through cooling,

17 it would later recover? Is that what you are saying?

18 A I would say it would recover to some degree.

19 I could not at this time, or with the evidence we have, say

20 it would fully recover to its complete original size. But

21 I would expect some recovery.

22 Q Do you have any idea -- all right, strike that.

23 Now let me ask you whether, if you did this for

24 eight years, whether your answer would be the same as it was

25 for five years.

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A No. Each time you extend the period, I would get, I would feel less and less sure of answering that the population would probably recover.

Q Can you tell me what would be the evidentiary basis upon which you would say that you doubt that it would fully recover?

A There isn't any evidentiary basis one way or another in this whole thing. You are asking me to just conjecture and I am going along with you the best I can, but I am going to stop at the end of five years. I am not going any further, because that is really stretching it out.

Q Would you say then really a determination as to whether or not the fishery would recover after this sort of operation is something that has to be determined on the basis of expert opinion based upon the best evidence that is available? Is that correct?

A I say that, yes, we ought to analyze the data we have and see what it shows in terms of this recovery business.

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Q Now, I have simply one question here that I want to ask you by way of clarification. Dr. Goodyear, when he was discussing the contribution of the Hudson River to the Middle Atlantic Fishery was asked -- this is on transcript pages 7623 and 7624, he was asked by me what his definition of the mid-Atlantic was and he uses the the Staff draws a conclusion about the contribution of the Hudson to the mid-Atlantic and they do this in several places in their testimony. At that point he said he was using -- I will turn to the page here, 7624. He said, "We use the middle Atlantic as used by the fishery statistics, which includes Delaware, New Jersey and New York."

I believe what Dr. Goodyear meant by that was the mid-Atlantic as defined by the Marine Fishery Services, but we will have to clarify this with him when he returns to the stand. Delaware, New Jersey and New York, is that area the area that you define on the map that you drew yesterday or Friday as the area from the Delaware line up to the Rhode Island border here, this area that you estimated as having 7.6 striped bass in it having been caught? Is that the area that you are talking about?

A Yes, I would rather call that, if you want to use my term, the Hudson influenced area, as we defined it, rather than try to call it middle Atlantic, because then that is a third middle Atlantic. You have the commercial fisheries

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1 statistics, we have the sport fisheries statistics Middle
2 Atlantic, and I don't want to throw another in here. So, if
3 we call it Hudson influenced area, it goes from Rhode Island
4 to Delaware. It includes Connecticut, whereas Dr. Goodyear's
5 did not include Connecticut catches on the North Shore of Long
6 Island Sound.
7 Q I agree with you, Mr. Clark, one of the problems
8 I think we are all having here is that the terminology is very
9 confusing. I think if we could all agree on what we are
10 talking about it would be very helpful for the record.
11 CHAIRMAN JENSCH: Including how long the plant
12 should run without cooling towers, is all that agreed to?
13 MR. TROSTEN: Yes, I agree that would be helpful
14 too, Mr. Chairman.
15 BY MR. TROSTEN:
16 Q Let me be sure about this. The Hudson influenced
17 area as you define it includes the Delaware Bay, New York
18 Bay. It includes the Hudson River; it includes all of Long Island
19 Sound. Is that correct?
20 A My Hudson influenced area.
21 Q Yes. And it includes all of the coastal areas from
22 the DElaware line up to the Rhode Island line?
23 A Yes, plus bays, estuaries, lagoons, rivers.
24 Q Did you say a moment ago -- I will confirm this with
25 the Staff -- that you understood Dr. Goodyear excluded the

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1 North Shore of Long Island, that is Long Island Sound from his
2 definition of mid-Atlantic?
3 A Only what the fishermen caught in those three
4 states of New York, New Jersey and Delaware. He didn't include
5 what the fishermen caught who were Connecticut people. So you
6 would have to add on the -- I mean there is nothing to keep
7 a guy from Long Island from going to the Connecticut shore
8 and catching a fish. But normally you would expect a New
9 York commercial fisherman to stay on his own side of the Sound.
10 Q This is all sports fisheries we are talking about.
11 Dr. Goodyear, as I understand it, when you say only talking
12 about --
13 A Commercial.
14 Q That is right, he was talking about commercial fishing,
15 I am sorry. I would like to go on to another area, Mr. Clark.
16 I would like to go on to the matter of the Carlson-McCann data
17 and the model you have just used. With respect to your
18 statement that the Indian Point site -- this is on page 1 of
19 your testimony -- is in the middle of the breeding and nursery
20 zones for the Hudson striped bass -- do you see that statement?
21 It is in the second paragraph, page 1?
22 A Yes.
23 Q Is it correct that spawning in the Hudson River
24 normally occurs north of Indian Point from Kingston to
25 Bear Mountain, with the greatest concentration near West Point.

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1 Would you say that is correct? Just to move along, I will say
2 I am taking this general statement from page A-2-22 of the
3 Staff Final Environmental Statement?
4 A A? Yes. Appendix A-2-22.
5 Yes, here it is. From Kingston to Bear Mountain.
6 Yes, I would agree with that statement.
7 Q Now, isn't Indian Point actually at the southern
8 edge, then, of the spawning zone?
9 A Yes.
10 Q Now, if that is the case, is it not incorrect
11 to say that the power plant is in the middle of the breeding
12 and nursery zones of the Hudson River striped bass?
13 A I don't think so.
14 Q If it is at the southern end of the spawning zones,
15 that doesn't make it in the middle of the spawning zone, does
16 it?
17 A No, sir, it does not.
18 Q Now, isn't it also correct that the largest known
19 nursery area in the Hudson River is south of Indian Point,
20 in Haverstraw Bay?
21 A That is true.
22 Q If that is true, then that doesn't put Indian
23 Point in the middle of the nursery area, does it?
24 A There is a map somewhere in this --
25 Q Yes, there is a map -- let's look at your map,

1 Figure 1, on page 9. Let's just analyze this for a minute.
2 Oh, I am sorry, are you going to use the map in there.
3 A I just wanted to see, he actually has the nursery
4 areas on a map somewhere in here.
5 CHAIRMAN JENSCH: Excuse me, I wonder if you
6 are referring to page 2 --
7 MR. TROSTEN: I am referring to page 1.
8 CHAIRMAN JENSCH: He said it is in the middle of two
9 zones. Now, you say the breeding is north and the nursery
10 is south -- was that the question?
11 MR. TROSTEN: Well, I guess one can interpret this
12 different ways, Mr. Chairman. I guess we have sort of
13 established what the facts are, and then we can all look at
14 these words.
15 CHAIRMAN JENSCH: Isn't this a question of semantics,
16 I mean the breeding zone is up here, and the nursery zone is
17 here, so it is in between two zones.
18 BY MR. TROSTEN:
19 Q Is that what you meant, it is in between the spawning
20 zone and the nursery zone?
21 A If you will look at Roman 5-46 of the Final Statement,
22 Figure Roman 5-7, you will see that Indian Point is almost
23 exactly in the middle of the nursery areas of the striped bass.
24 Q Roman 5-46?
25 A Yes, there they are actually in stipple on thatmap.

Q I am looking at this map and I see the little dots written all about it, and I can only assume on the basis of Dr. Goodyear's analysis that is contained elsewhere in his testimony, where he describes the major nursery area as south of the Indian Point and the major spawning as occurring considerably north of Indian Point, that these little dots must just be a very, very general representation of what he is talking about. Were you relying on this general map?

A You just said it itself. The spawning grounds are up here, the nursery grounds are up here and Indian Point is right in the middle of the whole thing.

Q So you say the spawning is north, the nursery is south, and Indian Point is somewhere in between.

A The spawning areas and the nursery areas, both overlap Indain Point. The heaviest part of the spawning is north of Indian Point, and the heaviest part of the nursery areas are south of Indian Point. And Indian Point is right in the middle of it all.

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BY MR. TROSTEN:

Q Is it true that there is really a minor amount of spawning at Indian Point? Relative to the rest of the river?

A Let's look at the --

MR. MACBETH: Could you give us the flow conditions for the year you are discussing? It is my understanding to know where the spawning takes place, you have to know where the salt front is, and that comes largely on fresh water flow.

MR. TROSTEN: I will refer you to two sources, page A-2-22 of the Final Environmental Statement, and also to Figure 1, which is drawn by Mr. Clark in his testimony, which purports to describe on the basis of the Carlson-McCann data the breeding locations of striped bass.

MR. MACBETH: It is those years we are talking about, 1966-67.

MR. TROSTEN: 1966, 1967, and whatever Dr. Goodyear had in mind on page A-2-22 of the Final Environmental Statement.

CHAIRMAN JENSCH: I think that is one of the problems, you are asking him what did Dr. Goodyear have in mind. I think you should ask what this witness had in mind when he wrote his testimony.

MR. TROSTEN: Mr. Chiarman, Dr. Goodyear -- the point I am trying to make is very simple. Dr. Goodyear, on page A-2-22 summarized a vast body of literature having to do

1 with the striped bass spawning and distribution, Clark,
2 Smith, McCann, Carlson, Jenson, Shaffer, Raney, and so forth,
3 and he drew a conclusion, "Their conclusions are summarized
4 in the following description, species spawn from Kingston
5 to Bear Mountain, with the greatest concentration of eggs in
6 the vicinity of West Point, although the exact variation
7 varies from year to year." That is what he said. All I am
8 trying to establish is that Indian Point is at the southern
9 extreme of the spawning area and the major nursery area is
10 south of Indian Point.
11 THE WITNESS: May I respond to your question that
12 there is only a minor amount of spawning at Indian Point?
13 BY MR. TROSTEN:
14 Q Yes.
15 A On Table 1 of my testimony, which we are now into,
16 following page 12, the average standing crop of eggs for the
17 season is shown to be highest in the Indian Point area than
18 any other place in the river.
19 Q What page was that?
20 A Table 1. Now there is a lot of numbers in this
21 table and I haven't looked at it recently, I would have to
22 refresh myself on this. But in the aggregate, the amount of
23 egg deposition is much higher above Indian Point, because
24 Indian Point is only one section of the river. But these
25 figures seem to say quite the opposite of what you said, there

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is not a minor amount of spawning there, it is most heavily saturated with eggs in those years of any section of the river. It is just that it becomes a smaller percentage of the whole when you combine the rest of from Coxsackie down to Cornwall and then compare it.

Q So you are pointing to Table 1 here which shows --

MR. MACBETH: Figure 1.

THE WITNESS: No, Table 1. After page 12.

MR. MACBETH: Excuse me.

BY MR. TROSTEN:

Q Which shows the production of fertilized eggs from Table 21 of Carlson-McCann. Is that right?

A Yes, sir. And the reason for that apparently is because of the density of eggs per thousand cubic feet was highest in the Indian Point section of any in the river. You might want to check that and see if I made an error in this table or something.

Q I think I am going to have to go back and look at this, because the numbers that you portray on this table, an estimated annual average egg production, seems inconsistent with Dr. Goodyear's conclusion, and also seems inconsistent with the Figure 1 you drew, in which you depicted egg production -- I am referring to your Figure 1 which appears on page 9 of your testimony -- which shows very light, light or none egg production at Indian Point.

A No, sir. It shows the heaviest of any.

Q Are you looking at Column A?

A I am looking at Figure 1.

Q Column A.

A River strip A or whatever, to the far left, you see all of those scratches going both ways there?

Q Yes.

A That, as you will see in the legend, is for heavy deposition of eggs. I am sorry, this is a bad map.

Q Okay. Mr. Clark, where were the samples of the striped bass eggs and larvae upon which your conclusions about spawning distribution were based, where were these taken?

A For the Indian Point section?

Q No, the Carlson-McCann sampling of the striped bass eggs and larvae.

A Well, I was looking for the Carlson-McCann report. Anyway, the Figure 1 that we were looking at shows where they were taken, I mean the different sections where they were taken. Did you mean where within each section? Or what depth?

Q What I am asking you is where in the Hudson River were these taken, not at what depth.

A Well, this "A" of Figure 1 shows all of the different places they were taken. Coxsackie, Hudson, Socrates, Kingston, Hyde Park, Marlboro, Cornwall.

Q So these samples were taken at places within these

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1 various seven, I guess it is, or nine segments?

2 A Right. Whatever it is, seven or eight.

3 Q Now in those locations where no samples were taken --

4 I am sorry, in those cases where no samples were taken at a

5 particular location, or at a particular time, can it be

6 inferred no striped bass spawning took place at those locations

7 and times?

8 A Pretty well.

9 Q How can you infer that?

10 A Oh, just figure if they were there, they should

11 have caught them.

12 Q I am saying if they did not sample at a particular

13 place.

14 A No, not unless you had some other evidence to go

15 on.

16 Q Now with regard to page 5 of your testimony, are

17 you implying on this page that striped bass remain planktonic

18 from the time they absorb the ~~yoke~~ yolk sac through the sixth or

19 seventh week, at which time you say they are approximately one

20 inch in length?

21 A Is that what I said?

22 Q Do you see the second paragraph --

23 A If I said it, I stick with it.

24 Q You say, "Within two weeks they grow to 25 to 30

25 inches, six or seven millimeters, absorb the yoke sac, and then

ar6

1 begin to feed on zooplankton, small planktonic life, performing
2 diurnal migration in pursuit of plankton. At this point
3 they are in the post-larval stage during which they remain
4 planktonic." Are you implying on page 5 that striped bass
5 remain "planktonic" from the time they absorb the ~~yoke~~ yolk sac
6 through the sixth or seventh week, at which time you say they
7 are approximately one inch in length?
8 MR. MACBETH: Would you read the next sentence,
9 where it says six or seven weeks after matching, is that the
10 six or seven weeks you are referring to? That seems to say
11 hatching, not yoke sac.
12 MR. TROSTEN: It is a little unclear to me. First
13 of all, there is a basic confusion here because Mr. Clark
14 uses one inch --
15 THE WITNESS: I am sorry, there is a mistake here.
16 That is one inch does not equal 38 millimeters. So that
17 should say -- well, it says one inch. So that -- but it is
18 25 millimeters. The conversion is wrong.
19 BY MR. TROSTEN:
20 Q Right. So you do mean one inch, not 38 millimeters
21 there, is that right? One inch, 25.4 millimeters?
22 A I expect so. Wait a minute, I can check it. Yes,
23 I do mean that.
24 Q Okay.
25 A One inch. 25 millimeters. I am sorry about that.

Q Are you saying that these organisms remain planktonic through the sixth or seventh week, which you are saying amounts to the time when they are approximately 25.4 millimeters long?

A Yes.

Q All right. Now would you define planktonic as you use it on page 5 in describing the post-~~yoke~~ yolk sac larvae? What do you mean by the term "planktonic"?

A Carried more or less passively with the transport of water.

Q Do you disagree with the Staff's conclusion that once the larvae have reached a length of about a half inch, they are capable of sustained swimming?

MR. KARMAN: Where are you referring to?

MR. TROSTEN: The Staff's conclusion is found on page A-2-22 again.

THE WITNESS: No, I wouldn't disagree with that.

BY MR. TROSTEN:

Q Does that imply to you -- I am sorry. If they are capable of sustained swimming when they reach one half inch, how old are they, according to your Figure 2? How old are they?

A Oh, about a few weeks old.

Q Look at your Figure 2-B.

A A few weeks old.

ar8

Q Would you say about four or five weeks?

A I would say five weeks would be all right.

Q Five weeks. Now if they are capable of sustained swimming at five weeks, as you have just indicated,does that not mean that they are not planktonic at that point in time?

A Not necessarily. There are lots of critters that can swim around that we still consider to be planktonic, because their basic mode of transportation continues to be water current rather than their own efforts. I mean it is just a question of some point at which you say these fish are being mostly carried by the current, when they are located from one place to another. That is planktonic. Whereas if most of their movement is concerned with their own swimming ability, their own self-determination, then you would say that they are not planktonic.

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Q Would you say that these fish at the age of five weeks, according to your calculations, have the capability to determine their own position in the water column?

A Yes, going up and down.

Q Do they also have the capability, if they are capable of sustained swimming, of choosing a place in the horizontal water column within some limits?

A They are capable.

Q So therefore -- I don't want to get into a quarrel with you about what the term planktonic means -- you are using the term planktonic in recognition of these facts we just discussed?

A Yes, there is only a week anyway, between five and six weeks, that we are quibbling about.

Q Or two weeks between five and seven weeks?

A Yes. Not one of us would be able to say that precisely, you know, that six weeks and one day they completely transform to a new way of life.

Q Would you please tell me what you mean by the term pelagic, as you use it on page 5, the last line?

A That means not demersal. It is an appositive term to the term demersal, or benthic, whichever you choose, that they are up in the water and they don't stay at the bottom.

Q With regard to your second paragraph on page 2, in discussing the growth rate of larval striped bass which you

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are discussing there --

A Excuse me, page 2?

Q Excuse me, page 5, paragraph 2, pardon me. In discussing the growth rate of larval striped bass, you state that within two weeks they grow to .25 to .30 inches, 6 or 7 millimeters, and absorb the yolk sac.

A Yes.

Q As the reference, you site Raney's 1952 paper called, "The Life History of the Striped Bass."

A Yes.

Q Within two weeks is sort of a vague term to me. What do you mean by that? Do you mean within two weeks of hatching or within two weeks of the fertilization of the egg?

A I am just checking on the growth. I think it is -- wait a minute. It looks to me like two weeks from hatching.

Q From hatching. Let's leave it at that. I think if you reflect on it, you might consider it from fertilization. But let's go on. In Raney's 1952 paper on page 41 he says that -- let me defer the question until I get the paper.

A I have a copy of it.

Q All right. Would you look at page 41. He says there the striped bass reach post-larval size, which is 9 millimeters, 240 hours after fertilization. That means 9 millimeters within 10 days after fertilization.

A Nine millimeters --

3mil

Q Within 10 days after fertilization?

A Yes.

Q In light of this, do you agree with my characterization of what he said?

A Oh, no, I haven't had a chance to read it.

Q Do you want to glance at it?

A Can you give me the line? Do you have a note on what line it is? That is all right. I will just read it all, but it will take a longer time. It says, "Otherwise, they reach the post-larval stage at 240 hours after fertilization, 9 millimeters." That is 10 days, right.

Q In light of this, don't you think your interpretation of 6 to 7 millimeters within two weeks after -- well, you said two weeks after hatching. I really believe it is two weeks after fertilization. But in light of what Raney said there, would you not say your statement that they grow to .25 to .30, or to 6 or 7 millimeters within two weeks is not in accord with Raney's report that they grow to 9 millimeters within 10 days?

A Those statements are very consistent. There is nothing inconsistent about "within two weeks," and "10 days." If you will give me a moment, I will check back in my notes and summarize and so on and I can tell you more precisely how I arrived at that.

Q All right.

4mil

A This will probably take about five minutes.

I have 10 days from hatching, stage, post-larvae size, 9 millimeters.

Q What are you reading from?

A My notes.

Q Your original notes?

A Then I have 18 days, 13 millimeters, I have 8 days, 6 millimeters. I seem to have a range of lengths and a range of days for Raney, not just that one thing. Maybe we are taking it out of context of the whole array of data and that is confusing.

Q Would you say it would be consistent with what Raney has said in the paper you have before you that they could grow to 6 or 7 millimeters within one week? Because if they grow to 9 millimeters within 10 days, 6 or 7 millimeters is shorter --

A They could grow to 6 millimeters within seven days. Does that answer your question?

Q Yes. Now you refer to -- I am still on paragraph 2 now, page 5 -- the sentence that we corrected a moment ago, 6 or 7 weeks after hatching they reach one inch, 25.4 millimeters or slightly more, and you cite Carlson-McCann. Could you tell me from your notes where in Carlson and McCann you got the figure from?

A This is the size at which they reach an inch?

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Q Yes.

A I only have the larval notes there.

Q Could you check that and we can come back to it.

A Yes.

Q Now in your footnote 6 which appears in the second paragraph on page 2 after the reference to absorbing yolk sac, you refer again to Raney's 1952 paper for a portion of your growth data. Now you have the paper before you. Are you aware that on page 42 of that report, that Raney says that young striped bass reach 36 millimeters, which is 1.4 inches, in three to four weeks, as contrasted to what you say here, which says that at six or seven weeks after hatching they reach 25.4 millimeters?

A Yes, I see that.

Q Is that not inconsistent, then, in that Raney's paper shows they are 36 millimeters in three to four weeks and you are showing six or seven weeks after hatching, they are 25.4 millimeters?

A That is inconsistent, right.

Q On what grounds did you choose the slower growth rate for striped bass that is portrayed in your paper?

A First if you look at Table 24 of Carlson McCann, the main volume, page 45, you will find the mean total lengths for the fish at each week. And there you find out how they were doing in 1966 or in '68 in the Hudson River. I thought

6mil

that was about the best thing I had to go on. I think it is the data right from that table that are drawn into my figure where I show the growth rate. Into Figure 2.

Q So you were drawing, then, on Table 24, as the basis for your choice of the growth rate you portrayed?

A Yes. That one that says Carlson-McCann?

Q Yes.

A Then there is a little dotted curve there and that is from Ed Raney's thing. Reference No. 6.

Q I see. So you are contrasting the more rapid growth rate portrayed in Raney's paper with the Carlson-McCann '66-'67 data.

A Right. I think that is the answer to that previous question where I get it, Table 24, so if we all agree I have satisfied that one, too, it will save some homework.

Q I am sorry. I didn't hear you.

A I say this is the growth rate from Carlson-McCann, which satisfies the previous open question. If we can close that, it will simplify things, too.

Q All right. Now I am turning to page 6 of your testimony. You say this, "In the first year of life, each brood of striped bass is exposed to a predictable risk from the power plants that draw water from the Hudson for the cooling of their steam condensers." Would you say that there are any uncertainties in the predictable risk to each striped bass

7mil

from power plants?

A Uncertainties? Yes, lots of uncertainties.

Q Is there lots of uncertainties? Okay. Let me give you a string of uncertainties, and see if you agree that these are the principal uncertainties that exist. Stop me, please, if you feel this is not a principal uncertainty. The number and concentration of larvae in the river at a particular time --

A Could I write these down and go back over them?

Q Sure.

A Yes. Continue, please.

Q The planktonic existence of larvae for a period of six to seven weeks.

A Are you reading a list of parameters to me here?

Q In effect that is what I am doing. I am reading you a list of parameters. Migration past Indian Point in a planktonic state. Uniform distribution of larvae across the river.

A Uniformity of distribution?

Q Uniform distribution.

A That is not a parameter. I mean if this is going to be parameters, we can discuss it one way; if it is just going to be suggestions or hypothesis or ideas, we would have to do it in another way.

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Q Perhaps I misunderstood your term "parameters."

A A parameter is a value. Uniformity of distribution would be a value.

Q Uniformity of distribution, I am sorry.

A Continue, please.

Q No compensation. Total entrainment lethality.

A Is this a --

Just go ahead.

Q I think we are having a semantic problem.

Finally impingement losses of some specific magnitude at the plant.

Now if we are not communicating about what these are, tell me what your question is.

A Now if I can get back to what you said you were going to do with this from the record, please?

MR. TROSTEN: Would you read the original question?

(The reporter read the question as requested.)

THE WITNESS: Uncertainties about the magnitude of entrainment?

BY MR. TROSTEN:

Q No, I was referring to page 6 of your testimony, in which you said "In this first year of life, each brood of striped bass is exposed to a predictable risk from the power plants that draw water from the Hudson for the cooling of their steam condensers." Just to say --

A Right. If you are going to predict it, what are the main variables?

Q No, I was saying if you say that this is a predictable risk, would each of these factors create uncertainty in your ability to predict what that risk was going to be to an individual brood.

Do you see what I am asking?

A From that standpoint, they are the variables in whatever prediction formula or model you have.

Q That is right.

A The number and concentration of larvae you would have to take into account. The period of planktonic existence of larvae you would have to take into account. The migration past Indian Point in a planktonic state you would have to take into account. The uniformity of lateral distribution, no.

Q May I stop you there?

Are you saying that if the distribution was indeed not uniform that this would not be something that you would have to take into account? Wouldn't it be important to determine whether the lateral distribution across the river was indeed uniform?

A I think you would just have to know what is in front of the plant. I mean it doesn't matter what is across the river and all of this stuff. It is just what is right

there where the plant would be sucking in. And --

Q But even if you knew what was right there, that was being sucked in, but you didn't know what was on the other side of the river, this would give you a very distorted view of percentages that were being withdrawn, wouldn't it?

A Certainly not, not if you had an estimate of the universe, a decent estimate of the universe of eggs, the distribution throughout the river, or the larvae, or juveniles, which ever you are after, all you have to do is know how many you are killing at the plant as compared to how many there are in the river.

Q Let me rephrase that somewhat. Instead of calling it uniformity of distribution across the river, supposing I were to call it distribution of the larvae, the lateral distribution of the larvae in the river, where they are laterally in the river. You have to take that into account, don't you, whether they are at the Indian Point plant or in the middle or on the far side, wouldn't you have to know that?

A I think all you have to do is know what is -- if this is your river coming down here, to Haverstraw Bay, and you are taking eggs out of here -- (Drawing on board.) -- at a predictable rate, there is a certain density in the area of the plant, you are taking them out at a predictable rate, that is all you have to know, how many you are taking out there, and how many are in the whole river, whether on the

1 left or right bank, wherever they are.

2 Q Supposing you have the river here, and it looks

3 like this -- (Drawing on board.) -- and it widens out down

4 here and you have Indian Point here, and wouldn't you have to

5 know whether say the larvae were over here, so that -- and the

6 influence of the plant is like that, say -- wouldn't you have

7 to know if the larvae were there, rather than over here?

8 A The question is what is the area of influence of

9 your plant? If you are sucking water from here, you want to

10 know what is in there, you don't care what is on the other side,

11 anymore than if they are in Coxsackie or in Yonkers.

12 Q Wouldn't you agree it would be important to know

13 whether the larvae are here or here or here?

14 A No, it doesn't have anything to do with it. It is

15 the concentration within the area of the influence of the

16 plant, which gives the density sucking in and that gives the

17 total kill for the year in relation to the whole spectrum of

18 fish up and down the river.

19 Q Let's go on with the list.

20 A Yes. No compensation -- the fact of compensation,

21 if it were true in the Hudson River, and I have already said

22 I didn't think it would apply there, if there is compensation

23 and you have any reason to think that there is compensation,

24 sure, put it in the model.

25 Q Now what about total entrainment lethality? In

ty 5

other words, is it important to take that into account?

A Yes, definitely.

Q What about the total magnitude or the magnitude of impingement losses, the actual magnitude of impingement losses?

A Sure, that is what we hope we would be able to calculate, right. I mean we are talking about what happens to the whole first year of the fish, it would be very helpful to know the total number killed on the screens.

Q So you would take that into account, too.

A That would be a good idea. I have tried to do it in my analysis.

Q Now certainly all larvae and young fish, of every brood of striped bass, are not entrained in the cooling water of a power plant that is located at Indian Point. Is that correct? They are not all entrained?

A No.

Q Now are all members of the larger stages, the screenable stages, actually impinged? Only a percentage are impinged, isn't that correct?

A Yes, that would be our experience from Indian Point because there are still some fish around Indian Point 1.

Q You have no direct information, do you, that all stages of striped bass which are small enough to pass through the Indian Point intake screens actually do so, do you?

A No, I don't have any information that they all go

through the screens.

Q Isn't it possible, Mr. Clark, that most, if not all, individuals of some of the larger stages of striped bass locate themselves in areas of the river that do not expose them to the plant intakes?

A Those nursery grounds at Haverstraw Bay, for instance, shoals?

Q That is one area. Or another area would be areas in the river above Indian Point.

A Right.

Q Now do you know of data collected at Indian Point, Mr. Clark, which demonstrate that all of the larvae that are entrained are subjected to lethal conditions?

A Yes.

CHAIRMAN JENSCH: Will you read that question again, please?

(The reporter read the question as requested.)

CHAIRMAN JENSCH: Thank you.

BY MR. TROSTEN:

Q You say you do not know of data collected at Indian Point which demonstrate that all larvae entrained are subjected to lethal conditions?

A I meant yes, I said yes, and I will tell you why. A lot of them are killed in there and therefore from Jerry ~~Hawler~~ Harris's little testimony, Pete Bibco, whoever, there are a

ty 7

lot of them killed, therefore there are lethal conditions in there and a lot of them are exposed to those lethal conditions. That is the specific answer to your question, are they exposed to lethal conditions, the answer is yes, a lot of them are killed, therefore those conditions must be lethal, true?

Q Let me be sure I understand your response.

You are saying all of the larvae that are entrained at Indian Point are subjected to lethal conditions because some of them are killed?

A Right.

Q It is only in that sense that you feel the larvae are exposed to lethal conditions?

A I think there was one of the runs where 5 percent of the fish survived. But the rest of them they all died.

Q Have there been runs where they all lived?

A I remember one, yes, I think they didn't do too bad when the heat wasn't turned on. I have got those data that we got from NYU which, if I could look at those, would refresh my mind. I have made some summaries. I haven't completed my analysis, but I have some summaries someplace.

End #27

MR. MACBETH: If it would be of any help, Intervenors were intending to offer some rebuttal testimony at the appropriate time on that particular experiment. Obviously, that material wasn't in the record at the time the October 30 th testimony was written.

So, we are kind of scratching to keep up to date here. I don't know whether you want to defer this, but we are having a little trouble finding the analysis of those experiments.

BY MR. TROSTEN:

Q. ~~You~~ Why don't you just summarize your view?

A. My view is that, my recognition of my summaries on that is that by the time they get down to that last station down there, near the outfall, 95 percent of them were dead when you had the heat turned on in there, when it was up on full power range. But that is the thing I would want to check.

Q. This will be covered in your rebuttal testimony.

MR. MACBETH: Yes.

THE WITNESS: It will be somewhere, you will get a shot at that sometime.

BY MR. TROSTEN:

Q. Now, turning to Page 7 of your testimony, you say, "Because of limitations on the extent and usefulness of the data at hand, the analysis includes a number of

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approximations based upon interpretive judgments." What are some of the limitations on the extended usefulness of the data to which you refer here?

A. Well, one of the main things that bothered me throughout this whole thing was the uncertanties of the efficiency of the gear. I will give you an example. When I was up at Woods Hole, I spent a lot of time studying gear selectivity, and when I was at Sandy Hook, I spent a lot of time coping with that, that was on trawl nets and at Sandy Hook, I spent a lot of time with plankton nets.

The problems we had in all sampling, wherever you involve a net or any other type of gear almost is the problem of representative sampling. With these nets, the problem generally is not we oversample or overestimate, but that we underestimate.

If you take a trawl net of the type that is originally used in sampling activities, you have a small mesh down here somewhere in the end of the net, and then larger meshes in the forward part, whatever they may be.

And what we found out is that for smaller sized fish, that about 90 percent of the fish would escape up in the front part of the net, and only 10 percent would get back here to the end, where they are recovered and brought aboard. So, if over a course of, if your boat is going along here, towing the net behind it, down this

dh3

track.

(Drawing on board.)

And let's say there is a thousand fish in the way of that net, and you tow from here to here, 900 of them, of the thousand that are in the piece of acerage you are towing over, would go out the front and only 10 percent would get back in this part, where they would be recovered and taken aboard the boat.

So if this happened to be three acres that you covered, you would end up saying there is, let's make it something I can handle in my head, say it was 10 acres, you would end up saying there is 100 fish per acre, if you could get them all, but with this sampling error, you end up saying there is 10 per acre.

So, your error throws you off, and you underestimate this by a factor of a whole order of magnitude. If you have an order of magnitude of escapements. Well, the same thing with a plankton net. It is commonly accepted, there are a great number of papers behind this, that your probability of catching any particular larvae is a function of its size.

So that if you are out there with a plankton net, catching larvae over this range of sea -- let's just take fish from 3 on th 12 millimeters, your chances of catching a little yolk sac larvae, and these are extremely hypothetical figures, you might have a 20 percent chance

dh4

with your net of getting one of those, because they are very slender, they can slip through the meshes once the yolk sac is broken. You might have an 80 percent chance with your net of catching an 8 millimeter or 7 millimeter.

By the time you get up to 12 millimeters, your chances of catching those might be only one percent, and by the time you get up to 20 millimeters, it is virtually zero. So unless you know the efficiency characteristics of your gear, your sampling can only be thought to be relative.

In other words, you hope that this kind of escapements would be consistent and so then you would have a relative population. And if all of your gear altogether were sampling only 10 percent of what would be there, you would have to, your relative population would be only 10 percent of all that is there, and you would have to multiply the whole thing by 10.

Now, unfortunately no such thing happens. This gear, you start with a small plankton net and go to one with a larger mesh, and then to a midwater trawl, and then to a larger trawl, and over the course of the season, you have all of this interlapping, intergrading efficiencies and there is just no way to put them together.

So, the best you can do is try to approximate the best you can, a relative curve. And if the relative curve shows you have 10 million at some time of the year,

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that only is a relative expression, and it might be 20, 30, 40 million. That is the problem. The main problem.

Q. Now you referred here to the uncertainties associated with the population estimates, population size estimates due to the problems with sampling. We have been discussing some other uncertainties, have we not, today, for example, uncertainties associated with the contributions, if you will, of the Hudson River spawning to the fishery along the coast?

A. Yes.

Q. That is another uncertainty, is that right?

A. Yes.

Q. Can you think of any other major uncertainties that you feel, on the basis of what we have been discussing in the last four days, are basic uncertainties here?

A. Well, another thing that makes it quite difficult to get a sac, to work out a model, is that --

(Drawing on board.)

if you will accept this as a cross-section of the river, this being the north and this being the south, I want to show the area where the breakish water comes in.

DR. GEYER: This is a longitudinal section.

THE WITNESS: Yes. This being the bottom of the river. And this being the surface. And you have this sort of density, this salt water wedge and this density

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current coming here, you have the shearing force, and the sort of mixing that goes on, all of this. And this thing now is up somewhere, coming out somewhere right around in the middle of all of the spawning.

By this, I don't mean the geometric middle or anything, but just up in the spawning area. Now, take fish that are up in here.

(Indicating.)

And the eggs hatch out and let's say the yolk sac larvae are drifting on downstream. They tend to swim up, in hatcheries, they even call this size of fish "swim up fry" because they tend to kind of lie on their back and swim up and then sink back down in the yolk sac stage.

Nevertheless, they are drifting down the river. Some place or other, they begin to, they lose the yolk sac and so on, and they begin to make these vertical migrations down here, down into somewhere around Haverstraw Bay or Tappan Zee, we run out of fish.

There is a few, but the majority seem to be like Indian Point was here, Haverstraw Bay starts here, we don't seem to get very many larvae or any kind of fish down here. So these fish seem to be recycling back upstream. At least they are not going beyond here. This is going upstream, this is coming downstream.

There is evidence in the nighttime they are up

dh7

near the surface, in the daytime, they are down near the bottom, since in June and in the summer there is more daytime than nighttime, they spend more time on the bottom than at the surface, enough to mean that mostly, or the probability is strong that they would be going upstream than downstream.

What I believe is happening is that the fish are being carried down and during their sojourn near the surface, they would be carried down, while they are in the bottom, they would be carried up.

So by this means, since on a net basis, they would be carried upstream, they are constantly sort of recycling in this fashion. If they are doing their vertical migration, they are just going like this.

You could describe their daily pattern as that, unless they get up to where this bottom moving water is no longer going up the river. Then they kind of get set back and so on. So, there is a process of cycling that goes on daily, which in the end results in them sort of coming upstream.

And unless you have this worked into your model, you are not going to be able to so easily predict with precision what will happen. Now, we don't have worked out the exact behavioral coefficients of this, and the exact relationship between the flow and the movements of the salt wedge up and down in relation to Indian Point, and so

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on. But that would be important to work into your model.

Q. As you indicate, that is not in your model at present, that process?

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A. I couldn't handle anything quite that complex.

Q Now, would it not also be helpful if you had more data on the horizontal distribution of eggs and larvae in the river through a sampling program in and around Indian Point, at and around Indian Point?

A It is like asking a barber if you need a haircut. I am a research guy, we always want data. There is never any end to our demands for data. I would be, you know, any model that you made would certainly be improved by every bit of detail that you could possibly get in. You get into diminishing returns once you have the essential variables pinned down but every bit would improve the degree of predictability.

Q I realize that among some research people anyway there is a desire to always do more research. But I was thinking in terms of your statement that, "Because of limitations on the extent and usefulness of the data at hand, the analysis includes a number of approximations based upon interpretive judgments."

Would you say the lack of data at hand causes you to have to make a number of approximations and interpretive judgments about the distribution of larvae across the river?

A Yes. The two essential points, I would believe, in this whole thing, are the ones that we have already discussed. One is all of this variation within sampling gear. If you knew, if you had confidence in the efficiency of your sampling gear, then you could say with far more precision what the absolute

population is in that river. If we ever say what the absolute number of critters living in that river is, then we would have real precision. So there is that, the efficiency of your gear and effectiveness of your sampling program for distribution of fish up and down the river. And No. 2 is the number of fish that are in the area of entrainments of the plant what is right here in front of the plant, so that you can compute the number that are actually going to go through the plant.

That is your kill. Then if you get your sampling, and all of your efficiencies and everything worked out, you can get absolute number of fish for the population as well as this absolute number for the plant. The trouble is now you could compute an absolute number for the plant, but you are stuck with a relative population for the river.

That is what I have had to do, compare a relative figure with an absolute figure. It doesn't work out too well.

Q Now, if you can compute an absolute number for the number impinged, but in terms of the number entrained, you are always dealing in relative numbers, isn't that right?

A You could actually measure the fish that are going through and being killed if you could improve the sampling efficiency. Jerry Lauer's thinking and Pete Bibko and all of putting a plankton net in front of the intake is full of these sampling errors. He might be catching one out of ten or one out

1 of five or one out of one. Until you know what the efficiency
2 of the gear is, you have no idea of how to convert relative
3 to absolute numbers. But presumably with the right kind of
4 sampling array and knowing the efficiency of the gear, you
5 would know the exact number of fish going through the
6 plant at any time. You just multiply that by the volume of
7 water and you have an absolute figure for entrainments.
8 Once you have that, you are all set. If you have
9 an absolute figure for the river, then you would know exactly
10 where you are, you could predict it within decimal points.
11 Q You are coming back to a point we discussed several
12 times, determining the population of fish in the river is
13 perhaps one of the keys here. Is that right? One of the basic
14 things that you think would have to be done.
15 A Yes.
16 Q Now, do you think that could be done?
17 A Oh, it could be done, at fantastic expense, and it
18 would probably take you 20 years to ever get to the point
19 of really being able to get anything out of it. I mean no one
20 yet has worked out a system that would give you the answers.
21 The gear efficiencies are the main thing that is not worked
22 out.
23 Q You say gear efficiencies.
24 A That is the main thing. Then you are sampling
25 representativeness in depths, time, and so forth. It would be

a research project of staggering proportions. So if you say possible, yes. If you asked me realistically, I would say no. I don't know what your budget is but it would be very expensive and time consuming.

MR. BRIGGS: Do I understand you to say there are no methods that have been developed for determining gear efficiency?

THE WITNESS: There are methods that have been developed. I think one of them still has limitations, but the thing that most of these plankton people have turned to is a very simply thing they call a bongo net. It is just two nets hooked together on a frame, and so you can put something on here and something different on there.

(Drawing on board.)

And then you can tow them and compare the sets of data from A with B. So youhave a control net plus a test net. Then over a period of time, if you could do enough of these, you could work it out. There is no control net that will have 100 percent efficiency for any size of critter. There is your trouble.

MR. BRIGGS: This is the point. How do you get the efficiency of the control net.

THE WITNESS: By testing it against a C, D, and E until by some proportion of interration you end up with something that might come close to what it could be.

1 DR. GEYER: By extrapolation.

2 THE WITNESS: Well, there are data, there are things
3 that have been worked out where people for instance, have
4 compared night and day catches, and shown that at nighttime
5 you get a far more of a certain size of larvae than you do in
6 the daytime, because they simply can't see. The
7 avoidance response is apparently three things; first far-field
8 perception of vibrations through the lateral line, and
9 secondly when they get closer to the net, it is the near-field,
10 which is actually audio reception by the fish and then third,
11 it is visual.

12 And they have actually worked this out to the point
13 of being able to predict how long it would take a fish to get
14 from the center of the net to the outside at a certain size.
15 And then you can convert that to the speed of the
16 net and do some theoretical calculations on a behavioral basis.
17 There is a lot of this that, some amounts to anecdotes, some
18 is useful to establish, at least, a relative degree of catch,
19 but I don't know anyone yet who has been able to give
20 you something they could solidly put down and say that is the
21 absolute efficiency of this gear. But the stuff we have to work
22 with here, it is just anybody's guess, you know, you don't know
23 where you are at.

24 Carlson-McCann reports what happened between '65
25 and '66, and by changing nets they just completely changed their

1 catch all around. So I was never able to solve this at
2 Sandy Hook.
3 MR. TROSTEN: Now --
4 CHAIRMAN JENSCH: Is this a general place to interrupt
5 your examination.
6 At this time, let us recess to reconvene in this
7 room at 4:25.
e29 8 (Recess.)
#30 9 CHAIRMAN JENSCH: PLease come to order.
10 BY MR. TROSTEN:
11 Q Mr. Clark, I would like to move on to the following
12 question. In the last sentence in paragraph 2 on page 6,
13 you say, "During their third and fourth months, the striped
14 bass " --
15 A Excuse me. Yes, I have it.
16 Q "During their third and fourth months the striped
17 bass gradually become large enough to be stopped by the
18 three-eighths inch mesh screens. Those that are impinged
19 on the screens suffocate and die."
20 Just so the record can be clear about this, do
21 all fish, in your view, that are impinged suffocate and die,
22 or are some impinged that later escape off the screen
23 and survive?
24 A It is my belief that the likelihood of a fish escaping
25 from the screens once it is impinged, that that likelihood is

very low. I mean it is a very low possibility that a fish would be able to extract itself, once it has been impinged.

Q This is just based on your feeling as a fishery biologist generally?

A On what you see when you have fish in tanks and you have screens over the drain and their reaction to it and so on, and the way Dr. Raney describes what happens to the fish when they finally get held against the screen and are not able to get off and so on. I haven't done any experiments on that.

Q Now, page 8, paragraph 1, is there not a considerable variation, Mr. Clark, in the spawning location from year to year, so that the numbers of various stages available for entrainments would vary from year to year?

A Yes, that is true.

Q You say that the Indian Point Plants are situated to intercept a substantial portion of larvae and juveniles as they move to the nursery areas. Do you see that on the bottom of the first paragraph?

A Yes.

Q Now, does the fact that the larvae and juveniles move past the plant necessarily mean they would be intercepted? Let's just go back to our diagram here on the blackboard. This sort of ties into what we were discussing before. Here you have Indian Point. This is the Hudson River, 4500 feet at this

1 point, right?

2 (Indicating on blackboard.)

3 A Yes.

4 Q Now, here is the plant. If the larvae and juveniles

5 were moving down the river or if they tended to locate

6 themselves on this side of the river, and grow in that area,

7 they wouldn't be intercepted by the plant. When I think of

8 something being intercepted, I think of something going

9 by a place where they are just bound to run into it, that is

10 how I think of it.

11 A Then I suppose Lovett would get them.

12 Q Would you answer my question about Indian Point.

13 A You mean if they are all over here, within,

14 very close to this shore, would they be entrained?

15 Q Well, I would assume that they are not all over

16 on the western shore. But those that are over on the western

17 shore, they would not be intercepted, would they?

18 A No.

19 Q And those that are over not on the western shore

20 exactly, but over sort of in the western quarter of the river,

21 they would not be intercepted, would they?

22 A No.

23 Q What you might say is only those that are within

24 the influence of the Indian Point Plant intakes would be

25 intercepted?

1 A Yes.

2 MR. MACBETH: When you have been drawing these lines,
3 this is for one individual pass of the plant. Obviously
4 if an organism goes past the plant a number of times, 10 or
5 15 times, it might one time be on the western shore and one
6 time on the east shore, perhaps. You have been describing
7 a single pass.

8 MR. TROSTEN: I have been describing a single pass,
9 that is correct.

10 CHAIRMAN JENSCH: Excuse me, while there is a pause,
11 does anything have to do with the location of the channel
12 as to where a substantial portion of the larvae will be, or
13 doesn't that follow? I remember some discussion about the
14 deep channel being on the eastern side and that had something
15 to do with the fish going to spawn, I think. Does it affect
16 the same larvae and juveniles the same way?

17 THE WITNESS: If they have an affinity for deeper
18 water for some reason, they would be on this side. If they
19 have an affinity for shallower water, they would be on the
20 other side and so on.

21 If they had their preference, if they have any, and can
22 exercise it, would be for deeper water, they would be over
23 there.

24 MR. TROSTEN: Apropos of your question, Mr. Chairman,
25 as you may recall from the profiles we were discussing the

1 Hudson River profile at Indian Point is sort of like this.

2 (Drawing on board.)

3 Very roughly. And there is a lot of relatively

4 shallow water over here, and then you have a deep part here.

5 So if we knew where they were, as Mr. Clark says, if they

6 had an affinity for deeper water, they would be here, if they

7 had an affinity for shallow water, they would be there.

8 CHAIRMAN JENSCH: Thank you.

9 THE WITNESS: Furthermore we know when they get older

10 and start taking up their bottom existence, say by September,

11 you would expect to find them located in the shallower flats,

12 when they are on the bottom.

13 MR. TROSTEN: Yes, that is right. And they do

14 go to the shallow flats, as a matter of fact, Mr. Chairman,

15 as they get older. One of the major disputes that is going

16 on in the hearing between the parties is the time in their

17 life when they actually do move to the flats, whether they

18 move to the flats at say the beginning of an age of a half

19 inch or somewhat larger or whether they move to the shallower

20 areas at an older age. Insofar as the Indian Point area itself

21 is concerned, it is of note that the profile of the river does

22 have a shallower area over on the western bank and the deeper

23 area on the eastern bank.

24 BY MR. TROSTEN:

25 Q Turning now to page 10 of your testimony, you say

1 here that, you mention in the beginning of the paragraph that
2 you used the Carlson-McCann data, and you point out that
3 they vary widely in their suitability for quantitative
4 analysis. In the last sentence, you say, "I was guided in
5 derivation of the population model by studies of Pearcy on
6 the survival of winter flounder in the estuary of the Mystic
7 River,Connecticut."
8 Let me ask you a couple of preliminary questions.
9 Am I correct in understanding what you have done here in
10 Figure 2 is that you have constructed a population curve for
11 the Hudson River striped bass population in 1966-1967 and what
12 you have done is you have used the combination of data points
13 that you estimated on the basis of the 1966-67 Carlson-McCann
14 data for some of the points on the curve, and these are the
15 ones designated by the "X's" and for some of the other points
16 on the curve, two of them to be specific, you have used a
17 computation based upon Pearcy's evaluation of the winter
18 flounder.
19 Is that right?
20 A Yes.
21 Q What I would like to explore with you now is the
22 suitability of using Pearcy's winter flounder model for
23 developing this curve of the striped bass population?
24 A Yes.
25 Q Is it not the Mystic River, which was studied by

Pearcy in his evaluation of the winter flounder, a very different river physically from the Hudson.

Let me tell you what I have in mind. Isn't the estuary only about 8.5 kilometers long?

A I would accept that.

Q That is about five miles long. Roughly, 8.5 is roughly 5.3 miles.

A That seems shorter to me than I recollect but I will accept it.

Q And do you recollect that it has a total area at mean low water of about 1.6, I am sorry, 5.4 kilometers?

A Is it going to be worth my digging out the paper?

Q Would you accept that.

A Yes, I will check it later.

Q Right. Now that is very different, is it not, than the length and area of the Hudson River?

e30 A Definitely.

Q Now, isn't the winter flounder a very different sort of fish than the striped bass?

A Yes.

Q To illustrate this point, the winter founder is not an anadromous fish, is it?

A No.

Q Now, the striped bass undergoes extensive coastwise migrations, but does the winter flounder do that?

A No, they are not so migratory. They are what we generally categorize as a resident fish.

Q Now, getting to the spawning characteristics of the striped bass and the winter flounder, the striped bass spawns for the most part when the temperature is about 58 to 67 degrees Fahrenheit, is that right, roughly?

A Yes. Maybe a little colder than 58.

Q Do you recall at what temperature the winter flounder spawns?

A I think it could be down in the 40s or 50s.

Q Would you accept, and you can check it later, that the winter flounder spawns in the range of 32 to 42 degrees Fahrenheit?

A Yes, I will accept that. They certainly seem to off the Sandy Hook, to spawn very early in the season.

Q Basically the data that I am using here are either from Percy or from Bigelow and Sloder.

A Yes, fine.

Q Now, the striped bass spawns relatively large eggs, say 3.4 millimeters in diameter.

A Well, it depends on where you are. If you are in the Chesapeake-Delaware Canal, they are much smaller, half that size.

Q I was going on the --

A Do you mean in the Hudson? I will accept 3, 3.2, yes.

Q Yes, in the Hudson River.

A Yes.

Q Now, as you know, these eggs have a slight negative buoyancy and they float freely in the water if there is a sufficient current, striped bass, that is.

A Yes, they are suspended.

Q Do you recall what sort of eggs the winter flounder lays?

A Dimersal.

Q They are dimersal in the sense that they stay off the bottom, but are they not adhesive eggs in the sense that they cling together, to each other?

A Dimersal means they are on the bottom.

Q Dimersal means they are just near the bottom, isn't that correct?

A Okay, they are sticky eggs; they stay on the

bottom; they don't float.

Q And the striped bass are not sticky eggs, is that right?

A No, they float around.

Q So the striped bass eggs would tend to be dispersed by the currents, but the winter flounder eggs, because they are sticky, appear in clumps, would not tend to.

A Right.

Q Now, let's talk about how long it takes for the striped bass eggs versus the winter flounder eggs to develop. How long do you think it takes for winter flounder eggs to hatch at their normal temperature?

A A number of weeks. Quite a few weeks.

Q Would you accept that, say at 37 to 38 degrees Fahrenheit it would take 15 to 18 days for them to hatch?

A At 38?

Q Thirty-seven or 38 degrees Fahrenheit.

A I will accept that. I can check all of these things later.

Q Sure. Now, striped bass eggs hatch in about 1.5 to 2 days, is that right, at their normal hatching temperature?

A No, at their normal temperature about two days.

Q So, that is a period of roughly two to two and a half weeks versus roughly two days.

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A Yes.

Q Now, striped bass larvae grow to a size of nine millimeters within at most a month, isn't that right?

A Well, whenever we said before.

Q Whatever we discussed this morning.

A Right. Fast compared to the winter flounder.

Q How long would you say it would take a winter flounder to reach nine millimeters?

A Months, maybe. A number of weeks anyway.

Q Would you again accept --

A Depending on the temperature and so on.

Q Would you accept it would take two and a half to three and a half months?

A Yes, I will accept that.

Q So, we have a period of at most a month versus two and a half to three months.

A Yes.

Q Now, the winter flounder also undergoes a very extensive metamorphosis, where one eye moves around to the top of the head. The striped bass doesn't do that, does it?

A No.

Q Now, as far as striped bass transformation into the juvenile state, would you say that this occurs at about 38 millimeters?

A Yes, I will accept that.

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1 Q Now, when does -- is it not true that the winter
2 flounder transforms into its juvenile stage at about nine
3 millimeters?
4 A That one I would have to check. I don't remember
5 that.
6 Q All right. Will you accept that also subject to
7 check?
8 A Sure.
9 Q Now, in light of everything we have been discussing
10 for the last five minutes, wouldn't you say that there are
11 very considerable differences between the striped bass in
12 regard to spawning time, spawning location, egg size and type
13 and rates of development of eggs and larvae?
14 A Yes.
15 Q Versus the winter flounder, that is.
16 A Yes.
17 Q Don't you think it quite likely that these
18 differences would cause there to be a difference in the
19 mortality rates between the eggs and larvae of the striped
20 bass and the winter flounder at the same stage of
21 developments?
22 A There could be. I don't think it necessarily
23 follows because they are different in other ways, that you
24 would expect a difference in mortality rate.
25 Everything is slower with the winter flounder.

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1 Lower temperatures, slower developments and so forth and so
2 on. That doesn't necessarily mean that their mortality rate
3 is going to be higher, because there is more time involved.
4 Q I can appreciate it might not necessarily mean
5 that. But let's take a specific example.
6 Wouldn't you say that there would be a difference
7 in mortality rate for the winter flounder eggs which are
8 lying on the bottom, in clumps, because of their adhesive
9 quality, for a period of 15 to 18 days relative to the
10 striped bass eggs?
11 A Yes, I would accept that could happen.
12 Q In other words, these winter flounder eggs would
13 be available for predation, for a period of roughly seven
14 times as long as the stiped bass eggs.
15 A Yes.
16 Q Now, taking the stage of winter founder, when
17 winter flounder are roughly two and a half months long -- I am
18 sorry, we established winter flounder are roughly two and a
19 half months old when they reach eight millimeters, versus
20 striped bass being, oh, a week or two weeks old when they reach
21 eight millimeters in size.
22 Now, what does this relationship of size versus
23 age between the winter flounder and the striped bass mean to
24 you in terms of your use of 43.3 percent survival for the
25 striped bass at the age of three weeks?

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1 You use that survival number in figure 2-A, based
2 upon percentages curve. My question to you is basically
3 this: Might striped bass survival at three weeks be much
4 higher than you depict in figure 2-A?
5 A Yes.
6 Q At the age of three weeks.
7 A It could be higher; it could be considerably higher.
8 Q Since each stage in the early life history of the
9 winter flounder takes a longer time, as you have said, than
10 the corresponding stage of striped bass, and consequently each
11 stage is exposed for a longer period of time to the dangers
12 of predation and other natural causes of mortality, is it not
13 possible that each live stage in the winter flounder might
14 have a higher mortality rate than the corresponding stage in
15 striped bass?
16 A Higher or lower, either way.
17 Q Well, is it not more likely it would be higher,
18 because of the longer period of time?
19 A No. If you want to say if everything else were
20 held equal, yes.
21 Q Yes?
22 A If you want all of that equality stuff. The
23 problem is their predators are different; everything is
24 different.
25 CHAIRMAN JENSCH: Let him finish. Go ahead; what

are these differences?

THE WITNESS: Mr. Trosten is postulating that just because more time goes by that the mortality should be higher. This is not necessarily the case. The amount of mortality is a function of all the kinds of stress and adversities and predation and so forth that the fish encounters. And those are the factors that cause the mortality. And it is their relative degree of operation, rather than the amount of time that goes by that counts. It is whether there is an awful lot of fish in that particular area that will come in and eat the eggs, or a lot of fish to take the larvae, or whatever else happens.

Certainly an egg on the bottom is going to be preyed on much more heavily by bottom type of fishes than one up in the water and similarly things like menhaden or alewives, whatever, that are in the water, or larvae of other fish that might eat a striped bass egg, wouldn't eat the winter flounder egg, and so forth.

It is the balances of the kinds of factors in their severity, rather than the rate of time involved. Everything else held equal, yes, time would definitely increase their mortality.

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BY MR. TROSTEN:

Q Let me ask you a concluding question in regard to Pearcy's model. Wouldn't you say these differences we have been analyzing between the winter flounder and the striped bass could lead to a result that, number one, Pearcy's model cannot be used with any real degree of accuracy in determining striped bass survival? Is that correct?

A Well, real degree of accuracy -- I used it with a good deal of reservation.

Q Now would you not also agree that the likelihood is great that the survival of striped bass at these various early stages -- I am sorry, that the survival of striped bass at the stages that you just had in Figure 2-A, would be much higher?

A Yes. That is possible. Quite possible.

Q Thank you.

CHAIRMAN JENSCH: Is that a concluding question on this subject?

MR. TROSTEN: Yes.

CHAIRMAN JENSCH: Why did you use the Pearcy model?

THE WITNESS: It is the only model available that I knew about at the time for estuarine fish that would, where there had been observations made so a curve could be fitted to some data rather than just dreamed up by some theoretical guy or a machine some place -- so that is the

one I used. I used it principally to guide the form of drawing the line from point to point. Now in one point here, I extrapolated and this is the part that gives me the greatest misgivings, from September on out to January, I extrapolated based on Pearcy's model. So it wasn't a question of just guiding the line between points, I actually had to use his extrapolated figure as the point. That is the thing that bothers me.

Now using it in this other place, up the graph here, where the 60 million fish at about two weeks, whatever it is, that doesn't bother me, putting that point in there from Pearcy because, you know, it is just to guide where you draw the line in. What really bothers me is having to extrapolate out the other end into unknown territory.

DR. GEYER: What you are saying is if you hadn't had Pearcy, the line along September would have been essentially the same as you have it now?

THE WITNESS: Yes. I couldn't then have shown any decline in the population after September.

CHAIRMAN JENSCH: So it was a question of using the only available actual data in that regard?

THE WITNESS: Yes.

CHAIRMAN JENSCH: It wasn't controlling, I infer from your statement, it wasn't controlling, it was just a guide to your Figure 2. Is that correct?

THE WITNESS: Yes, sir. And they are still using the Pearcy model today, or in the last year or two, I have come across a reference where they are still using this Pearcy model. Apparently nothing else better has been developed for use anywhere.

CHAIRMAN JENSCH: Thank you.

Will you proceed.

BY MR. TROSTEN:

Q Mr. Clark, apropos of the last answer, of course, I am not quarreling with Pearcy's model as a model. The purpose of my line of questioning has been to establish the appropriateness, or the validity or the possibility of using Pearcy's model to draw the sort of conclusions that you have. I am not quarreling with the fact that it may be a very good model. I just wanted to explore with you whether or not you can just do it. Maybe it is the best you can do, but maybe it is just not a good thing to do, because it just doesn't apply. That is the purpose of the questioning.

A Well, you are welcome to your opinion on that, Mr. Trosten.

CHAIRMAN JENSCH: Well, in reference to a theoretical, as I understand it, you used some phrase a while ago, in comparison to some theoretical computer or machine, you preferred to use actual data in the model. Isn't that correct?

THE WITNESS: I feel safer using actual experimental data than I would something that was strictly theoretical, yes, sir.

BY MR. TROSTEN:

Q Now turning to page 12 of your testimony, Mr. Clark, what I would like to discuss with you now is the population estimates generally. I would like to discuss with you the basis that you have for concluding that the populations are what they are. Now I will say at the outset that I recognize that you have stated in your testimony that these are relative numbers, these are relative values, and you have reiterated that point today in your discussion. And you have also indicated that these numbers could be very well, as I recall you said, they could be maybe 10 percent of what the actual numbers are.

A Yes, sir.

Q So I don't want to belabor this point, but I think it is kind of well to just go over a couple of these things briefly.

A Good.

Q Now in light of your characterization of these numbers, do you have any idea of really how much greater the actual population might be? You gave a number of, say, 10 percent. But do you have any way of knowing that? Could it be, instead of 10 percent of the actual number, could it be

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1 percent of the actual number, 5 percent? How would you know what the actual population is, other than just a guess, really?

A I haven't tried to -- yes, I have, too. I have tried to come to an opinion on that from what I could see, and I just got confused about it, and so I quit trying. I would dearly love to be able to come up with a figure which represents the actual size of the populations of fish in the Hudson River. Then maybe we would have something to connect with the big fishery out there, which we think is of importance. But I have not been able to satisy myself of any scheme or way or method from the data we have available of saying what the absolute population is with certainty.

Q Well, perhaps we never will be able to know what the population of the Hudson River is with certainty. But let me ask my question, to be sure I have an answer from you, and then we can go to the next one.

Do you have any way of knowing how much lower the population estimate is that you made -- you have expressed a qualitative feeling that it is much lower, that the Carlson-McCann numbers are much lower than the numbers. You gave a number of 10 percent as sort of a top-of-the-head number. But do you have any way of knowing how much lower? Could they as well be 1 percent as 10 percent, as far as you are concerned?

A Well, you get a gut feeling about things, after

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1 you have been in the business for a number of years, and your
2 instinct is worth something. Usually if something is really,
3 really way out of whack, you get alarmed, you see signs of
4 it, things are not consistent, they don't tie together, et
5 cetera, et cetera. And if it were as bad as 100 times as much
6 in that river as Carlson-McCann show, I think the bells would
7 start ringing.
8 Q You mean if there really were 100 times as many
9 eggs and larvae in the river as Carlson and McCann show,
10 there would be something that would tend to indicate that?
11 A Yes.
12 (Drawing on board.)
13 Take a figure of 2 million; all you are saying is if
14 there are 100 times that many, that would be 200 million.
15 I don't think it could possibly be as high as 200 million.
16 And I don't have a scientific basis, it is just the whole array
17 of data and my instinct about the situation there. But 200 --
18 Q What was the 2 million number you referred to?
19 A I am just taking an estimate that one could derive
20 from the Carlson-McCann data. And say if that gives you,
21 yields you something like 2 million young-of-the-year, as
22 your output, and I multiply that by 100, it is 200 million
23 fish, and I just don't believe that there could be 200 million
24 fish in the river. That seems high to me.
25 Q Well, other than your educated guess that there

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1 couldn't be 200 million fish in the river, is there anything
2 else you can offer other than that?
3 A No, sir.
4 Q Now a question about your paragraph 14, page 2.
5 MR. MACBETH: We didn't number the paragraphs.
6 Could you indicate which paragraph?
7 MR. TROSTEN: I beg your pardon; page 14, paragraph 2.
8 I am sorry.
9 CHAIRMAN JENSCH: Along about this time of the day,
10 I think we have to make allowances.
11 BY MR. TROSTEN:
12 Q Page 14, paragraph 2. You state there, "From the
13 1968 data, Carlson-McCann estimated a daily withdrawal of
14 463,000 planktonic eggs by the proposed Storm King plant,
15 which worked out to about 6 percent of the fertilized planktonic
16 eggs produced." Do you see that there?
17 A Yes.
18 Q And you go on to say, "A basic error in the
19 procedures used by Carlson and McCann led to an underestimate
20 of the percentage of .6 percent, which caused an overestimate
21 of the total produced."
22 In saying this, Mr. Clark, you seem to be under
23 the impression that Carlson and McCann first found the per-
24 centage removed, and from that deduced the total production of
25 eggs in the estuary. Now isn't it true that the reverse is

1 actually true, and that Carlson and McCann first found the
2 total production and then determined the number removed?
3 A Well, the basic problem here is that Carlson and
4 McCann made a drastic error in their computations and they
5 considered the Hudson River to be a unilateral, a uni-
6 directional flowing river, and they excluded --
7 Q Yes, but --
8 A May I continue?
9 Q You can, but I thought maybe you misunderstood my
10 question, because you seemed to be directing yourself to some-
11 thing else.
12 A Are you going to cut me off at this point?
13 Q No, go ahead.
14 A They took the river to be like a fresh-water river
15 that flows downstream toward the ocean and has no tides in
16 it. When you do that, you make a mistake of large magnitude
17 in the type of calculation they made to the extent that they
18 underestimated the damage that would be done and the amount
19 that would be entrained there by a factor of about 10 to 12 to
20 15, depending on these tidal cyclings, amplitudes and so
21 forth. That was the basic problem with that. That is why
22 that figure was so low.
23 Now with a low figure like that, you start trying
24 to determine the percentage of the total number and you get
25 a very much larger original, an estimate of the original amount

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1 of eggs produced. Now if they had had a higher percentage,
2 a more suitable, a more accurate percentage, they never would
3 have calculated 6 billion eggs, they couldn't have. They
4 would have been more down where John Lawler and I have been,
5 around a couple of billion or so, a little less, a billion and
6 a half.

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Q As I was afraid, you must have misunderstood my question. I wasn't asking you whether Carlson and McCann were correct in estimating the number of eggs removed by the Cornwall plant. I realize you disagree with Carlson and McCann's conclusion and I know they feel their method of estimating is correct. The only thing I was asking you was whether or not they indeed followed a method different than what you seem to believe that they followed and that is that they first estimated the total production of eggs in the estuary, and then estimated the total number of eggs that were withdrawn by the Cornwall plant, rather than estimating the number withdrawn and then multiplying that by the volume in the estuary to determine the total production in the estuary.

A Mr. Trosten, that is all set forth in Table 20 of Carlson-McCann on page 41. I would have to review these formulae and derivations and so forth that I made from them in order to give you the exact answer to that question.

Q Well --

A I get a little confused when I start trying to do calculations in my head.

Q We will get back to that at a later time. When you are looking at that, I would ask simply that you direct your attention in drawing your conclusions as to whether you have implied, you have inferred the wrong method used by Carlson

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and McCann, to Table 20, on pages 40 and 41 of the Hudson River fisheries investigation, and we can get back to this question at some later time.

All right. Now, turning to -- I gather you would agree that based upon what you have said about Carlson and McCann, that the population of eggs could be considerably higher than the number that you have used in your model, right?

A That could easily be true. One thing that is very complicated in all of this is where you take the population of eggs. It is such a short period of time that your median is very critical, where you pick it and where you do it, because they are apparently dying at a very fast rate. A large proportion of them are probably never fertilized at all. The mortality is probably exceedingly heavy throughout the egg stage. To try to knife in there to pick an exact point of what you are going to define as your point of population is a very tricky thing.

Q It is also possible that a population of early larvae -- referring now to page 15 of your testimony where you discuss the early larvae stage -- isn't it also possible that the population of early larvae is very considerably higher than the number you ascribe to it in Figure 2-A?

A Figure 2-A?

Q Yes.

A This is possible.

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Q Right. Now when you were at the blackboard earlier in the afternoon, we were talking about the importance of knowing what is going on in the vicinity of Indian Point, and you made the point that you just had to know what was going on in this area here, because if you knew what was going on in the whole river, you would then know enough. Now at the present state of our knowledge about the population of early larvae in the river, you would say that we really don't have any very accurate idea of the magnitude of that population in the river, is that correct?

A Of the -- not of the distribution, not in the way they are distributed, or their relations to flow, any of these factors, just the magnitude of the size of the population.

Q Yes.

A I would say we are in extreme doubt on that point.

Q And just to confirm this point, you would say that the number given in your testimony as to the number of early larvae, I forget what number that is right now, it is set forth in Table 7, and various other places -- that this number is certainly at the low end of what could be a much higher scale, wouldn't you think so?

A What is at the low end?

Q The estimate of the population of early larvae which you set forth in your testimony, is at the low end of what could be a substantially higher range of values, wouldn't you agree

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1 to that?

2 A That there are more fish?

3 Q More early larvae, that life stage of the striped

4 bass?

5 A Yes, there could be more.

6 Q Now on page 17 -- excuse me, I have gone by page 16.

7 I have one question on that page. You say on page 16

8 "During their third and fourth months" --

9 A What line is that on, Mr. Trosten?

10 Q I think it is on page 16.

11 No, just a moment. I will defer that until we

12 find that.

13 Turning to page 17, you estimate that the number of

14 early larvae produced and recruited to the population in a

15 year is 112 million. And you say "According to Pearcy's

16 model, the reduction in population that corresponds to a

17 larval length of 8 millimeters is 43.3 percent or 62.5

18 million remaining of 112 million at the age of about three

19 weeks," and you refer to figure 2-B.

20 Do you see that there?

21 A Yes, sir.

22 Q In light of what we have said earlier concerning

23 the applicability of Pearcy's model, don't you think that your

24 estimate of the reduction might be rather high and that

25 taking the two factors together, the underestimation of

population and the overestimation of reduction, that your figure on page 19 of 62.5 million might well be much lower than the actual population of striped bass surviving to that stage?

A Could there be lots more than 62.5 million fish alive on the fourth week or whatever?

Q Yes.

A Yes.

Q Thank you.

Now let's turn to stage 3, which is later larval and prejuvenile.

CHAIRMAN JENSCH: Before we go to another subject, would this be a convenient time to recess?

MR. TROSTEN: Yes, Mr. Chairman.

Let me just say this that all that remains really of the cross-examination of Mr. Clark is to go through some remaining questions about the use of the Carlson-McCann data, the population estimates and the estimates of mortality, which are contained in table 7 of Mr. Clark's testimony. And some wrap-up questions having to do with the last part of his testimony.

I certainly intend that we will finish all cross-examination of Mr. Clark tomorrow.

Dr. Lawler has some questions that he would like to address to Mr. Clark concerning the actual model itself that he has used and the computations he has gone through on table 7.

What I would like to ask the Board and the parties, if we could do, if we are going to break now, could we simply agree that tomorrow we will continue on and conclude the cross-examination of Mr. Clark?

We might have to run a little over the normal hour, Mr. Chairman, but I would ask the indulgence of everybody to do that so we can conclude.

CHAIRMAN JENSCH: The trouble with giving a blank approval that we are going to go on forever, let's say we will adhere to the regular schedule until some very compelling reason indicates that there has been an underestimation of the number of subjects you need to cover. But I think this, that we could shorten the noon hour or something like that. I think that these hearings just can't go as long as the lights are on, that is all, because there is a certain efficiency loss of both the witness and the interrogating lawyer at this time of day, and it doesn't contribute to kind of exhaust people just because we say we are stalwart and rugged and stay forever.

MR. MACBETH: Could I add one further, what I hope will not be a problem, but since Dr. Aynsley is planned for Wednesday, Mr. Clark is scheduled to give testimony at the Shoreham proceeding on Wednesday. So that if we don't finish tomorrow, it simply won't be possible to pick it up Wednesday. I hope we can --

CHAIRMAN JENSCH: If we will start at a quarter to 9 tomorrow, cut our noon hour tomorrow.

MR. KARMAN: Mr. Chairman, I run into a problem at quarter to 9.

CHAIRMAN JENSCH: I think we can compact some of this.

Will you agree, Mr. Clark, to find out how large the number of fish is of striped bass or what-not is really a tough problem?

THE WITNESS: Yes, sir.

CHAIRMAN JENSCH: Does that take care of some of your problems?

Very well. We will recess to reconvene in this room tomorrow morning at 9 o'clock.

(Whereupon, at 5:10 p.m., the hearing was adjourned, to reconvene at 9 a.m., Tuesday, 16 January 1973.)

End #33

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