



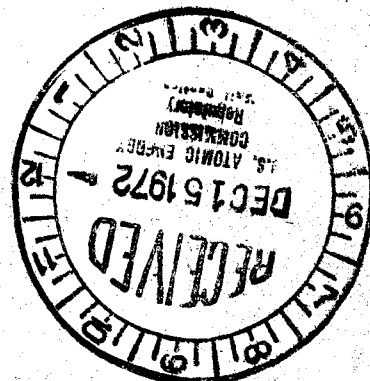
**UNITED STATES ATOMIC ENERGY COMMISSION**

**IN THE MATTER OF:**

**CONSOLIDATED EDISON COMPANY OF  
NEW YORK, INC.**

**(Indian Point Station, Unit No. 2)**

**Docket No. 50-247**



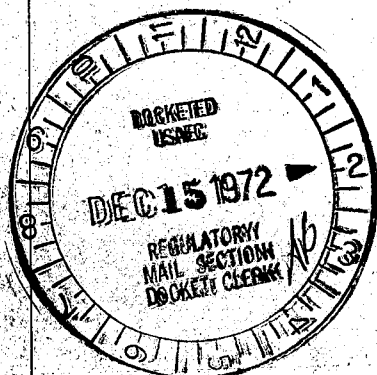
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**Place - Croton-on-Hudson, New York**

**Date - Tuesday, 5 December 1972**

**Pages. 6380 - 6620**

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UNITED STATES OF AMERICA  
ATOMIC ENERGY COMMISSION

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

Springvale Inn  
Croton-on-Hudson, New York

Wednesday, 5 December, 1972

The above-entitled matter came on for further  
hearing, pursuant to notice, at 9:00 a.m.

BEFORE:

- SAMUEL W. JENSCH, Esq., Chairman, Atomic Safety  
and Licensing Board
- DR. JOHN C. GEYER, Member
- MR. R. B. BRIGGS, Member

APPEARANCES:

(As heretofore noted)

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C O N T E N T S

<u>Witness:</u>	<u>Page:</u>
Robert P. Geckler	6382
George W. Knighton	"
Moshe Siman-Tov	"
Charles C. Coutant	"
Charles M. Carter	"
Dr. Mary Jane Oestmann	"
Phillip Goodyear	"
William Yee	"

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P R O C E E D I N G S

1  
2 CHAIRMAN JENSCH: Please come to order.

3 Will the witnesses resume the stand. Dr. Coutant,  
4 Dr. Goodyear, and Mr. Siman-Tov.  
5 Whereupon,

6 ROBERT P. GECKLER,

7 GEORGE W. KNIGHTON,

8 MOSHE SIMAN-TOV,

9 CHARLES C. COUTANT,

10 CHARLES M. CARTER,

11 DR. MARY JANE OESTMANN,

12 PHILLIP GOODYEAR and

13 WILLIAM YEE

14 resumed the stand on behalf of the Regulatory Staff, and  
15 having been previously duly sworn, were examined and testified  
16 further as follows:

17 CHAIRMAN JENSCH: Is the Applicant ready to  
18 proceed?

19 MR. TROSTEN: Yes, Mr. Chairman.

20 CHAIRMAN JENSCH: The witnesses have resumed the  
21 stand. Will you proceed?

22 MR. TROSTEN: Yes, Mr. Chairman. I guess the best  
23 way to go about this would be to repeat the series of questions  
24 I asked of Dr. Goodyear yesterday and ask for his responses.

25 CHAIRMAN JENSCH: Proceed.

1 MR. TROSTEN: Well, the first question was as  
2 follows: I showed you the list of documents that was  
3 attached to the letter of November 18 from me to Chairman  
4 Jensch, and the attached list of testimonies on which the  
5 Applicant was relying dealing with environmental matters  
6 affecting Indian Point 2, and I asked if you would review  
7 this list and tell the Board and me whether you personally  
8 reviewed and evaluated each of these documents and portions  
9 of the transcript with the exception of those that were  
10 submitted on October 30th, prior to your time that <sup>your</sup> ~~the~~ work  
11 on the Final Environmental Statement was concluded?

12 WITNESS GOODYEAR: There were several of these  
13 which I had not reviewed: the testimony of Bertram Swartz  
14 on the effects of delayed operation of Indian Point Unit 2, May  
15 18, 1972. I had not reviewed that particular document.

16 Nor have I reviewed the State of New York,  
17 Department of Environmental Conservation Order, dated April  
18 28, 1972.

19 The other material you had reference to, I had  
20 reviewed.

21 MR. TROSTEN: Thank you very much, Dr. Goodyear.

22 My next question was this: Did you review and  
23 evaluate the testimony of Dr. Lauer and Dr. Lawler dated  
24 April 5, 1972, prior to the time your work on the Draft  
25 Environmental Statement was finished?

1 WITNESS GOODYEAR: I had not reviewed their  
2 testimony as such. I was aware of some of the material in  
3 the testimony of the -- Dr. Lauer's testimony at the time  
4 the draft statement was prepared. This information came  
5 from the publication which I had in draft form at the time.  
6 So I was aware of some of the information. But I had not  
7 reviewed their testimony per se.

8 MR. TROSTEN: Neither Dr. Lauer's nor Dr. Lawler's?

9 WITNESS GOODYEAR: This is correct.

10 MR. TROSTEN: As of the time that your work on  
11 the Draft Environmental Statement was completed?

12 WITNESS GOODYEAR: This is true.

13 MR. TROSTEN: Now is it correct that in meetings  
14 which took place prior to April 5th that --

15 MR. KARMAN: Mr. Chairman, I wonder if at this  
16 time it might not be a good idea for the record to indicate  
17 that the testimony of Dr. Lauer and Dr. Lawler was dated  
18 April 5, 1972, and the Regulatory Staff's Draft Environmental  
19 Statement was published and issued on April 13, 1972.

20 MR. TROSTEN: Yes. I think that's a helpful  
21 addition to the record.

22 CHAIRMAN JENSCH: Very well. Proceed.

23 You make a distinction, I take it, Staff counsel,  
24 on the date of the Lauer-Lawler testimony and the time of  
25 actual receipt? It may have been later than the date of

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1 issuance?

2 MR. KARMAN: That's correct, Mr. Chairman.

3 CHAIRMAN JENSCH: Very well. Proceed.

4 MR. TROSTEN: I believe if I understood the  
5 point Mr. Karman was making was that the testimony was  
6 received by the Regulatory Staff just approximately a week  
7 before the Draft Environmental Statement came out, and there  
8 wasn't time for the Staff to look at it. Is that correct?

9 MR. KARMAN: Well, the Draft Environmental State-  
10 ment was in publication at that time.

11 CHAIRMAN JENSCH: Already prepared long before  
12 the Lawler --

13 MR. KARMAN: That's correct, sir.

14 CHAIRMAN JENSCH: Very well. Proceed.

15 MR. TROSTEN: Thank you.

16 Is it correct, Dr. Goodyear, that prior to April  
17 5 you participated in meetings with representatives of  
18 the Applicant and its consultants at which material which  
19 eventually was contained in the April 5th testimony by Dr.  
20 Lauer and the April 5th testimony by Dr. Lawler was orally  
21 given to you?

22 WITNESS GOODYEAR: Yes.

23 MR. TROSTEN: Now have you had an opportunity to  
24 review Dr. Lauer's October 30th testimony concerning  
25 the work performed by New York University on the effects of

1 Indian Point plant operations on the Hudson River biota?

2 WITNESS GOODYEAR: The October 30th?

3 MR. TROSTEN: Yes, sir.

4 WITNESS GOODYEAR: I have looked at it, but I  
5 have not been able to -- I haven't had enough time to analyze  
6 it in sufficient depth to really comment much upon it.

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1 MR. TROSTEN: I understand. Now if Dr. Lauer's  
2 October 30th testimony contained any material that caused you  
3 to alter any of your conclusions as they are expressed in the  
4 Final Environmental Statement, would you so advise the Board  
5 and the parties of that fact?

6 WITNESS GOODYEAR: Certainly.

7 MR. TROSTEN: Thank you. If this testimony contained  
8 any facts that you considered particularly material to the  
9 conclusions you have drawn in the Final Environmental  
10 Statement, would you also so advise the Board and the parties?

11 WITNESS GOODYEAR: Yes.

12 MR. TROSTEN: Thank you very much.

13 Now is the same true for the testimony of Dr. Raney,  
14 Dr. McFadden, and Dr. Lawler, of October 30th?

15 WITNESS GOODYEAR: Yes.

16 MR. TROSTEN: In other words, I appreciate very much  
17 your answers, you would not feel there was any reason why you  
18 had to conceal your point of view as a scientist simply  
19 because a particular position had been asserted in the Final  
20 Environmental Statement and it was later affected by material  
21 that you subsequently had a chance to review?

22 WITNESS GOODYEAR: I feel quite free.

23 MR. TROSTEN: Okay. Thank you very much.

24 I would like to turn now to the other questions  
25 that were left for discussion today, Mr. Chairman.

1 CHAIRMAN JENSCH: Proceed.

2 MR. TROSTEN: The first one dealt with page 5-22  
3 and I asked Dr. Goodyear whether it was correct that those  
4 of the references that are cited in Appendix 5-1 included <sup>which</sup>  
5 studies of the large size receiving water populations have  
6 indicated no effects of entrainment on receiving water popula-  
7 tions of phytoplankton?

8 WITNESS GOODYEAR: One moment.

9 (Witnesses conferring.)

10 WITNESS GOODYEAR: Would you repeat the question?

11 MR. TROSTEN: Yes. Perhaps if I gave you the whole  
12 question in context, it might be easier for you to consider.  
13 The first part of my question was this: Isn't it  
14 correct that information available from other power plants  
15 and cited in your Appendix 5-1 indicates that photosynthesis  
16 of phytoplankton may be stimulated in the winter, spring, and  
17 fall and during some parts of the summer?

18 In response to that question, you indicated yes,  
19 that was true.

20 Then I asked is it correct that those of the  
21 references which you cite in that appendix which also included  
22 studies of the large size receiving water populations have  
23 indicated no effects of entrainment on the receiving water  
24 populations of phytoplankton?

25 WITNESS GOODYEAR: Of those that were listed here,

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1 there is no clear effect. This is true.

2 MR. TROSTEN: Thank you very much.

3 I believe there was just one more question that  
4 I think we were going to discuss as of yesterday. Would you  
5 permit me to review my notes for a moment?

6 I see there were two. You indicated a moment ago,  
7 Dr. Goodyear, that you had reviewed the New York University  
8 testimony, that is the testimony of Dr. Lauer dated April 5,  
9 1972, before preparing the Final Environmental Statement.

10 WITNESS GOODYEAR: Yes.

11 MR. TROSTEN: Now I am a little puzzled and one of  
12 the reasons why I asked you this series of questions is  
13 because I cannot see any indication in Appendix A-5 -- in  
14 Appendix 5-1 of the Final Environmental Statement that  
15 indicates -- that reflects that Dr. Lauer has performed the  
16 work that he did. In other words, I don't see any mention of  
17 the studies that were performed by Dr. Lauer. Can you explain  
18 to me why there is no reference at all to Dr. Lauer's work that  
19 has been performed at Indian Point in Appendix A -- in  
20 Appendix 5-1 and I am thinking here specifically of pages A-5-2  
21 through A-5-5.

22 WITNESS GOODYEAR: The last paragraph in that  
23 section --

24 MR. TROSTEN: Is this page --

25 WITNESS GOODYEAR: A-5-4, that information comes

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1 from NYU studies.

2 MR. TROSTEN: In other words, the citations 14 and  
3 15 --

4 WITNESS GOODYEAR: Yes. The figure on the next  
5 page, A-5-2 -- Figure A-5-2 is based on the same data as  
6 Figure 4 on page 16 of Dr. Lauer's April 5th testimony.

7 MR. TROSTEN: Well, looking at the footnotes here,  
8 this is perhaps what puzzled me about this. I note  
9 Footnotes 14 and 15 refer to the Howells and Weaver study  
10 published in 1969, authored by <sup>Suyneth</sup> ~~Quinn~~ Howells and Dr. Lauer  
11 and also refers to studies in which Dr. Lauer participated,  
12 that is the Heckner-Howells-Lauer and Hirschfield studies in  
13 1971; but there is no reference to the April 5th testimony  
14 which contains the most recent and more updated information  
15 <sup>and</sup> ~~and~~ was rather puzzled by this. Could you explain why the more  
16 recent studies which New York University has been conducting  
17 since 1969 and 1971 and which are more pertinent to the subject  
18 at hand were not referred to in the section of the Final  
19 Environmental Statement?

20 CHAIRMAN JENSCH: I suppose he would have the  
21 opportunity to reject the premise that it is more pertinent?  
22 I think your statement is that it is more pertinent. He may  
23 not have accepted that premise.

24 MR. TROSTEN: Let me rephrase that, Mr. Chairman.  
25 I accept your criticism of that question. More up to date,

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I would say.

WITNESS GOODYEAR: The information in the Heckner-  
Howells-Hirschfield-Lauer article is very similar to the  
material in his appendix or in his April 5th testimony and  
the April 5th testimony itself contained no more information  
which was useful to me at the time. There is one point that  
should be brought out and that is that between the preparation  
of the draft and the Final Statement, most of the emphasis  
was not directly on the plankton-zooplankton populations  
partly as a result of Dr. Lauer's work, because he was able  
to dispel several problems that might have arisen so that  
his information that he fed in was considered, but the primary  
work between the draft and the Final Statement was done on fish  
rather than on the less important aspects from this standpoint.

MR. TROSTEN: I see. Now am I correct that pages  
A-5-2 through A-5-5 are the same as pages 5-14 through 5-17  
of the draft statement? I have sort of eyeballed it, Dr.  
Goodyear, and it looks to me as if it is the same <sup>language</sup> ~~writing~~,  
is that correct?

WITNESS GOODYEAR: I'd have to check, but I wouldn't  
be surprised.

MR. TROSTEN: Okay. Is it correct there was more  
recent information contained in Dr. Lauer's April 5th testimony  
which you had not had an opportunity to review as of the time  
your work            was finished on the Draft Environmental

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1 Statement than is contained in the 1969 and 1971 NYU studies?

2 WITNESS GOODYEAR: Yes.

3 MR. TROSTEN: All right.

4 WITNESS GOODYEAR: I might point out that the  
5 information -- this appendix forms a sort of a method of  
6 compiling various and sundry relative facts. The input, Dr.  
7 Lauer's input to the analysis on these points was done in Section  
8 5 rather than in the appendix.

9 MR. TROSTEN: Well, I have just one or two more  
10 questions to ask you about this and then I think we can go on  
11 to another topic. I can see that there is a reference to work  
12 that was performed at Indian Point here on page A-5-4 and  
13 A-5-5, but there is no reference to any of the conclusions  
14 which were contained in Dr. Lauer's document of April 5th  
15 similar to the conclusions that I perceive were drawn here  
16 from the other authors, and I wondered why there was no  
17 discussion of Dr. Lauer's conclusions in -- on pages A-5-2  
18 or A-5-5 or for that matter, in the part of the text which is  
19 about page 5-22 where this subject was discussed.  
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1 WITNESS GOODYEAR: Excuse me. I don't think I  
2 understood exactly what your question was.

3 MR. FROSTEN: Well, my question was this: On  
4 pages A-5-2 through A-5-5 there is a discussion -- at least  
5 I interpret it as a discussion of the conclusions of the  
6 authors of these various papers, their conclusions as a  
7 result of the studies that they had performed at the  
8 Dresden Nuclear Power Station and at the Connecticut Yankee  
9 Nuclear Power Station and various work that had been per-  
10 formed and had nothing to do with power plants. I don't  
11 see any discussion of the conclusions of the New York University  
12 work headed up by Dr. Lauer in this Appendix. All that you  
13 have pointed me to now is a very brief and generalized  
14 discussion of the abundance of species that may appear in  
15 the Hudson River and I wondered if there was some particular  
16 reason why you did not refer to Dr. Lauer's conclusions either  
17 in the text or in these pages that we have been discussing.

18 (Witnesses conferring.)

19 WITNESS GOODYEAR: We were charged with an indepen-  
20 dent review of the material and actually the work we performed  
21 was an analysis of the data acquired by people in the area  
22 which included Dr. Lauer's data that he has gathered.

23 His conclusions could be compared but this would  
24 require considerable amount of time and effort and there --  
25 that was time and effort we did not have, that was, in fact,

1 not a major item in the overall picture of the problems  
2 that might be inherent.

3 MR. TROSTEN: Now, in conducting an independent  
4 review, that did not in your mind mean that you were  
5 charged with the responsibility of ignoring material or  
6 data or opinions that were submitted to you by the Applicant,  
7 did it?

8 WITNESS GOODYEAR: No.

9 MR. TROSTEN: In other words, in conducting an  
10 independent review, you were to consider data and opinions  
11 submitted to you by the Applicant along with everything else  
12 and form a judgment on your own?

13 WITNESS GOODYEAR: Yes.

14 MR. TROSTEN: Well, under those circumstances and  
15 particularly since this Board is now responsible for reviewing  
16 the review that you performed insofar as contentions are  
17 concerned, do you not think it would be helpful for this  
18 Board to see in this document the conclusions that were  
19 submitted to you by the Applicant that differ from the con-  
20 clusions that you drew?

21 MR. KARMAN: I don't see why that is necessarily  
22 so, Mr. Chairman. The witness has indicated that he did  
23 take into consideration some of the work that was submitted by  
24 Dr. Lauer and the NYU force together with the other cited  
25 references, and these are the conclusions that we came to.



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1 I really don't think it is that important whether Dr. Lauer  
2 gets a footnote as to his April 5th testimony or not.

3 CHAIRMAN JENSCH: I think the question was don't you  
4 -- I think the Board can decide that and while his comment  
5 would be interesting, I don't think it would be  
6 persuasive at all. I think it is an immaterial inquiry.  
7 Objection is sustained.

8 MR. FROSTEN: With regard to page 5-34, you have  
9 a statement that appears in the first sentence of the second  
10 full paragraph on the page and it reads, "Data from the  
11 laboratory and field studies conducted for the Applicant  
12 support this position."

13 By this position, I take it to mean the position  
14 expressed in the immediately preceding paragraph. Would you  
15 agree with my interpretation of that?

16 WITNESS GOODYEAR: Yes.

17 MR. FROSTEN: There is a footnote there, footnote  
18 42 which is to the best of my knowledge the only reference that  
19 appears in this section and the appendix to Dr. Lauer's  
20 work. There is a reference to Dr. Lauer's testimony.

21 WITNESS GOODYEAR: Yes.

22 MR. FROSTEN: Do you not agree that Dr. Lauer's  
23 testimony strongly disputes the position that is  
24 expressed in that sentence?

25 CHAIRMAN JENSCH: Is this one of these questions

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1 where the best evidence is a comparison you make yourself  
2 and you can read it and say it looks contrary and if some  
3 other person looks at it, he says my opinion looks somewhat  
4 like. Should we ask him to give an interpretation of a  
5 comparison?

6 MR. TROSTEN: It might be in that category, Mr.  
7 Chairman. I am just curious to know whether Dr. Goodyear  
8 thinks Dr. Lauer agrees with that sentence.

9 CHARIMAN JENSCH: I am having difficulty with the  
10 materiality of it. Can you help me a little further in that  
11 regard? I think if you are going to say, are the data from  
12 Dr. Lauer different than the data from some other source, I  
13 think that he could place an interpretation on data, but to  
14 compare opinions, I presume Dr. Lauer will take the stand or  
15 whatever is proffered testimony in direct shows, it shows  
16 his conclusion. This gentleman is giving, as I understand  
17 it, the -- he is representing the Staff. He is representing  
18 a Staff judgment. He is taking the responsibility for this  
19 projection, but after all, it is a Staff consideration as you  
20 know; Staff documents reflect kind of combined opinions and  
21 there may be other factors that play a part.

22 To say don't you agree Dr. Lauer differs with you,  
23 is something we can discern, I think, with some ready application  
24 of our efforts.

25 (Laughter.)

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1 CHAIRMAN JENSCH: It seems to me it is immaterial.

2 MR. TROSTEN: I will go on, Mr. Chairman. I  
3 guess the reason I asked the question is, I know Dr. Lauer  
4 strongly disagrees with the sentence and he, no doubt, will  
5 say so when he is on the stand. It seems odd that this is  
6 the only place at which Dr. Lauer's work is cited with a  
7 footnote.

8 All right. We can go on.

9 CHAIRMAN JENSCH: If you want some greater recog-  
10 nition to what he has done, maybe that question could be  
11 propounded, but until it is, let's go on to something else.

12 MR. TROSTEN: All right.

13 The last question I asked you yesterday, Dr. Goodyear,  
14 was this and I was referring to page 5-37. I asked you if  
15 you studied Dr. Lauer's testimony of April 5th and October 30th  
16 concerning temperature tolerance of microinvertebrate  
17 zooplankton and the survival in intake and discharge canal  
18 samples.

19 WITNESS GOODYEAR: The answer is yes.

20 MR. TROSTEN: Not fully is what you have already  
21 said?

22 WITNESS GOODYEAR: Yes.

23 MR. TROSTEN: Does the April 5th testimony not  
24 indicate a very minor entrainment mortality of microinver-  
25 tebrate zooplankton?

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1 WITNESS GOODYEAR: These were the conclusions  
2 that were expressed. There are some problems with interpreta-  
3 tion of data of this sort because the criteria that was  
4 used for determining the degree of mortality of the  
5 entrained organisms was simply motility and the  
6 motility itself is not a good means of determining whether  
7 the organism will survive. More importantly, for the  
8 discussion herein, whether or not it can maintain its  
9 naturally productive rate.

10 MR. TROSTEN: Well, am I not correct in thinking that  
11 this particular discussion dealt with the matter of mortality  
12 as opposed to continuing itself normal, whatever that may be,  
13 level of reproduction?

14 I thought that really all we were talking about  
15 in this particular section was mortality <sup>although</sup> and I understand,  
16 and I accept the point that more than simply mortality is  
17 ultimately involved.

18 CHAIRMAN JENSCH: What is the question?

19 WITNESS GOODYEAR: Yes.

20 MR. TROSTEN: Is it not true that <sup>the</sup> particular  
21 section that we were talking about on page 5-37 deals with  
22 the subject only of mortality, not with the subject of  
23 possible injury that may occur which is below the level  
24 of mortality? In other words, on page 5-37, you are discussing  
25 the subject of mortality, the third sentence, for example,

1 starts out, "If high entrainment mortality is encountered, selected  
2 tion for heat-tolerant microcrustaceans . . ." and so forth.  
3 As I understand it, this is a discussion on mortality.

4 CHAIRMAN JENSCH: The section on V-39 is still  
5 part of that section, the second full paragraph talks about  
6 decrease in reproductive potential of the neomysis. IS  
7 that a part of your --

8 MR. TROSTEN: No, sir. I was talking about the  
9 microinvertebrates as opposed to the neomysis. The neomysis  
10 is another matter.

11 CHAIRMAN JENSCH: Excuse me. Proceed.

12 WITNESS GOODYEAR: The next sentence beyond that  
13 one is talking about reduced reproductive capacity. If you are  
14 looking at a population, changes in population, mortality  
15 may not be the most important thing because if you can reduce  
16 the reproductive capability of an organism and leave it  
17 swimming around in the field, for instance, then it is still  
18 competing for food and resources, but it cannot add its  
19 contribution reproductively. So the answer is -- to your  
20 question is that this is not talking just about straight  
21 mortality. It is talking about anything which could reduce  
22 the reproductive capability.

23 MR. TROSTEN: In other words, that is what you  
24 intended to mean by this? You weren't talking just about  
25 mortality, you were talking about things other than mortality  
that might occur?

1 WITNESS GOODYEAR: Including mortality, yes.

2 MR. FROSTEN: Do you not agree that Dr. Lauer's  
3 April 5th testimony indicated very minor mortality to micro-  
4 invertebrate zooplankton?

5 WITNESS GOODYEAR: No.

6 MR. FROSTEN: You don't agree with that?

7 WITNESS GOODYEAR: No.

8 MR. FROSTEN: Dr. Goodyear, do you agree that  
9 microinvertebrate zooplankton can tolerate the cooling system  
10 plume temperatures expected at Indian Point at all times  
11 except for the possible exception of the summer?

12 WITNESS GOODYEAR: Many species can, yes.

13 MR. FROSTEN: Is there a species that you are  
14 aware of that cannot tolerate the plume temperature,  
15 that is resident at Indian Point?

16 WITNESS GOODYEAR: Not entrained to the plant but  
17 in the plume.

18 MR. FROSTEN: Yes, sir.

19 WITNESS GOODYEAR: Again I have to ask you  
20 what you mean exactly by tolerate.

21 MR. FROSTEN: Well, let's start with tolerate  
22 in the sense that it will be -- it will survive.

23 WITNESS GOODYEAR: I am not familiar with any  
24 species which would not survive that.

25 MR. FROSTEN: All right. Let's talk about a

ak 9 1 sublethal effect and would you tell me the species that  
2 you are referring to so that we could discuss that.

3 WITNESS GOODYEAR: I am not really referring to any  
4 particular species. The capability of detecting or determining  
5 stresses on populations of wide variety of microzooplankton  
6 is very, very difficult to do. The very fact that you have  
7 population shifts through the season from one form to the  
8 other indicat that conditions change from optimal for one  
9 species to optimal for another. The competitive  
10 interactions between them are responsible for the replacement,  
11 so that I can't answer your question really either way.

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1 MR. TROSTEN: I appreciate that it is quite  
2 difficult to determine these things so that you have to give  
3 a qualified answer, but I thought that I was asking you what  
4 species that you knew of that would encounter a sublethal  
5 damaging effect as a result of its presence in the plume  
6 for the period of time that it would be in that plume?

7 WITNESS GOODYEAR: Excuse me for a second.

8 (Witnesses conferring.)

9 WITNESS GOODYEAR: I would have to answer by  
10 saying that there isn't any particular species which I  
11 could point out as having a particular limit. The fact  
12 that they do have is reflected in the seasonal patterns. It  
13 is the kind of thing where you know they have limits because  
14 of their population fluctuations and you can get some informa-  
15 tion from them. I have not studied the material in a great  
16 enough depth to pick an individual species out.

17 MR. TROSTEN: So, in other words, you don't know.  
18 You are not aware of any evidence that indicates that there  
19 is any particular species at Indian Point that is being  
20 subjected to a sublethal stress as a result of its presence  
21 in the plume?

22 WITNESS GOODYEAR: Or that there is not.

23 MR. TROSTEN: Yes, I understand that.

24 WITNESS GOODYEAR: Yes.

25 MR. TROSTEN: Now in light of the answer you



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1 gave me about Dr. Lauer's October 30th testimony, you may  
2 want to qualify your response to what I'm about to ask you,  
3 but I will go forward with it.

4 Have you studied Dr. Lauer's testimony of April 5th  
5 and October 30th concerning temperature tolerance of macro-  
6 invertebrate zooplankton? I am referring here to the gammarus  
7 and the neomysis and the survival of these organisms in  
8 the intake and discharge canal samples.

9 WITNESS GOODYEAR: Again the same answer, April  
10 5th, yes; and to a lesser degree, October 30th.

11 MR. TROSTEN: Does this testimony not indicate  
12 to the extent that you have reviewed it, Dr. Goodyear, a  
13 very minor entrainment mortality to gammarus and neomysis?

14 WITNESS GOODYEAR: To gammarus, yes; to neomysis,  
15 there appears to be more damage than was anticipated. It is  
16 difficult to say what minor is. I'd have to ask you for  
17 a definition of it. It is potentially not a very small effect.  
18 It could be a much larger effect.

19 MR. TROSTEN: I am referring here now to pages  
20 34 to 40 of Dr. Lauer's October 30th testimony, insofar as  
21 gammarus is concerned.

22 CHAIRMAN JENSCH: Let's see. Do you have that  
23 before you?

24 WITNESS GOODYEAR: No, I don't.

25 CHAIRMAN JENSCH: I wonder, if you are going to

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1 refer to a document, if he shouldn't have it before him.

2 The Staff may assist the witness.

3 WITNESS GOODYEAR: Would you repeat your question,  
4 please?

5 MR. TROSTEN: My question was: Does this not  
6 indicate very minor entrainment mortality to gammarus and  
7 neomysis? I guess I can rephrase that to indicate and ask you,  
8 does this not indicate that the entrainment mortality occurs  
9 over a very short duration?

10 CHAIRMAN JENSCH: You want him to refer to pages  
11 34 to 40 of the testimony, is that right?

12 MR. TROSTEN: I am referring to pages 34 to 40.

13 CHAIRMAN JENSCH: He may review those pages.

14 MR. TROSTEN: On pages 34 to 40, of course, Dr.  
15 Goodyear, the discussion is, of course, there of gammarus.

16 WITNESS GOODYEAR: And the question was -- would  
17 you repeat it, please, for me?

18 MR. TROSTEN: I asked you does this not -- does  
19 the mortality to gammarus not occur over a relatively short  
20 period of time?

21 WITNESS GOODYEAR: To gammarus specifically?

22 MR. TROSTEN: Yes.

23 WITNESS GOODYEAR: Yes.

24 CHAIRMAN JENSCH: I think there is an outstanding  
25 question to you, Applicant's counsel, as to the minor effect.

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1 I think the witness said for you to tell him what you mean  
2 by minor as far as neomysis is concerned.

3 MR. TROSTEN: What I meant by that question, Mr.  
4 Chairman, was does this constitute a significant portion  
5 of the population of neomysis?

6 WITNESS GOODYEAR: What is significant?

7 MR. TROSTEN: I am afraid I will have to ask you  
8 that question, Dr. Goodyear, since you are the biologist.

9 MR. KARMAN: No, I don't think --

10 CHAIRMAN JENSCH: I think the question has to be  
11 clear. If you give him a qualifying term, I think it is the  
12 obligation of the questioner to know precisely to what you  
13 are directing the witness' attention.

14 Numbers, can you put a number on things? 1 percent,  
15 20 percent?

16 MR. TROSTEN: All right. Could you put a number  
17 on the percentage of the neomysis population, Dr. Goodyear,  
18 that the mortality in the Indian Point 2 plant would repre-  
19 sent?

20 WITNESS GOODYEAR: I have not been provided  
21 sufficient data to determine the size of the population  
22 that's being exposed.

23 MR. TROSTEN: So you are not aware of what percentage  
24 of the total population of neomysis would be represented by  
25 any entrainment mortality in Indian Point 2?

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1 WITNESS GOODYEAR: This is correct.

2 MR. TROSTEN: All right, sir.

3 On page 5-37, you refer -- and on pages A-5-13  
4 through A-5-18, you mention various literature surveys  
5 concerning the effects on zooplankton of entrainment. Will  
6 you take a look at those pages for just a moment and  
7 refresh your recollection? A-5-13 through A-5-18.

8 You recollect those pages now, Dr. Goodyear?

9 (No response.)

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2 MR. TROSTEN: The question I am about to ask you  
3 is this: You have indicated that you considered Dr. Lauer's  
4 April 5th testimony prior to the time that the Final  
5 Environmental Statement was drawn up, but could you direct my  
6 attention to some place in here where the work that was per-  
7 formed on site at Indian Point was considered and discussed,  
8 the findings of Dr. Lauer concerning the impact of plant  
9 operations on zooplankton?

10 WITNESS GOODYEAR: Again this information was  
11 considered, but the primary focus was not on zooplankton  
12 populations in preparation for the Final Statement. It is a  
13 matter of time, really, to prepare the material.

14 MR. TROSTEN: I am --

15 CHAIRMAN JENSCH: Let him finish. Go ahead.

16 WITNESS GOODYEAR: The inclusion of his material  
17 wouldn't have changed any of the conclusions that were reached  
18 during the analysis. They are all consistent with the  
19 conclusions which were reached. So as to a discussion or  
20 bringing up another set of discussions between the Draft  
21 and the Final Statement, that didn't seem to be time well  
22 spent, if you would.

23 MR. TROSTEN: Dr. Goodyear, do you consider that on-  
24 site studies are important in determining the impact of power  
25 plant operations?

WITNESS GOODYEAR: Yes.

2mil 1 MR. TROSTEN: And were Dr. Lauer -- and were  
2 Dr. Lauer's studies that were reported in that April 5th  
3 testimony on-site studies?

4 WITNESS GOODYEAR: Yes.

5 MR. TROSTEN: Were the other studies that are  
6 reported on in here performed at Indian Point on Hudson  
7 River organisms?

8 WITNESS GOODYEAR: Some of the species were the same,  
9 but they were not Hudson River -- they were not on-site  
10 studies.

11 MR. TROSTEN: Were they performed -- they were not  
12 performed on the Hudson River, although they may have involved  
13 some species present in the Hudson River and elsewhere, is that  
14 right?

15 WITNESS GOODYEAR: Yes.

16 MR. TROSTEN: All right. Now, in other words, what  
17 you have done here is to site a number of studies that deal  
18 with other facilities, other locations, but to exclude from  
19 this discussion the studies that were performed at Indian  
20 Point on the Hudson River organisms, is that correct?

21 MR. KARMAN: Mr. Chairman, I think that the  
22 previous testimony of Dr. Goodyear would indicate that they  
23 were considered in his analysis. Again I have to make a  
24 statement that if there's not a particular footnote, that  
25 does not mean they were not considered.

mil 1 MR. TROSTEN: Mr. Chairman, I am sorry. I find  
2 it a little difficult to understand the train of logic that  
3 states that, well, these studies were all considered, but  
4 I just didn't mention them. I mentioned everything else  
5 that I studied and looked at, but I just didn't feel like I  
6 would mention this. When this happens repeatedly, it begins  
7 to make you wonder. That is the reason I am inquiring of  
8 Dr. Goodyear why this occurred.

9 CHAIRMAN JENSCE: I thought his further answer was  
10 that the conclusions were considered, but in some respects  
11 the data were consistent with the other presentations and it  
12 didn't seem advisable to duplicate the statement of similar  
13 conclusions or something to that effect. Was that your view,  
14 Dr. Goodyear?

15 WITNESS GOODYEAR: Essentially, yes. I would like  
16 to point out that the -- there is some mention of the work --  
17 it is not cited, unfortunately, but the last sentence in the  
18 Section V --

19 MR. TROSTEN: What page?

20 WITNESS GOODYEAR: A-5-18.

21 MR. TROSTEN: Would you read the last sentence  
22 for me, please?

23 WITNESS GOODYEAR: (No response.)

24 MR. KARMAN: I think it would make more sense to  
25 read the whole paragraph.

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1                   WITNESS GOODYEAR: Yes. It reads obviously it is  
2 impossible to make absolute statements concerning mortality  
3 organisms which will be drawn through any given plant.  
4 Unfortunately, such data have not been compiled for Indian  
5 Point Unit 1 during critical times of the year. Although  
6 preliminary observations indicate that at least some of these  
7 organisms, the organisms entrained, survive.

8                   CHAIRMAN JENSCH: Before proceeding, may I inquire,  
9 in your question previously, if I may, as to the April 5th  
10 Lauer testimony, did I understand that the data there reflected  
11 pertained to conditions of actual operations of Indian Point  
12 No. 1 or was it just a survey of the site without operations?

13                   MR. TROSTEN: Operations of Indian Point 1, Mr.  
14 Chairman.

15                   CHAIRMAN JENSCH: Going on the type of data col-  
16 lected?

17                   MR. TROSTEN: Yes, that's correct.

18                   CHAIRMAN JENSCH: Thank you. Proceed, please.

19                   MR. TROSTEN: In other words, that excerpt you just  
20 read and particularly the last sentence, represent the sum of  
21 your thinking and the only mention that exists in this segment  
22 of the Final Environmental Statement that specifically reflects  
23 Dr. Lauer's testimony, is that correct?

24                   MR. MACBETH: Mr. Chairman, I think that was two  
25 questions. We have one, a suggestion that it was either the



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1 sum of Dr. Goodyear's thinking or the only mention. The two  
2 things may not be synonymous.

3 MR. TROSTEN: I will break the question up and ask  
4 only the last question.

5 CHAIRMAN JENSCH: Very well. Proceed.

6 WITNESS GOODYEAR: Within this segment, I believe  
7 it -- I would have to check again to make sure, but I very well  
8 -- that very well may be the only mention of his work in this  
9 report.

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1 MR. TROSTEN: Now with regard to the other studies  
 2 that you cited and which you characterized as presenting  
 3 results similar to Dr. Lauer's work, were the Delta Ts the  
 4 same as the Delta Ts that would be experienced by organisms  
 5 passing through Indian Point 1 or Indian Point 2, <sup>me</sup> passing  
 6 ~~through the Delta T~~ Delta T's ~~through the Delta T~~

7 WITNESS GOODYEAR: I am not at all certain that  
 8 it was ever intended for the -- for anyone to believe that  
 9 the data were similar to the rest of the data or that his  
 10 observations were similar to the rest of the observations.  
 11 If that was the -- what was derived from reading it, it  
 12 is a little misleading because there is no intent to show  
 13 what <sup>Indian</sup> ~~Indian~~ Point, say, will do, based upon the other studies,  
 14 per se.

15 MR. TROSTEN: Are you saying that perhaps this  
 16 discussion has no relevance to Indian Point 2 or is immaterial  
 17 to Indian Point 2 because the conditions might not be the  
 18 same?

19 WITNESS GOODYEAR: They reflect similar stresses.  
 20 These data from these other studies are looking at similar  
 21 things and have similar stressing factors. To be able to  
 22 make the very clear comparison between Indian Point and any  
 23 other plant would require very detailed population analysis,  
 24 and that has not been done.

25 MR. TROSTEN: Were the transit times involved

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1 with these organisms the same as <sup>the</sup> other organisms going  
2 through Indian Point 2 or Indian Point 1?

3 WITNESS GOODYEAR: For which? You say these.

4 MR. TROSTEN: I am referring to the zooplankton  
5 organisms that are the subject of discussion on pages  
6 A-5-13 through A-5-18. And I guess -- you are also discussing  
7 fish, eggs and larvae, too, aren't you? My question is:  
8 Are the transit times being experienced by these organisms,  
9 whatever they might be, the same in the studies that are  
10 described on these pages?

11 WITNESS GOODYEAR: Certainly not.

12 MR. TROSTEN: All right. Where the chlorine  
13 concentrations the same as would be experienced by organisms  
14 passing through Indian Point 1 or Indian Point 2?

15 WITNESS GOODYEAR: In most of the -- the precise  
16 concentrations and exposure times would be different for each  
17 facility so that the answer is they could be or they may not be.

18 MR. TROSTEN: The answer is you don't know, isn't  
19 that correct?

20 WITNESS GOODYEAR: The answer is I don't know  
21 exactly what the exposure at Indian Point 2 will be because  
22 the -- for instance, you ask about chlorine, the decomposition  
23 rate of chloramines are formed, and the decomposition rate  
24 of chloramines at these other plants are unknown.

25 MR. TROSTEN: You don't know what the transit times

1 were in these other plants, do you -- or did you?

2 WITNESS GOODYEAR: Well, they vary quite a bit.  
3 I wouldn't want to -- some of them, for instance, at Chalk  
4 Point Plant is quite long transit time. I might have to look  
5 at each one.

6 MR. TROSTEN: Do you know whether the transit times  
7 are the same for Indian Point 2 versus each of these plants?

8 WITNESS GOODYEAR: I would assume they would -- I  
9 doubt it very seriously.

10 MR. TROSTEN: Do you know whether the pressure  
11 changes that would be experienced by organisms in each of  
12 these plants is the same as the pressure changes that would  
13 be experienced in Indian Point 1 or Indian Point 2?

14 (Witnesses conferring.)

15 WITNESS GOODYEAR: I doubt they would be the same.

16 MR. TROSTEN: I am still a little puzzled by  
17 this, Dr. Goodyear. If there are these differences that  
18 we have identified here in the last few moments, or these  
19 *uncertainties about* uncertainties, pressure change, chlorine concentration,  
20 transit time, Delta Ts across the condenser, and there are  
21 many others as we both know which we could go through, how  
22 can you be sure that the results from these studies are  
23 similar to the results in Dr. Lauer's studies which were  
24 performed on -- under conditions equivalent to operation  
25 of Indian Point 2 and under conditions of operation of

1 Indian Point 1?

2 WITNESS GOODYEAR: You keep saying similar. I  
3 am a little confused by that.

4 MR. TROSTEN: Well, as I -- let me see if I can  
5 rephrase my question. As I understood the response to one  
6 of my previous questions, you said that you didn't think it  
7 was necessary to report on the NYU studies because you felt  
8 that the results were similar to what the other studies  
9 reported, and then we have started to discuss whether these  
10 other studies were dealing with the same conditions as are  
11 present at Indian Point and which were reported in Dr.  
12 Lauer's testimony and we discover that there was great  
13 uncertainty as to whether the conditions were the same,  
14 and indeed, in many cases we know the conditions were quite  
15 different.

16 Then I asked you, well, if the conditions are  
17 different, what makes you think that the conclusions of  
18 Dr. Lauer are really the same and support the conclusions  
19 that are expressed in here, and hence don't have to be reported  
20 on or discussed in this document?

21 WITNESS GOODYEAR: The conclusions are consistent  
22 with the conclusions in Chapter 5 where the data is. The  
23 material in the appendix provides a framework, a data base  
24 for the analysis that was done in Chapter 5. There is no  
25 assumption on my part or no need from the analysis for each

1 of these to agree. They each had different characteristics  
2 and each had -- provide different stresses to the aquatic  
3 environment.

4 It was those stresses, the kinds of things that  
5 do occur, that have to be evaluated. Those stresses were  
6 the things that this material was meant to elucidate, not  
7 that they would be the same for Indian Point 2. There was  
8 never any intent to do that.

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1 MR. TROSTEN: All right.

2 WITNESS GOODYEAR: I might point out, however, that  
3 the material in Appendix 5-1 is primarily designed to point out  
4 that certain types of stresses do certain things. The analysis  
5 is not in -- of potential effects at Indian Point, is not  
6 in the appendix.

7 MR. TROSTEN: I understand that, Dr. Goodyear. I  
8 appreciate that the conclusions that you have drawn are  
9 contained at page 5-37 through 5-39, but would you not agree  
10 that the basis for the conclusions that are drawn on page 5-37  
11 through 5-39 are the literature studies that are contained in  
12 the appendix? If it is not the literature survey contained  
13 in the appendix, would you tell me what is the basis for the  
14 conclusions that are expressed on 5-37 through 5-39?

15 WITNESS GOODYEAR: The basis for most of the  
16 conclusions are given. The conceptual framework is given in  
17 that series of discussions.

18 MR. TROSTEN: Isn't indeed the basis for that  
19 conclusion contained in the appendix, <sup>what is</sup> ~~in the~~ literature survey  
20 contained in the appendix? Isn't that where you derive the  
21 information from which you draw the conclusions? Let me  
22 read you the conclusions contained here and ask you where  
23 they come from. I am reading from page 5-39. You say, for  
24 example, that operation of Unit No. 2 -- I am reading from  
25 the second full paragraph on this page -- "will decrease

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1 the reproductive potential of the Hudson for neomysis to some  
2 extent. High entrainment mortality will reduce the standing  
3 crop of neomysis, but may be compensated for by increased  
4 immigration from other areas."

5 "Similar arguments apply to gammarus fasciatus and  
6 other species with long generation times."

7 Where is the data base for the conclusions I have  
8 just read to you?

9 WITNESS GOODYEAR: The data base for the gammarus  
10 fasciatus, that first, is the fact that gammarus -- well, read  
11 the next sentence where it is concluded the data supplied  
12 by the Applicant indicate that gammarus populations are less  
13 likely to be affected than are populations of neomysis because  
14 of higher thermal tolerances.

15 MR. TROSTEN: Yes.

16 WITNESS GOODYEAR: The neomysis are killed by entrain-  
17 ment.

18 MR. TROSTEN: That's correct.

19 WITNESS GOODYEAR: The high --

20 MR. TROSTEN: Some of them. Excuse me. When I  
21 said that's correct --

22 WITNESS GOODYEAR: There are neomysis that are killed  
23 by entrainment.

24 MR. TROSTEN: There are neomysis killed by  
25 entrainment.



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1 WITNESS GOODYEAR: The conclusions for the state-  
2 ment that the operation of Unit 2 would re-- decrease the  
3 reproductive potential of the Hudson of neomysis to some  
4 extent comes from the page V-38 where the Ratheon data,  
5 their discussion of the location of the neomysis population.  
6 The data basis -- includes both Dr. Lauer's data, data from  
7 other locations and the discussion on page V-38.

8 MR. TROSTEN: Are you finished?

9 WITNESS GOODYEAR: Well, essentially, yes.

10 MR. TROSTEN: Does the Ratheon data which you men-  
11 tioned a moment ago say anything about mortality at Indian  
12 Point 2?

13 WITNESS GOODYEAR: Nothing about mortality, but about  
14 distribution.

15 MR. TROSTEN: Well, I am afraid, then, I am lost.  
16 I don't really understand how you derive the conclusion from  
17 the Ratheon data that operation of Unit No. 2 will  
18 decrease the reproductive potential of the Hudson for neomysis  
19 to some extent.

20 WITNESS GOODYEAR: The distribution of the neomysis  
21 from Ratheon data indicate that, for instance, as it is quoted  
22 here the juvenile concentrations of neomysis were higher  
23 upstream from the plant and the adult concentrations were  
24 higher downstream from the plant. This means there is a  
25 transition zone at that location. If there is a -- well --

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1 this would indicate a potential nursery at that zone when  
2 the salinity is as it was when they were sampling.

3 This information, combined with mortality informa-  
4 tion, temperature, tolerance information would indicate that  
5 entrainment mortality would be experienced and the distribution  
6 of the population from their data indicate that this entrain-  
7 ment mortality could represent a fairly significant impact on  
8 their populations because of the nursery area.

9 MR. TROSTEN: Now Dr. Goodyear, how many years of  
10 sampling were involved in the Ratheon data that you quoted  
11 there?

12 WITNESS GOODYEAR: Principally one.

13 MR. TROSTEN: One year?

14 Now does the population -- is the population of  
15 necmysis the same longitudinally year after year?

16 WITNESS GOODYEAR: No.

17 MR. TROSTEN: Does it differ depending upon salt  
18 front?

19 WITNESS GOODYEAR: Both within the year and during  
20 the year.

21 MR. TROSTEN: Is it possible the necmysis popula-  
22 tion could be entirely different than what was depicted in that  
23 one year?

24 WITNESS GOODYEAR: Certainly.

25 MR. TROSTEN: All right. Now on the basis of that,

5mi. 1 do you conclude that it is possible that the Indian Point  
2 plant might have no impact upon the neomysis population,  
3 depending upon where the population happened to be that year?  
4 In other words, they may not be anywhere near Indian Point  
5 one year, is that possible?

6 WITNESS GOODYEAR: With high enough fresh water  
7 flow.

8 MR. TROSTEN: Yes.

9 All right. I now understand the basis from which  
10 you drew that conclusion, Dr. Goodyear, and I think we can go  
11 on to another discussion.

12 On page 5-37 you say that, "Larger epibenthic crus-  
13 tacean components (amphipods and mysids) of the zooplankton  
14 will be similarly affected."

15 Do you mean affected by the microcrustaceans?

16 MR. KARMAN: I think Dr. Goodyear ought to read  
17 the paragraph before to see what leads up to that.

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1 WITNESS GOODYEAR: To answer your question, the  
2 stresses upon the individuals which are exposed would be  
3 similar to those of the microcrustaceans and as was said,  
4 there could be significant reduction in concentrations of  
5 microcrustaceans. This is also true of some of the larger  
6 crustaceans. Again, this is not to try to quantify this  
7 information because the data base for estimating the  
8 percentages of various forms, the data base is not -- or  
9 at least at the time -- I have not examined the data base  
10 which could allow for computation of a percentage of a  
11 population. But again, the statement as it reads, reflects  
12 that the crustacean -- larger crustacean components -- I  
13 am speaking of the ones that are small and have to pass  
14 through the screen -- but the larger epibenthic crustaceans,  
15 particularly the amphipods and mysids, will be affected  
16 similarly in manner anyway to the microcrustacean.

17 MR. TROSTEN: That means if the microcrustaceans  
18 are not ~~perished~~ <sup>affected</sup>, that is they are not killed as a result  
19 of entrainment, that means the larger epibenthic crustacean  
20 components would not be affected, that is they would not be  
21 killed by entrainment? Is that what you mean?

22 WITNESS GOODYEAR: This is speaking of stresses,  
23 similar --if you read the first sentence, it says, "The  
24 combined influences resulting from plant operations may  
25 affect the zooplankton community. These effects will result

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1 from additions of residual chlorine, entrainment, and  
2 exposure to the thermal plume."

3 That material is what is referred to as the  
4 first sentence in there.

5 MR. TROSTEN: In the discussion that went on  
6 before, and I don't want to rehash that, I believe that you  
7 agreed that the results which you hypothesized might occur  
8 here also might not occur, is that correct?

9 WITNESS GOODYEAR: Yes.

10 MR. TROSTEN: And all I was trying to ask you  
11 about was if those results did not occur with regard to  
12 the microcrustacean components, isn't it true that they would  
13 not occur with regard to the larger epibenthic crustacean  
14 components?

15 WITNESS GOODYEAR: No.

16 MR. TROSTEN: That is not true?

17 WITNESS GOODYEAR: The comparison or the absolute  
18 statement that you just made, I don't know of any bases for  
19 it.

20 MR. TROSTEN: Well, let me ask you what was the  
21 basis then for your statement, "Larger epibenthic crustacean  
22 components will be similarly affected."

23 In other words, you hypothesized an effect with  
24 regard to the microcrustaceans and then you said the same  
25 effect will occur with regard to the -- are they  
macrocrustaceans? Is that what they are called?

(No response.)

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MR. TROSTEN: If you were able to draw that conclusion, why is it not logical for me to draw the conclusion I did?

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MR. MACBETH: Mr. Chairman, I lost the question. Could we have it stated a little more simply?

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CHAIRMAN JENSCH: I think the question is, what conclusions he would draw and you say shouldn't he agree to the conclusions you have drawn. I think the previous question also that depending upon, as I understand it, the longitudinal distribution and the salinity content and so on, would it affect the population distribution which could give those possibilities you hypothesize. I wonder if the precise conclusion you would like to have him draw, could be stated?

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MR. TROSTEN: The precise conclusion I would like to have Dr. Goodyear draw is this: Is it correct that if high entrainment mortality did not occur with regard to microcrustaceans, that one could conclude that high entrainment mortality would not occur with regard to the larger epibenthic crustacean components?

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WITNESS GOODYEAR: I would not come to that conclusion, no.

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MR. TROSTEN: But you would come to the conclusion that if high entrainment mortality did occur with regard to the microcrustaceans, then high entrainment mortality would occur with regard to the larger epibenthic components?

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1 WITNESS GOODYEAR: No.

2 MR. TROSTEN: Then I am completely lost because  
3 of this.

4 CHAIRMAN JENSCH: If you are in a predicament  
5 in that regard, I think the situation might warrant  
6 further interrogation, perhaps this would be a convenient  
7 time to take a recess and we could get all compass points on  
8 this.

9 At this point, let's recess and reconvene in this  
10 room at 10:25.

11 (Recess.)  
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1 CHAIRMAN JENSCH: Please come to order.

2 The witnesses have resumed the stand.

3 Would you proceed, Applicant's counsel?

4 MR. TROSTEN: Would you read back the last ques-  
5 tion to the witness?

6 In the break, you and I had a chance to talk  
7 about this, and I guess I know what my question is, and I  
8 guess you know what your answer is.

9 MR. MACBETH: I hope Dr. Goodyear is going to  
10 repeat the questions as well as the answers.

11 CHAIRMAN JENSCH: There is some matter of physical  
12 transaction involved here.

13 Go ahead and see how it goes.

14 (Laughter.)

15 WITNESS GOODYEAR: The question, as I understood  
16 it, was related to whether or not the epibenthic crustaceans  
17 mentioned in the first sentence of the second paragraph  
18 on 5-37, whether or not the epibenthic crustaceans would  
19 be similarly affected to the microcrustaceans. The effect --  
20 that sentence is antecedent to the second sentence of the  
21 first paragraph, and in essence what it is saying is that  
22 they will be subjected to the same type of stresses as a  
23 microcrustacean.

24 MR. TROSTEN: Thank you, Dr. Goodyear. That does  
25 clarify it for me.



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1 Now that I understand the statement that appears  
2 there, I have an additional question about it. If a species  
3 of macrocrustaceans were to undergo diurnal vertical migration  
4 as you have said the larger epibenthic crustaceans do, doesn't  
5 this indicate that there -- that the effects on them will  
6 be different than the microcrustaceans, the effects as you  
7 have just described them?

8 WITNESS GOODYEAR: (No response.)

9 MR. TROSTEN: Perhaps I should say doesn't this  
10 indicate they will be subjected to different effects?

11 WITNESS GOODYEAR: The population exposure could  
12 not be estimated in the same way. The -- I don't know a way  
13 of making a direct comparison on what the diurnal populations  
14 might be. Diurnal and vertical migration might increase  
15 the exposure rather than decrease it, although it would appear  
16 likely to decrease it some from -- there is a point, the  
17 duration of a segment of the population in the Indian Point  
18 area would be greater for something which does migrate  
19 vertically in the water column such as neomysis or gammarus,  
20 once the salt front is just beyond Indian Point.

21 The microzooplankton have another little problem  
22 in population maintenance because the net downstream transport  
23 represents a loss to their population just as entrainment or  
24 predation by other fishes or any of these components.

25 So their exposure, the effects of the plant upon

1 them, have to include a net outflow or net reduction of  
2 re-transport downstream. This means they have to reproduce  
3 fast enough to overcome the net loss of organisms from the  
4 population as well as to overcome all the predatory influences  
5 of everything in the area, including the plant.

6 MR. TROSTEN: Would you not agree that it is  
7 important to analyze the particular situation faced by a  
8 population in the particular area with a particular ~~peri-~~<sup>plant</sup>  
9 ~~situation~~ in order that these various effects that you have  
10 been discussing in general terms could be analyzed and  
11 evaluated for that particular situation?

12 WITNESS GOODYEAR: Yes.

13 MR. TROSTEN: Dr. Goodyear, why do you --

14 CHAIRMAN JENSCH: May I interrupt there?

15 MR. TROSTEN: Yes.

16 CHAIRMAN JENSCH: If you agree in that regard, what  
17 do you think is an adequate time for such a study? Can you  
18 indicate?

19 WITNESS GOODYEAR: I know of no such studies on  
20 zooplankton populations. It would be very difficult to do. I  
21 am really not prepared to answer your question without studying  
22 it some more in detail.

23 CHAIRMAN JENSCH: Thank you.

24 Proceed.

25 MR. TROSTEN: With respect to your response to my

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1 question, Dr. Goodyear, and your comment about net downstream  
2 transport, why do you say this represents a loss to the  
3 population of these organisms? Does it not only represent a  
4 change in the population in a given area?

5 WITNESS GOODYEAR: If it is net loss, wouldn't  
6 be a change in the population. It would be a -- I am not  
7 sure I understand exactly what you mean because the loss  
8 to a local population is a removal from that population,  
9 whether by immigration -- demigration, rather, or mortality.

10 MR. TROSTEN: I am referring to a loss to a local  
11 population.

12 WITNESS GOODYEAR: I am sorry. I just don't under-  
13 stand.

14 MR. TROSTEN: Well, perhaps we can go on to another  
15 subject and I can collect my thoughts, and perhaps we will  
16 be more explicit.

17 Dr. Goodyear, before I move on to another subject,  
18 I want to see if I can sharpen the questioning that's taken  
19 place earlier this morning by calling your attention to a  
20 particular conclusion that appears on page 2 of Dr. Lauer's  
21 October 30th testimony. Do you have that before you, Dr.  
22 Goodyear?

23 WITNESS GOODYEAR: Yes.

24 MR. TROSTEN: It is in the summary statement, and  
25 I will read it out. It's conclusion number three.

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1 "No significant effect on zooplankton abundance  
2 in the Hudson River (particularly gammarus and neomysis)  
3 will result from planned operation of both units," referring  
4 there to Units 1 and 2.

5 Do you agree with that conclusion expressed by  
6 Dr. Lauer?

7 WITNESS GOODYEAR: There is a potential foreign  
8 effect. His statement is within the realm of possibility.  
9 I could agree with it on that basis, but I have not seen a  
10 discussion around any framework which would derive that con-  
11 clusion or which would support that conclusion.

12 MR. TROSTEN: Well, now, Dr. Lauer has expressed  
13 a conclusion. Now, anything is -- I guess almost anything is  
14 possible for -- or impossible, I suppose, and he has not said  
15 that it is possible that there will be no significant effect.  
16 He said there in his opinion, no significant effect on zoo-  
17 plankton abundance in the Hudson River, particularly gammarus  
18 and neomysis, will result from plant operation at both units.  
19 I will have to ask you again, do you agree or do you not  
20 agree with that sentence?

21 (Witnesses conferring.)

22 MR. TROSTEN: Could you try yes or no, and as the  
23 Chairman has said in the past, give me your reasons for it.

24 MR. KARMAN: If it is susceptible to a yes-or-no  
25 answer.

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WITNESS GOODYEAR: As an absolute statement, I  
can't agree with it. But, again, as I am saying, it is  
within the realm of possibility.

MR. TROSTEN: Do you disagree with the sentence?

WITNESS GOODYEAR: I know of factors which have  
not been evaluated such that I really cannot either wholly  
agree or disagree with the statement.

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MR. TROSTEN: So in other words, you are not in a position to either agree or to disagree with it?

WITNESS GOODYEAR: Yes. That is a correct statement. All right. Excuse me.

(Witnesses conferring.)

MR. TROSTEN: All right, Dr. Goodyear. I will accept your answer that you do not know whether you agree or disagree with that conclusion by Dr. Lauer. Now what information do you think you would need to have before you would be in a position to tell me that you either agree or you disagree with that sentence?

WITNESS GOODYEAR: I would need some fairly good longitudinal estimates of the measurements -- the measurements of the distribution of both forms throughout the season and including all the reproductive parameters, very similar to the type of analysis done for the striped bass. It is -- you can't really make a broad sweeping statement without a foundation for it.

MR. TROSTEN: I see.

WITNESS GOODYEAR: So it would take a varied population analysis.

MR. TROSTEN: How long do you think it would take to perform such a population analysis?

WITNESS GOODYEAR: Depending on how good things went --

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(Laughter.)

MR. TROSTEN: Things don't usually go very well.

(Laughter.)

WITNESS GOODYEAR: Several years would probably be a good estimate.

MR. TROSTEN: Thank you, Dr. Goodyear.

MR. KARMAN: I didn't hear the answer to that.

WITNESS GOODYEAR: I said several years would probably be a good estimate.

MR. TROSTEN: I would like to turn to another subject, Dr. Goodyear.

I would like to consider with you now the subject of elevated temperatures generally. On page 5-19 with respect to the third sentence in Item D, and I am going to read that sentence aloud so we can all consider it, I am going to ask you a question. The sentence reads, "During periods when ambient water temperatures are about 80 degrees Fahrenheit, many of these organisms --" describing organisms in the previous sentence -- "will be living near their upper limits and probably above their thermal range of metabolic insensitivity."

Now with respect to that sentence <sup>when</sup> how will the ambient temperature in the channel of the river be around 80 degrees Fahrenheit at Indian Point?

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CHAIRMAN JENSCH: Where is the channel of the

river?

MR. TROSTEN: The channel of the river is the deepest portion, Mr. Chairman. I think it is about 40 feet, at that point, is that correct? Closer to 60 feet, I gather.

CHAIRMAN JENSCH: And how far off shore?

MR. TROSTEN: I understand it to be approximately 2,000 feet off shore, Mr. Chairman.

CHAIRMAN JENSCH: Thank you.

WITNESS GOODYEAR: Probably less than ten percent of the time.

MR. TROSTEN: Now, is that based upon the same analysis that is referred to on page 12-12?

WITNESS GOODYEAR: I might also point out the sentence says, "Ambient water temperatures are about 80 degrees Fahrenheit."

Ambient is a little misleading because the real intent is discussion when the temperature, the overall temperatures are about 80 degrees which would include the plant as well. So there is no real intent to say that 80 degrees Fahrenheit is ambient in that sentence.

MR. TROSTEN: So you are saying in other words, there might be some situations when the temperature of the water in the channel of the river might be <sup>for</sup> one reason or another, about 80 degrees Fahrenheit?



1 WITNESS GOODYEAR: Yes.

2 MR. TROSTEN: All right. Is it correct that the  
3 maximum tolerated temperature of aquatic species generally  
4 increases with acclimation temperatures?

5 WITNESS GOODYEAR: Yes.

6 MR. TROSTEN: And unless you know the acclimation  
7 temperature used in a particular test, isn't it also true  
8 that the maximum tolerated temperature shown in that test  
9 cannot meaningfully be compared with the conditions that will  
10 prevail at Indian Point 2 during the summer?

11 WITNESS GOODYEAR: Yes.

12 MR. TROSTEN: Or at some other time?

13 WITNESS GOODYEAR: Certainly.

14 MR. TROSTEN: Now, with respect to page 5-19 in  
15 determining the maximum tolerable temperature of a species  
16 in the summertime at Indian Point, would you not have to  
17 consider the acclimation temperature for the species to be  
18 in the 77 to 78 degree Fahrenheit range, approximately?

19 WITNESS GOODYEAR: Not necessarily. For species  
20 which are exposed to the plume acclimation temperature goes  
21 up very rapidly with exposure to higher temperatures. So  
22 their actual acclimation could be equivalent to a higher  
23 temperature than the ambient.

24 MR. TROSTEN: So their acclimation temperature in  
25 some cases might be higher actually than 77?

1 WITNESS GOODYEAR: Yes.

2 MR. TROSTEN: All right. Now, with regard to  
3 page 5-20 and I am referring specifically to Table 5-5,  
4 what are the acclimation temperatures listed in 5-5, please?  
5 Would you mind reading them off the ones that are listed?

6 WITNESS GOODYEAR: 59 --

7 MR. TROSTEN: These are Fahrenheit?

8 WITNESS GOODYEAR: Right. 59. Another for  
9 pseudopleuronectes, 45 to 82.

10 MR. TROSTEN: What does that mean.

11 WITNESS GOODYEAR: It is a series of tests.

12 Menidia menidia is 45 to 82; striped bass, 40,  
13 white perch, 40, fungus 45 and 82. Neomysis, 59, 43 to 68 and  
14 59 again.

15 (Laughter.)

16 MR. TROSTEN: Pretty high temperature?

17 WITNESS GOODYEAR: I think that is supposed to be  
18 77 but I have to check. 34 to 77, okay.

19 59 for crangon, 59 for monoculoides, 59 for gammarus  
20 and 41 to 77 for acartia tonsa.

21 CHAIRMAN JENSCH: The reporter was getting the  
22 answer.

23 MR. TROSTEN: Is it not correct that the acclimation  
24 temperatures you have just read are for the most part less  
25 than 77 to 78 degrees?

ak4 1 WITNESS GOODYEAR: Yes.

2 MR. TROSTEN: Is it not correct that some of the  
3 acclimation temperatures experienced by the fishes in the  
4 river will be higher than 70 to 80 degrees which you indicated  
5 a moment ago?

6 WITNESS GOODYEAR: Yes.

7 MR. TROSTEN: Now, for those species where the  
8 acclimation temperature is not shown for the test, isn't it  
9 correct, Dr. Goodyear, that the data that are presented here  
10 are useless for the purposes of this discussion if you  
11 don't know what the acclimation temperature is?

12 WITNESS GOODYEAR: For predictive purposes they are  
13 useless, yes.

14 MR. TROSTEN: Now, on page 5-19 on the bottom  
15 of the page and the top of page 5-22, you refer to the  
16 probability of plankton being exposed to temperatures in  
17 excess of 85 degrees Fahrenheit and between 83 degrees  
18 Fahrenheit and 85 degrees Fahrenheit, is that correct?

19 WITNESS GOODYEAR: Yes.

20 MR. TROSTEN: Now, aren't there many references  
21 in the literature including some you quote on page )-5-1 to  
22 A-5-16 that say the optimum temperature for growth and  
23 diversity of phytoplankton, invertebrates species is between  
24 85 and 89 degrees Fahrenheit?

25 WITNESS GOODYEAR: Yes.

1 MR. TROSTEN: Isn't it true that exposing these  
2 organisms to these temperatures would be beneficial to them,  
3 to the temperatures that you describe on the bottom of page 5-19  
4 and the top of page 5-22?

5 WITNESS GOODYEAR: For some habitats.

6 MR. TROSTEN: Do you know whether those habitats  
7 include the ones at Indian Point?

8 WITNESS GOODYEAR: One moment.

9 (Witnesses conferring.)

10 WITNESS GOODYEAR: Would you repeat the question  
11 again please?

12 MR. TROSTEN: Yes. I wanted to find out whether  
13 you knew whether Indian Point included the habitats for which  
14 exposure of these <sup>plankton</sup> ~~organisms~~ to the temperatures of  
15 80 to ~~90~~<sup>85</sup> degrees would be beneficial?

16 WITNESS GOODYEAR: I don't know. I really can't  
17 answer that.

18 MR. TROSTEN: All right. So it is possible then  
19 that the sentence that appears on the bottom of page 5-19 and the  
20 top of page 5-22 might actually be -- might actually mean that  
21 exposing these organisms to this 85 water temperature is  
22 actually good for them, that it actually is going to increase their  
23 abundance and diversity, but you don't know whether that is  
24 true or not?

25 WITNESS GOODYEAR: These exposures are

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1 exposing populations that are -- well, I guess the best way  
2 to put it would be to say that the exposures are not of  
3 sufficient duration to contribute -- to constitute a change  
4 in the environment which would be beneficial.

5 MR. TROSTEN: All right. So what you are saying  
6 is that exposing them to these temperatures might be good  
7 for them, but you are not sure because maybe you are not exposing  
8 them long enough to make it good for them, is that right.

9 WITNESS COUTANT: If I could amplify on that. Usually  
10 optimum temperatures are measured under a constant temperature  
11 condition over several days, a prolonged period and diversity  
12 -- species' diversity is again something that develops over  
13 a long period of time. When statements are made about optimum  
14 growth or optimum species diversity, these reflect relatively  
15 constant conditions in prolonged periods of time. The conditions  
16 being referred to in this paragraph are relatively short  
17 exposures to a temperature higher than the acclimation or  
18 the previous temperature that that population has been held  
19 at. So it isn't a matter of making a direct comparison between  
20 optimum conditions determined under constant conditions and  
21 the question of optimum or nonoptimum during this brief exposure.

22 MR. TROSTEN: All right. Thank you very much for  
23 that explanation, Dr. Coutant. For the reasons you have given,  
24 isn't it correct that the exposures of these organisms to  
25 these types of temperatures for this period of time -- excuse

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1 me. Let me rephrase the question. Do you agree that there is  
2 no reason to believe that exposing these organisms to these  
3 temperatures for this period of time would be bad for them?

4 WITNESS COUTANT: As the comments earlier reflected,  
5 this depends upon the acclimation temperature. Probably  
6 if the acclimation temperature were close to the 80 degree level  
7 we are talking about, and the exposure was the 80-85 range,  
8 this would not then be detrimental.

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1 MR. TROSTEN: So for the same reasons that you *are*  
2 unable to tell whether the exposures would be good for them,  
3 you are also unable to tell whether these exposures would be  
4 bad for them?

5 WITNESS COUTANT: In terms of the criteria you  
6 suggested, that is growth and species diversity.

7 MR. TROSTEN: Those were the terms that I was  
8 discussing.

9 WITNESS COUTANT: That is correct.

10 MR. TROSTEN: Thank you very much.

11 Dr. Coutant, a question has been referred to me.  
12 You suggested a moment ago that there -- the exposure time  
13 was sufficiently short for these zooplankton organisms that  
14 you were unable to determine -- that it seemed unlikely, as I  
15 recall you said, that population shifts would occur because  
16 of the short duration of the exposure time. Did I understand  
17 You correctly?

18 WITNESS COUTANT: Within those exposure times, that  
19 correct.

20 MR. TROSTEN: Within those exposure times, right.

21 Is that the same thing as saying you don't think  
22 there would be any population shifts?

23 WITNESS COUTANT: Not necessarily. I think there's  
24 a distinction that has to be made between the changes that  
25 occur within that period of time and the small stresses that

1 those planktonic organisms would incur, that would be  
2 reflected over a much longer period of time. For example,  
3 if you take two species with very differing temperature  
4 tolerances, a short exposure to a high temperature, to the  
5 more sensitive one, may have and could very well have effects  
6 on its ability to produce organic matter, its reproductive  
7 potential. It would be reflected in how fast it reproduced  
8 itself. They would be different fro the more tolerant organism.  
9 So that comparing the two organisms that receive this brief  
10 exposure and culturing them in the laboratory, if you will,  
11 for several weeks, the more sensitive organism could lose  
12 out to the more tolerant one. That is, the more tolerant  
13 species would have a competitive advantage over the more  
14 sensitive one, looking at it over the long term.

15 MR. TROSTEN: Well, if that were true, is it  
16 also true that if you looked at these populations over the  
17 long term, that you might see a beneficial result if you  
18 looked at them long enough? In other words, aren't these  
19 things two sides of the same coin, Dr. Coutant? If you look  
20 at them long enough, you might see beneficial results from  
21 running these things through the plant in the long term? On  
22 the other hand, if you look at them long enough, conceivably  
23 you might see some adverse things?

24 WITNESS COUTANT: To directly answer the question,  
25 it is conceivable, but the specifics of the situation would



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1 have to be looked at very carefully.

2 MR. TROSTEN: I certainly agree with that, but  
3 I sense sort of a feeling of uncertainty about -- on your  
4 part or Dr. Goodyear's part for expressing the view that  
5 exposing these organisms to these temperatures for these  
6 short periods of time might produce good results. You seem  
7 sort of unwilling to draw that conclusion, but somewhat more  
8 willing to draw the conclusion that it might produce adverse  
9 results. If I do -- if I am correct in sensing that feeling,  
10 I don't quite understand why that feeling would exist.

11 WITNESS COUTANT: It exists primarily because of  
12 the difference between a stress which is what occurs to an  
13 organism on a short-term exposure and the creation of an  
14 environmental condition that could be optimum for growth for  
15 the organism on a long term. The short-term exposure  
16 constitutes a stress which in general detracts from the  
17 organism's productivity.

18 WITNESS GOODYEAR: I would like to point out  
19 that particularly with the zooplankton populations, our  
20 conclusion really says that there will be selection for  
21 heat tolerant -- more heat-tolerant forms, those which are  
22 more nearly in their ambient temperature in the plume. It is  
23 a competitive interaction between species, between populations  
24 that will give you an effect. Whether or not the effect is  
25 good or not is another question entirely.

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1 MR. TROSTEN: Thank you, Dr. Goodyear. That's  
2 very helpful.

3 Now on Table 5 on page 5-20, if the ambient  
4 temperature were indeed about 59 degrees, how does the  
5 result for *Alosa pseudoharengus* -- please tell me if I am  
6 mispronouncing this -- compare with Indian Point for that  
7 time of year, the first species on that page?

8 WITNESS GOODYEAR: I am not --

9 MR. TROSTEN: How does the acclimation temperature  
10 of 59 degrees Fahrenheit for *Alosa pseudoharengus* compare  
11 with the ambient temperature for Indian Point during the  
12 summertime?

13 WITNESS GOODYEAR: It is quite a bit below it.

14 MR. TROSTEN: Quite a bit below that. All right.

15 Now with regard to this table, the increased  
16 temperature in the plume of Indian Point 2 would be much less  
17 than 14.4 degrees Fahrenheit over ambient, would it not,  
18 due to the jet dilution factor?

19 WITNESS GOODYEAR: Would you repeat that again now?  
20 I was -- never mind. Would you repeat the question again?

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1 MR. TROSTEN: Yes. The increased temperature in  
2 the plume of Indian Point 2 would be much less than 14.4 degrees  
3 Fahrenheit over ambient, would it not, as a result of the jet  
4 dilution factor?

5 WITNESS GOODYEAR: On the surface, yes.

6 MR. TROSTEN: Right. And it would be less than  
7 14.4 degrees Fahrenheit in a very short period of time even  
8 below the surface?

9 WITNESS GOODYEAR: Yes.

10 MR. TROSTEN: All right. Now the delta T that is  
11 shown here for *alosa pseudoharengus* is 14.4 degrees, is that  
12 correct? In other words, if I understand this correctly,  
13 you have got an acclimation temperature of 59 degrees and then  
14 an upper critical temperature. As I understand the way this  
15 sort of test is performed, you take the fish and you move it  
16 out of the environment in which it is at the acclimation  
17 temperature and put it swiftly into the -- where it is at  
18 the upper critical temperature, isn't that correct?

19 WITNESS GOODYEAR: Yes.

20 MR. TROSTEN: So, in other words, the -- the change  
21 that this fish experienced in this test was much greater than  
22 the change that a fish would experience in moving from the  
23 ambient temperature in the plume to a point in the plume where  
24 it would be subjected to the increased thermal effect? You  
25 see the point that I am making?

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CHAIRMAN JENSCH: Excuse me. Could you identify

2 the time for Indian Point change from the acclimation  
3 temperature to the -- is it the upper critical? Is there  
4 a turbulence in the discharge that gives you a time factor  
5 for this?

6 MR. TROSTEN: Yes. Well, using the Staff's  
7 conservative model, Mr. Chairman, as I understand it, in 10  
8 seconds you would have a three to one reduction in temperature  
9 as a result of the jet dilution factor. In 10 seconds, the  
10 -- this three to one factor would reduce the temperature  
11 accordingly at the surface.

12 Now as I understand it, the temperature would  
13 start to reduce very sharply at first and then decreasingly  
14 reduce. But at the end of 10 seconds there would be a three  
15 to one reduction, is that correct? *mr. Siman-Tov*

16 CHAIRMAN JENSCH: Thank you.

17 WITNESS SIMAN-TOV: The 10 seconds, I am not  
18 completely sure. But an overall description might be true  
19 that it will be about -- if I can estimate -- about 15 minutes  
20 within the channel and would be exposed to the delta T of  
21 the condenser. Then after the discharge point were left  
22 something like in the order of, let's say half a minute of --  
23 within -- being within the jet and during the travel from the  
24 discharge out to the surface, which probably would not be  
25 much -- an upper limit -- more than 30 seconds. The

1 temperature will decay by factor of two.

2 The factor itself is, of course, a little bit  
3 indecisive, but we -- a factor of two is probably a reasonable  
4 estimate. It might be a factor of three.

5 CHAIRMAN JENSCH: Thank you. Now with that  
6 explanation, can you answer the question or do you desire  
7 to have the question reread?

8 MR. TROSTEN: Do you understand the question I was  
9 addressing to you?

10 MR. KARMAN: Why don't you have it repeated?

11 (The reporter read the pending question.)

12 WITNESS GOODYEAR: As I understand the question  
13 you are asking if the 14 degree -- if the fish would be  
14 exposed to a 14 degree at the plume?

15 MR. TROSTEN: That is the question.

16 WITNESS GOODYEAR: No.

17 MR. TROSTEN: Would the plume temperature at  
18 this time of year, late spring and early fall, when the  
19 acclimation temperature was 59 degrees, not be significantly  
20 less than 73.4 degrees Fahrenheit?

21 All right, let's go over this slowly.

22 The 59 degree temperature which you described  
23 actually is the ambient temperature at Indian Point for early  
24 spring and late fall. Would you accept that as a --

25 WITNESS GOODYEAR: Yes.

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1 MR. TROSTEN: -- as a hypothesis? That  
2 can be demonstrated.

3 Now would the plume temperature at the time of  
4 year which is early spring and late fall when the acclimation  
5 temperature was 59 degrees, not be significantly less than  
6 73.4 degrees?

7 In other words, you take the ambient temperature  
8 and you add the heat load from the plant and then you can  
9 compute what the plume temperature would be, it would be a  
10 varying temperature, depending upon what point in the plume;  
11 but wouldn't the plume temperature be significantly less than  
12 73.4 degrees as a result of the jet dilution factor which we  
13 were discussing with the Chairman?

14 WITNESS GOODYEAR: Certainly.

15 MR. TROSTEN: All right. Doesn't that mean, then,  
16 that the plume temperature as well as the delta T is sig-  
17 nificantly less than the upper critical temperature in the  
18 delta T which <sup>and</sup> is shown in this test?

19 WITNESS GOODYEAR: Yes.

20 MR. TROSTEN: Doesn't that mean, therefore, that  
21 this test has no real bearing on what would happen at Indian  
22 Point to a fish that swam into the plume?

23 WITNESS GOODYEAR: If you wanted to predict --  
24 it has a bearing because it says there won't be an effect.

25 (Laughter.)

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MR. TROSTEN: Doesn't it mean, though, Dr.

Goodyear --

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MR. TROSTEN: I have been instructed to say thank

arl 2 you.

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(Laughter.)

4

CHAIRMAN JENSCH: Stop while you're ahead, I

5

guess.

6

MR. TROSTEN: All right. Let's take --

7

WITNESS GOODYEAR: Excuse me. Could we have a

8

moment?

9

MR. TROSTEN: Yes.

10

(Witnesses conferring.)

11

MR. TROSTEN: Before I go on with the remainder

12

of my questions, Dr. Goodyear, perhaps I ought to ask you

13

whether this table shows that exposing all of these organisms

14

listed on that table has no effect, because if that's the

15

case, I think we can probably save about 15 minutes. I just didn't

16

appreciate that when I embarked upon this line of questioning.

17

WITNESS GOODYEAR: Most of them -- I would have

18

to go through on an individual pair by pair.

19

MR. TROSTEN: Why don't we do this, Dr. Goodyear:

20

At the break you go through that, if you would, please, sir,

21

and find out one that you think shows a significant effect

22

and let your counsel know, and we can discuss that. All right?

23

WITNESS GOODYEAR: Okay.

24

MR. TROSTEN: Fine. Thank you.

25

All right. I would like to move to another subject,



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1 please, Dr. Goodyear, the subject of chemical discharges.

2 On page 5-14, would you tell me, please, which  
3 organisms were the subject of the study in Table 5-3?

4 And that appears on page 5-15.

5 (Witnesses conferring.)

6 WITNESS GOODYEAR: It would take a few minutes  
7 to find the species. These data are from the McKee & Wolf,  
8 and as said, they are minimums where toxic levels were found.

9 MR. TROSTEN: Are these the same species considered  
10 in Table 5-4, is that from McKee and Wolf also, or from a  
11 series of references? I guess it is from a series of  
12 references, isn't it? That's on page 5-18. That's not from  
13 the McKee and Wolf?

14 WITNESS GOODYEAR: That's correct.

15 MR. TROSTEN: Would you mind checking at the break  
16 to see what the organisms were that were the subject of  
17 Table 5-3, and letting me know?

18 WITNESS GOODYEAR: I don't -- just a moment.

19 MR. TROSTEN: Thank you.

20 (Witnesses conferring.)

21 WITNESS GOODYEAR: If you turn to page AV-19,  
22 the phosphate is related to Daphnia magna.

23 MR. TROSTEN: Excuse me just a moment.

24 Okay. Go ahead. We are taking notes on this.

25 By the way, you can do this later, if you like, Dr.

1 Goodyear.

2 WITNESS GOODYEAR: Okay. The answers to your  
3 question are all in this --

4 MR. TROSTEN: In other words, if we turn to page  
5 A-5-19, we will see the organisms in test conditions with  
6 regard to each of the chemicals that are listed in Table 5-37

7 WITNESS GOODYEAR: Yes.

8 CHAIRMAN JENSCH: That means pages preceding  
9 5-19?

10 MR. TROSTEN: Yes. A-5-19 to A-5-21. Is that  
11 where it ends?

12 WITNESS GOODYEAR: Yes.

13 MR. TROSTEN: Okay. Thank you.

14 Now with regard to page 5-17, which of the data  
15 points refer to organisms found in the Hudson River?

16 (No response.)

17 Would you like to study that, too?

18 WITNESS GOODYEAR: Yes. I believe I would.

19 MR. TROSTEN: Why don't you take a look at that?

20 While you are thinking about that, why don't you  
21 let me know if rainbow trout and Chinook salmon are known to  
22 exist in the Hudson River.

23 WITNESS GOODYEAR: At Indian Point or --

24 MR. TROSTEN: Well, let's try both. Let's have  
25 Indian Point first.

ar4

1 (Witnesses conferring.)

2 MR. TROSTEN: I think that some of the fishermen  
3 are waiting with bated breath to hear about this.

4 CHAIRMAN JENSCH: They'll bait their hook.

5 (Laughter.)

6 WITNESS COUTANT: I think zero and rainbow  
7 have been stocked into the upper Hudson. I don't know if  
8 they have been successful. Rainbow trout could be at Indian  
9 Point.

10 MR. TROSTEN: They have been stocked in the fresh  
11 water portion of the Hudson?

12 WITNESS COUTANT: The rainbow trout is an anadromous  
13 fish, and the steelhead race from Oregon have been transplanted  
14 to many of the eastern tributaries in hopes that they can  
15 establish a steelhead run for the eastern tributaries.  
16 The Delaware River has been highly stocked. The Chesapeake  
17 has been highly stocked. I am quite sure the Hudson has also.

18 MR. TROSTEN: Thank you.

19 Have you examined the data from bioassays  
20 on Hudson River organisms in Hudson River water which have  
21 been submitted to the Staff by the Consolidated Edison  
22 Company? These are contained in Dr. Lauer's April 5th and  
23 October 30th testimony.

24 WITNESS GOODYEAR: Yes.

25 MR. TROSTEN: Where would these appear on Figure

ar5

1 5-1, do you know?

2 WITNESS GOODYEAR: The-- some of those data  
3 that you are referring to -- let me put it back up for a  
4 second and explain the particular problem with those data.  
5 Almost anyone who has ever run bioassays for toxics of any  
6 kind will be able to tell you that there is a very significant  
7 mortality.

8 As a matter of fact, exposures to some things  
9 would not produce mortality until sometime later. This is  
10 true for many pesticides in particular. Damages incurred  
11 during an exposure may actually kill the organism. We may  
12 be many hours before he dies.

13 The particular studies you are talking about were  
14 very restricted in their length so that none of the delayed  
15 mortality could be -- well, none of the delayed mortality  
16 was reflected so that inclusion on this table wouldn't be  
17 particularly meaningful. There are several points that it  
18 could be, but --

19 WITNESS COUTANT: If I could amplify, too, the  
20 table in the figure includes only data on which good  
21 quantitative chemistry was done to residual chlorine throughout  
22 the test. If you go through the literature of chlorine  
23 toxicity, you find many more studies than are reported in this  
24 table. But one of the principal difficulties with most of  
25 these tests is that residual chlorine was not determined

ar6

1 throughout the course of the test which is particularly  
2 important at the left-hand side of the figure where the  
3 time dependency, time and concentration dependency is  
4 really what's under consideration; and my recollection of the  
5 tests that were done on the Hudson River biota indicated  
6 that the concentration of residual chlorine did change through-  
7 out the test and was not certain throughout the test. So on  
8 the criteria that we used in preparing this figure somewhat  
9 independently, those data wouldn't have been useful to us,  
10 and it would be difficult to precisely locate those data  
11 on this figure.

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1 MR. TROSTEN: Am I correct, Dr. Coutant, that the  
2 reason why you included -- you did not include the New York  
3 University studies is because of the -- what you considered  
4 to be lack of adequate data on residual chlorine and not  
5 the lack of adequate data on -- and not the length of the  
6 test, is that correct, because I was getting two answers, one  
7 from Dr. Goodwear and one from you? I am not quite sure

2mil

1 36 hours.

2 MR. TROSTEN: I see. All right. Let's take another  
3 one, then. Were all of these run sufficiently long that  
4 you could tell whether there was delayed mortality or a  
5 delayed effect? For example, some of these are stated in  
6 terms of seven day, TL 50, 96 hour TL 50, slight avoidance 10  
7 minutes, and so forth and so on.

8 Were all of these tests run so that you were able  
9 to determine precisely what the delayed mortality was?

10 WITNESS GOODYEAR: They were run so that there  
11 was an end point, an effective end point for the time  
12 interval as specified.

13 MR. TROSTEN: An effective end point? I am sorry.  
14 I don't quite understand that.

15 (Witnesses conferring.)

16 WITNESS GOODYEAR: That is what is plotted on the  
17 table.

18 MR. TROSTEN: You mean on the --

19 WITNESS COUTANT: I think the point is that the table  
20 attempts to provide more data than just the figure would  
21 alone and it is just a source of information that you are  
22 asking that is presented in the table, that is what was the  
23 ~~effect of end point~~ *effective end* point for that particular test? Was it a test  
24 to consider the long term effects? Was it one that ended  
25 after 24 hours? These are the -- this is the sort of

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1 information that is presented in that center column of the  
2 table.

3 MR. TROSTEN: Could you tell me how in this  
4 respect -- I guess we are talking now about effective end  
5 point -- I thought before we were talking about the possible  
6 delayed mortality that could occur after a test, and I guess  
7 now we are talking about the effective end point of a test.  
8 But how does the test work done by New York University  
9 differ, insofar as this effective end point is concerned, from  
10 all of the tests that are described on this table?

11 WITNESS GOODYEAR: Many of the samples had little or  
12 no mortality within the three-hour period, so that -- well,  
13 it is fairly -- if you have mortality at a given point in  
14 time, then you have an estimate of the time dimensions.  
15 If you don't have mortality, you terminate the experiment.  
16 You have no point to plot.

17 MR. TROSTEN: Supposing you ran a test and ran it  
18 for a hundred days, then had no mortality. Would that mean  
19 that the test was useless?

20 WITNESS GOODYEAR: No.

21 MR. TROSTEN: Then I don't quite understand.

22 WITNESS GOODYEAR: You still couldn't plot it on  
23 this graph.

24 MR. TROSTEN: That seems to say that if you -- the  
25 better you are, the less useful the data is. Speaking as a



1 layman, I don't understand it.

2 WITNESS GOODYEAR: The better you are, the less  
3 useful the data is, the -- not the less meaningful.

4 MR. TROSTEN: Is that the reason why the New  
5 York University studies aren't plotted here, is because  
6 they didn't show any mortality?

7 WITNESS GOODYEAR: They were terminated -- there's  
8 two reasons. We are just talking about one of them. They  
9 were terminated before -- many of them were, not all of them  
10 -- but they were terminated before mortality, so that you  
11 don't have an effective end point; and there's really no  
12 reason to expect that some of them might not have died.

13 MR. TROSTEN: Well, what does item 3, safe  
14 concentration, mean? Data point three?

15 One problem, I guess I am having is that the  
16 effect end point column has terminology that is not defined.  
17 It is just a subjective statement which is difficult for a  
18 layman to understand.

19 WITNESS COUTANT: Well, having gone through some  
20 of this literature, although I don't remember all of it in  
21 detail, the general impression one has is that  
22 investigators having worked independently, come up with  
23 different end points; their definitions of end point differ  
24 considerably and it is very difficult to put together a  
25 table and a figure like this to try to summarize all the data

Smil 1 in a consistent manner.

2 As I mentioned, one of the principal criteria  
3 in gathering these particular references was the adequacy  
4 of the chemistry involved. I think you'd have to go to the  
5 individual papers and get that author's particular definition  
6 of his end point, something that was beyond the scope of  
7 trying to do here. Certainly they do differ.

8 To answer your earlier question about safe concen-  
9 tration, my recollection is that this is a long-term exposure  
10 in which the population continued to reproduce. The scud is  
11 one of these <sup>macro-</sup> ~~macro-~~ crustaceans we have been talking  
12 about in which the laboratory studies can be continued  
13 through the growth and reproduction of the population.

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MR. TROSTEN: Well, let's see. Where does data .3 <sup>point</sup> appear here? Oh, I see. It is off on the far right.

Are you saying then -- could you do this for me? Could you give me a -- just a simple definition of why the New York University studeis are different from all of these studies here as far as ~~effect~~ <sup>effective end</sup> ~~end~~ point is concerned? What is the basic difference between the New York University studies and each and every one of these studies that is plotted on this graph?

WITNESS COUTANT: The basic difference is a graph has to have two axes, one of which is concentration and the other time. When we look at the New York University data, that were presented to us in the formal testimony, I believe, the concentration was given as a range and it was admitted that the concentration varied throughout the test and was uncertain. So in terms of plotting the points for whatever purpose, we would like to be able to plot them on this curve and then find out where they lie. But in fact, it isn't possible because the concentration factors are -- pardon me, the concentration levels are uncertain.

MR. TROSTEN: And each of the tests that are depicted on this graph, you have concluded clearly indicated what the concentration and exposure was on the basis of your review of the literature depicting these things?

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1                   WITNESS COUTANT: Yes, in fact, I might add that  
2 the data which were used for this figure, were obtained with  
3 us jointly, with the Environmental Protection Agency, with  
4 the -- excuse me -- in an attempt to obtain the best data  
5 that was available.

6                   The individual tests have been discussed with us  
7 and the EPA personnel particularly with respect to this  
8 chemical criterion -- it is an attempt to be consistent with  
9 respect to the chemistry which is so very crucial to the chlorine  
10 toxicity.

11                  MR. TROSTEN: All right. I think I will move on  
12 to another subject from this. I may want to return to that,  
13 Dr. Coutant, after I have had a chance to think about your  
14 response a little bit further.

15                  I would -- now, with respect to your conclusion, that  
16 data from No. 1 should not be extrapolated to Unit 2 because  
17 chlorinated water was retained during Unit No. 1 operation  
18 for approximately 40 minutes as compared to about 10 minutes  
19 with Unit No. 2 in operation -- and here I am referring to  
20 the conclusion expressed on the bottom of page 5-16 and the  
21 top of page 5-19. I want to ask you several questions. Would  
22 you mind looking at the bottom of page 5-16 and I will ask  
23 my questions.

24                  Is it correct that when both units are operating  
25 and Unit No. 1 is being chlorinated that unchlorinated water

eak 3

1 from Unit No. 1, together with unchlorinated <sup>water</sup> ~~water~~ from Unit  
2 No. 2, will mix with the chlorinated water from Unit No. 1.

3 WITNESS GOODYEAR: Yes.

4 MR. TROSTEN: Won't this result in higher dilutions  
5 in the discharge canal outfall than when Unit No. 1 is  
6 operating alone and is being chlorinated?

7 WITNESS GOODYEAR: Yes.

8 MR. TROSTEN: Is it not correct also that dilution  
9 will be higher than when Unit No. 1 is operating alone if  
10 both units are operating and Unit No 2 is being chlorinated?

11 WITNESS GOODYEAR: Yes.

12 MR. TROSTEN: Now, could this increased dilution  
13 that we have described in these two cases, possibly result  
14 in a lower discharge concentration in the cases I have  
15 described notwithstanding the shorter retention time in the  
16 discharge canal?

17 WITNESS GOODYEAR: This is possible, yes.

18 MR. TROSTEN: Hasn't Unit 1 <sup>discharge</sup> ~~discharged~~ concentrations  
19 to the river or haven't they been monitored and shown to be  
20 one-tenth part per million or less?

21 WITNESS GOODYEAR: Free residual chlorine or  
22 free chlorine residual, whichever way.

23 MR. TROSTEN: All right.

24 CHAIRMAN JENSCH: Wait a minute. I think in  
25 answering the question, he defined the subject matter, but

eak4

1 I think your question asked for a specific response.

2 Can you give it?

3 WITNESS GOODYEAR: I really need just a little more  
4 definition of the question because the information I have  
5 looked at there is no way for me to tell whether or not  
6 ~~chlorine~~ <sup>chloramine</sup> production was a part of that decay of the .01  
7 .1 part per million residual discharge. For the free residual,  
8 the answer is yes. But there are other active chlorine  
9 compounds which I can't -- the information wasn't provided  
10 me to what extent they are present.

11 MR. TROSTEN: Let me see if I understand your  
12 response. I asked you whether the discharge concentration  
13 from Unit 1 had been monitored and shown to be usually  
14 a tenth part per million or less and you said that is true  
15 as far as free chlorine residual but there might be chloramines  
16 produced as a result of reaction with ammonia?

17 WITNESS GOODYEAR: Ammonia and other nitrations.

18 MR. TROSTEN: Which hadn't been measured and you  
19 weren't sure what those chloramines might be, is that  
20 correct?

21 WITNESS GOODYEAR: The extent to which  
22 they would be there, that is true.

23 MR. TROSTEN: All right. Thank you. Would you wait  
24 just a moment, please?  
25

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2 MR. TROSTEN: Now the particular measurement that  
3 you were referring to that you expressed an uncertainty about,  
4 was this the measurement that is referred to in Appendix D,  
5 chlorination of Indian Point? You referred to a measurement that  
6 had been provided to you and about which you expressed  
7 uncertainty. Can you tell me what measurement that was,  
8 because I will have to check now to see the extent to which  
9 chloramines were also included in the measurement.

10 WITNESS GOODYEAR: These data were provided me as a  
11 result of a question at the beginning of the review about a  
12 year ago.

13 MR. TROSTEN: I see.

14 WITNESS GOODYEAR: I may have them here with me.  
15 They are Xeroxes of work sheets.

16 MR. TROSTEN: All right. Will you look also during  
17 the break at the document entitled, "Chlorination at Indian  
18 Point," which we will provide to you, which is in evidence in  
19 this proceeding and we will give you the reference and see if  
20 you still have the uncertainty concerning this. We will come  
21 back and discuss this, all right?

22 Now on page 5-16, I want to ask you a question.  
23 Are you aware of data that demonstrate that close to 100 percent  
24 mortality to aquatic biota has occurred as a result of  
25 chlorination during entrainment in Indian Point, Unit No. 1?

WITNESS GOODYEAR: Would you repeat that, please?

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1 MR. TROSTEN: Yes. Let me call your attention  
2 before I ask you the question, to the first paragraph under  
3 Item 3 on page 5-16.

4 WITNESS GOODYEAR: The paragraph?

5 MR. TROSTEN: Yes.

6 WITNESS GOODYEAR: Figure 5-1 --

7 MR. TROSTEN: No. You need not read it aloud.  
8 I just suggest you take a look at it.

9 WITNESS GOODYEAR: Oh.

10 (Witness complying.)

11 MR. TROSTEN: My question is, are you aware of data  
12 that demonstrated --

13 CHAIRMAN JENSCH: Wait a minute. He hasn't  
14 finished yet.

15 WITNESS GOODYEAR: Yes, I have.

16 CHAIRMAN JENSCH: Oh, I am sorry.

17 MR. TROSTEN: Are you aware of data that demonstrate  
18 that 100 percent mortality to aquatic biota has occurred as a  
19 result of chlorination during entrainment in Indian Point  
20 Unit 1?

21 WITNESS GOODYEAR: No.

22 MR. TROSTEN: You are not?

23 WITNESS GOODYEAR: No.

24 MR. TROSTEN: Thank you very much.

25 If that is the case, may I ask you why you state



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1 here during chlorination high mortalities of organisms that  
2 pass through the plant are expected and may approach 100  
3 percent for many species?

4 WITNESS GOODYEAR: The principal reason for that  
5 statement is that it -- that is not necessary and uncommon  
6 in other plants. The retention time for the sampling has  
7 been done at Indian Point. It does not preclude those  
8 organisms which came through alive, from dying later.

9 MR. TROSTEN: In other words, what you are saying  
10 is that it is conceivable that this might happen, that is,  
11 that organisms which come through alive subsequently die.  
12 There are no data which demonstrate that these organisms  
13 which come through Indian Point plant alive subsequently  
14 die. But you are suggesting that this might occur and you  
15 think that the data are not adequate for you to form a judg-  
16 ment on this at the present time, is that correct?

17 WITNESS GOODYEAR: That would be a good way of  
18 putting it, yes.

19 MR. TROSTEN: All right. Thank you.

20 Now on page 12-40, I would like to ask you what  
21 laboratory tests or field studies with respect to Hudson  
22 River organisms support your statement about the delayed  
23 reaction of organisms exposed to chlorine concentrations.  
24 This is the statement that you make that you -- well, you  
25 made it several times this morning and it is contained in the

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1 last paragraph on page 12-40.

2 WITNESS GOODYEAR: 12-40?

3 MR. TROSTEN: 12-40.

4 I would like to have you refer me to the  
5 laboratory tests or the field observations with respect to  
6 Hudson River organisms which support your hypothesis expressed  
7 in the last paragraph on that page.

8 WITNESS GOODYEAR: The -- one moment.

9 (Witnesses conferring.)

10 WITNESS GOODYEAR: I know of no studies which are  
11 designed primarily or which demonstrate this specifically,  
12 but it is very common, and people who run toxicity studies,  
13 especially of the type that were done here, or  
14 actually just trying to keep animals alive in the laboratory,  
15 find this sort of thing out. Toxicants don't necessarily  
16 kill things within a very short time interval. It depends  
17 a lot on what mechanism is involved and what the -- to what  
18 degree they are exposed. This is a general trend that is  
19 not specific to any one toxicant.

20 MR. TROSTEN: In other words, if I understand  
21 what you are saying correctly, the sum of your opinion is  
22 as follows: Although the tests that have been run at Indian  
23 Point with the Hudson River organisms do not show mortality,  
24 and although there are no laboratory tests or field observa-  
25 tions with regard to Hudson River organisms other than those

Smil 1 conducted by the Applicant which specifically show mortality  
2 to these organisms when exposed under the conditions at Indian  
3 Point, you believe that this type of delayed mortality might  
4 occur based upon general considerations having to do with  
5 toxicity, is that really what you are saying?

6 WITNESS GOODYEAR: More or less. Some of the  
7 organisms that you are referring to the toxicity data for them  
8 do exist, so that one part of your question or one part of  
9 your statement is not necessarily true. There are other  
10 studies which show toxic effects, less concentrations than  
11 the initial concentration, for instance, that was used at Indian  
12 Point.

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MR. TROSTEN: Dr. Goodyear, if you were establishing an experiment which would provide the data that you feel would be necessary to resolve this uncertainty in your mind, what data would you suggest be collected?

WITNESS GOODYEAR: The uncertainty as to the delayed mortality or to the chloramine?

MR. TROSTEN: At the moment I am talking about the uncertainty as to delayed mortality which is expressed in the last paragraph on page 12-40.

WITNESS GOODYEAR: Two things need to be done. One is to have a continuous flow-through system. It depends upon what species you are looking at. You would need to have a continuous flow-through system to do the same type of data that is plotted in the table so that you could maintain concentrations. For the static system that was used, the organisms should have been kept for perhaps two weeks before being disposed of, and at least 48 hours. The three-hour time period is just not good enough.

MR. TROSTEN: In your opinion, if tests were performed in accordance with the suggestions you have just made, this would resolve the uncertainty in your mind?

WITNESS GOODYEAR: The tests should be designed to provide a number rather than a lack of a number. If you can establish a point, run a gradient for 48 hours or 7 days, you get a series of tests so that you can find the toxic level.

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1 MR. TROSTEN: In other words, you think --

2 CHAIRMAN JENSCH: Excuse me. Has he finished  
3 his description?

4 Go ahead.

5 WITNESS GOODYEAR: Once you found a toxic level,  
6 you would have a relative to something you know, and  
7 then it is comparable to the other data. So does that answer  
8 your question?

9 MR. TROSTEN: I just have one question to ask  
10 you about that. Are you suggesting that these tests, in  
11 order to resolve the uncertainty in your mind, should be  
12 run to the point where you kill the organisms and then you  
13 would have data that would be helpful to you?

14 WITNESS GOODYEAR: Well, they shouldn't be run  
15 until they killed the organisms from the lowered concentra-  
16 tions backwards, rather than higher concentrations down.

17 WITNESS COUTANT: If I could amplify on that, I  
18 think one of the points Dr. Goodyear is trying to point out  
19 is that the optimum <sup>sort</sup> short of bioassay test, the toxicity  
20 test, is run to the point where you do receive positive  
21 results in terms of time or concentration, and then having  
22 determined where your positive results lie, then the negative  
23 values, concentrations or times leading up to those points  
24 have some very real value.

25 In contrast, many tests that are done for

1 practical reasons, which we all understand often are done  
2 not to the point of determining what is in fact an end point,  
3 such as was referred to in the table on chlorine so that  
4 the negative values of the other tests have questionable  
5 meaning.

6 MR. TROSTEN: All right. Thank you very much.

7 MR. BRIGGS: Is it true that there are no tests  
8 that have been run where these tests were exposed to chlorine  
9 or have tests been run like this?

10 WITNESS GOODYEAR: At Indian Point?

11 MR. BRIGGS: No, just tests for chlorine.

12 WITNESS GOODYEAR: Well --

13 WITNESS COUTANT: I am stretching my memory a  
14 little bit, but in our discussions with the Environmental  
15 Protection Agency, which is currently doing a number of  
16 bioassay tests on chlorine at the National Water Quality  
17 Lab in Duluth, they have given *Daphnia magna* short-term  
18 exposures and put delayed mortality into delayed reproductive  
19 success. I think the investigator doing that work is John  
20 Eaton, but this can be checked for you.

21 MR. BRIGGS: Is that the only one you have  
22 reference to? My problem is this: that as I read the  
23 sentence, it seems to imply that this is a common situation  
24 with exposure to chlorine and then the answers that you gave  
25 seem to indicate that what was being talked about was other

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1 kinds of toxicity where it is common and not necessarily  
2 with chlorine, that there were few, if any, data available  
3 for chlorine exposures. Is my understanding right?

4 WITNESS GOODYEAR: I have seen other data for  
5 chlorine exposures.

6 MR. BRIGGS: I see. Thank you.

7 MR. TROSTEN: Turning now to page 5-16,  
8 paragraph 3 -- paragraph 4, there is a sentence that reads:  
9 "The length of time that organisms will be exposed to toxic  
10 levels of residual chlorine is presently unknown." Do you  
11 see that sentence there?

12 WITNESS GOODYEAR: Yes.

13 MR. TROSTEN: I want to know if the Staff, in  
14 making that sentence, had considered the rate studies which  
15 are shown in the text entitled *"Water and Waste Water  
Treatment"*  
16 by Fair, Geyer and Oken, Volume 2, which shows chloramine  
17 formation as a result of hyperchlorous acid and functions of  
18 pH and temperature? Are you aware of that text which shows  
19 the results I have just characterized?

20 WITNESS GOODYEAR: One moment.

21 MR. KARMAN: Is this text reference in the state-  
22 ment?

23 MR. TROSTEN: No, sir, it is not.

24 CHAIRMAN JENSCH: Do you have the text here?

25 MR. TROSTEN: I don't think we have it here. We

1 can certainly make it available.

2 WITNESS COUTANT: These statements are cited  
3 in the statement on A-5-23.

4 MR. TROSTEN: So you are aware of this text, and  
5 do you agree that it shows what I just indicated?

6 WITNESS GOODYEAR: I wish you would repeat that  
7 again.

8 MR. TROSTEN: Just a moment, while I consider  
9 what I will repeat.

10 (Laughter.)

11 CHAIRMAN JENSCH: The management of the institu-  
12 tion here has requested that when we take a noon recess,  
13 we take it in here -- not until 1:00 o'clock, in order not  
14 to overload their dining facilities. Maybe this would be a  
15 convenient time to take a recess before we recess for lunch,  
16 so that we can come back and continue until 1:00 o'clock.  
17 Is that agreeable to the parties?

18 MR. MACBETH: Yes.

19 CHAIRMAN JENSCH: Very well. At this time let  
20 us recess to reconvene in this room at 12:05.

21 (Recess.)

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1 CHAIRMAN JENSCH: Please come to order. The  
2 witnesses have resumed the stand. Applicant, will you pro-  
3 ceed, please?

4 MR. TROSTEN: I believe, Mr. Chairman, that we  
5 were at the point where I had inquired of Dr. Goodyear whether  
6 the Staff had considered the rate studies shown in the text  
7 entitled, "Water and Waste Water Treatment," by Fair,  
8 Geyer, and Oken, Volume 2, which shows chloramine formation  
9 as a function of hyperchlorous acid and <sup>ammonia</sup> ~~amino~~ concentrations  
10 and temperature.

11 WITNESS GOODYEAR: That particular volume, I  
12 don't --

13 WITNESS COUTANT: As I mentioned earlier, that work  
14 of Fair is cited on page A-V-23 and in that vicinity. Fair's  
15 work in particular points out the factors that are necessary  
16 to be understood in waters before these rates can be  
17 calculated. They include pH and other factors. It is because  
18 of uncertainties with respect to these factors at Indian  
19 Point that it makes it very difficult to do the kind of analy-  
20 sis that Fair was able to do with the more standardized water.

21 MR. TROSTEN: In other words, then -- are you  
22 finished, Dr. Coutant?

23 WITNESS COUTANT: Yes.

24 MR. TROSTEN: As I understand your response, there  
25 is a method known which is described in this text for

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1 determining chloramine formation and what you are saying is  
 2 that you don't know all of the factors that you would have to  
 3 know concerning, for example, pH and temperature and so forth,  
 4 to enable you to determine the chloramine formation using this  
 5 known method of determining the formation of ~~chloramine~~ *chloramine*?

6 WITNESS COUTANT: Yes, that's correct. Although  
 7 I think I qualify this known method, as you say, because  
 8 Fair was working with rather idealized water solutions,  
 9 whereas we are dealing with a natural water source which has a  
 10 lot more components in it, I believe, than Fair's water.

11 A number of Fair's calculations are based on  
 12 theoretical grounds which are founded on using pure water,  
 13 if I recall correctly.

14 MR. TROSTEN: I understand now that the basis of  
 15 your statement --

16 Now, Dr. Goodyear, do you recall Dr. ~~Fair's~~ *Lawler's* testimony  
 17 in June of this year which appears on transcript page 6046.  
 18 Now, I only have one copy of it here, so I guess what I  
 19 should do is to read you what Dr. Lawler said and then I  
 20 will give it to you and you can look at it.

21 WITNESS GOODYEAR: Okay.

22 MR. TROSTEN: Mr. Macbeth was cross-examining  
 23 Dr. Lawler about the subject of chloramine production and Dr.  
 24 Lawler testified concerning the split between free chloramine  
 25 -- excuse me. He testified as to the split between free

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chlorines and chloramines, which is the subject that you said was of concern to you and the reason why you said you were uncertain about the measurements of discharge concentrations of chlorines, is that correct?

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WITNESS GOODYEAR: The rate of decay.

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MR. TROSTEN: Let me call your attention to what Dr. Lawler said. He said, "The answer to your question is the split between free chlorine and chloramines that we observed in the discharge canal is 85 percent of the total residual chlorine in the free form and 15 percent was in the combined form of chloramines."

12

13

Now that is really the pertinent point. I can give this to you if you want.

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WITNESS GOODYEAR: No. I would like to ask at what time of the year was this done, and do you know what the ammonia concentration in the river was at that time?

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MR. TROSTEN: I don't know and we don't know at this particular point in time, the answer to that question, although obviously it could be determined.

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But is that the point that is -- in other words, you do recall Dr. Lawler's testimony?

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WITNESS GOODYEAR: I recall the testimony and as I recall, the - -

CHAIRMAN JENSCH: Let him see the book. There might be something about the context.

WITNESS GOODYEAR: This testimony is very similar to the same type of questions I would have asked to be asked. The ammonia in the river is partly a product of metabolism of organisms and it varies during the year. It is also from the aquatic sewage effluent there. Most waters, and I am certain it is true of the Hudson River, most waters have a typical annual cycle which depends upon temperature and net outflow as well as other factors. The problem with this particular situation was that the ammonia concentration compared to the normal ammonia concentration is not known or, at least, it wasn't reported that I know of, for the time that these analyses were done. Now, the ratio of the chloramines to free chlorines is going to be influenced a lot by the amount of ammonia that is present during chlorination.

MR. FROSTEN: If you knew what the ammonia concentration were at that time, would that resolve the question in your mind?

WITNESS GOODYEAR: It could. It may not. If the ammonia concentrations were similar to ammonia concentrations during the summer, for instance, with the decay scheme that is

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1 indicated here, that would aid quite a bit.

2 MR. TROSTEN: Would it resolve the question?

3 WITNESS GOODYEAR: I would have to think on that  
4 a little while.

5 WITNESS COUTANT: Actually it probably would not.  
6 The -- most of the discussions of chlorine chemistry are  
7 described in terms of reaction with ammonia which is  
8 one of the first reaction components to be sure, but the  
9 chlorine also attaches to other organics and in fact, it forms  
10 a whole host of chlorinated organics that in themselves are  
11 toxic so that the chloramine reactions are only the first  
12 step in the series of chlorinated reactions that go on  
13 still leaving a residue of toxic products.

14 These toxic materials are being identified. It  
15 happens at our laboratory at Oak Ridge using gas chromatography  
16 and other methods of separating the chloramatic organics  
17 in waters after chlorination.

18 I think a lot of the discussions with respect  
19 to precise ammonia concentrations and others are  
20 really only the first step in simplifying the complex  
21 reactions that go on with natural waters.

22 MR. TROSTEN: Now, on the bottom of page 5-16 you say  
23 However, data from Unit No. 1 should not be extrapolated . . .  
24 discharge concentrations will be higher."

25 This is the bottom of page 16 and top of page 17 --

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1 MR. MACBETH: Nineteen.

2 MR. TROSTEN: Top of page 19, thank you.

3 How much do you mean by the term, "correspondingly  
4 higher," as you use that term? You use the term correspondingly  
5 higher --

6 WITNESS GOODYEAR: Actually, it would be a more  
7 complex function than indicated there.

8 MR. TROSTEN: It is not a layer of the cake then,  
9 ~~is it?~~ *linear relationship?*

10 WITNESS GOODYEAR: No.

11 MR. TROSTEN: Thank you.

12 Referring to Figure 5-1, page 5-17, that is the  
13 table we were discussing before and its corresponding table,  
14 5-4 on page 5-18, since the tabular data in Table 5-4 is  
15 generally presented in terms of 50 percent mortality, what  
16 connection was applied to generate the short-term toxicity  
17 threshold, the dotted line, and the *chronic* ~~product~~ toxicity  
18 threshold? In other words, which effect is meant by short  
19 duration toxicity threshold and chronic toxicity threshold?

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1 WITNESS COUTANT: Well, these lines are plotted,  
2 dotted with reason, actually.

3 MR. TROSTEN: What does a dotted line mean versus  
4 a solid line?

5 WITNESS COUTANT: You are not quite as sure as  
6 if it were solid.

7 (Laughter.)

8 Actually, in most toxicity experiments, two  
9 components of toxicity are identified. This is common  
10 in toxicological literature. That is a phase in which it  
11 is time-dependent and concentration-dependent. Then this  
12 fades off in some cases very distinctly, in other cases  
13 not so distinctly, to a phase in which times are on the long  
14 scale and you are in what's commonly known as the chronic  
15 experiment in which you are dealing with such things as  
16 reproductive success and other factors.

17 So putting those two lines on the figures was a  
18 way of bounding the data points that are referenced in the  
19 table in the way of standard bioassay, distinguishing these  
20 two points. The chronic threshold toxicity is really  
21 determined, the location of that line, is really determined  
22 by reference four up at the far right-hand side. That's the  
23 lowest point that was identified.

24 That's brought over to a point that roughly  
25 bounds data points that are represented by six in 46 up at the

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1 left-hand side, and 11, which you see about the lower  
2 middle of the figure. So these lines are rough attempts  
3 to bound the data, and that's what we mean by a threshold  
4 in terms of both the chronic toxicity level and short-term  
5 toxicity level.

6 MR. TROSTEN: Basically what you did is you took  
7 a ruler and you drew a line down in a direction from point 6  
8 down in the direction of point 11, and then paralleled  
9 the lower axis until you could reach point 4?

10 WITNESS COUTANT: Yes, that's correct.

11 MR. TROSTEN: If point number 6, which is the one  
12 boundary point of the curve, refers to instant lethality,  
13 why isn't it shown at 10 minutes exposure; turning to Table  
14 5-4, I notice you say brook trout. Is that a species in  
15 the Hudson River? Did you say that is something that is  
16 stocked, Dr. Coutant? I can't remember.

17 WITNESS COUTANT: No, it is the rainbow that  
18 I believe has been stocked into the Hudson system.

19 MR. TROSTEN: So the brook trout which is one  
20 boundary point of your curve, is something that is not in  
21 the Hudson River, is that right?

22 WITNESS COUTANT: I suspect that's correct, yes.

23 MR. TROSTEN: Now taking that point, which is  
24 one of the critical points in the curve, it is shown to be  
25 lethal instantly. Now why did you show that as 10 minutes?



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1 What was the reason for that?

2 WITNESS COUTANT: That's a good question. The  
3 term "instantaneous death" has been used by a number of  
4 investigators differently. In temperature effect studies,  
5 for instance, I can think of several papers in which if  
6 the organisms die in less than a minute, the author simply  
7 reports it as instantaneous death. This term unfortunately  
8 is used a bit casually, and it would require going back  
9 to the original reference to determine the time this could  
10 be done.

11 MR. TROSTEN: Okay. Now point 11, which is another  
12 critical point in your curve, that's also a brook trout,  
13 isn't it?

14 WITNESS COUTANT: Yes, that's correct.

15 MR. TROSTEN: Okay. Now what is the -- what is  
16 discussed, what is that?

17 WITNESS COUTANT: The gammarus we have been  
18 talking about is a scud.

19 MR. TROSTEN: I see. Would you tell me, please,  
20 why points 13, 35, and 47 are shown in Table 4, but they  
21 don't appear in Figure 5-1?

22 WITNESS COUTANT: This was a mistake. In drafting  
23 this figure in subsequent reports we caught it at that time.  
24 but it didn't get caught in time to make it into the final  
25 statement we have here.

1 We can locate these points for you with some  
2 study. I had forgotten to do that for the errata.

3 MR. TROSTEN: Would you take a look at that  
4 and let me know if it would change the shape of that curve?

5 WITNESS COUTANT: Actually it wouldn't. My  
6 recollection is that one of the points -- in fact, I think  
7 it was more than one of the points, fell in the middle of  
8 the scale, and we see a whole lot of numbers clumped together.  
9 It didn't, in fact, change the boundaries in the revision  
10 of the figure.

11 MR. TROSTEN: All right. Turning back just for a  
12 moment to this reference 6, the one about brook trout, didn't  
13 your original reference define instantly at all, or did  
14 you say in effect that it just isn't clear what was meant  
15 by that term? Could it have been 15 minutes?

16 WITNESS COUTANT: I don't recall, frankly. It  
17 would take some checking to find out.

18 MR. TROSTEN: I see. Now if you were to remove  
19 the reference to salmonid fish, which are not found at  
20 Indian Point from this graph, would that change the shape of  
21 the toxicity curve?

22 WITNESS COUTANT: It probably would. There is  
23 suggestion that the warm water fishes may be somewhat more  
24 tolerant to chlorine. This is beginning to come out of data  
25 that are being gathered by the State of Michigan at several

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1 power plants in the state of Michigan. Those data really  
2 aren't conclusive. In fact, they are not even strongly  
3 indicative, I guess you would say, at this stage of the game.  
4 They do suggest, though, that warm water fishes may be  
5 more tolerant. The problem we have with all of this business  
6 is assessing the information to date and making a judgment  
7 based on that and this, I think, represents the best informa-  
8 tion we had at the time this statement was put together.

9 It may be that a precise comparison of a species  
10 at Indian Point and their toxicity, once that information is  
11 gathered, would show that it would be slightly different  
12 from this present figure.

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2 MR. TROSTEN: In other words, if you were to  
3 eliminate these fish which are not found at Indian Point,  
4 you might -- if you were to draw a similar rough toxicity  
5 curve, find it was much higher on the scale than the one  
6 that is shown here?

7 WITNESS COUTANT: It is certainly possible,  
8 although these data aren't available.

9 MR. TROSTEN: And finally it is also true that  
10 this curve really has to be interpreted very carefully by a  
11 reviewer because it is a general document that is prepared  
12 to just sort of show a collection of data and to determine  
13 whether it really applies to Indian Point, one would have to  
14 look very carefully at the data that are presented on this  
15 curve?

16 WITNESS COUTANT: That's correct. And really that  
17 is the intent of the Staff in including the table with it  
18 rather than a simple figure with dots on it.

19 MR. TROSTEN: Do the concentrations that are used  
20 in the cited experiments reflected on this table 5-1, refer  
21 to initial concentrations or to cumulative average exposure  
22 concentrations?

23 WITNESS COUTANT: Again, without reviewing the  
24 individual studies, I am not sure. As I mentioned earlier,  
25 one of the criteria that we used in selecting these data to  
plot was the fact that the data were quite complete with

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1 respect to the chemistry. How complete we'd have to check  
2 reference by reference.

3 MR. TROSTEN: Generally what methods were used  
4 for chlorine analysis by the investigators cited in Table  
5 5-4, do you know?

6 WITNESS COUTANT: Again, I'd have to say I don't  
7 know specifically, but this was one of the criteria that  
8 were used. The investigator had to have some reliable  
9 numbers, using a reliable method before we believed his data.

10 MR. TROSTEN: So, in other words, you made a general  
11 judgment that these were reliable data, but the degree to  
12 which they are reliable varies from case to case?

13 WITNESS COUTANT: That's correct. Now I might  
14 add just for point of information that the laboratory has  
15 agreed that the question of chlorine toxicity is terribly  
16 vague because of a lot of problems with the chlorine  
17 chemistry. As an initial step toward resolving some of  
18 this, we have had one of our chemists prepare a topical  
19 summary of chemical considerations in assessing the toxicity  
20 of chlorine to aquatic life and this is in draft form.

21 We have a faint Xerox copy which can be provided  
22 for your examination.

23 Probably the most important --

24 MR. TROSTEN: We'd very much like to see it.

25 WITNESS COUTANT: We can provide it, yes.

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2 chlorine chemistry is poorly known. It is very difficult  
3 to make predictions based on the inadequacies of the  
4 chemistry of the original chlorine toxicity tests. It is  
5 also difficult, based on the lack of information about the  
6 chlorine chemistry in the natural waters, such as power  
7 plants, where we are attempting to determine what  
8 would happen.

9 MR. TROSTEN: If you would ask your counsel to  
10 provide us with a copy, we would very much appreciate it.

11 Can the Staff differentiate between <sup>references</sup> ~~differences~~  
12 reporting chloramines and those reporting free chlorine in  
13 Table 5-4?

14 WITNESS COUTANT: Not off the top of my head.  
15 Some of the tests, for instance -- I think the one that is  
16 cited as the scud did in fact use a concentration, method  
17 of determining the concentration that included the chloraminer.  
18 If you can give me a second to check the numbers.

19 MR. TROSTEN: Yes.

20 (Witnesses conferring.)

21 WITNESS COUTANT: Yes, I did.

22 MR. TROSTEN: Thank you.

23 Point No. 6 which is again the critical point on  
24 the graph for brook trout was determined in 1934 before  
25 the advent of a metric type of titration. I hope that is the

4mil 1 right word. Can the Staff comment on the accuracy of low  
2 level or that Orthotolidine analysis?

3 WITNESS COUTANT: That, frankly, is beyond the  
4 scope of my expertise and we would have to bring in a  
5 chlorine chemist.

6 MR. TROSTEN: I can assure you it is beyond the  
7 scope of my expertise.

8 (Laughter.)

9 All right. Thank you very much.

10 DR. GEYER: May I ask a question?

11 CHAIRMAN JENSCH: Sure.

12 MR. TROSTEN: Now on page --

13 CHAIRMAN JENSCH: Excuse me.

14 DR. GEYER: I would like to interject a question  
15 here, if I might. On page 5-18, Table 5-4 says that it is  
16 total residual chlorine. That would normally be interpreted  
17 to mean both free and combined chlorine, is that correct?

18 WITNESS COUTANT: That's correct. Thank you for  
19 picking up that.

20 MR. TROSTEN: Thank you, Dr. Geyer.

21 On page 7-5, paragraph three, the statement  
22 appears -- would you turn to that page.

23 The chlorine demand of the river water could  
24 result in producing some chloramines which are also toxic to  
25 fish and biota. Do you see that sentence and its context?

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1 WITNESS COUTANT: Yes, I do.

2 MR. TROSTEN: Now does the use of the term also  
3 imply that <sup>chloramine</sup> ~~chlorine~~ toxicity does not normally correspond  
4 directly to chlorine toxicity?

5 WITNESS COUTANT: Yes, it is not directly comparable.

6 MR. TROSTEN: It is not directly -- the toxicity  
7 of chloramine is not directly comparable to the toxicity of  
8 free chlorine, is that correct?

9 WITNESS COUTANT: That's correct.

10 MR. TROSTEN: Why does figure 5-1 show both types  
11 of chlorine on the same curve if that is the case?

12 WITNESS COUTANT: The data that are presented on  
13 that figure exclude what is commonly referred to as the free  
14 chlorine. Now I assumed in your previous question you were  
15 making a distinction between chloramine toxicity and free  
16 chlorine toxicity. There is a considerable difference shown  
17 between those two. The figure reference to the total residual  
18 chlorine rather than free chlorine.

19 MR. TROSTEN: Can those not be the same thing?

20 WITNESS COUTANT: I think before we get into a  
21 semantic question, we could refer to the appendix which defines  
22 these.

23 MR. TROSTEN: Would you do that?

24 I guess the question, as I understand it, is that  
25 cannot residual chlorine be free chlorine?



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1 WITNESS COUTANT: I believe it can't. I think we  
2 should refer back to the appendix.

3 WITNESS GOODYEAR: Several definitions are given  
4 on page A-5-22.

5 MR. TROSTEN: Would you <sup>direct</sup> ~~correct~~ my attention --

6 WITNESS GOODYEAR: The residual chlorine is equated  
7 to active chlorine, C.

8 MR. TROSTEN: Thank you very much.

9 Excuse me just a moment.

10 Does the definition active chlorine include free  
11 chlorine? It does, does it not?

12 WITNESS GOODYEAR: The active chlorine?

13 MR. TROSTEN: Yes.

14 WITNESS GOODYEAR: Yes.

15 MR. TROSTEN: Thank you.

16 Now on page iii, the summary of the Staff's  
17 position, paragraph one, the statement is made that chlorina-  
18 tion may result in up to half a part per million of residual  
19 chlorine. Do you see that?

20 WITNESS GOODYEAR: Yes.

21 MR. TROSTEN: Now did the Staff consider the effect  
22 of dilution by Unit No. 1 flow as well as satisfaction of  
23 non-ammonia chlorine demand and destruction of chlorine by  
24 sunlight in stating that conclusion?

25 WITNESS GOODYEAR: I believe so, yes.

7mil 1 MR. TROSTEN: Would you tell me the basis -- explain  
2 the consideration that you gave to these and how you concluded  
3 that the residual may be half a part per million, up to half  
4 a part per million?

5 (Witnesses conferring.)

6 WITNESS GOODYEAR: Let me reflect on that a moment.

7 MR. TROSTEN: Thank you.

8 CHAIRMAN JENSCH: Where was the conclusion to  
9 which you referred, half a part per million?

10 MR. TROSTEN: That is expressed on page iii  
11 in the first sentence of the third paragraph.

12 CHAIRMAN JENSCH: Thank you.

13 WITNESS GOODYEAR: That value of .5 parts per  
14 million represents the upper limit essentially and includes  
15 both the chlorine residual and the free -- or the chloramines  
16 and free chlorine.

17 MR. TROSTEN: It is correct -- are you finished?  
18 Excuse me.

19 WITNESS GOODYEAR: The -- I believe I better --

20 MR. TROSTEN: Would you like to think about that a  
21 little while?

22 WITNESS GOODYEAR: Yes.

23 WITNESS COUTANT: The thing is a simple statement  
24 of the upper limit as Dr. Goodyear mentioned, based on just  
25 how much you planned to add to the cooling water. It isn't

8mil 1 implied -- it isn't intended to imply the reactions we have  
2 been discussing.

3 MR. TROSTEN: When you say an upper limit, I realize  
4 of course, it says up to, but nevertheless the number of .5  
5 parts per million appears there and you have just expressed  
6 the idea that the concentration could be .5 parts per million,  
7 is that correct?

8 WITNESS GOODYEAR: That is -- as I remember -- I  
9 am going to have to check my notes on this -- but I think the  
10 .5 is derived from the limits that are imposed.

11 MR. TROSTEN: Yes. I think there's probably --  
12 I suggest that perhaps you might want to consider this, Dr.  
13 Goodyear, because it is true that there is a New York State  
14 limit concentration limit of .5 parts per million that perhaps  
15 *is what you had*  
~~you had in mind~~ when you made this statement. In thinking  
16 about this problem, I would like to offer for your  
17 consideration the fact that the sodium hypochlorite is  
18 injected into the condensers at one part per million and only  
19 one-half of the condenser is chlorinated at each time so  
20 there is an immediate one to one dilution at the moment of  
21 injection.

22 I then ask you to consider also while you are  
23 thinking about this, the other factors in addition to  
24 dilution of satisfaction of non-ammonia chlorine demand and  
25 destruction of chlorine by sunlight and ask you if you might  
wish to comment on that.

ari 1 WITNESS GOODYEAR: In the first place, I am not  
2 certain I am responsible for that statement. However, I  
3 will find out for you.

4 MR. TROSTEN: Thank you. Thank you very much.

5 Now with regard to the phrase which appears  
6 in that paragraph, I'll read you the sentence, the whole  
7 sentence. "The residual chlorine and any chloramines formed  
8 from reaction with nitrogenous materials in the river water  
9 may be toxic to aquatic life in the thermal plume and in the  
10 immediate vicinity of the cooling water outfall."

11 With regard to the phrase "may be toxic to aquatic  
12 life in the thermal plume," is the Staff aware of the rate of  
13 dilution in the plume and that an organism in the plume would  
14 probably be exposed for a period much less than the 10  
15 minutes which is the least value which is shown in Figure 5-1?

16 WITNESS GOODYEAR: I am not certain how -- well,  
17 this has been the problem all along. We don't know how fast  
18 the material decays, the chloramines particularly, decay in  
19 the plume. You have a dilution loss.

20 MR. TROSTEN: Well, let me -- excuse me. Go ahead.

21 WITNESS GOODYEAR: Go ahead.

22 Okay.

23 You have a dilution loss which will reduce it by  
24 a factor of three or so when it comes out of the discharge  
25 canal. Now if it's being discharged at -- for instance, one

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1 tenth of a part per million, it will still be, when it  
2 surfaces, disregarding dilution, disregarding decay, when  
3 the plume surfaces and stops being diluted very rapidly, the  
4 concentration will be something on the order of three parts  
5 per -- three tenths of a part -- three hundredths of a part  
6 per million, which is still higher than some of the studies  
7 that have been shown to be toxic.

8 Now we don't know the duration to which such  
9 organisms would be exposed because we don't know how fast  
10 the chloramines decay, your concentration from the reaction.

11 MR. TROSTEN: And the reasons you don't know are  
12 the reasons you have given earlier in your testimony?

13 WITNESS GOODYEAR: Yes.

14 MR. TROSTEN: Now if it could be shown that an  
15 organism would be exposed in the plume for considerably less  
16 than 10 minutes, which is the minimum period shown in your  
17 table, Figure 5-1, then you would conclude that there would  
18 be no toxicity to such organisms, isn't that correct?

19 WITNESS GOODYEAR: Would you repeat that again,  
20 please?

21 MR. TROSTEN: If it could be shown that an  
22 organism would be exposed in the plume for much less than the  
23 10 minutes, which is the minimum figure shown on your Figure  
24 5-1, for short duration toxicity threshold, then you would  
25 conclude that such an organism would suffer no toxicity, isn't

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1 that correct?

2 WITNESS GOODYEAR: No.

3 MR. TROSTEN: You would not conclude it?

4 WITNESS GOODYEAR: Not necessarily. The 10-minute  
5 interval is more related to determining the effect or  
6 mortality, say, than is the -- than it is to the concentra-  
7 tion.

8 MR. TROSTEN: You would --

9 WITNESS GOODYEAR: For an organism to die in 10  
10 minutes, he has got to be fairly severely damaged, and the  
11 10-minute periods included really don't reflect the duration  
12 of exposure, the cumulative exposure, and the time it  
13 takes for the organism to expire.

14 You don't understand?

15 MR. TROSTEN: Not really.

16 (Laughter.)

17 Let me just rephrase my question, and I have a  
18 very simplistic question in mind, I guess. That is that  
19 if -- you have depicted a short duration toxicity threshold  
20 and as I understand what this figure means, it means that  
21 if an organism is exposed for 10 minutes, the minimum value  
22 that you show, the minimum concentration and the minimum  
23 time is 10 minutes at about three tenths, I guess it is,  
24 three tenths of a part per -- three tenths of a part per  
25 million. That's the minimum you show for toxicity; and

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all I am asking you is -- is that wrong, Dr. Coutant?

WITNESS COUTANT: That's a minimum time, but maximum concentration.

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1 MR. TROSTEN: Right.

2 WITNESS COUZANT: The tenor of what we were talking  
3 about previously was the dilution within the plume so that  
4 an exposure of less than ten minutes to the high concen-  
5 tration really says nothing about the more prolonged exposure  
6 to lower concentrations in the plume.

7 MR. TROSTEN: All right. All right. I understand  
8 what you are saying.

9 All right. So what you are saying is that merely  
10 knowing the length of duration of exposure in the plume would  
11 not answer your question. You also have to know the concen-  
12 tration in the plume, is that correct?

13 WITNESS GOODYEAR: Yes.

14 MR. TROSTEN: I see. On page 7-5, paragraph 3.

15 WITNESS GOODYEAR: Repeat that please.

16 MR. TROSTEN: 7-5, paragraph 3, "You say the use of  
17 sodium hypochlorite to prevent fouling of the circulating  
18 water system may result in toxic concentrations of chloramines  
19 in the Hudson River near Indian Point."

20 MR. KARMAN: Do you have that section, Dr. Goodyear?

21 MR. TROSTEN: Do you see that sentence there?

22 WITNESS GOODYEAR: Yes.

23 MR. TROSTEN: Regarding that phrase, "Toxic  
24 concentrations of chloramines in the Hudson River  
25 near Indian Point," did the Staff consider the jet  
dilution factor in making that statement?



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WITNESS GOODYEAR: Yes.

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3

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MR. TROSTEN: All right. Should one discuss toxic concentrations without defining the time of the exposure?

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WITNESS GOODYEAR: The effect -- to be able to predict any effect from exposure, you have to have both the concentration and the time.

8

9

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11

MR. TROSTEN: Yes.

WITNESS GOODYEAR: We have not been able to obtain the duration of exposure so we haven't been able to predict any -- we can't really go any further.

12

13

MR. TROSTEN: So you are not sure of the duration of exposure at this point in time, is that right?

14

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WITNESS GOODYEAR: That is true.

MR. TROSTEN: And that is the reason for your uncertainty?

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WITNESS GOODYEAR: Yes.

MR. TROSTEN: All right. Now, on page 12-40, you say the discharge concentration -- returning now to this sentence we were looking at several -- a while ago, the discharge concentration of residual chloxine from Unit No. 1 has at times exceeded half a part per million. At what time was this measurement performed, do you know?

24

25

WITNESS GOODYEAR: Not off hand. I have a little note beside this sentence, as a matter of fact.

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MR. TROSTEN: Okay.

2

WITNESS GOODYEAR: I will have to check. I think

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I know but I would rather not say.

4

MR. TROSTEN: Do you know whether the procedure

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used was the same then as it is now and what the --

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WITNESS GOODYEAR: I think not.

7

MR. TROSTEN: Do you know what the analytical

8

method was that was used?

9

WITNESS GOODYEAR: Not right off hand.

10

MR. TROSTEN: And both of these could affect

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the validity of the determination, isn't that correct?

12

WITNESS GOODYEAR: Yes.

13

MR. TROSTEN: Now, on Appendix V-21, subheading

14

D.7, with respect to the phrase, ammonia levels in the Hudson

15

River have been measured up to half a part per million --

16

do you see that in the next to the last paragraph, page A-5-21?

17

You say, "Since ammonia levels in the Hudson have been

18

measured up to half a part per million, chloramine

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concentration in the discharge water may be relatively high."

20

Do you see that?

21

WITNESS GOODYEAR: Yes.

22

MR. TROSTEN: At what time was this performed?

23

WITNESS GOODYEAR: The ammonia concentration?

24

MR. TROSTEN: Yes.

25

WITNESS GOODYEAR: I am not certain. It has been

eak41 published on a couple of occasions with more than one  
2 determination in the river.

3 MR. TROSTEN: Do you know how high measurements  
4 were reported of ammonia?

5 WITNESS GOODYEAR: No, I do not.

6 MR. TROSTEN: <sup>the</sup> Since the formation rate of  
7 chloramines is very dependent on pH, isn't that correct?

8 WITNESS GOODYEAR: Yes.

9 MR. TROSTEN: Do you know what pH levels  
10 accompanied these high ammonia values?

11 WITNESS GOODYEAR: Not specifically, no.

12 MR. TROSTEN: Mr. Chairman, I have no further  
13 questions on the matter of chemical  
14 discharges. I would like to turn to another topic.

15 CHAIRMAN JENSCH: Is this a convenient place to  
16 recess?

17 MR. TROSTEN: Yes, it is.

18 CHAIRMAN JENSCH: Very well.

19 Does the Staff desire to review any matters during  
20 the noontime break? Would you like a little longer time for a  
21 recess, Staff counsel?

22 MR. KARMAN: I think that we have several items  
23 which we indicated we would look at during a recess but hope-  
24 fully we can have some answered by the time we get back  
25 after the luncheon recess.

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CHAIRMAN JENSCH: What time do you suggest for  
the recess?

MR. KARMAN: 2:30.

CHAIRMAN JENSCH: At this time, let's recess to  
reconvene in this room this afternoon at 2:30.

(Whereupon, at 12:05 p.m., the hearing was  
recessed, to reconvene at 2:30 p.m., this same day.)

AFTERNOON SESSION

(2:30 p.m.)

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3 CHAIRMAN JENSCH: Please come to order. The  
4 witnesses have resumed the stand. Applicant ready to proceed?  
5 Would you proceed, please?

6 MR. TROSTEN: Yes, I will, Mr. Chairman.

7 There were several open questions left over from  
8 this morning's session. Perhaps we could just wrap those  
9 up, Dr. Goodyear, and proceed to the next subject.

10 Do you remember the first one?

11 WITNESS GOODYEAR: Would you repeat for me?

12 MR. TROSTEN: Yes. You were going to check table  
13 5-5 which appears on page 5-20 and you were going to let me  
14 know if all of those upper critical temperatures -- I am  
15 sorry. If the results of the experiments indicated that  
16 there was no problem with the fish or the organisms being  
17 exposed to those upper critical temperatures. You made an  
18 observation about what the result of the first test indicated  
19 and I believe the result was there was no problem. You were  
20 going to check all of these data and let me know what the  
21 results were.

22 WITNESS GOODYEAR: The --

23 MR. TROSTEN: I am not really sure what this  
24 table is supposed to prove. Perhaps you could just tell  
25 me quickly and then we could move on.

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1 WITNESS GOODYEAR: Well, it is not supposed to prove  
2 anything. It was provided to indicate the type of information  
3 that is available and also the type of information that is  
4 available for Indian Point, species at Indian Point.

5 MR. TROSTEN: Let me -- perhaps if I asked you this  
6 question, it would resolve all our concern and we could move  
7 right on. Do you agree, Dr. Goodyear, that table 5-5 does not  
8 demonstrate that during periods when ambient temperatures are  
9 about 80 degrees Fahrenheit, many of the organisms listed in  
10 that table are living near their upper limits and probably  
11 above their thermal range of metabolic activity, metabolic  
12 insensitivity?

13 WITNESS GOODYEAR: There are some species in the list  
14 which would be apparently near their -- or at least above their  
15 upper -- or their range of metabolic insensitivity.

16 For instance, *neomysis americana* --

17 MR. TROSTEN: Now, is that a Hudson River -- you  
18 have *neomysis mercedes*, that is a -- not a Hudson River  
19 species. *Neomysis americana* is, is that right?

20 WITNESS GOODYEAR: I believe that is correct.  
21 Both were at one time or another supplies as Hudson River  
22 form. I believe *neomysis americana* is the one that is  
23 currently present. That is the only -- that is the principal  
24 species on this list which would be above the range of insensi-  
25 tivity.

3mil

1 MR. TROSTEN: All right, now --

2 WITNESS GOODYEAR: Again this list is just provided  
3 to show the general range that these things -- general range  
4 of upper critical temperatures and each -- the degree of  
5 certainty for any one example would be very limited.

6 MR. TROSTEN: All right. And it is the -- the list  
7 is not intended to show that when the ambient temperatures  
8 is 80 degrees at Indian Point that these organisms would be  
9 exposed in the plume to temperatures that were above their  
10 upper critical limits, is it? It is not intended to show  
11 that?

12 WITNESS GOODYEAR: No.

13 MR. TROSTEN: Okay, fine. Thank you.

14 Now there was a question that I asked you on page  
15 -- relative to page 5-14. You were going to check for me and  
16 let me know which organisms were the subject of the study in  
17 Table 5-3. Have you had an opportunity to do that?

18 WITNESS GOODYEAR: I thought we had discussed that.

19 MR. TROSTEN: I am sorry. That was the one we were  
20 going to look at ourselves. I beg your pardon.

21 All right. Am I correct that the minimum toxic  
22 level for boron of 10 parts per million is not consistent  
23 with what appears in the appendix, Dr. Goodyear?

24 WITNESS GOODYEAR: Now that you mention it...

25 MR. KARMAN: What page of the appendix are you

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1 referring to, Mr. Trosten, please?

2 WITNESS GOODYEAR: It is A-V-20.

3 MR. TROSTEN: Perhaps Dr. Coutant could look at  
4 that while I ask you another question. Would that be all  
5 right?

6 Have you -- the other question that I asked you was  
7 which of the data points which appear in Figure 5-1 refer to  
8 organisms found in the Hudson River. Are you able to tell me  
9 about that?

10 WITNESS GOODYEAR: Actually I had forgotten about  
11 that one.

12 MR. TROSTEN: If we make a note of that, perhaps  
13 you could just quickly give us that information tomorrow  
14 morning. I don't want to take up the Board's time.

15 WITNESS COUTANT: We did a rough check and it is  
16 approximately half of the species in that list correspond  
17 to the species list as given in the appendix.

18 MR. TROSTEN: All right. We will let that pass  
19 for the time being. Do you know where the data points from  
20 bioassays in the Hudson River -- organisms in Hudson River  
21 water would appear on this chart? Are you able to tell us  
22 that if you were to plot those on this chart?

23 WITNESS COUTANT: As we mentioned earlier that  
24 really isn't possible because the concentrations given in the  
25 testimony provided to us --



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MR. TROSTEN: You had difficulty finding that?

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WITNESS COUTANT: Yes.

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Go ahead.

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1 MR. TROSTEN: All right. Now there was just one  
2 other open question which I think we can resolve now. That  
3 is I asked you whether it was true that Unit No. 1 discharge  
4 concentration to the river has been monitored and shown to be  
5 usually less than one tenth part per <sup>million</sup> ~~million~~ or less. I  
6 referred you to Appendix D, page 226, Volume II of the  
7 Final Environmental Statement. Do you agree that is a correct  
8 statement?

9 WITNESS COUTANT: I think we are still trying to  
10 locate some information on the previous question. While  
11 Dr. Goodyear does that, though, there is one other question  
12 that was in the record that you didn't mention, and perhaps  
13 I can dispose of while he finishes, and that is the data  
14 points that were missing on Figure 5-1.

15 MR. TROSTEN: Yes.

16 WITNESS COUTANT: If someone will turn on the  
17 slide projector, I will point those out.

18 MR. TROSTEN: Thank you.

19 (Slide.)

20 WITNESS COUTANT: I believe I am correct in that  
21 the points that were left off were 13, 35, and 47.

22 MR. TROSTEN: Yes.

23 WITNESS COUTANT: Number 35 is the same as  
24 number 42.

25 (Indicating.)

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1 Point 47 is off the scale slightly. It is about  
2 where the zero is.

3 (Indicating.)

4 And point 13 I wasn't able to find the exact  
5 time in the papers, but it was a chronic study, and I am  
6 assuming that it follows approximately there, although it  
7 could easily well have been anywhere along this line in  
8 this general area.

9 (Indicating.)

10 MR. TROSTEN: You are indicating a line -- could  
11 you indicate for the record?

12 WITNESS COUTANT: It is approximately the same  
13 horizontal level as point 11, and exactly where along the  
14 line or time scale, I am not sure.

15 MR. TROSTEN: Have you had an opportunity to  
16 locate that language, Dr. Goodyear, on Appendix V-26?

17 WITNESS GOODYEAR: Would you repeat that again,  
18 please?

19 MR. TROSTEN: Yes. My question is: Isn't it  
20 correct that Unit No. 1 discharge concentrations to the  
21 river have been monitored and shown to be one tenth part  
22 per million or less?

23 MR. KARMAN: Mr. Trosten, did you ask this this  
24 morning? I don't recall that question or anything to do  
25 with volume II of the Final Environmental Statement.

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1 MR. TROSTEN: I did not refer to it as Volume II.  
2 I referred to it at that time as the appendix called  
3 Chlorination at Indian Point. It is reproduced in Volume II,  
4 Mr. Karman. I just wanted to give it to Dr. Goodyear so  
5 he could look at it.

6 WITNESS GOODYEAR: That is what is in Appendix D,  
7 yes.

8 MR. TROSTEN: Does that not indicate that discharge  
9 concentrations have actually been measured in 1968,  
10 during chlorination, and that they showed that discharge  
11 concentrations are usually one tenth part per million or  
12 less?

13 WITNESS GOODYEAR: Yes.

14 MR. TROSTEN: All right. I am prepared to -- yes.  
15 I am sorry.

16 You were going to consider, Dr. Goodyear, the  
17 statement on page iii, paragraph one, that chlorination  
18 may result in up to half a part per million of residual  
19 chloramine, and you were going to consider that in terms  
20 of the satisfaction of nonammonia chlorine <sup>demand</sup> ~~se-~~ man, the  
21 effects of dilution by Unit No. 1, and the destruction of  
22 chlorine by sunlight, and let us know whether your conclusion  
23 or the conclusion of the Staff as expressed in that language  
24 I read ought to be modified.

25 WITNESS GOODYEAR: That conclusion that's in

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1 that paragraph reflects the legal discharge limit.

2 MR. TROSTEN: It reflects the legal discharge  
3 limit and not the concentrations that are expected to be  
4 there, is that correct?

5 WITNESS GOODYEAR: That is correct, yes.

6 MR. TROSTEN: All right. Thank you.

7 All right. I'd like to turn now to the subject  
8 of the likelihood of entrainment of eggs and larvae, Dr.  
9 Goodyear, and I am going to refer you now to page 5-22. For  
10 your benefit, I would like to say that what I would like to  
11 explore with you now is the data <sup>base</sup> in general, and some  
12 specific questions about the data base which is used in  
13 the Staff's entrainment model. That's the general purpose  
14 of my <sup>questioning</sup> ~~question~~.

15 Now on page 5-22, when you say, and I am going  
16 to quote you, "For passive or nearly passive organisms  
<sup>consumption</sup>  
17 ~~consumer~~ rates are similar in magnitude to the rate at which  
18 water is used."

19 You see where that quotation appears?

20 WITNESS GOODYEAR: Yes.

21 MR. TROSTEN: You are not implying that all or  
22 most organisms in the river which are physically small enough  
23 to be entrained are passive or nearly passive, are you?

24 WITNESS GOODYEAR: No.

25 MR. TROSTEN: In other words, this generalization

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1 won't apply to them?

2 WITNESS GOODYEAR: To many species, yes.

3 MR. TROSTEN: For example, an organism that  
4 tended to be on the bottom most of the time would not be  
5 subject to this generalization?

6 WITNESS GOODYEAR: This is true.

7 MR. TROSTEN: Or an organism that preferred a  
8 particular portion of the river?

9 WITNESS GOODYEAR: Also true.

10 MR. TROSTEN: Or one which tended to be located,  
11 say, in the center of the river?

12 WITNESS GOODYEAR: Also true.

13 MR. TROSTEN: All right. Now on page 5-26,  
14 when you refer to your estimate of the monthly average  
15 probability of randomly distributed organisms moving down-  
16 stream being entrained, you aren't saying that all organisms  
17 in the river which are physically small enough to be entrained  
18 are necessarily randomly distributed, are you?

19 WITNESS GOODYEAR: No.

20 MR. TROSTEN: Or that all of them in the river  
21 are necessarily moving downstream?

22 WITNESS GOODYEAR: No.

23 MR. TROSTEN: Now with respect to page 5-39, are  
24 the life cycles of the species mentioned in the last paragraph  
25 on this page significantly different than the life cycle of  
the striped bass? Do you want to take a look at that page?

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MR. KARMAN: Striped bass is mentioned in that list.

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Mr. Trosten.

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MR. TROSTEN: Yes. The other species besides

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striped bass.

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WITNESS GOODYEAR: All of them -- well the answer

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is that the striped bass has a very particular lifestyle.

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MR. TROSTEN: And so the other species <sup>or</sup> of life

8

cycles of lifestyles which are different or may be different

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than the striped bass?

10

WITNESS GOODYEAR: Yes.

11

MR. TROSTEN: Fine. Now, if this is so, could there

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be significantly -- could there be significant behavioral

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differences or life history aspects of these different

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species which could influence their location in the river?

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WITNESS GOODYEAR: Yes.

16

MR. TROSTEN: The time that they spawn?

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WITNESS GOODYEAR: Yes.

18

MR. TROSTEN: Their migrations?

19

WITNESS GOODYEAR: Yes.

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MR. TROSTEN: Their favorite locations in the river?

21

WITNESS GOODYEAR: Yes.

22

MR. TROSTEN: Their feeding habits?

23

WITNESS GOODYEAR: Certainly.

24

MR. TROSTEN: And their population sizes?

25

WITNESS GOODYEAR: Yes.

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2 MR. TROSTEN: Now, could the susceptibility of  
3 these species to entrainment mortality be different than for  
4 the striped bass?

5 WITNESS GOODYEAR: Yes.

6 MR. TROSTEN: Therefore, could there be very  
7 major differences in the impact of entrainment on the  
8 populations of any of these species as compared with the  
9 striped bass?

10 WITNESS GOODYEAR: Yes.

11 MR. TROSTEN: And could there be very different --  
12 could there be major differences in the impact of entrainment  
13 on the individual members who are being entrained as compared  
14 with the striped bass?

15 WITNESS GOODYEAR: Yes.

16 MR. TROSTEN: All right. Now, on page 5-30,  
17 paragraph C-1 --

18 CHAIRMAN JENSCH: C-1?

19 MR. TROSTEN: I seem to have the wrong page number  
20 here.

21 I am sorry. 5-39, I beg your pardon, 5-39,  
22 paragraph C-1, where you say, "Recruitment rates may be lowered."  
23 You see that in the last sentence on the --

24 WITNESS GOODYEAR: Yes.

25 MR. TROSTEN: Are you saying that the antithesis may  
also be true, in other words, that the recruitment rates  
may not be lowered?



1 WITNESS GOODYEAR: No.

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2 MR. TROSTEN: Let me just ask you the question  
3 about the meaning of the sentence. If you say that something  
4 may happen, is that the same thing as saying it may not  
5 happen?

6 WITNESS GOODYEAR: I think the key is in the degree  
7 to which --

8 MR. TROSTEN: Let me just ask you the -- just  
9 the basic question. When you say something may happen, does  
10 that also mean it may not happen?

11 WITNESS GOODYEAR: Yes.

12 MR. TROSTEN: Does that not mean, therefore, that  
13 when you say, "Recruitment rates and standing crops of  
14 several species may be appreciably lowered," et cetera, that  
15 you can also read that sentence to read, "Recruitment rates  
16 and standing crops of several species may not be appreciably  
17 lowered?"

18 WITNESS GOODYEAR: Yes.

19 MR. TROSTEN: Thank you.

20 Now, what data do you need in your opinion, Dr.  
21 Goodyear, to remove most of the uncertainty from the  
22 speculation which is reflected in that sentence? Would you  
23 look at that sentence and reflect on it and tell me what are  
24 the data that you think that you need to remove from your  
25 mind the uncertainty which is reflected in that sentence?

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WITNESS GOODYEAR: Basically, one would need to have accurate information about the size of the spawning population, about limiting factors or those factors which limit the population size, growth, and the fecundity of the population. You also need to know spawning locations and the lifestyle in the early stages.

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MR. TROSTEN: Would the reporter read that back.

8  
(The reporter read the record as requested.)

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MR. TROSTEN: In your judgment, this is a summation of the information that you would need, is that correct?

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WITNESS GOODYEAR: It is an outline.

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MR. TROSTEN: Outline of it, yes.

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WITNESS GOODYEAR: Yes.

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MR. TROSTEN: In your opinion, Dr. Goodyear, would it be possible to obtain such information?

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WITNESS GOODYEAR: It would certainly be possible to do so. It would take a great deal of time and study to do it.

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MR. TROSTEN: How long do you think it would take to do that, Dr. Goodyear?

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WITNESS GOODYEAR: Probably ten years or so, depends on how much information can be gleaned from previous reports.

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For some species such as the American shad, it wouldn't take so much time.

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MR. TROSTEN: Now, there is a considerable amount

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of information on the striped bass, isn't that correct?

WITNESS GOODYEAR: This is true.

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1 MR. TROSTEN: So that if you were comparing  
2 different species about which you wanted to gain information,  
3 comparing one anadromous species versus -- the shad is  
4 anadromous, isn't it?

5 WITNESS GOODYEAR: Yes.

6 MR. TROSTEN: Comparing one species against  
7 another, you would probably have a better go at it with the  
8 striped bass, wouldn't you, than you would with most other  
9 fishes, probably?

10 WITNESS GOODYEAR: To compare the other species to  
11 the striped bass?

12 MR. TROSTEN: To gain this sort of information,  
13 considering the relative amount of time it would take to  
14 get this sort of information on the striped bass versus  
15 some other species, you would probably have a better --  
16 be able to get it relatively more quickly for the striped  
17 bass, don't you think, than for some other species?

18 MR. MACBETH: Could I have a clarification? It  
19 is my understanding the striped bass have not been included  
20 in the list up to this point. The last answers Dr. Goodyear  
21 gave do not apply to the striped bass. I may have misunder-  
22 stood that. I would like to be clear about it.

23 MR. TROSTEN: I am glad you raise that. I should  
24 clear it up. I was interpreting Dr. Goodyear's remark to include  
25 the striped bass. Were you including the striped bass in

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1 those remarks?

2 WITNESS GOODYEAR: If you were starting from  
3 scratch in trying to glean all of the information that's  
4 available now, you would be in the same situation.

5 MR. TROSTEN: Well, were you including the  
6 striped bass in this discussion that we have had up to now  
7 about the factors that you would need to know in order to  
8 remove the uncertainty in the second sentence in C?

9 WITNESS GOODYEAR: The factors are the same.  
10 The time period for estimating is completely different.

11 MR. TROSTEN: Right. But were you talking about  
12 the striped bass when you answered my question about what  
13 information you would need to have in order to remove the  
14 uncertainty that's reflected in that second sentence in C?

15 WITNESS GOODYEAR: Yes.

16 MR. TROSTEN: All right. Does that clarify the  
17 matter, Mr. Macbeth?

18 MR. MACBETH: Up to a point. It is unclear to  
19 me whether Dr. Goodyear was also saying that it would take  
20 10 years with present data to have that state of knowledge  
21 about the striped bass.

22 MR. TROSTEN: We will get to that. I just wanted  
23 to be sure we were all talking about the same thing.

24 We are talking now about the striped bass at  
25 this point in time.

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1 WITNESS GOODYEAR: Fine.

2 MR. TROSTEN: Now I asked you how much time you  
3 thought it would take to gain the information that would  
4 be needed to remove the uncertainty reflected in that  
5 sentence. Now I am talking specifically about the striped  
6 bass. Am I correct in interpreting your previous remarks  
7 to mean that you think it would take 10 years to get this  
8 information on the striped bass?

9 WITNESS GOODYEAR: It would take 10 years to  
10 get this information on all of the species that are listed.

11 MR. TROSTEN: On all of the species that are  
12 listed? I see. I am sorry. I didn't understand your  
13 previous remark.

14 Well, how long do you think it would take to get  
15 this information on the striped bass?

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2 WITNESS GOODYEAR: Most of the information is  
3 already known for the striped bass. If not all. The --  
4 there are very few points of uncertainty left.

5 MR. TROSTEN: About the striped bass?

6 WITNESS GOODYEAR: In regard to the factors we  
7 discussed a few minutes ago, yes.

8 MR. TROSTEN: I missed the last thing you said,  
9 Dr. Goodyear.

10 WITNESS GOODYEAR: In regard to those factors  
11 which control the population which you need to know to deter-  
12 mine whether or not you could expect an appreciable reduction  
13 in recruitment.

14 MR. TROSTEN: Is it your theory, then, that these  
15 various factors that you indicated would have to be known  
16 in order to remove the uncertainty from that sentence or known  
17 about the striped bass at the present time now?

18 WITNESS GOODYEAR: There's very good information  
19 on the striped bass.

20 MR. TROSTEN: All right. Would you give me some  
21 references, one or more references that would indicate to me  
22 where I could find the answers to the general questions that  
23 you listed in your previous statement when you listed the  
24 factors that would have to be investigated?

25 WITNESS GOODYEAR: Would you like to have them?

MR. TROSTEN: I'd like to have you give me the list

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1 of them.

2 (Witnesses conferring.)

3 WITNESS GOODYEAR: I'll be glad to do it, but it  
4 will require digging around a little bit.

5 MR. TROSTEN: All right. I would be very interested  
6 in having such a list. While you are -- of course, I am not  
7 asking for it now, but I ask you to think about it and let  
8 me know whether you can give me a list that provides the  
9 answers to all of the questions that you listed as being  
10 necessary to be answered with regard to that sentence, second  
11 sentence in C.

12 Just for openers, let me ask you one or two  
13 questions about the data that we have on the striped bass.  
14 Do we have 10 years of information on the striped bass in the  
15 Hudson River, as far as their fecundity is concerned?

16 WITNESS GOODYEAR: Fecundity information --  
17 for striped bass in general, fecundity per female hasn't  
18 changed significantly over a very long span of time. This  
19 information has been around much more than 10 years.

20 MR. TROSTEN: How about the growth rate of striped  
21 bass, Dr. Goodyear?

22 WITNESS GOODYEAR: Would you make your question a  
23 little more specific?

24 MR. TROSTEN: Do we have 10 years of information  
25 collected in the Hudson River about the growth rate of striped



3mil

1 bass?

2 WITNESS GOODYEAR: There is data spanning -- the  
3 answer is yes, but it must be qualified in that it is not  
4 continuous records.

5 MR. TROSTEN: Where are these data contained, Dr.  
6 Goodyear, that contain 10 years of growth data on striped  
7 bass in the Hudson River?

8 (Witnesses conferring.)

9 WITNESS GOODYEAR: I think there needs to be a  
10 clarification here. When you say 10 years of data, I say not  
11 that it has to be continuous for 12 years, but it would take  
12 something on the order of 10 years to accumulate it.

13 MR. TROSTEN: Well, I don't understand, really,  
14 what 10 years of data really means. Are you saying 10 years  
15 of -- a period spanning 10 years or what do you mean by 10  
16 years of data?

17 WITNESS GOODYEAR: The original question was how  
18 long would it take to accumulate the information for that list?

19 MR. TROSTEN: Yes.

20 WITNESS GOODYEAR: And there's an educated guess,  
21 if you would, 10 years would probably be from my point of  
22 view, probably 10 years' worth of work to get it.

23 MR. TROSTEN: What kind of work did you have in  
24 mind? Did you have 10 years of field work or did you have  
25 in mind 10 years of study of existing literature or what did

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1 you mean?

2 WITNESS GOODYEAR: If you remember, I also  
3 qualified it by saying that the amount of time could be reduced  
4 if sufficient information is available in the literature.

5 MR. TROSTEN: Yes.

6 WITNESS GOODYEAR: So if you were to  
7 start to do the field work and analysis now on it -- on a --  
8 with no data base to work from, for all those species, it  
9 would probably take about 10 years. Some of them, I don't know  
10 how much background information there is.

11 MR. TROSTEN: All right. Let's go back and talk  
12 about the striped bass specifically, then, and given the fact  
13 that the striped bass is probably the best known, the most stud-  
14 ied fish in the Hudson River, would you tell me how long would  
15 it take to gather the information, including the information  
16 that isn't already available, in order to remove the uncertainty  
17 that is contained in -- that is reflected in the second  
18 sentence in C on page 5-39?

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WITNESS GOODYEAR: Again, I would say that most of the data is already available.

MR. TROSTEN: All right. Then I guess I will go back to the answer that you gave to me when I asked you what we had to know in order to respond to that question and as I <sup>recall</sup> ~~said~~, you said we would have to know the size of the spawning populations, we would have to know limiting factors, factors which limit populationsize and factors which limit growth, factors which limit fecundity. We have to know the spawning location and we have to know the lifestyle of the bass in the early stages, is that correct?

WITNESS GOODYEAR: That is correct.

MR. TROSTEN: And are you telling me now that we already have most of the information which is necessary to tell us the answers or to fully describe those things?

WITNESS GOODYEAR: That is correct.

MR. TROSTEN: All right. Let's explore your conclusion then as we go along, that probably would be the best way to do this, Dr. Goodyear.

All right. Would you turn to page A-5-52, Dr. Goodyear?

Do you see the statement that most adult striped bass spawn upstream from Indain Point, in the first sentence on the page?

WITNESS GOODYEAR: Yes.

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MR. TROSTEN: Would you tell me what the data base is for that statement?

WITNESS GOODYEAR: There are three sets of longitudinal estimates, the 1967 Hudson River Fisheries investigation data, 1966 Hudson River Fisheries investigation data, and the <sup>Rathyn</sup> ~~Ratcher~~ and Miller data from 1954 and '55. Rathen Corporation data also indicate that this is true and I do not know of any data that would indicate otherwise.

MR. TROSTEN: Now, the striped bass have been known to spawn both above and below Indian Point, isn't that correct?

WITNESS GOODYEAR: Yes.

MR. TROSTEN: Does the striped bass spawning depend on temperature?

WITNESS GOODYEAR: Yes.

MR. TROSTEN: Does it depend on salinity?

WITNESS GOODYEAR: Yes.

MR. TROSTEN: Does it depend on river flow?

WITNESS GOODYEAR: Velocity, you mean?

MR. TROSTEN: Flow of fresh water in the river and velocity, yes.

WITNESS GOODYEAR: Both of those play a factor, yes.

MR. TROSTEN: Does this mean that in any particular year, the striped bass spawning could take place in a different location?

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1 WITNESS GOODYEAR: Within certain bounds, yes.

2 MR. TROSTEN: Does it mean, for example, that it  
3 could take place in a particular year below Indian Point?

4 WITNESS GOODYEAR: A portion of it, yes.

5 MR. TROSTEN: Does it mean that all of it could  
6 take place below Indian Point if certain conditions were correct?

7 WITNESS GOODYEAR: Yes.

8 MR. TROSTEN: Is this an example of a situation  
9 where if you had more data, it would enable -- more than  
10 the 1967, 1966, and 1954-'55 data that it would help you

11 to form a better judgment whether the statement, "most  
12 spawning takes place  
13 spawning upstream from Indian Point," is accurate?

14 WITNESS GOODYEAR: Could you repeat that, please?

15 MR. TROSTEN: If you have more data than  
16 the data you describe to me in response to my previous question

17 would it help you to form a better judgment whether your  
18 statement that most spawning occurs  
19 upstream from Indian Point is  
20 correct?

21 WITNESS GOODYEAR: I don't think so.

22 MR. TROSTEN: You don't think that you would be  
23 able to better judge if you had more data?

24 WITNESS GOODYEAR: I don't think it would  
25 change the conclusion.

MR. TROSTEN: I didn't ask you that. I asked  
you if it would help you to form a better judgment as to  
whether that conclusion was correct?

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WITNESS GOODYEAR: And I must ask you what ---

2

as far as I am concerned, the data is very clear cut.

3

MR. TROSTEN: No. I am not asking you that, Dr.

4

Goodyear. I am asking you whether <sup>it</sup> you had more data, it would

5

help you to form a better judgment. I am not asking you

6

whether you think that the additional data would confirm

7

what you already believe.

8

WITNESS GOODYEAR: I am a little confused about what

9

you mean by better judgment?

10

MR. TROSTEN: Well, if you had an additional

11

five years of data concerning the location of spawning and

12

the correlation of this spawning to the factors that I mentioned

13

or any other factors that are relevant here, would it help

14

you to form a more sophisticated and perhaps ~~a judgment~~ <sup>a better judgment</sup> that

15

you had more confidence in concerning the location of the

16

spawning of the striped bass in the Hudson River?

17

WITNESS GOODYEAR: I could get more detailed

18

description from one detailed study, yes. But the basic

19

conclusions are not violated in any other

20

river system that I know of.

21

MR. TROSTEN: Well, are you saying that the data

22

are immutable and there is nothing you can imagine that

23

would change your conclusion, is that what you are saying?

24

I shouldn't say that the data are immutable but

25

that your conclusions are immutable.

(Witnesses conferring.)

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MR. KARMAN: Dr. Goodyear, are you sure you  
understand the question?

4  
WITNESS GOODYEAR: No, I am not.

5  
MR. KARMAN: Well, let's get that straightened out.

6  
MR. TROSTEN: I am asking you if you had several  
7  
more years of data collected concerning the spawning of  
8  
striped bass in the Hudson River, would it help you to form  
9  
a better judgment as to the location, a more accurate  
10  
judgment as to the <sup>location</sup> ~~location~~ of the spawning of the striped  
11  
bass in the Hudson River? Is that clear? I don't --

12  
WITNESS GOODYEAR: I think so, yes.

13  
CHAIRMAN JENSCH: Would this be more data on  
14  
the location or more data on temperature? What kind of  
15  
data do you think would affect the judgment?

16  
MR. TROSTEN: More data on the location of the  
17  
spawning correlated with temperature, salinity, river flow  
18  
conditions, and other matters, Mr. Chairman, that are  
19  
normally considered to be pertinent to the location of the  
20  
striped bass spawning.

21  
CHAIRMAN JENSCH: Thank you.

22  
MR. TROSTEN: I guess I don't understand what  
23  
the problem with my question is, Dr. Goodyear.

24  
MR. KARMAN: Maybe I can help. I think what Mr.  
25  
Trosten is trying to get at, unless I am wrong, is that this

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1 additional information which may be gleaned as a result  
2 of the study of these various factors, could this be an  
3 additional help in analyzing? Could this be some type of  
4 valuable information which may or may not be useful at the  
5 analysis of such information, this question of helping or --  
6 but it can't hurt, this type of thing. I think this is what  
7 he's driving at.

8 MR. TROSTEN: I am not asking you to tell me,  
9 Dr. Goodyear, that if you had more information you necessarily  
10 would change your conclusion. If you are concerned about  
11 that, that's not the thrust of my question.

12 WITNESS GOODYEAR: What I said a minute ago,  
13 at least I thought I did, was that it would aid in the  
14 refinement or description of what goes on in the Hudson.

15 MR. TROSTEN: All right. Let's go on from there.  
16 Has any study at a power plant site demonstrated that a  
17 greater proportion of the annual production of fertilized  
18 eggs occurs in the vicinity of the plant?

19 WITNESS GOODYEAR: A greater proportion than  
20 what?

21 MR. TROSTEN: Than the normal proportion.

22 WITNESS GOODYEAR: Not to my knowledge.

23 MR. TROSTEN: All right. If that's the case, would  
24 you tell me, please, why you have concluded, on page 5-40,  
25 that because of this relationship between temperature and



ar3

1 spawning location, the discharge of heated water by  
2 the Indian Point Units can be expected to result in a greater  
3 proportion of the annual production of fertilized eggs  
4 occurring in the vicinity of the plant, although the extent  
5 of this would vary from year to year, depending upon the  
6 salinity of the water at Indian Point. I am reading from  
7 page 5-40.

8 WITNESS GOODYEAR: I am sorry.

9 WITNESS SIMAN-TOV: When you refer to a page,  
10 please wait a moment until we can find the page.

11 MR. TROSTEN: I am sorry. Excuse me. I beg  
12 your pardon.

13 WITNESS GOODYEAR: I am not sure what the question  
14 really was.

15 MR. TROSTEN: My question was first, had any study  
16 of a power plant site demonstrated that a greater proportion  
17 of the annual production of fertilized eggs occurs in the  
18 vicinity of the plant and you said no, you were not aware  
19 of any such study.

20 Then I asked you could you tell me why you say,  
21 or more specifically what is the basis for your statement  
22 that I just read to you on page 5-40.

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1 WITNESS GOODYEAR: Simply because the trigger for  
2 spawning activity is temperature and -- actually there are  
3 two things. The trigger for the spawning is the temperature  
4 above -- generally above 58 degrees. The degree to which --  
5 the spawning -- the spawning activity increases sharply around  
6 60 degrees, 60, 62 degrees, both on the -- well, in several  
7 different places, including the Senasqua system and a  
8 couple of others I can't think of right now. The distribution  
9 of spawning in the river system has been shown to be related  
10 to the -- both the position of the salt front which is  
11 regulated by the outflow and by the temperature. When the  
12 temperature reaches this sort of a magical 60 degree level,  
13 the fish begin to spawn and they spawn very markedly just  
14 above the salt front.

15 If the temperature rise is delayed, they move further  
16 upstream so that the spawning activity is distributed over a  
17 longer portion of the spawning grounds.

18 If you add a significant amount of heat and if  
19 you -- for instance, can raise the local temperature by just  
20 a couple of degrees, you can in fact provide a stimulus for  
21 spawning activity to occur.

22 MR. TROSTEN: Now that last point is purely your  
23 hypothesis, is that correct? You are not saying that there  
24 is any data that demonstrates that this will occur, is that  
25 correct? You say that you can provide a stimulus?

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1 (Witnesses conferring.)

2 WITNESS GOODYEAR: The striped bass are known to --  
3 well, in the Patuxent, the Chalk Point plant, the fish  
4 actually are inhibited in their upstream migration by the  
5 plume, if you would There is no good data or any data at all.  
6 to show that they are actually spawning.

7 You mentioned a --

8 MR. TROSTEN: I asked you --

9 CHAIRMAN JENSCH: Let him finish. Let him finish.

10 Go ahead.

11 WITNESS GOODYEAR: The hypothetical situation,  
12 as long as you are looking at the things which trigger cues --

13 MR. TROSTEN: What was that?

14 WITNESS GOODYEAR: It is a cue for a particular  
15 behaviorial manifestation. As you manipulate cues, you can  
16 manipulate the behavior of the animals. This is especially  
17 true for fish and there is quite a lot of data to indicate  
18 that the temperature rise regulates the initiation of spawning  
19 activity.

20 MR. TROSTEN: Are you finished, Dr. Goodyear?

21 In other words, what you are saying is that your  
22 theory that a greater proportion could occur is based simply  
23 on the fact that there is a demonstrated relationship  
24 between temperature rise and spawning, is that correct?  
25 That is the basis --

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1 WITNESS GOODYEAR: That is basically the point.

2 MR. TROSTEN: That is the theory, is that correct?  
3 There isn't any other basis for it? It is the theory that  
4 you have just enunciated in the last minute or two?

5 WITNESS GOODYEAR: Yes.

6 CHAIRMAN JENSCH: Is that your theory or is that  
7 a theory generally entertained by marine biologists?

8 WITNESS GOODYEAR: It seems -- it is a well-  
9 accepted concept. I mean it is not my own by any matter of  
10 means.

11 CHAIRMAN JENSCH: I inferred from the question that  
12 there was some implication in the question that it was something  
13 you cooked up. It is a well-recognized concept, is that  
14 correct?

15 WITNESS GOODYEAR: Yes. Published in several  
16 publications.

17 CHAIRMAN JENSCH: Excuse me for interrupting.  
18 Will you proceed, Applicant?

19 MR. TROSTEN: Are you suggesting that this particular  
20 theory that the power plant -- that a greater proportion of  
21 the annual production of eggs will occur in the vicinity of  
22 the plant is supported by -- and accepted by expert theory  
23 in a number of open publications?

24 WITNESS GOODYEAR: The relationship between  
25 temperature rise --

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1 MR. TROSTEN: No. I know that is well accepted,  
2 Dr. Goodyear. I wasn't saying that. I think there is a  
3 sharp distinction which I am trying to draw between the well  
4 accepted, well understood relationship between temperature  
5 rise and -- or temperature and spawning and the theory that  
6 a power plant, that the temperatures in a power plant are  
7 such that they are going to trigger spawning at that point  
8 in any significant degree because you are equating the two  
9 and I am suggesting that the two are not the same.

10 WITNESS GOODYEAR: I am sorry. I didn't mean  
11 to equate the two. That was not the intent.

12 CHAIRMAN JENSCH: May I interrupt? In other  
13 words, you are saying that any temperature rise, whether it  
14 comes from a -- any conduit or electricity or anything that  
15 gets heat into the water, whether it comes from the power  
16 plant effluent or whatever the cause, when there is a rise  
17 in temperature, it is going to increase the spawning, is that  
18 correct, no matter where it occurs?

19 WITNESS GOODYEAR: Within certain boundaries, yes.  
20 The temperature rise from say 57 to 65 degrees is very impor-  
21 tant. If an upstream migrating fish, striped bass, encounters  
22 temperatures in that range, they will spawn.

23 CHAIRMAN JENSCH: Whether it comes from the power  
24 plant or any other cause of heat?

25 WITNESS GOODYEAR: Right. Normally it comes from

5mil.

1 the solar radiation that is heating up at this time of the  
2 year.

3 CHAIRMAN JENSCH: Yes. I understood what the  
4 Applicant's counsel was trying to be sure that nothing from  
5 a power plant could do such a thing and you are saying no  
6 matter what this heat source is, it can happen, is that cor-  
7 rect?

8 WITNESS GOODVEAR: Yes.

9 CHAIRMAN JENSCH: Thank you. Please proceed.

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WITNESS GOODYEAR: Could we have a moment,  
please?

MR. TROSTEN: Yes.

(Witnesses conferring.)

WITNESS GOODYEAR: Okay.

MR. TROSTEN: Is there any evidence of such an  
event occurring at any power plant on the Hudson River,  
Dr. Goodyear?

WITNESS GOODYEAR: No. Not to my knowledge.

MR. TROSTEN: Are there factors which influence  
the location of spawning other than temperature, Dr. Goodyear?

WITNESS GOODYEAR: Yes.

MR. TROSTEN: Could you list some of these factors  
for me?

WITNESS GOODYEAR: Salinity is one, and water  
velocity is generally considered another. Those are the  
major -- of course, the time of the year, variety of weather  
are lesser factors.

MR. TROSTEN: What about bottom conditions, Dr.  
Goodyear?

MR. KARMAN: Is that a clear question as to bottom  
conditions?

WITNESS GOODYEAR: I understand the conditions.

MR. TROSTEN: The <sup>substrate</sup> ~~substrait~~ conditions, Dr.  
Goodyear, is what I was getting at.

1 WITNESS GOODYEAR: I understand the question.  
2 However, I am not certain of the answer.

3 MR. TROSTEN: You think it might, but you are not  
4 sure, <sup>it</sup> might or might not?

5 WITNESS GOODYEAR: I don't really have any  
6 opinion. I think the bottom conditions may be more strongly  
7 influenced by the water velocity than -- which is related  
8 to -- apparently related to spawning.

9 MR. TROSTEN: How about the possibility of  
10 behavioral characteristics of the fishes themselves? I  
11 was thinking specifically of a homing instinct.

12 WITNESS GOODYEAR: Well, this is certainly a  
13 factor.

14 MR. TROSTEN: You think that is a factor that  
15 could influence spawning location?

16 WITNESS GOODYEAR: Within the river -- within the --  
17 within the particular river system.

18 MR. TROSTEN: Yes. Within a particular river system.  
19 Now do you think that any of these factors that you have just  
20 enumerated might possibly override a -- any other factors  
21 such as temperature?

22 WITNESS GOODYEAR: Not -- there needs to be a  
23 combination of factors, not just a single one.

24 MR. TROSTEN: Do you think that any particular  
25 combination of these factors might override the fact that



1 there is a power plant located on the river which is  
2 adding a certain amount of heat to the river?

3 WITNESS GOODYEAR: Well, again the -- there is a  
4 requirement for several things for spawning. The lack of  
5 any one of them would inhibit spawning, including temperature.

6 MR. TROSTEN: Yes, I understand that, but I don't  
7 think you really responded to my question. I am asking you  
8 whether the combination of these factors occurring <sup>in a</sup> ~~in the~~  
9 particular way -- you agree that the combination of these  
10 factors will induce spawning probably in a particular location  
11 and the precise mix of these combinations is very difficult  
12 to predict. Is that correct?

13 WITNESS GOODYEAR: The -- I am not sure what you  
14 are -- the mix -- you have to have virtually all of the  
15 factors rather than a mixture. You can't -- you have to have  
16 a fresh water environment, and they have to have a temperature  
17 and also the spawning condition which occurs in the spring of  
18 the year.

19 MR. TROSTEN: All of these factors produce, Dr.  
20 Goodyear, a different result in different years, isn't that  
21 correct? They don't spawn, all of these <sup>fish</sup> at precisely the  
22 same temperature? There is a range over which they spawn?  
23 They don't spawn in the same location precisely? They don't  
24 spawn at precisely the same time? Peak densities are not the  
25 same at all times. In other words, there is a bunch of

1 factors that comes together and causes a certain  
2 situation in terms of spawning location and intensity that  
3 takes place each year, is that correct?

4 WITNESS GOODYEAR: Yes.

5 MR. TROSTEN: And could this combination of  
6 factors completely override the fact that a power plant  
7 was located on the river and adding a certain amount of heat?

8 WITNESS GOODYEAR: Under the appropriate conditions,  
9 any one of the factors could override it.

10 MR. TROSTEN: All right. Thank you very much.

11 CHAIRMAN JENSCH: I wonder if I can understand  
12 that question and answer. What combination of factors did  
13 you have in mind in your question that was overriding?

14 MR. TROSTEN: Well, the combination of factors that  
15 I had in mind, Mr. Chairman, would be factors such as the  
16 location of the salt front at a particular time of year, the  
17 fresh water flow which is certainly related to the location  
18 of the salt front, the temperature in the river at the  
19 particular time of year, and those were the principal  
20 *climatic* ~~climatic~~ and environmental factors that I had in mind.

21 CHAIRMAN JENSCH: How do those override the power  
22 plant?

23 Does it make any difference if the heat source  
24 is from the power plant or anywhere?

25 MR. TROSTEN: They could override in this way,

1 Mr. Chairman. For example, if the salt front were considerably  
2 north of Indian Point, and since spawning takes place a few  
3 miles upstream of the salt front, the fact that Indian  
4 Point was located where it is and is adding heat to the  
5 river would mean absolutely nothing in terms of the spawning.  
6 That's what I meant.

7 CHAIRMAN JENSCH: Very well. I understand. Thank  
8 you.

9 Will you proceed?

10 MR. TROSTEN: All right. Let's go on to another  
11 subject, Dr. Goodyear.

12 What proportion of the early growth stages of the  
13 striped bass is planktonic, according to Figure 5-5?

14 WITNESS GOODYEAR: Would you repeat that again?

15 MR. TROSTEN: Yes, I will. Can you tell me what  
16 proportion of the early growth stage of the striped bass is  
17 planktonic according to Figure 5-5?

18 CHAIRMAN JENSCH: Which is on V-42?

19 MR. TROSTEN: Which is on page V-42, yes.

20 WITNESS GOODYEAR: Directly from this graph you  
21 cannot interpret that particular information.

22 MR. TROSTEN: Thank you. Have striped bass larvae  
23 measuring less than one half inch been found in the shallow  
24 waters of the Hudson River?

25 WITNESS GOODYEAR: Certainly.

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MR. TROSTEN: Now in order to get to such locations, would they probably have to swim there?

WITNESS GOODYEAR: Not necessarily.

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MR. TROSTEN: Well, how else would they probably get there?

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WITNESS GOODYEAR: Just passing transport gets them there.

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7

MR. TROSTEN: Well, the striped bass, if they are spawned in moving water, they are spawned there, isn't that correct?

8

WITNESS GOODYEAR: This is true.

9

10

11

12

13

MR. TROSTEN: <sup>If a</sup> ~~if~~ striped bass were found which was less than one-half inch in length in shallow waters, isn't it ~~possible~~ that in order to get to those shallow waters, that the individual organism would have had to move himself to that point?

14

WITNESS GOODYEAR: Not necessarily.

15

16

17

MR. TROSTEN: In other words, it is possible that he might have been swept into that point by the current of the water?

18

WITNESS GOODYEAR: Yes.

19

20

21

MR. TROSTEN: Although it is perhaps unlikely that he would have gotten there by the current of the water?

22

23

24

25

WITNESS GOODYEAR: Not necessarily.

MR. TROSTEN: Do you agree with this statement, "The hatched striped bass larvae continue to drift with the currents and tides until they gain control over their own movement"?

2mil 1

CHAIRMAN JENSCH: Did the reporter hear that

2

all right?

3

THE REPORTER: Yes.

4

CHAIRMAN JENSCH: Thank you.

5

Would the reporter read that?

6

(The reporter read the pending question.)

7

WITNESS GOODYEAR: Yes.

8

MR. TROSTEN: When is a striped bass capable of

9

sustaining --

10

MR. KARMAN: Mr. Trosten, I wonder if you could

11

use the mike?

12

MR. TROSTEN: I am sorry.

13

When is a striped bass capable of sustained

14

swimming?

15

WITNESS GOODYEAR: For -- oh -- I think I would

16

like to be a little more specific. Sustained swimming in

17

terms of vertical movements could occur before the yolk sac

18

is absorbed, which is in 10 days.

19

MR. TROSTEN: Is there some other definition

20

that you had in mind?

21

WITNESS GOODYEAR: Well, if by sustained swimming

22

one would have reference to being able to maintain a position

23

in a current of water, this would occur at some time quite

24

a bit later.

25

MR. TROSTEN: Can you describe for us when such

3mil<sub>1</sub>

an organism would be capable of sustained swimming in the sense that you have just described it?

WITNESS GOODYEAR: This would have to be related to a specific set of criteria, if you would.

MR. TROSTEN: All right. Then what did you have in mind when you said on page A-2-22 that once the larvae reach a length of 0.5 inches, they appear capable of sustained swimming?

WITNESS GOODYEAR: What page was that on, please?

MR. TROSTEN: A-2-22, in the second paragraph. It is one, two, three, four, five, six, seven lines from the bottom of the second paragraph.

WITNESS GOODYEAR: This would be related to vertical -- sustained swimming -- capability of sustaining themselves in the vertical column of water.

MR. TROSTEN: This was something that you said a moment ago was what they could do when they were about 10 days old, is that right?

WITNESS GOODYEAR: From the time that the yolk sac is absorbed --

MR. TROSTEN: Excuse me. From the time the yolk sac is absorbed, 10 days after that, they are capable of sustaining -- they are capable of vertical movement, is that right? Is that what you said a moment ago?

WITNESS GOODYEAR: Not exactly. From -- the

4mil

1 larval striped bass are not capable of maintaining themselves  
2 in a water column for the first few days and are dependent  
3 primarily upon hydrological forces.

4 MR. TROSTEN: For the first few days after the  
5 eggs hatch?

6 WITNESS GOODYEAR: Yes, after the eggs hatch.

7 MR. TROSTEN: From one to three days, that is  
8 when the eggs hatch?

9 WITNESS GOODYEAR: Right.

10 MR. TROSTEN: And from the first few days after  
11 that when they are yolk sac larvae, you say they are incapable  
12 of maintaining their position in the water column, is that  
13 right?

14 WITNESS GOODYEAR: As the yolk sac is absorbed  
15 they develop the capacity for maintaining themselves in  
16 the water column.

17 MR. TROSTEN: I understand.

18 WITNESS GOODYEAR: And are fairly mobile by the  
19 time they are a half an inch in length. But they still  
20 cannot swim sufficiently fast to maintain themselves in it.  
21 For instance, one half foot per second tidal current.

22 MR. TROSTEN: One and a half foot per second?  
23 Yes, a current of that velocity.

24 WITNESS GOODYEAR: Yes.

25 MR. TROSTEN: But surely the phrase that appears



5mil 1 in your description of the striped bass, "once the larvae  
2 reach a length of 0.5 inches, they appear capable of  
3 sustained swimming," you weren't referring to being  
4 able to swim against the one and a half foot per second  
5 current at that time, were you?

6 WITNESS GOODYEAR: No.

7 MR. TROSTEN: What sort of sustained swimming  
8 were you talking about?

9 WITNESS GOODYEAR: Once the fish gets to that  
10 length, they are capable of, for instance the diurnal migration  
11 which proceed in the next sentence. The sustained swimming  
12 would be -- in the context as used here, sustained swimming  
13 would be related to their being able to maintain themselves  
14 away from any <sup>substrate</sup> ~~substrait~~, but not necessarily to regulate  
15 their position in the river.

16 MR. TROSTEN: Well, Dr. Goodyear, isn't it true  
17 that a yolk sac larvae is able to perform vertical diurnal  
18 migrations?

19 WITNESS GOODYEAR: Yes.  
20  
21  
22  
23  
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1 MR. TROSTEN: Now, isn't it true that a yolk sac  
2 larvae is not one-half inch in length? You know what I  
3 mean? I am not saying that there isn't any yolk sac  
4 larvaw, but --

5 WITNESS GOODYEAR: This is true. Again, I must point  
6 out that this is a gradation?

7 MR. TROSTEN: Yes. So that in other words --

8 CHAIRMAN JENSCH: Wait a minute. Go ahead.

9 Did you finish?

10 WITNESS GOODYEAR: The half inch -- the half  
11 inch fish is a more mobile fish than the yolk sac larvae  
12 is, but his movements, his patterns of movement are not that  
13 much different than a late yolk sac larvae.

14 MR. TROSTEN: Now, a half inch fish is a much  
15 older fish than a yolk sac larvae, isn't he?

16 WITNESS GOODYEAR: Yes.

17 MR. TROSTEN: And a yolk sac larvae is able to  
18 ~~maintain~~ <sup>maintain</sup> diurnal -- to perform vertical diurnal migrations  
19 before the yolk sac is absorbed, isn't that right?

20 WITNESS GOODYEAR: This is true.

21 MR. TROSTEN: Isn't it true also that a fish which  
22 is much older than a yolk sac larvae which is say, at that stage,  
23 we will say last ten to fourteen days, say, after the egg is  
24 hatched, that a fish that <sup>was</sup> ~~were~~ much older as a one-half inch  
25 fish is, would be able to swim much more readily than a yold sac

eak2

1 larvae?

2 WITNESS GOODYEAR: They are much more capable.  
3 Their ability to maneuver in the water, it would be much  
4 better, there is no question about it. Yolk sac larvae are  
5 not the most agile things in the world.

6 MR. TROSTEN: They are not the best swimmers  
7 around?

8 All right. Let me ask you again then, you have  
9 said that the yolk sac larvae can perform vertical  
10 diurnal migrations and that he can do that before the yolk  
11 sac is absorbed and you said that the half-inch long fish  
12 is a much older fish than the yolk sac larvae and you  
13 said that he is capable of stronger, more powerful  
14 swimming than the yolk sac larvae. Now, will you tell me what  
15 you mean by sustained swimming? You said he  
16 can't swim against the one and a half foot per second  
17 which I fully concur with. But how fast can he swim? What  
18 is his capability to swim.

19 CHAIRMAN JENSCH: Which one? The yolk larvae  
20 or the half inch?

21 MR. TROSTEN: The half-inch fish.

22 Again if you can just tell me really what you  
23 had in mind, if you can help me to understand what you had  
24 in mind when you used that sentence in there, it would be very  
25 helpful for me.

In this connection how long are they at the end

eak 3 1 of the yolk sac larvae stage?

2 WITNESS GOODYEAR: I would have to check. About  
3 three-tenths of an inch, in that area.

4 MR. TROSTEN: So it is a little bit more than  
5 half of the length of this fish?

6 WITNESS GOODYEAR: Yes.

e 38 7 If you look on page V-43.

8 MR. TROSTEN: Yes, sir.

9 WITNESS GOODYEAR: This is data that was withdrawn  
10 from a curve study by Steve Link. What he found was  
11 a fish below .5 inches in total length could not resist a  
12 longitudinal flow. There is a fairly significant change by  
13 the time the fish became an inch in length. Now, the sustained  
14 swimming is related to being able to sustain themselves in  
15 the water column and not related to propelling themselves  
16 necessarily from one point to another in terms of distance,  
17 sustained capability for feeding, for instance.

18 MR. TROSTEN: Is that what this figure indicates  
19 or is that what you are telling me?

20 WITNESS GOODYEAR: That is what this .5 inches  
21 over here was talking about, sustained swimming capability  
22 is not sustained in the sense that moving horizontally in  
23 the water column.

24 MR. TROSTEN: Does this figure indicate they can't  
25 do that?

WITNESS GOODYEAR: No. There is no intent for it

1 to mean that it can't do that, that they can't resist  
2 a flow. They are still being dispersed by hydrological  
3 forces.

4 MR. TROSTEN: No. This figure doesn't show that.

5 WITNESS GOODYEAR: It shows their capability of  
6 resisting a flow, is very low. The capability of regulating  
7 their position in the water column is very good.

8 MR. TROSTEN: Well, I am sorry but I don't see  
9 that this figure shows that because it starts out with zero and  
10 doesn't show whether -- in which direction, whether up or  
11 down or sideways the fish could go, does it?

12 WITNESS GOODYEAR: Well, this is a test -- this  
13 data comes from test apparatus which was used to determine  
14 the capability of striped bass and salmon also to resist flows  
15 of particular velocities in order to estimate what kind  
16 of things -- protection apparatuses would be necessary at the  
17 Contra Costa Plant.

18 MR. TROSTEN: This doesn't indicate that a fish that  
19 was subjected to -- that a half an inch fish which was sub-  
20 jected to a low flow of less than half a foot per second,  
21 for example, could not travel horizontally or perpendicularly  
22 to the flow, does it?

23 WITNESS GOODYEAR: No. There is no intent for  
24 it to show that. But they do not resist the flow.

25 MR. TROSTEN: All right. Now can a half an inch

Peak 5

1 fish migrate from a point in the water column to another  
2 point laterally, would you say?

3 WITNESS GOODYEAR: Yes.

4 MR. TROSTEN: Could a half an inch fish migrate  
5 from a point in the water column to a point in the shoals?

6 WITNESS GOODYEAR: Yes.

7 MR. TROSTEN: Do, indeed, half-inch fish migrate to  
8 points in shoals?

9 WITNESS GOODYEAR: It is quite possible.

10 MR. TROSTEN: Have they been found there?

11 WITNESS GOODYEAR: Fish of that size have been  
12 found on shoals.

13 MR. TROSTEN: And they -- you said before that  
14 they have the capability to move there?

15 WITNESS GOODYEAR: Yes.

16 MR. TROSTEN: Thank you.

17 Now, Dr. Goodyear, relative to one of your earlier  
18 comments, do you think it would be helpful to have more informa-  
19 tion about the capability of these young fish to migrate, in  
20 forming judgments such as you expressed on page 5-39 as to  
21 the susceptibility of these organisms to entrainment? You  
22 know the basic statement that we discussed for so long about  
23 the recruitment rates and standing crops being appreciably lowered  
24 in response to the increased mortality caused by entrainment  
25 of eggs and larvae. We were discussing what information was  
available and what you needed to help you make a judgment.

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1 Would it help you make a judgment if you had more information  
2 about that? About the ability of these young fish to swim  
3 and to move about in the river?

4 WITNESS GOODYEAR: Well, any additional information  
5 would refine the estimates, yes.

6 MR. TROSTEN: Yes. Thank you.

7 All right. Now, on page 5-42, is it true that  
8 Figure 5-4 -- I am sorry, I have the wrong page.

9 CHAIRMAN JENSCH: Okay.

10 MR. TROSTEN: I am talking about Figure 5-5 on page 42.

11 Is it true that this figure taken from the Carlson and McCann  
12 Report measures the growth of striped bass in the Hudson  
13 River of varying types for one year.

14 WITNESS GOODYEAR: Yes.

15 MR. TROSTEN: Figure 5-5 doesn't indicate how long  
16 any individual fish remains planktonic, does it?

17 WITNESS GOODYEAR: One moment.

18 (Witnesses conferring.)

19 WITNESS GOODYEAR: Not directly.

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1 MR. TROSTEN: Is it correct that according to  
2 Figure 5-5 -- excuse me. Let me rephrase that question.

3 Isn't it true that what Figure 5-5 shows is that  
4 on the basis of data collected during one year, there were  
5 some striped bass in the planktonic mode for six to eight  
6 weeks, defining for this purpose planktonic mode as being  
7 fish that were under a half an inch in length, isn't it true  
8 that that's what that figure demonstrates?

9 WITNESS GOODYEAR: Not directly. There's -- if  
10 you will notice the way the information is presented,  
11 there's a mean, a minimum, and a maximum size. If the maximum  
12 size is considered to be the older fish, then the length of  
13 time from -- there's -- they are spawning, the first spawning  
14 to the particular interval you are looking at, that length of  
15 time would be an index -- would be an estimate of the length  
16 of time that it takes for the striped bass to grow to that  
17 size.

18 Now the mean and the minimum can't be used for  
19 that because both of those estimates can have and do have  
20 contributions from younger age groups which will be smaller.  
21 Now it takes something like 10 weeks for them to reach one  
22 inch in length so that the six to eight week estimate,  
23 whereas I agree in principle, the six to eight week estimate  
24 cannot be gleaned directly from this diagram. This diagram  
25 will be more indicative of a -- up to a 10-week planktonic



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1 mode, although the fish begin to leave their planktonic  
2 mode as they turn from -- well, as they start to grow.  
3 You see, the rate of increase in the length rises markedly.  
4 This is an indication in a change in food habits.

5 MR. TROSTEN: Well, it is correct, isn't it,  
6 Dr. Goodyear, that what this is measuring is the catch of  
7 young striped bass with plankton nets and then trawling gear  
8 for one year and it is measuring the size of the majority of  
9 the fish that are caught with these gear, this type of gear  
10 in the river over the entire length of the river over this  
11 period of time, and it is just measuring the trend of the size  
12 of the population. It is not measuring the size of individual  
13 fish, isn't that correct?

14 WITNESS GOODYEAR: Not exactly. If you limit the  
15 observations to the maximum-sized individuals, I agree with  
16 you, the mean and the minimum -- or the mean, anyway,  
17 represents the general trend which is composed of several  
18 different age groups. The maximum should consist of the oldest  
19 fish and these are the maximum sizes that were taken during  
20 any particular interval.

21 MR. TROSTEN: Isn't the contribution to the  
22 maximum -- isn't that upper line composed of fish that were  
23 spawned at different times commencing on May 5th? And at  
24 different places in the river?

25 WITNESS GOODYEAR: At different places.

ar3

1 MR. TROSTEN: And at different times, right?

2 WITNESS GOODYEAR: Well, I am sure there is a  
3 variation in time.

4 MR. TROSTEN: Well, did all the spawning take  
5 place on May 5th that year?

6 WITNESS GOODYEAR: I think you are missing -- the  
7 answer is no, to that question, but I think you are missing  
8 the point, because the maximum size captured during the study  
9 interval would represent the oldest fish present, or should,  
10 so that -- for instance, if you took the whole collection,  
11 it would represent several weeks of spawning. The maximum  
12 would represent the oldest fish; the mean would represent  
13 a conglomerate of age groups.

14 MR. TROSTEN: The maximum would -- there is no --  
15 can anyone tell how old a fish is, Dr. Goodyear, when they  
16 catch it?

17 WITNESS GOODYEAR: Within certain -- the answer is  
18 yes.

19 MR. TROSTEN: How do you tell how old a fish is,  
20 Dr. Goodyear?

21 WITNESS GOODYEAR: From -- for larva fish, it  
22 is generally done by the stage of development.

23 MR. TROSTEN: Those aren't larval fish in the upper  
24 line, isn't that right?

25 CHAIRMAN JENSCH: He's giving answer<sup>an</sup> to your question.

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1 and then you go back to the chart. He's probably going to  
2 tell you how you find your age from different kinds of fish.  
3 Let him finish, please.

4 WITNESS GOODYEAR: Of course, the older fish can  
5 be aged with scale shavings and that sort of thing.

6 MR. TROSTEN: Right.

7 WITNESS GOODYEAR: I think maybe we need to make a  
8 distinction about larval, the term larval. As I have used  
9 it here, it includes both the yolk sac and the post-yolk sac  
10 stages.

11 MR. TROSTEN: Yes.

12 WITNESS GOODYEAR: And actually represents more in  
13 mode of life than it does a particular age group or size  
14 group, although the same -- this information represents the  
15 same things, just a different way of looking at it.

16 But that upper line represents larvae up to the --  
17 say one inch size class.

18 MR. TROSTEN: Do you know how old the larvae  
19 were that compose that upper line, or are you really saying  
20 that these were larvae of a certain size?

21 WITNESS GOODYEAR: They are larvae of a certain  
22 size which should be the oldest larvae present. Since you  
23 know the initiation or the period the spawning was initiated,  
24 the length of time between the initiation of spawning and the  
25 collection of that size class should be an index or the

ar5

1 relative indication of the age of that larvae.

2 MR. TROSTEN: Well, you know that if all the larvae  
3 in the river grow at exactly the same rate and have exactly  
4 the same characteristics, do you know whether that's true,  
5 Dr. Goodyear?

6 WITNESS GOODYEAR: This would not be true.

7 CHAIRMAN JENSCH: Is this a convenient place to  
8 interrupt your examination?

9 MR. TROSTEN: Certainly.

10 CHAIRMAN JENSCH: At this time let's recess to  
11 reconvene in this room at 4:10.

12 (Recess.)

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CHAIRMAN JENSCH: Please come to order.

The witnesses have resumed the stand. Proceed,  
please counsel.

MR. TROSTEN: I don't think there was a question  
before the witness. Was there, Mr. Reporter?

THE REPORTER: No, there wasn't.

MR. TROSTEN: Dr. Goodyear, is it possible that  
fish spawned on May 8th escaped the nets set for them in  
1968 in order *for them to be reflected in* the data gathered  
in Figure V-5?

WITNESS GOODYEAR: Yes. They could have -- there  
is a possibility that this represents the slightly  
biased sample because of net downstream transport so the older  
larvae from the original spawning wouldn't be in the area  
during the sampling and it also presupposes that the same is  
not true for larvae that were spawned above the Cornwall  
area such that they wouldn't -- the older larvae wouldn't  
have been transported into the Cornwall area from upstream.

MR. TROSTEN: I am afraid I don't quite understand  
your answer. Could you explain that. I didn't  
understand -- I asked you whether it is possible that  
fish spawned on May 5th escaped the nets and your answer  
was yes, I guess, but then you added something else that  
I didn't understand.

WITNESS GOODYEAR: The answer was yes.

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1 MR. TROSTEN: All right. Then let's go on from  
2 there. It is true, is it not, that the net sizes changed  
3 progressively during the period of sampling in 1968?

4 WITNESS GOODYEAR: Yes.

5 MR. TROSTEN: Now, does this --

6 MR. KARMAN: Mr. Trosten?

7 MR. TROSTEN: I am sorry. I thought this was on.

8 Does this suggest to you that the May 5th fish,  
9 that is the fish that were spawned on May 5th, are no longer  
10 in the nets on June 30th, for example?

11 WITNESS GOODYEAR: Would you repeat that, please?

12 MR. TROSTEN: Does this suggest to you that the  
13 fish that were spawned on May 5th are no longer  
14 being caught in the nets on June 30th?

15 WITNESS GOODYEAR: No.

16 MR. TROSTEN: Well, let me -- let's go back and  
17 go over this again. We know that the net sizes were being  
18 changed progressively during this period, is that correct?

19 WITNESS GOODYEAR: This is correct.

20 MR. TROSTEN: And we know that one reason why  
21 they were changing the nets was because they were having  
22 difficulty with catching the fish, is that correct?

23 WITNESS GOODYEAR: That is correct.

24 MR. TROSTEN: And we know that it is possible  
25 that the fish were escaping the nets over this period of time

eak3

1 which is why they were changing the net <sup>size</sup> ~~size~~ correct?

2 WITNESS GOODYEAR: Yes.

3 MR. TROSTEN: Now, since we know all that, does  
4 that suggest to you that a fish that was spawned on May 5th  
5 was -- would not be caught on June 30th in the net or might  
6 not be caught on June 30th in the net?

7 CHAIRMAN JENSCH: While there is a pause, may I  
8 add, how did they change the nets? The mesh size change,  
9 larger, smaller? Which was did they change them?

10 MR. TROSTEN: They changed them to make the mesh  
11 size larger, Mr. Chairman.

12 MR. KARMAN: What are you reading from, Mr. Trosten?

13 MR. TROSTEN: The Carlson and McCann Report,  
14 Table I which is the document from which Figure 5-5 was taken.

15 CHAIRMAN JENSCH: Does the witness have that before  
16 him?

17 WITNESS GOODYEAR: I am just looking for it right  
18 now.

19 CHAIRMAN JENSCH: Maybe he ought to have that before  
20 him.

21 They made the mesh size larger, Applicant counsel.  
22 Does that mean the smaller fish would slip through? Is  
23 that the thought? If they had difficulty catching them and  
24 they made the mesh size larger, more of them might get away.

25 MR. TROSTEN: As I understand it, Mr. Chairman, this

1 matter of <sup>gear</sup> ~~peer~~ selectivity is beyond me, but my understanding  
2 of it is that when you have the mesh size too small, you  
3 create water resistance. As you draw through the water, the  
4 fish sense this and they get out of the way. So you  
5 make the mesh size larger in order to avoid  
6 creating this water resistance and you begin to catch them  
7 again. At least, this is the theory that the people  
8 responsible for the gear --

9 CHAIRMAN JENSCH: The mesh size isn't so large  
10 that the fish go through the net and they get caught in the  
11 fish -- sweep of the net?

12 MR. TROSTEN: That is right.

13 MR. KARMAN: The only problem we have with the  
14 question is that parts of it you said might not and parts of  
15 it you said would not. Let's try to straighten that out.

16 MR. TROSTEN: All right. I will try to straighten  
17 that out.

18 Do the facts that I have described suggest to you  
19 that fish spawned on May 5th are no longer collected, were  
20 no longer collected in the nets on June 30th?

21 DR. GEYER: What was the date of the change of  
22 net size? Are you talking about after the change or before  
23 the change?

24 MR. TROSTEN: What happened was this, Dr. Geyer.  
25 This is reflected in Table 1 of the Carlson and McCann Report.



eak 5

1 on page 14. They started their sampling in 1968 on May 12th  
2 and the Table 1 shows the gear and the mesh that was being  
3 used in the different weeks. And if you look down this  
4 table, you see that they were changing in a way back and forth  
5 at the beginning and then they began to move to the larger  
6 sizes as time goes on. For example, during the week of  
7 May 12th through May 13, they were using mesh 0.20 by  
8 0.31 inches. They switched back on the 19th to the 25th, first  
9 to the smaller mesh and back to the larger and back to the  
10 smaller and back to the larger. They oscilated back and forth  
11 the following week and then the week after that, they began  
12 to move to the larger mesh and so on. It was kind of a  
13 constantly shifting thing. The general trend was  
14 towards a larger size mesh.

15 DR. GEYER: But the date of June 30th, they had  
16 changed then to the larger size?

17 MR. TROSTEN: By June 30th, they had changed to  
18 a larger size. In fact, they had changed to a larger  
19 size before then. They were moving progressively towards  
20 a larger size net but not steadily.

21 DR. GEYER: Thank you.

22 CHAIRMAN JENSCH: All right. Your question to  
23 Dr. Goodyear now is do you think you can catch the  
24 fish, that they caught enough fish with the larger mesh?

25 MR. TROSTEN: No. It was diffezent, Mr. Chairman.

eak 6

1 Let me try once more.

2 My question to Dr. Goodyear is, do you consider  
3 on the basis of the facts reported in this table, that fish  
4 that were spawned on May 5th were no longer being caught  
5 in the nets on June 30th? That is --

6 WITNESS GOODYEAR: That doesn't follow my inter-  
7 pretation.

8 MR. TROSTEN: Would you explain to me why it doesn't  
9 follow?

10 WITNESS GOODYEAR: Because there is a continuous  
11 gradation which is not necessarily related to the mesh size.  
12 There is a fish -- the smaller mesh, for instance, on the week  
13 of 6-16, the smallest mesh caught a size intermediate  
14 between the --

15 MR. TROSTEN: Now, the week of 6-16, they were  
16 already using the Size 2 mesh and then the Size 3 mesh.

17 WITNESS GOODYEAR: They started out with Size 2 mesh.

18 MR. TROSTEN: Yes. At the very beginning they  
19 started out with Size 2 mesh, that is correct.

20 WITNESS GOODYEAR: And every interval -- every  
21 week they had samples with Size 2 mesh.

22 MR. TROSTEN: That is correct. Excepting for the  
23 week of 6-9 to 6-15 when they were using Size 3  
24 mesh as well as Size 2 mesh.

25 WITNESS GOODYEAR: Well, up until they stopped  
using the Size 2 mesh, they had samples each week which

Peak 7

1 included the Size 2 mesh.

2 MR. FROSTEN: Yes.

3 WITNESS GOODYEAR: There is a continuous grade  
4 of the sizes which couldn't indicate any correlation with  
5 mesh size, any great correlation with mesh size. There is  
6 a gradation of increasing length of fish which in  
7 some cases, the smaller mesh caught fish of either intermediate  
8 size to the larger mesh indicating that there is not a real strong  
9 selection from the mesh size.

10 MR. FROSTEN: Are you finished?

11 WITNESS GOODYEAR: Yes. We are looking -- there is a --  
12 we are looking principally at the maximum size fish. You do  
13 understand that?

14 MR. FROSTEN: Yes. You are looking at the maximum  
15 sized fish being caught with that gear?

16 WITNESS GOODYEAR: Yes. Throughout each weekly  
17 interval.

18 MR. FROSTEN: Yes. I understand.

19 Isn't it possible, Dr. Goodyear, that a fish  
20 that was hatched on May 5th could have grown to a length  
21 such that by June 16th, he escaped the smaller mesh net  
22 before it was increased?

23 CHAIRMAN JENSCH: Excuse me. While there is a pause, is  
24 there some factor here you should tell us about? What is  
25 the force of the movement of the sweep of the net.

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1 which would propel the fish out of the way of the oncoming  
2 catch? I am having great difficulty in the logic. I don't  
3 understand the technical fish activity, but the logic  
4 of saying that if there is a fish sweep going up the --  
5 fish net sweep going up the river, whatever direction, that --  
6 don't you agree that some fish from a certain date of spawning  
7 won't be caught. I suppose once you catch anything, who knows  
8 what you are going to catch, and how can you separate out from  
9 a sweep of a fish net, fish that is supposed to be spawned on June  
10 or May 5th?

11 MR. FROSTEN: Let me see if I can try to explain  
12 this, Mr. Chairman. The problem here that I am trying  
13 to explore with Dr. Goodyear is what is the age of  
14 the fish that are being caught and which are being reflected  
15 in this top line, figure 5-5.

16 CHAIRMAN JENSCH: He said you are looking  
17 at the size of the fish?

18 MR. FROSTEN: That is right. He is saying  
19 that that particular line represents the growth of the  
20 fish that were spawned on May 5th, that that is the -- that  
21 line represents the -- I am sorry, this represents the growth  
22 of the individual fish in the river <sup>and</sup> ~~ans~~ what I am trying  
23 to get him to explain is whether there could have been  
24 fish that were spawned early in this period which grew  
25 to a certain size by, say, the early part of June such that

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1 when you try to catch them in the nets, that they would  
2 escape the nets because there is this force of water that  
3 goes before the net as it is being pulled through the water  
4 by the boat so that these fish would have grown and would be  
5 much larger than -- by the time, say June 16 or June 30th  
6 came along, because they weren't being caught in these  
7 nets any longer. That is the point I am trying to get at.  
8 I am trying to explore just how large fish really are in  
9 the Hudson River as opposed to how large this line indicates  
10 the average fish, if you will, is that is being caught  
11 in the Hudson River. Dr. Goodyear is saying that he thinks he know  
12 enough on the basis of these data to know really how large  
13 the fish are as they grow in the Hudson River during this  
14 period of time.

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1 CHAIRMAN JENSCH: Yes, I understand his statement.  
2 I am having difficulty correlating your -- the premise of  
3 your question that the sweep of the net will create such a  
4 force that it will separate out the May 5th spawned fish.  
5 I don't see any relationship between the force of the sweep  
6 of the net and the May 5th spawned fish.

7 There may be other fish excluded or caught or  
8 all kinds of things happen, but how can you say don't you  
9 agree that there's -- there will be some May 5th fish  
10 not caught?

11 MR. TROSTEN: The reason for that, Mr.  
12 Chairman, is that as the fish grow larger, they acquire  
13 a greater swimming capability as Dr. Goodyear explained,  
14 so that when you come along with the trawling gear and try  
15 to capture them, they have the capability to sense the  
16 movement of water and move out of the way and they acquire  
17 this capability more and more, we believe, as they grow  
18 older so that the older ones, the ones that were actually  
19 spawned about May 5th, would be the ones that would tend  
20 to escape whereas the younger ones, the ones spawned later  
21 and were still too young to have this capability to escape,  
22 would be collected in the samples and would show up on this  
23 larger line. That is what I am trying to establish with  
24 Dr. Goodyear.

25 CHAIRMAN JENSCH: Yes. As I understand it,

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1 the certainty you are seeking in the question would seem to  
2 require as a predicate that you have some measurement of  
3 the swimming capability of the May 5th fish as -- to be  
4 available to consider the force of the sweeping fish net,  
5 to see if one capability can resist that force of the net  
6 because otherwise it seems to me you don't have the factors  
7 for certainty that you are seeking this witness to express.

8 Now maybe I don't understand your question.

9 MR. TROSTEN: Mr. Chairman, it is true we don't  
10 have as good an idea as we would like to have and nobody  
11 does about the swimming capability of these fish which is  
12 one of the real problems that we are exploring in the hearing.  
13 But we do know that the larger fish are able to escape the  
14 sweep of the net, which is why the people who are responsible  
15 for the trawling do change their gears. That is why they  
16 do it. That is why Carlson and McCann in 1968 when they  
17 were performing these samplings for May through August  
18 were changing their gears because of this fact which is  
19 reflected in the capability of these organisms to escape.

20 CHAIRMAN JENSCH: Carlson didn't measure the  
21 swimming capability of the fish nor the force of the fish  
22 net sweep?

23 MR. TROSTEN: Well, he measured the force of the --  
24 there are measurements of the velocity of the gear going through  
25 the water, but, no, they didn't measure the actual capability.

3mil 1 I am not aware of any measurements of the actual capability  
2 of these young bass to swim. I don't know of any. Maybe  
3 there are.

4 CHAIRMAN JENSCH: Excuse me. Proceed. I am  
5 having difficulty, but proceed.

6 Can you tell us how many May 5th fish escaped  
7 the sweep of the net?

8 WITNESS GOODYEAR: I would like to point out a  
9 couple of interesting facts. You were asking me if my  
10 June 30th -- if those fish which were the first spawned  
11 were large enough to have escaped the sampling gear.

12 MR. TROSTEN: Yes, I asked you that.

13 WITNESS GOODYEAR: All right. On that date,  
14 the sampling gear, largest sampling gear, largest net  
15 sampling gear was first used and if you look at the change  
16 in the size, the relative change in the maximum size fish  
17 in those two gears, you do find a significant increase,  
18 but it is one which is continued through the rest of the  
19 sampling if there had been a -- if the May fish had grown  
20 sufficiently large to escape the net, then the -- if they  
21 had grown sufficiently large enough to escape the net,  
22 then the continuation of the growth curve which you see  
23 plotted here and which is drawn from the scale, continuation  
24 of that growth curve should have been very abrupt because --  
25 which it is not. It goes from point 67 to point 91



ovex a three-week period It is abzu",t crve 'o  
 that the sanpl.-g gear would apparently have bee:a, **inlitiated**  
 3 **within .a time** period, if you will," **which** would include the  
 May **5th** -- or at least earliexlarne 7 not **necessarily** May  
**5th**, but larvae or i **ni-vi &l** , spawned. !mch earzlier.  
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 last **collecton.:o.spawn** of eggs, and you compare **the**  
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 9 **cllection of** eggs nd you look at **the**

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1 MR. TROSTEN: All right. Under those circum-  
2 stances can you be absolutely certain that the maximum length  
3 of the fish in, say, the June 30 catch represented a fish  
4 hatched on May 5th? Can you be certain of that?

5 WITNESS GOODYEAR: No.

6 MR. TROSTEN: All right. Let's go on a minute.

7 MR. BRIGGS: Could I ask a question just a minute  
8 here?

9 You have talked about changing net sizes from,  
10 I believe, a size two to a size three; is that right?

11 WITNESS GOODYEAR: And then to a size four.

12 MR. BRIGGS: And when was the change made to  
13 size four?

14 WITNESS GOODYEAR: The first use of size four  
15 in the June 30th sampling.

16 MR. BRIGGS: And from June 30th on, was size  
17 four used or were sizes three and four used?

18 WITNESS GOODYEAR: Three and four on June 30th,  
19 and four from then on.

20 MR. BRIGGS: Four after June 30th?

21 WITNESS GOODYEAR: Actually there is only -- they  
22 changed sampling gear to trawls after the week of 7-14 to 7-20.

23 MR. BRIGGS: So there was a change at that time  
24 also?

25 WITNESS GOODYEAR: Yes.

1 MR. BRIGGS: Thank you.

2 MR. TROSTEN: All right. Dr. Goodyear, I want to  
3 ask you another question about page 5-42. Would you say that  
4 it is very likely that the individual fish, individual  
5 striped bass, actually reaches the stage where it is clearly  
6 no longer planktonic, and I am defining the stage where it  
7 is clearly no longer planktonic for this purpose as one  
8 half inch in length.

9 WITNESS GOODYEAR: Okay.

10 MR. TROSTEN: In less than six weeks?

11 WITNESS GOODYEAR: Yes.

12 MR. TROSTEN: Thank you.

13 Dr. Goodyear, does Figure 5-10 on page 5-45 --  
14 Figure 5-10 on 5-45 show that the larvae have already moved  
15 to the shoal areas in June of that year, of those two years,  
16 really?

17 WITNESS GOODYEAR: We are looking at Table 5-10?

18 MR. TROSTEN: I beg your pardon. Table 5-10 on  
19 page 5-45.

20 The June, of course, is shown for the year 1970,  
21 not for the year 1969.

22 WITNESS GOODYEAR: Yes.

23 MR. TROSTEN: The answer to my question is yes?

24 WITNESS GOODYEAR: Yes.

25 MR. TROSTEN: All right. Does this table also show

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1 that even in May there are more larvae in the shoals  
2 than in either the intermediate or the deep waters?

3 WITNESS GOODYEAR: Yes.

4 MR. TROSTEN: Doesn't Figure 5-10 -- Figure 5-10  
5 now which is on page 5-51, doesn't that figure show after  
6 the middle of June the larvae avoid the plankton nets? By  
7 that I mean they aren't planktonic any more?

8 WITNESS GOODYEAR: They avoid the plankton nets,  
9 yes, but --

10 MR. TROSTEN: Does that mean --

11 CHAIRMAN JENSCH: Wait a minute. Let him answer.

12 WITNESS GOODYEAR: That doesn't necessarily mean  
13 they are not planktonic or pelagic, if you would rather use  
14 that term?

15 MR. TROSTEN: Let's talk about planktonic for a  
16 moment. If they avoid the plankton nets, please tell me why  
17 this means that they -- please tell me why this doesn't mean  
18 that they are no longer planktonic.

19 WITNESS GOODYEAR: One moment.

20 (Witnesses conferring.)

21 WITNESS GOODYEAR: This is a matter of semantics  
22 more than anything else. In the term that I consider  
23 planktonic, it means that they are occupying the same type of  
24 habitat and the same behavioral characteristics that they had  
25 earlier. But they are more capable of avoiding plankton nets,

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1 for instance.

2 MR. TROSTEN: Oh, I see. We ought to discuss that  
3 because I really don't understand that terminology, and  
4 perhaps you can help me on this.

5 Doesn't planktonic mean that it is -- floats in  
6 the water body with essentially no motive power of its own, very,  
7 very weak motive power of its own? Isn't that what planktonic  
8 means?

9 WITNESS GOODYEAR: This is a common description  
10 of the planktonic form.

11 MR. TROSTEN: And -- but you are <sup>not</sup> using that  
12 common description, you are using a different description  
13 when you use the term "planktonic" in this final environmental  
14 statement?

15 WITNESS GOODYEAR: Planktonic really refers to a  
16 mode of life.

17 MR. TROSTEN: No.

18 CHAIRMAN JENSCH: Let him finish now. He's going  
19 to explain the whole thing. He's used it.

20 MR. TROSTEN: I just want to make sure he answers  
21 that question.

22 WITNESS GOODYEAR: The planktonic existence  
23 describes a mode of life which depends upon water currents  
24 for transportation. The -- it doesn't necessarily presuppose  
25 their mobility or size or for that matter avoidance of

1 something. If, for instance, you try to -- with a small  
2 net to catch some of the larger zooplankton, these are  
3 larger microcrustaceans as a rule such as the larger  
4 Daphnia, you will find they are very capable swimmers and  
5 will avoid nets much in the same way these fish are avoiding  
6 plankton nets, but it is a difference in -- the planktonic  
7 mode is referred primarily to a mode of existence rather  
8 than a particular description about the organism itself.

9 MR. TROSTEN: Are you finished, Doctor?

10 WITNESS GOODYEAR: Yes.

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1 MR. TROSTEN: I want to be sure now -- excuse me.  
2 Go ahead. Do you want to consult?

3 (Witnesses conferring.)

4 WITNESS GOODYEAR: Go ahead.

5 MR. TROSTEN: The way you just described the  
6 term "planktonic," is that the same definition that you  
7 intended when you used that word in the sentence on page  
8 5-40 that reads, "The juvenile bass grows slowly at first  
9 and remain planktonic for about six to eight weeks"?

10 WITNESS GOODYEAR: Yes.

11 MR. TROSTEN: When you used the term "planktonic"  
12 in that sentence, did you mean to imply that the juvenile  
13 bass you were describing had an avoidance capability in a  
14 sense of an ability to avoid a net?

15 WITNESS GOODYEAR: Would you repeat that, please?

16 MR. TROSTEN: When you used the term "planktonic"  
17 to describe the juvenile bass in that sentence, did you mean  
18 to indicate that those bass possessed an avoidance capability  
19 during that period of time sufficient that they could avoid  
20 a plankton net?

21 WITNESS GOODYEAR: This is the six to eight week  
22 period that is related to their habitat preference or their  
23 behavior, really. It doesn't have anything to do with the  
24 plankton net. Your statement concerning whether or not they  
25 can avoid a plankton net has in a passive form -- not in the

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1 passive form, the planktonic form, it is true.

2 MR. TROSTEN: In other words, as far as you know,  
3 you believe that the juvenile bass during the -- during a six  
4 to eight week period of their -- the initial six to eight  
5 week period of their life have a capability to avoid the  
6 plankton net?

7 WITNESS GOODYEAR: The latter part.

8 MR. TROSTEN: During the latter part of this period  
9 of time?

10 WITNESS GOODYEAR: Yes.

11 MR. TROSTEN: All right. Would you say then that  
12 the juvenile bass, during the latter part of this six to  
13 eight week period have a capability of motion such that  
14 they can avoid other structures or objects?

15 WITNESS GOODYEAR: Yes.

16 MR. TROSTEN: All right. How long are the  
17 juvenile bass, would you say, at the end of their -- of  
18 this six to eight week period which you described as a  
19 planktonic stage?

20 WITNESS GOODYEAR: Something on the order of one  
21 and a half inches.

22 MR. TROSTEN: One and a half inches long at the  
23 end of this six to eight week period?

24 WITNESS GOODYEAR: Well, from one to one and a  
25 half inches. The capability of distinguishing a transition --



1 transition doesn't occur as sharply as, say, six weeks or  
2 eight weeks. It would occur throughout a period and would  
3 depend primarily upon the particular environment, how much  
4 favorable habitat is there, how much food is available and  
5 other things of this nature.

6 MR. TROSTEN: Now when would you say during the  
7 period of their existence, this six to eight week period of  
8 existence, what you describe as planktonic, do they acquire  
9 the capability to avoid the plankton nets?

10 WITNESS GOODYEAR: About their sixth week, fifth  
11 or sixth week, and again it is not an all-or-none change.  
12 It is a graded -- sort of graded response. You can almost  
13 always catch some of them -- I'll give you an example. The  
14 1967 plankton tow data from the Cornwall project shows  
15 collections of larvae five and six weeks after the last major  
16 spawning which would indicate they stayed in the water  
17 column as planktonic forms for at least that length of time.

18 MR. TROSTEN: Excuse me just a minute.

19 Does the plankton data referred to on page 5-10  
20 indicate a sharp drop-off in the number of plankton collected  
21 at the <sup>beginning</sup> ~~beginning~~ of June?

22 CHAIRMAN JENSCH: What was that reference, 5-10?

23 MR. TROSTEN: Figure 5-10 on page 5-51.

24 WITNESS GOODYEAR: These data are unfortunately  
25 provided as average total entire month. That was a mean

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1 concentration per one thousandth of cubic meters for the  
2 month sampling.

3 MR. TROSTEN: So you can't tell?

4 WITNESS GOODYEAR: Right.

5 MR. TROSTEN: Would you let me confer for a moment,  
6 Mr. Chairman?

7 CHAIRMAN JENSCH: Certainly.

8 (Board conference.)

9 MR. TROSTEN: Dr. Goodyear, referring again to  
10 Figure 5-5, you indicated a moment ago that fish, striped  
11 bass, would grow from one to one and a half inches at the  
12 end of this six to eight week period, is that right? Correct?

13 WITNESS GOODYEAR: I indicated they would stay  
14 planktonic and that the -- let me reflect a moment.

15 (Witnesses conferring.)

16 WITNESS GOODYEAR: Yes, this is true.

17 MR. TROSTEN: All right, now, if a fish were  
18 spawned at the beginning of June, I ask you now to look at  
19 Figure 5-5, would it reach a size -- how large would it be  
20 according to your calculations after six weeks?

21 WITNESS GOODYEAR: When was it spawned?

22 MR. TROSTEN: The 1st of June.

23 WITNESS GOODYEAR: The 1st of June?

24 Should be approaching an inch.

25 MR. TROSTEN: In other words, right on that line,

1 just about on that line, the maximum line, right? Look at  
2 the six week period which is about July 14. Do you see it?  
3 Can you see it right on that line there?

4 WITNESS GOODYEAR: Yes.

5 MR. TROSTEN: All right. And if it were eight  
6 weeks old, it would -- and it were one and a half inches  
7 long, look at that line. It is just about that length, isn't  
8 it, one and a half -- eight weeks from the 1st of June,  
9 which is the 28th of July, look at that line. Isn't it  
10 just about 1.5 inches?

11 WITNESS GOODYEAR: Yes.

12 MR. TROSTEN: You think that corroborates your  
13 point of view on this?

14 WITNESS GOODYEAR: It doesn't -- in essence, yes.

15 MR. TROSTEN: All right. Thank you.

16 Now, Dr. Goodyear, you indicate the juvenile bass  
17 are subject to entrainment by the Indian Point Plant for  
18 six to eight weeks, is that correct? I believe you say that  
19 on page 5-40. Yes, you do say that.

20 WITNESS GOODYEAR: Yes.

21 MR. TROSTEN: How long does a striped bass egg  
22 live?

23 WITNESS GOODYEAR: How long does it take to hatch?

24 MR. TROSTEN: How long does it take to hatch from  
25 the time it is spawned and fertilized, yes.

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WITNESS GOODYEAR: Depending upon water temperature,

an average of about a day and a half.

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1 MR. TROSTEN: Striped bass eggs are found mostly  
2 on the bottom, aren't they?

3 WITNESS GOODYEAR: That depends upon the location.  
4 If they are spawned just upstream from the salt water front,  
5 they generally stratify.

6 MR. TROSTEN: aren't they demersal  
7 generally? I understood they were.

8 WITNESS GOODYEAR: They are slightly more  
9 dense than fresh water and tend to sink when they are  
10 far enough upstream when they don't impinge upon a salt  
11 wedge. However, if you will go through the Rathjer-Miller  
12 data and the Hudson River fisheries investigation data, you  
13 will find that whereas upstream from Indian Point, far enough  
14 upstream to get away from the salt wedge, the eggs do become  
15 much more abundant closer to the bottom. As you move  
16 downstream, they become more abundant up off the bottom in  
17 the new fill density.

18 MR. TROSTEN: After the egg hatches and the yolk  
19 sac larvae begins to develop, at some point in its life stage  
20 it begins to perform diurnal vertical migrations. We  
21 discussed that before, isn't that correct?

22 WITNESS GOODYEAR: This is true.

23 MR. TROSTEN: Yes, sir. Then doesn't the larvae  
24 -- and I guess that is the right term, after several weeks  
25 of performing these diurnal vertical migrations move to the

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1 shoals after a period of about four weeks, a total of --  
2 a total period of about four weeks after it was hatched?

3 WITNESS GOODYEAR: After a period of time, yes.  
4 It would depend upon growth rate of the fish. I would  
5 suspect more like five weeks.

6 MR. TROSTEN: You think it might be five although  
7 -- somewhere between four and five?

8 WITNESS GOODYEAR: Perhaps longer, even, than  
9 that. Are you saying after yolk sac absorption or after  
10 hatching?

11 MR. TROSTEN: Four weeks after hatching.

12 WITNESS GOODYEAR: I would disagree with that.

13 MR. TROSTEN: You would disagree with that?  
14 Would you say it would be closer to five?

15 WITNESS GOODYEAR: It would be closer to six.  
16 Maybe even longer than that.

17 MR. TROSTEN: Would you tell me -- would you  
18 <sup>report</sup> ~~point~~ to something in the environmental point if there is  
19 something that indicates that it would be more than four,  
20 perhaps more than five or six.

21 CHAIRMAN JENSCH: Well, I wonder if this is  
22 the kinds of review he can do overnight rather than try  
23 to go through the whole report and find a line or two on  
24 this subject? Could this go to some other time?  
25 Have you examined it to find if there is any such

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1 statement in there? What has your search revealed?

2 MR. TROSTEN: I have found nothing that indicates  
3 that and I was under the impression from my conversation  
4 with Dr. Goodyear before that figure 5-10 was contrary  
5 to what he just said, and that it would support the notion  
6 that they move to the shoals in about four weeks after  
7 they are hatched. I thought that from what Dr. Goodyear  
8 said before that he would agree with me on that.

9 CHAIRMAN JENSCH: I don't mean to limit the  
10 inquiry, but my only thought is whether the search could  
11 be undertaken elsewhere other than on the stand now.

12 MR. TROSTEN: All right. If you would ponder  
13 this, Dr. Goodyear, and let me know what data contradicts  
14 what I have just said, I would appreciate that.

15 Would you?

16 WITNESS GOODYEAR: Certainly.

17 MR. TROSTEN: Thank you very much.

18 If a fish of entrainable size, that is less than  
19 one and a half to two inches, were not in front of an  
20 intake screen at Indian Point, it could not be entrained,  
21 could it?

22 WITNESS GOODYEAR: This is true.

23 MR. TROSTEN: Therefore, the fact that it <sup>could not</sup> could  
24 swim fast enough to avoid the intake would not be  
25 significant for that particular organism, isn't that correct?

1 WITNESS GOODYEAR: This is true.

2 MR. TROSTEN: Therefore, figure 5-6 which  
3 has to do with water velocity and figure 5-9 which has to do  
4 with seasonal abundance of young of the year striped bass  
5 would in no way demonstrate that the organism just described  
6 <sup>would</sup> to be entrained, would it?

7 WITNESS GOODYEAR: Would you repeat that, please?

8 MR. TROSTEN: My question was considering this  
9 organism which is not in front of the intake for Indian  
10 Point No. 2, is it not so that figure 5-6 and figure 5-9  
11 in no way demonstrate that such an organism would be  
12 entrained? Do you agree with that?

13 CHAIRMAN JENSCH: I wonder if we could have  
14 the page references in order to follow?

15 MR. TROSTEN: Certainly, Mr. Chairman. Figure  
16 5-6 is on page 5-43 and figure 5-9 is on page 5-50.

17 CHAIRMAN JENSCH: Thank you.

18 MR. TROSTEN: I beg your pardon. I have given  
19 you a wrong reference, Mr. Chairman. I referred to figure  
20 5-6 and figure 5-9 and I should have referred to figure 5-6  
21 and table 5-9. Table 5-9 is on page 5-44, excuse me.

22 CHAIRMAN JENSCH: Thank you.

23 WITNESS GOODYEAR: Would you please repeat the  
24 question again.

25 MR. TROSTEN: Would you repeat the question, Mr.



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1 Reporter?

2 (The reporter read the pending question.)

3 WITNESS GOODYEAR: The answer is yes.

4 MR. TROSTEN: Thank you.

5 Would you tell me, Dr. Goodyear, the basis on  
6 which you calculated table 5-9 and if you prefer to go back  
7 and consult your notes and let me know that tomorrow morning,  
8 that would be fine unless you can tell me right now.

9 MR. KARMAN: What page is that?

10 MR. TROSTEN: Table 5-9 on page 5-44.

11 MR. KARMAN: Table 5-9?

12 MR. TROSTEN: Yes.

13 WITNESS GOODYEAR: These estimates are based  
14 upon the volume that was measured passing through the nets  
15 and assuming that the length of time that they were  
16 fished is as it was described in the methods and materials.

17 MR. TROSTEN: Thank you.

18 Dr. Goodyear, if we were able to obtain intake  
19 concentrations of larvae for each week of the year and  
20 concentrations of the larvae in the channel at Indian Point  
21 at different depths and at different stations across the  
22 channel, would it not be a more reliable basis for making  
23 an estimate of the number of organisms that would be entrained  
24 in the plant?

25 CHAIRMAN JENSCH: May I have the premise of that

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1 question, would you reread it, Mr. Reporter, please?

2 (The reporter read the pending question.)

3 CHAIRMAN JENSCH: Thank you.

4 WITNESS GOODYEAR: More reliable than --

5 MR. TROSTEN: Than the basis we now have.

6 WITNESS GOODYEAR: Yes.

7 MR. TROSTEN: Thank you.

8 How long do you think it would take to obtain  
9 such data, Dr. Goodyear?

10 WITNESS GOODYEAR: Well, if the sampling and  
11 the weather were to be favorable, then in a single year,  
12 from sampling such as was done at Cornwall in '68, would  
13 probably be sufficient.

14 MR. TROSTEN: One year you think would do it?

15 WITNESS GOODYEAR: Yes.

16 Provided, of course, if the sampling was adequate.

17 MR. TROSTEN: Provided, of course, that the salt  
18 front was the same and the usual problems you have when  
19 you try to run these things?

20 WITNESS GOODYEAR: Yes.

21 MR. TROSTEN: Thank you. On page 5-40,  
22 paragraph 3, you refer to figure A-5-12. You see where  
23 you make that reference?

24 WITNESS GOODYEAR: Yes.

25 MR. TROSTEN: That figure is referenced in

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1 support of the following sentence: "The eggs and larvae  
2 drift with the current in a net downstream direction and  
3 *concentrate*  
~~concentration~~ in a region of low salinity generally in  
4 the vicinity of the plant."

5 And you cite figure A-5-12, okay?

6 WITNESS GOODYEAR: Yes.

7 MR. TROSTEN: Isn't it correct that figure A-5-11  
8 and A-5-12 and A-5-13 which appear on pages A-5-55 through  
9 A-5-57 show that the bulk of the larvae are above Indian  
10 Point rather than their being "concentrated in the vicinity  
11 of the plant"?

12 Let's start with A-5-12 which is the one you cited  
13 first.

14 WITNESS GOODYEAR: I think we need some clarification  
15 tion on what the bulk of the larvae. I am not sure just  
16 exactly what you are driving at.

17 MR. TROSTEN: Well, let's go back and read your  
18 sentence and then maybe we can figure this out.

19 MR. KARMAN: What page is that sentence on  
20 again?

21 MR. TROSTEN: The sentence appears on 5-40  
22 and I will read it again and ask you what you -- excuse  
23 me, I guess you *did not use* ~~did~~ use the word bulk -- you did not  
24 use that word. I'll read your sentence again. You say,  
25 "The eggs and larvae drift with the currents in a net

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1 downstream direction and concentrate in the region of  
2 low salinity, generally in the vicinity of the plant."

3 All right. Now is it not true that figure  
4 A-5-12 shows that the mean number of larvae, mean percent  
5 per mile for the season is above Indian Point?

6 WITNESS GOODYEAR: Yes.

7 MR. TROSTEN: What did you mean when you used  
8 the term they concentrate in the region of low salinity  
9 generally in the vicinity of the plant?

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1 WITNESS GOODYEAR: It is a mean. I am not sure  
2 exactly what your point is. They concentrate in the region  
3 of low salinity.

4 MR. TROSTEN: Well, do you see where Indian Point  
5 is on these graphs?

6 WITNESS GOODYEAR: Yes.

7 MR. TROSTEN: And do you see how starting in June,  
8 June 5th to the 11th, June 6 to 18th, June 19th to the  
9 25th, June 26 to the 2nd of July, the third of July through  
10 the 9th of July, there are always considerably more larvae  
11 above Indian Point than there are at Indian Point or below  
12 Indian Point. Do you see that? Just let me finish here.  
13 Do you see in the bottom figure where it says mean percent  
14 per mile for season that the numbers, the mean numbers  
15 show more larvae, considerably more larvae above Indian  
16 Point starting, you know, about a mile point 44 and running  
17 way up there to a mile point 90 and then -- then they show  
18 at Indian Point or below Indian Point?

19 Now under those circumstances, would you say that  
20 that series of diagrams shows the larvae concentrating  
21 in the vicinity of the plant?

22 WITNESS GOODYEAR: Yes.

23 MR. TROSTEN: You would say that?

24 WITNESS GOODYEAR: (No response.)

25 MR. TROSTEN: All right. Thank you.

Now, on page A-5-61 with respect to your assertion

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1 that downstream drift of eggs and larvae occurs, is it possible  
2 that what is really being observed in the existing data is  
3 a succession of downstream hatches as the water temperature  
4 rises in the downstream area.

5 CHAIRMAN JENSCH: To what sentence are you directing  
6 his attention in A-V-61, the second of Section B?

7 MR. TROSTEN: I am directing his attention to the  
8 -- just a moment, Mr. Chairman.

9 The second sentence in B, that is correct, Mr.  
10 Chairman.

11 CHAIRMAN JENSCH: Thank you. I wonder if the  
12 Reporter would reread the question?

13 (The reporter read the record as requested.)

14 WITNESS GOODYEAR: It is possible but not  
15 likely.

16 MR. TROSTEN: Dr. Goodyear, I would like to go back  
17 for a moment to these figures that I mentioned to you before,  
18 A-5-11, A-5-12, and A-5-13. I got absorbed on A-5-12 which is  
19 the one you cited and which is the one you say supports your  
20 view that the larvae concentrate in the vicinity of Indian  
21 Point and I wanted to ask you to look at Figure A-5-11.  
22 Do you see that there?

23 MR. KARMAN: Page A --

24 MR. TROSTEN: Figure A-5-11 on A-5-55. Thank you,  
25 Mr. Karmen.

Start May 31st to June 3rd. You see where

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1 Indian Point is. Draw a line from Indian Point up through  
2 the top. See it there?

3 WITNESS GOODYEAR: Yes.

4 MR. TROSTEN: Now, do you see the peak of the  
5 larvae up above mile point 50, somewhere between mile point 50  
6 and mile point 60? Do you see that large bulk of larvae  
7 up there and then extending all the way up to mile point 110?

8 WITNESS GOODYEAR: Yes.

9 MR. TROSTEN: Let's look down at June 7 through  
10 June 10. Do you see the much larger -- there is a peak around  
11 Indian Point apparently there. Do you see the large numbers  
12 of larvae that appear extending up to about mile point 80?

13 WITNESS GOODYEAR: Yes.

14 MR. TROSTEN: Now, let's look down at June 14 to  
15 June 17. You see how the peak is up about mile point 50  
16 and there are significant numbers of them up to about mile  
17 point 80?

18 WITNESS GOODYEAR: Yes.

19 MR. TROSTEN: You see the one for June 22nd where  
20 the peak is below Indian Point about mile point 36.  
21 There are humps up there, mile point 50 and mile point 80.

22 Finally, do you see the last graph which is the  
23 percent distribution of all 1955 larvae from the <sup>Rathjen Mills</sup> ~~Rathjen Mills~~.  
24 Study. Do you see where the peak for the year is about mile  
25 point, oh, I would say about mile point 48 and the vast  
bulk of them extend from about -- from a peak of mile point 48

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1 north to about mile point 80.

2 WITNESS GOODYEAR: The peak is about mile point 47.

3 MR. FROSTEN: Well, it is north of Indian Point,  
4 somewhere between Indian Point and mile point 50 -- let's  
5 say -- all right. It is slightly north of it, right.

6 Do you see the large numbers of larvae extending up to  
7 mile point 80?

8 WITNESS GOODYEAR: Yes.

9 MR. FROSTEN: Now, do you consider that that Figure  
10 A-5-11 on page A-5-55 supports your contention that the  
11 larvae concentration in the vicinity of the plant?

12 WITNESS GOODYEAR: Yes.

13 MR. FROSTEN: Now, let's look at Figure A-5-13 on page  
14 A-5-57.

15 CHAIRMAN JENSCH: Do you mind if I interrupt  
16 a moment?

17 I wonder just to follow that last question and  
18 answer, the witness believes that Figure A-5-11 does support  
19 his theory. Would you tell us how?

20 WITNESS GOODYEAR: Well --

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1 CHAIRMAN JENSCH: What are the data that are  
2 supportive of that?

3 WITNESS GOODYEAR: If you look at the data that  
4 is presented here, the earlier distributions have higher  
5 preponderance of young upstream from Indian Point. As the  
6 time passes, there is a net downstream movement with an  
7 increased concentration in the area of the salt front. This  
8 is generally in the area of Indian Point. Now if you look  
9 at the time and excursion length, it would move to about  
10 mile point 40 or 45 or 46. You incorporate in -- even in  
11 the percent distribution for all of the 1955 data, the highest  
12 concentration for the -- or the highest abundance, these are  
13 really abundance estimates rather than concentration, the  
14 highest abundance is in that area. This is true for -- for  
15 instance, the June 14th to June 17th. You compare June 7th  
16 to the June 14th collections, you will notice that the -- at  
17 Indian Point, June 7th is highest, but there are an abundance  
18 of upstream fish or fish upstream. The next week the upstream  
19 predominance that you see in the preceding diagrams is not  
20 there. That indicates that most of the fish are at Indian  
21 Point in this case.

22 So the increased abundance of concentration at  
23 Indian Point seems fairly apparent to me from these diagrams.

24 CHAIRMAN JENSCH: Thank you.

25 Now you were about to turn to Figure A-5-13.

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1 MR. TROSTEN: I want to turn there. Before we  
2 turn to there, I want to ask Dr. Goodyear a question about  
3 what he has just said.

4 CHAIRMAN JENSCH: Very well. Proceed.

5 MR. TROSTEN: Dr. Goodyear, do you see the June  
6 14 through June 17 figure? Do you see the abundances there  
7 in striped bass larvae captured for 10-minute plankton tow?

8 WITNESS GOODYEAR: Yes.

9 MR. TROSTEN: Do you see the size of the  
10 abundance? The peak is at 36 for a 10-minute plankton tow?

11 WITNESS GOODYEAR: Yes.

12 MR. TROSTEN: When you look down to June 20  
13 to June 22, you see what the abundances are?

14 WITNESS GOODYEAR: Yes.

15 MR. TROSTEN: In other words, the peak abundance  
16 which is below Indian Point -- well, the peak abundance at  
17 Indian Point is at about six for a 10-minute tow.

18 WITNESS GOODYEAR: Yes.

19 MR. TROSTEN: Do those data indicate to you that  
20 the larvae observed from June 14 to June 17, 36 <sup>per 10-minute</sup> ~~per tow~~ <sup>number</sup> ~~per tow~~  
21 plankton, have moved to Indian Point or below Indian Point?  
22 In other words, you have three times the number, more than  
23 three times the number of larvae above Indian Point, and have  
24 you observed where those larvae have migrated to?

25 WITNESS GOODYEAR: Much of the loss that you see

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1 there is probably due to mortality of the yolk sac. That's  
2 about the same period that they stop collecting eggs.

3 MR. TROSTEN: That is the hypothesis you offer  
4 for that?

5 WITNESS GOODYEAR: One moment.

6 I'll have to check that. I believe so.

7 MR. TROSTEN: I am sorry. I didn't hear what  
8 you said, Dr. Goodyear.

9 WITNESS GOODYEAR: I would like to check that.

10 MR. TROSTEN: You think about that and let me  
11 ask you another question while you are thinking about that.

12 Is it not true that up to now we have just been  
13 talking about the peak values like 36 for June 14 through 17,  
14 and all the peaks that we have been describing here above  
15 and below Indian Point? That's what we have been discussing  
16 up to now, isn't that correct? In general we have been  
17 describing the peaks.

18 WITNESS GOODYEAR: The peaks, yes.

19 MR. TROSTEN: Yes.

20 Now do you not agree that the population of the  
21 larvae is actually described by the area under these lines?

22 WITNESS GOODYEAR: Yes.

23 MR. TROSTEN: That's where the whole population  
24 is.

25 WITNESS GOODYEAR: Yes.

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1 MR. TROSTEN: So that all of the population  
2 that is described under this line is above Indian Point  
3 and remains above Indian Point throughout the entire season  
4 as indicated by this line, is that not true?

5 WITNESS GOODYEAR: Would you repeat that again,  
6 please?

7 MR. TROSTEN: I said the population of the striped  
8 bass is reflected not just by the peaks, but by the area  
9 under the line and is it not true that as shown clearly by  
10 these figures that the vast bulk of the population of the  
11 striped bass is above Indian Point from May 31 through the  
12 22nd of June?

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1 (Witnesses conferring.)

2 WITNESS GOODYEAR: There are -- I need to check  
3 a couple of factors before I commit myself to an  
4 answer for that, but there are significant numbers that remain  
5 upstream.

6 MR. TROSTEN: Would you say that it is the vast  
7 bulk of the population that remains upstream as indicated  
8 by the <sup>Rathjen-Miller</sup>~~Rathjen-Miller~~ data of 1955.

9 WITNESS GOODYEAR: Not without checking some  
10 figures. The 1955 data in the other diagrams, I diverted  
11 the numbers so they would reflect relative abundance in the  
12 area rather than concentration because the five-mile segment  
13 at Indian Point has a lot more water in it than a five-mile  
14 segment 100 miles upstream.

15 Now, these values in Figure A-5-11 are not  
16 so transformed so they are more reflective of a concentration  
17 which then would have to be corrected through volume and I  
18 would have to check to make sure.

19 MR. TROSTEN: All right. Why don't you check that,  
20 Dr. Goodyear.

21 Then let's look at Figure A-5-13. Now, do you  
22 agree that the peaks of -- are above Indian Point in each of  
23 these figures with the exception of one characterized as you  
24 did in the Final Environmental Statement by an unusual salt  
25 front situation, that is the week of 6-25 to 7-1. But with

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1 that one exception is it not true that the peaks of the larval  
2 distribution all appear above Indian Point in the 1967 data?

3 WITNESS GOODYEAR: No.

4 MR. TROSTEN: Would you show me where besides that  
5 one week, they are at Indian Point or below Indian Point?

6 WITNESS GOODYEAR: 6-25.

7 MR. TROSTEN: That is the one I meant. 6-25 is the  
8 one where they are below.

9 WITNESS GOODYEAR: The 7-2 --

10 MR. TROSTEN: That is close, I agree.

11 WITNESS GOODYEAR: The sampling station has the  
12 upper limit.

13 MR. TROSTEN: I will accept that is close.

14 WITNESS GOODYEAR: 7-9 has a peak downstream.

15 MR. TROSTEN: Yes, I guess I would have to agree  
16 with you that 7-9 is slightly above -- below as opposed to  
17 above Indian Point.

18 Now, accepting the peaks for what they are with  
19 one below Indian Point or two below Indian Point and one  
20 slightly above and the rest above, will you look down at the  
21 bottom, the mean percent per mile per season. Is not the  
22 peak slightly above Indian Point?

23 WITNESS GOODYEAR: Yes.

24 MR. TROSTEN: Is not the vast bulk of the population  
25 above Indian Point as indicated by that chart subject to the

1 qualifications -- is that subject to the same qualifications.

2 WITNESS GOODYEAR: No.

3 MR. TROSTEN: It is not? All right. So in that  
4 particular one, in the Hudson River Fisheries Investigation,  
5 1957 data, the vast bulk of the population is above  
6 Indian Point throughout the season, is that correct?

7 WITNESS GOODYEAR: I would say no.

8 MR. TROSTEN: You would say no.

9 WITNESS GOODYEAR: I must point out that the mean  
10 percent per mile per season includes estimates before fish had  
11 drifted downstream; in other words, if you look at the 6-11  
12 to 6-17 period and you note the peak during that week and  
13 compare it with the peak on the next week. Now, if you averaged  
14 those two values together for a particular station, you come up  
15 with an intermediate but the same fish have contributed to  
16 a higher peak downstream so you can get a real good idea of  
17 what this means if you look at the July 2nd information which  
18 indicates fairly low concentrations upstream with higher  
19 concentrations from an interval of -- from Cornwall to  
20 Peekskill.

21 Now when you average that value in with the other  
22 values, you increase the average density of fish at  
23 mile point 80 which is plotted on the mean percent per mile,  
24 but, in fact, it doesn't mean that they contributed --  
25 that they didn't contribute to the Indian Point area. You

1 peak 4 understand?

2 MR. TROSTEN: Well, I think I understand, Dr.  
3 Goodyear. The problem is that you are -- I am afraid you  
4 are begging the question. The hypothesis you advance to explain  
5 this, that is <sup>passive</sup> ~~passive~~ downstream drift, is the point in issue  
6 here. That is why we are discussing this. I am simply asking  
7 you that putting aside your hypothesis which is your means  
8 of explaining these data so that it conforms with your theory  
9 that the organism is concentrated in the vicinity of the  
10 plant, is it not true that throughout the season more of these  
11 organisms are above Indian Point and remain -- they are  
12 above Indian Point then are at Indian Point or below Indian  
13 Point, significantly more organisms?

14 CHAIRMAN JENSCH: Excuse me, may I ask a question  
15 about your question?

16 MR. TROSTEN: Yes.

17 CHAIRMAN JENSCH: As I understood the  
18 gentleman's hypothesis as he described it, there is  
19 a general movement downstream.

20 MR. TROSTEN: Yes, sir.

21 CHAIRMAN JENSCH: If you ran a line from the peak  
22 excluding this 6-25 to July 1 period,  
23 you would show, would you not, that there is from the peaks  
24 a general movement downstream as he has projected?

25 MR. TROSTEN: Yes, sir. I heard Dr. Goodyear



eak5 1 say that. I don't think that is true and in a moment we will  
2 explore why that isn't true. I don't think that shows it.  
3 We can look at another figure that will show that that  
4 is not the case.

5 CHAIRMAN JENSCH: Excuse me. Will you proceed?  
6 Do you have the question in mind.

7 Mr. Reporter, will you please read the last  
8 question?

9 (The reporter read the record as requested.)

10 WITNESS GOODYEAR: The answer is no.

11 MR. FROSTEN: All right. Let's go back over this,  
12 Dr. Goodyear. Are there significantly more organisms above  
13 Indian Point than at Indian Point or below it  
14 from 6-11 to 6-17?

15 WITNESS GOODYEAR: During that period there are  
16 significantly more above it.

17 MR. FROSTEN: Right. During the period from 6-18  
18 to 6-24.

19 WITNESS GOODYEAR: Same.

20 MR. FROSTEN: Significantly more above than  
21 at it or below? Right?

22 (No response.)

23 MR. FROSTEN: During the period from 6-25 to 6-31.

24 WITNESS GOODYEAR: Below it.

25 MR. FROSTEN: It is a little hard to tell you see.

1 You have that long, long line going up there.

2 MR. KARMAN: Mr. Trosten, don't argue with the  
3 witness. He said below and that is his answer. You may  
4 have a different opinion but his answer is below.

5 MR. TROSTEN: I am sorry, Mr. Karman. Dr.  
6 Goodyear, do you see that long line there that extends from  
7 Indian Point all the way up to mile point 110? I am  
8 having a little difficulty reading that but would you  
9 say by inspection that there are more organisms below Indian  
10 Point than above it? Would that be your view of those  
11 data?

12 WITNESS GOODYEAR: Yes.

13 MR. TROSTEN: Let's take July 2 through July 8,  
14 would you say there are more above Indian Point or below  
15 Indian Point?

16 WITNESS GOODYEAR: In this case, it would be more  
17 above.

18 MR. TROSTEN: Let's look at July 9 through July 15.  
19 Would you say there are more above Indian Point or below  
20 Indian Point?

21 WITNESS GOODYEAR: I would say below.

22 MR. TROSTEN: I would say below?

23 WITNESS GOODYEAR: Yes.

24 MR. TROSTEN: Would you just by inspection, would  
25 you tell me how that is so? Maybe I am not reading this  
graph right.

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1 WITNESS GOODYEAR: Well, you notice that the last  
2 point -- it is unfortunate they didn't sample further down  
3 from that location, but they still have a significant  
4 number, actually the highest collections are at the lowest  
5 sampling station on the river.

6 MR. FROSTEN: If you were to go five more miles,  
7 then you can go to zero and draw the line, or ten more miles  
8 and draw the line connecting zero to that point.

9 MR. FROSTEN: Do you know that that is  
10 true, Dr. Goodyear, or is that a conjecture that you are making?  
11 That is you were to extend that line, it would continue in  
12 the same direction? Do you know that the slope of that curve  
13 would remain the same?

14 WITNESS GOODYEAR: No. What I said was -- excuse  
15 me. That if you --

16 MR. FROSTEN: I am sorry. I think --

17 CHAIRMAN JENSCH: Let him go ahead and tell us  
18 what he did say so we will have it clearly.

19 WITNESS GOODYEAR: What I did say was if you went  
20 up one more sampling distance and connected to zero that  
21 you would find that the preeminence of the upstream -- in  
22 the upstream directions you were indicating did exist, were not  
23 nearly so obvious.

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1 MR. TROSTEN: Let's look at the last summary  
2 paragraph, mean percent per mile per season. Would you say  
3 that this shows that for the season the numbers of organisms  
4 per mile was greater above Indian Point than below Indian  
5 Point?

6 WITNESS GOODYEAR: Yes.

7 MR. TROSTEN: Thank you.

8 CHAIRMAN JENSCH: Are you going to change from  
9 another subject?

10 MR. TROSTEN: Yes, sir.

11 CHAIRMAN JENSCH: Let me ask you, with some very  
12 capable assistance, I might say, I have drawn a line from  
13 each of the peaks excluding this one as I recall that you  
14 felt was an unusual situation between June 25th and July  
15 1, and if you connected the peaks of each of those other  
16 weekly sections, does not that show a downward passive  
17 drift which is really what the gentleman has talked about?  
18 Not the numbers in the area, but rather that there is a drift  
19 downstream? Have you tried that?

20 MR. TROSTEN: Yes, let's do it, Mr. Chairman.  
21 Let's take the peak --

22 CHAIRMAN JENSCH: His whole -- the whole premise  
23 of your questioning, as I understand it, is the gentleman's  
24 statement that there was a passive downstream drift. Now it is  
25 that general movement that I understood he was advancing.

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1 You have put your questioning on the basis of where the  
2 numbers are of larvae or whatever these things are, so  
3 that you have taken a different factor for your premise than  
4 the witness has established? Have you not?

5 MR. TROSTEN: Yes.

6 Well, I think I have not taken -- I have been  
7 questioning his premise, Mr. Chairman, but I will be pre-  
8 pared to take the peaks that are shown on the 1967 HRFI  
9 data and let's connect them and see if it shows a consistent  
10 movement. From 6-11 to 6-17, the peak is at about mile point  
11 70, is that correct?

12 CHAIRMAN JENSCH: That's what I have.

13 MR. TROSTEN: That's what I have. From 6-18  
14 to 24, the peak is at mile point 55, a downward direction.

15 CHAIRMAN JENSCH: All right. Skip to July 2nd.

16 MR. TROSTEN: Well, I think you really have to  
17 consider them all, Mr. Chairman.

18 CHAIRMAN JENSCH: I thought you threw out the  
19 June 25th one because you said that was an unusual salinity  
20 situation, and you ought to kind of brush that one aside is  
21 the impression --

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1 MR. TROSTEN: No, I didn't have the impression  
2 that you should brush it aside, Mr. Chairman. I was  
3 merely calling attention to the fact -- this isn't critical  
4 to drawing a line.

5 CHAIRMAN JENSCH: No, no.

6 MR. TROSTEN: It was just a matter that I was  
7 calling attention merely to the fact that Dr. Goodyear had  
8 commented on the unusual situation. You show a downstream  
9 peak again on June 25 through 7-1, and then you show an  
10 upstream drift from July 2nd through July 8, and then you  
11 show a --

12 CHAIRMAN JENSCH: May I have that? An upstream  
13 on July 2nd?

14 MR. TROSTEN: Yes, from July 25th -- from the  
15 July 25th peak -- from the June 25th peak, excuse me, to  
16 the July 2nd peak, there is an upstream tendency, and then  
17 there is a downstream tendency on July 9.

18 CHAIRMAN JENSCH: Well, you have taken, as I under-  
19 stood it, the unusual condition -- I understood you had both  
20 agreed that this June 25th to July 1 was an unusual condition  
21 of salinity as it is very evident that it is an unusual  
22 condition. If you took out the unusual and tried to deal  
23 with the normal, you would exclude that section of June 25th  
24 of '71. Assuming for the moment that you did accept that  
25 premise that you would exclude the unusual salinity condition,

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1 and you drew your line from the peaks of June 18th to June  
2 24th to the section for July 2nd to July 8th, would you agree  
3 then that it is a general downstream drift, would you not?

4 MR. TROSTEN: No, I wouldn't, and I would like  
5 to turn back to the body of the text and call the Chairman's  
6 attention to the peaks on the 1966 data on the immediately  
7 preceding page.

8 CHAIRMAN JENSCH: I will be glad to do that when  
9 we finish. Let's take a look at this before we get  
10 diverted into some other red herring, like they say.

11 (Laughter.)

12 WITNESS SIMAN-TOV: I plotted here a curve in a  
13 very rough form of what you are saying, which means a  
14 mileage versus time of the peak excluding the time from  
15 June 25th, and I guess it is just showing this general trend  
16 of going downstream with time, excluding one point.

17 MR. TROSTEN: Mr. Siman-Tov, I do not consider  
18 myself that this shows movement. I think it shows abundance.  
19 The Chairman has asked a question as to whether or not these  
20 peaks all move in the downstream direction at the same time.  
21 They do not all move downstream at the same time.

22 I don't know to what extent the July -- the June  
23 25th peak is or is not unusual. You have commented that it  
24 is unusual, and it is obvious that the salt front is in a  
25 somewhat different position. If you look at the peaks in the

1 1966 data of the Hudson River fisheries investigation, you  
2 will see quite clearly that there is no consistent downstream  
3 movement from the peaks. Look at the June 5th peak, look  
4 at the June 12th peak, look at the June 19 peak, and the  
5 June 26 and the July 3rd. They do not consistently move  
6 in a downstream direction.

7 This is also true, I believe, if you look at the  
8 peaks in the 1955 data, the May 31st peak, the June 7 peak,  
9 and the June 14 peak, and the June 20 peak. There is no  
10 consistent trend of the peaks in any of these.

11 CHAIRMAN JENSCH: So you really are attacking  
12 the portion of his statement that they generally settle in  
13 the vicinity of Indian Point in view of the experience of  
14 '66, but if you excluded the unusual salinity condition for  
15 1967, you would agree that they would generally move toward  
16 the Indian Point location?

17 MR. TROSTEN: Oh, no, I wouldn't, Mr. Chairman.

18 WITNESS GOODYEAR: I would like to make a point  
19 here. The statement was not that they increase in concentra-  
20 tion at Indian Point, but that they -- the -- as they drift  
21 into the salt front or into the salt saline portion of the  
22 estuary, they tend to slow down and concentrate with a  
23 greater downstream movement increasing.

24 Now if you look at the data from -- let's take  
25 '55, on Figure A-V-11.



1 MR. TROSTEN: A-V-11?

2 WITNESS GOODYEAR: The population does not continue  
3 to drift past the saline portion. This is -- I might point  
4 out also that this is not solely seen in the Indian Point or  
5 in the Hudson River data. It is also true for other popula-  
6 tions of striped bass.

7 MR. TROSTEN: Dr. Goodyear, would you turn to  
8 Figure 5-9, please?

9 MR. KARMAN: Page?

10 MR. TROSTEN: Page 5-50, thank you, Mr. Karman.

11 WITNESS GOODYEAR: 5-50?

12 MR. TROSTEN: Yes.

13 Dr. Goodyear, does this show a greater abundance  
14 of striped bass larvae above Indian Point in the Marlboro  
15 and Cornwall sector in the month of August than in the  
16 Peekskill and Croton sector near Indian Point?

17 CHAIRMAN JENSCH: Is Indian Point indicated --

18 MR. TROSTEN: Mile point 44, Mr. Chairman.

19 CHAIRMAN JENSCH: Thank you.

20 WITNESS GOODYEAR: The answer is no, because  
21 they are not weighted for available habitat. In other words,  
22 the Peekskill and Croton sections have a great deal more of shoal  
23 area than do any of the others.

24 MR. TROSTEN: *These show* ~~This shows~~ the average number per  
25 haul that were collected, is that correct?

ar5 1

WITNESS GOODYEAR: That's correct.

2

MR. TROSTEN: Is it true that 10 were collected  
were haul in -- at Marlboro and Croton in August?

3

4

WITNESS GOODYEAR: Yes.

5

MR. TROSTEN: And does it show that somewhat  
more than six <sup>per</sup> ~~were~~ collected?

6

7

WITNESS GOODYEAR: Yes.

8

MR. TROSTEN: In Peekskill and Croton in August?

9

WITNESS GOODYEAR: Yes.

10

MR. TROSTEN: And does this show that in -- at  
mile point 125 and 127, six were also collected?

11

12

WITNESS GOODYEAR: Yes.

13

MR. TROSTEN: Thank you, Dr. Goodyear.

14

WITNESS GOODYEAR: If you would turn to Figure

V-7.

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MR. TROSTEN: V-7?

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MR. KARMAN: Page V-46?

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WITNESS GOODYEAR: Page V-46.

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If you look at the relative -- actually table V-7 would be better because it does have the index to Shoal area. If you look at the various sectors that were included in this diagram, you find that the Peekskill and below the area from Peekskill down contains by far the greatest proportion of habitat.

MR. TROSTEN: Yes.

WITNESS GOODYEAR: So that the <sup>valleys</sup> ~~valleys~~ that you see must be weighted for that condition before you can say that there is a larger -- a greater abundance upstream than downstream.

MR. TROSTEN: Did Carlson and McCann in their 1966 or 1967 data that are reported on Figure A-5-12 and Figure 5-9 on page 5-50 proceed to weight <sup>these</sup> ~~best~~ in such a way that you could make that judgment or did they just produce an average number per haul as indicated on this -- on this figure 5-9?

WITNESS GOODYEAR: They produced the average number per haul, but they also said that they were not to be used for estimates of -- for quantitative estimates for comparison between sections because the river -- the sampling could not be quantitative as well.

2mil 1

2 MR. TROSTEN: Do you agree that the Carlson  
and McCann data cannot be used for quantitative estimates?

3 WITNESS GOODYEAR: The same -- for the seine  
4 haul data this is true.

5 MR. TROSTEN: But the trawl haul data can be.

6 WITNESS GOODYEAR: The trawl haul data can be.

7 MR. TROSTEN: And this is the figure that is  
8 contained in 5-9?

9 WITNESS GOODYEAR: This is seine haul data in  
10 5-9.

11 MR. TROSTEN: Excuse me. That is seine haul data,  
12 I beg your pardon.

13 CHAIRMAN JENSCH: While there is a pause, and I  
14 don't mean to assume the condition of my question, but I  
15 notice you are not holding the microphone. Are you  
16 getting tired? Would you like to recess?

17 MR. KARMAN: Mr. Chairman, might I at  
18 this time -- it has been a rather long day with this group  
19 of witnesses and primarily Dr. Goodyear. At the last  
20 recess Mr. Trosten, Mr. Macbeth and I discussed the  
21 possibility of -- of course, with the Board's permission,  
22 calling a halt at 6:00 o'clock tonight. We have been  
23 at it steadily since 9:00 this morning and I feel I have  
24 some duty to see that my witnesses don't --

25 CHAIRMAN JENSCH: Well, I think very firmly that

3mil

1 at a time when a same group of witnesses have been under  
2 interrogation that they do become exhausted. The interrogator  
3 himself gets tired. I think it gets to be a passive  
4 downstream inefficiency.

5 (Laughter.)

6 I don't think we need to shave this thing so  
7 much until 6:00 o'clock. I agree that you just can't  
8 keep going -- you can keep going as long as the lights  
9 stay on, so if this is a convenient place to interrupt,  
10 how do you feel?

11 You have anything further? Were you about to  
12 change to a different subject?

13 MR. TROSTEN: I am afraid there are many things  
14 that I feel I have to talk to Dr. Goodyear about concerning  
15 the Carlson-McCann data. The only problem I have, I fully  
16 agree we ought to try to run at reasonable hours and I am  
17 getting tired, too, Mr. Chairman. The problem is I am  
18 becoming concerned over the availability of the Staff  
19 witnesses and Mr. Macbeth's need to cross-examine, too. I  
20 certainly would like to conclude my cross-examination  
21 as soon as we could. Perhaps could we go a  
22 little bit longer and then recess?

23 I am willing to break it off now if you want,  
24 Mr. Chairman.

25 CHAIRMAN JENSCH: Do you feel you might

4mil

1 accomplish more with a few minutes' informal discussion  
2 with him off the record so when we proceed in the  
3 morning you may have resolved some of the matters that  
4 are the basis of your questioning?

5 MR. TROSTEN: It is possible, Mr. Chairman. I  
6 think that it is really sort of necessary to go through  
7 this type of dialogue with Dr. Goodyear.

8 CHAIRMAN JENSCH: I don't want to change  
9 your programming at all, but I do think we are getting  
10 very close to 6:00 o'clock.

11 MR. TROSTEN: Why don't we adjourn, then?

12 CHAIRMAN JENSCH: The witnesses, I think, have  
13 a pretty severe test of jumping around in the booklet.  
14 You have your cross-examination pretty well prepared.  
15 I think it is difficult for witnesses to stay on the stand  
16 forever.

17 We will extend the same accommodation to your  
18 witnesses when they get up here.

19 At this time, let us recess, to reconvene  
20 in this room tomorrow morning at 9:00 o'clock.

21 (Whereupon, at 5:45 p.m., the hearing was  
22 adjourned, to reconvene at 9:00 a.m., December 6, 1972.)  
23  
24  
25

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