Docket No. 50-286

DEC 2 0 1974

Daniel R. Muller, Assistant Director for Environmental Projects, L

REVIEW OF ORNL'S STRIPED BASS MODELS AND PRELIMINARY FES FOR INDIAN POINT UNIT NO. 3 - TAR NO. 941

PLANT NAME: Indian Point Unit No. 3
LICENSING STAGE: CP
DOCKET NUMBER: 50-286
RESPONSIBLE BRANCH: Environmental Projects Branch No. 1
PROJECT MANAGER: M. J. Oestmann
REQUESTED COMPLETION DATE: NA
DESCRIPTION OF RESPONSE: TAR Response
REVIEW STATUS: Environmental Specialists Branch - Complete

The Environmental Specialists Branch staff has reviewed the preliminary FES for Indian Point-3 prepared by ORNL. Our review has been directed toward the striped bass model (Enclosure 1) with some attention given to other portions of the text (Enclosure 2). Evaluation of the striped bass models represents our final response to TAR No. 941 and, also, our input to the independent review panel chaired by B. Joe Youngblood. A copy of the draft FES with numerous marginal comments was informally transmitted to the EPM on November 27, 1974. We have not seen need to include all of those comments (e.g. typos) in this report.

The conclusions drawn from our "Preliminary Evaluation of ORNL's Indian Point-3 Entrainment and Population Dynamics Analysis" (memorandum, R. Ballard to G. Knighton/B. Youngblood, dated September 24, 1974) have been reconsidered in light of the additional information presented in the FES. Our findings are grouped into the following categories to facilitate review by the ORNL staff:

Category A. Previously identified concerns which have been adequately treated in the FES. No additional response from the ORNL staff is required.

Category B. Previously identified concerns and new issues raised in the final review which merit further consideration prior to issuance of the FES. The qualitative treatment of these issues, as requested of the ORNL staff, should not cause inordinate delay of the FES schedule.

Category C. Issues bordering on the limits of the "state-of-the-art" which are identified to make the ORNL staff cognizant of certain model weaknesses. Although it would be desirable to expand on these issues in the FES, we recognize that time limitations may not permit full treatment as suggested. However, the staff should be prepared to address these issues if they should arise during the environmental hearing proceedings.

It is our judgement that the FES is technically sound and, taking into account the revisions itemized in Category B, a satisfactory document for issuance. We recommend that the ORNL staff consider the issues identified in Category C prior to the Environmental hearing, and be prepared to discuss these potentially contentious matters. The issues are summarized below and discussed in more detail in Enclosure 1.

Category A Issues

1. Presentation of Final Models: In our opinion, ORNL has presented the models in expert fashion. The mathematical representations of the models are technically sound. Assumptions and selection of model inputs, except as identified in the enclosures, are clearly defined and defensible.

2. Use of the Most Current Environmental Data: For the most part, ORNL has incorporated the most currently available data supplied by the applicant. Data from previous studies on the Hudson River have been used by ORNL only in instances where there are inadequacies in the applicant's data. The applicant's environmental programs are providing continuous data updates, but due to lag-time in data reduction the use of some 'older' data is necessary. Additionally, the selection of a baseline for evaluating incremental and/or cumulative impacts of the existing and proposed plants dictates the use of older data which are representative of the pristine or pre-Indian Point condition.

3. Use of Models in Defining Issues Which Require Additional Research: ORNL has run their models with a best estimate of model inputs. To test the sensitivity, ORNL then varied the inputs over a wide range about their 'best estimate'. The results indicate that the percent reduction value of the young-of-the-year (y-o-y) stages can vary appreciably depending on which baseline case is selected, i.e. the hypothetical clean river conditions (Case 1), the 1973 conditions (Case 2), or the conditions with all plants in operation except Indian Point 1-2-3 (Case 3). The single most important parameter influencing y-o-y model response is the intake density ratio (f_I). As the value of f_I decreases, the sensitivity of the percent

reduction values to f_I increases. We concur in ORNL's conclusions that the f_I values obtained by the applicant's consultant (QLM) may be unrealistically low and that additional information about vertical and lateral distributions is needed.

In analyzing the adult population model runs, the results were found more sensitive to changes in the fishing control parameters (PMAX, PMIN, and D) than to changes in any other parameters. ORNL concludes that "...the present uncertainties in the values of these three parameters are the primary impediments to narrowing the range of uncertainty in the forecasts themselves" (FES, p. B-188).

4. The Relationship Between State-Of-The-Art Of Sampling Accuracy and Model Sophistication: ORNL has provided useful summaries and valid criticism of the applicant's research program. As demonstrated by the sensitivity analyses, predictions based on mathematical models are greatly influenced by values of the input parameters used. It is made clear in the discussion that data inadequacies may result from poor experimental design but also from the present state-of-the-art of sampling a mobile population in an open system. Data inadequacies would likely be more critical in a more complex (three-dimensional) model, as is supposedly being developed by the applicant.

Category B Issues

1. Entrainment Probability Concept: The concept of "mean monthly probability" of entrainment is presented in a manner which can be misinterpreted. ORNL should clarify the discussion as presented in Chapter V and in the Summary and Conclusions.

2. Position on the Applicant's "Erroneous" Approach: The position taken by ORNL that the applicant's approach to modeling compensation is "erroneous" should be tempered. ORNL's reason for adopting a different approach (i.e. fishing as the important compensatory mechanism) is stated simply as opinion. This discussion should be rewritten so that the reader is not given an impression that the AEC staff has the privilege to make assumptions and introduce opinions but that the applicant is not so privileged. In the enclosure, we have noted certain aspects of ORNL's model which could also be labeled as "erroneous" due to a lack of 'hard' supportive data.

3. Interspecific Relationships: Interspecific relationships clearly affect the striped bass population in the Hudson River and New York Bight. ORNL has included reference information on changes in the fish community of Lake Erie as indicative of difficulties in extrapolating the results of a single-species model to the real

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world. The discussion would be strengthened by stating how interspecific relationships might alter the predictive capability of the striped bass models.

4. Degree of Stock Interchange in a Closed-System Model: There are limits in applying a closed system population model to what is known in reality to be an open system (i.e. some interchange among Atlantic stocks of striped bass). A paucity of data hampers the quantitative treatment of the degree of interchange. ORNL should discuss, in qualitative terms, which model parameters would likely be most affected by these recognized model limitations.

5. Shoaling Parameter: The method used to calculate the shoal parameter should, in general, reflect more than a simple ratio of river width to maximum depth. Other geometric, ecological, and behavioral aspects can be theorized. ORNL should give a more convincing argument for using the selected method.

6. Model Time Resolution: ORNL's discussion of spatial resolution in the y-o-y model (size of discrete element) is adequate. However, further discussion of time resolution would be helpful in responding to the ASLAB's finding that a model with high temporal resolution (three hours) best conforms to reality.

Category C Issues

1. Compensation in the Hudson River Striped Bass Population: ORNL has modeled the expected impact on the Hudson River striped bass population and the fisheries which it supports under assumed natural steady-state conditions. It is apparent from reported increases in landings since the early 1940s that natural (and perhaps man-induced) forces have acted on the striped bass population in complex ways which cannot be treated in a steady-state model.

2. Effect of Weather on Fishing Effort and Success: Regional statistical agents for the National Marine Fisheries Service in New York and New Jersey have identified weather conditions as being a significant factor affecting landings of striped bass. Such variability has not been considered in the probability of survival from death by fishing.

3. Survival Probability in Relation to Spatial Distribution: The relationship between population size and survival probability (from fishing) is based on the assumption that schooling behavior of the species is the major factor which determines the spatial distribution. It may also be envisioned that the survival

probability could remain unchanged if the distribution pattern simply expands spatially when the population size increases, i.e. density is unchanged with more fish being distributed over a greater area.

4. Effect of Environmental Factors on Shoaling Behavior: The importance of environmental factors (e.g. temperature, salinity, and turbidity) in affecting the shoaling behavior of fish may be significant. Data are lacking to allow proper assessment of these relationships but the potential weakness in the model should, at least, be recognized.

5. Effect of Food Availability on Growth Rate and Mortality Rate: Only salinity and temperature are considered as the important variables in controlling growth rate and mortality rate in the young-of-the-year model. Food availability is also an important variable.

6. Fisheries Aspects of the Benefit-Cost Analysis: In its estimations of the size and dollar-value of the striped bass sport fishery, ORNL has not considered errors which might arise from application of results of broad regional studies to specific localities.

This review was conducted by C. Billups, W. Knapp, W. Pasciak, and J. Bolen of the ESB staff. They are available for discussions with the ORNL staff, if further clarification of the identified concerns is desired.

Original Signed by
H. R. Denton

Harold R. Denton, Assistant Director
for Site Safety
Directorate of Licensing

Enclosures:
As stated

cc: See next page.

cc: w/o enclosures
A. Giambusso
W. McDonald
J. Panzarella
SS Branch Chiefs

cc: w/enclosures
S. Hanauer
F. Schroeder
TR Asst. Directors
D. Muller
R. Ballard
M. Oestmann
W. Knapp
W. Pasciak
J. Bolen
C. Billups
G. Knighton
B. Youngblood
J. Swinebroad
D. Hamilton

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DATE ➤	12/20/74	12/20/74	12/20/74			

ENCLOSURE 1

ENVIRONMENTAL SPECIALISTS BRANCH
COMMENTS ON INDIAN POINT #3 MODELS

ORNL's population models described in the FES are based on a conceptual approach which, in many aspects, is fairly convincing and likely to be agreed with for the most part. Nevertheless, there are certain shortcomings. These are mainly issues which are difficult, if not impossible, to predict. It is likely that neither the applicant nor any intervenor will be able to explain these problem areas. We identify many of the weaknesses of the models in hope that it will help ORNL in defending them. We are not implying that ORNL should throw out their weaker arguments since many of the problem areas border on the limits of the "state-of-the-art". Some of the following concerns were previously raised in our report to G. W. Knighton, dated September 24, 1974, entitled "Preliminary Evaluation of ORNL's Indian Point-3 Entrainment and Population Dynamics Analysis". Other issues have resulted from our review of the finalized models.

CHAPTER 5 ENVIRONMENTAL IMPACTS OF STATION OPERATION

Entrainment

The concept of "mean monthly probability" of entrainment is presented in a manner which can easily be misinterpreted. The magnitude of entrainment depends not only on temporal changes in river flow, but also on temporal changes in the abundance and distribution of organisms. It is confusing to read a discussion which highlights the probability aspects of entrainment, but which largely fails to consider abundance and distribution of biota. ORNL should consider entrainment in light of both aspects.

Compensation in the Hudson River Striped Bass Population

Density-Independent Factors

The lab criticizes repeatedly and strongly the applicant's failure to identify a specific and credible density-dependent mechanism for y-o-y striped bass. Mechanisms presented by the lab should not be considered as being entirely representative of natural mechanisms. In many instances, it appears that the lab has "over-reacted" to criticism from the applicant, intervenors, and the appeal board.

It is difficult to accept completely the lab's statement that "...striped bass populations on the Atlantic coast are controlled primarily by a compensatory process in which fishing mortality limits the production of adult individuals as a decreasing function of population density." It is well known that commercial landings of striped bass in New York Bight have increased at least seven fold since the early 1940s. In New York State the increase was largely due to increased landings by haul seine, and more recently, gill nets, pound net and otter trawls. Increased landings in New Jersey are largely results of improved catches by inshore trawlers from Point Pleasant and Ocean City, operating three or more miles offshore. It is generally agreed that landings have increased more rapidly than effort directed at striped bass, and that striped bass have become increasingly abundant in New York Bight in the past two decades. It is apparent that natural forces (and perhaps man-induced) have acted on the population in manners which ORNL has not considered. It appears highly unlikely that the lab's interpretation of compensatory mechanisms as they relate to the variety of commercial fishing methods used to catch striped bass are completely accurate and applicable to modeling. The concept of a single commercial fishery for striped bass in which effort responds to abundance is an oversimplification.

With regard to the relationship between sport-fishing intensity and production of adult striped bass, the lab would be equally hard-pressed to explain why the striped bass population has increased when recreational landings of striped bass have also increased. It appears that the lab equates population density with abundance of striped bass, and that many of their arguments are based upon density rather than abundance. Implications of such an approach are discussed in greater detail in the next section.

It is difficult to accept long-range (40 and 80 years) predictions which result from application of the y-o-y and adult models to commercial and recreational fisheries for striped bass. Natural fluctuations over such long periods will undoubtedly act to make it exceedingly difficult to quantify and predict plant-related effects on striped bass. Likewise, commercial fishing effort directed at striped bass is likely to change (as it has in the past 20 years) in manners which cannot be modeled. ORNL should emphasize that they are modeling the expected impact on the Hudson River striped bass population and the fisheries which it supports under assumed natural steady-state conditions. Such conditions are highly unrealistic and need further examination.

It is difficult to envision how the lab's mechanism for species-specific directed fishing effort would act as a density-independent mechanism. Most of the inshore fishing effort directed at migratory pelagic species along the New York shoreline is by haul seine, gill net, and pound net, with some inshore trawling. Although these gears do not appear to be overly specialized or specific for particular species, they are to a large extent. Seasons, areas, and alternative methods of fishing can be varied so that effort is directed toward particular species. Inshore trawling for striped bass along the New Jersey coast is also rather specific.

Trawlers generally take greatest numbers of striped bass in late winter in deep "offshore holes", where the species overwinters. Often the direction which this commercial fishing effort takes is determined by market conditions and preferences as well as abundance and distribution of all target species. In recent years, declining landings by the offshore trawl fleets of New York and New Jersey have provided much incentive for inshore fishing directed largely at striped bass and other migratory pelagic species. The likelihood of there being a constant "background" mortality acting on striped bass due to species-specific directed fishing effort is not as high as the lab suggests.

ORNL recognizes that commercial fishing effort for striped bass along the south shore of Long Island is greatest in October and November and along the east shore of New Jersey is greatest in January, February and March. The lab should also recognize that the intensity and success of this effort is largely dependent upon weather. L. T. Smith and E. A. LoVerde, regional statistical agents for NMFS in New York and New Jersey, respectively, have repeatedly referred to weather as being a significant factor affecting landings of striped bass. ORNL should consider weather variability, particularly as it relates to commercial and recreational fishing effort in inshore waters.

Density-Dependent Factors

The discussion of the relationship between population size and probability of surviving fishing* is based on the assumption that the schooling behavior of striped bass is the major factor which determines the spatial distribution of the species in estuarine and marine environments. Assuming that fishing effort increases in proportion to

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*This concept is equivalent to the probability of survival from death by fishing as represented in the adult population model as PSF_i.

population size, the probability of surviving fishing will only decrease if the density of striped bass in the fishing areas increases (absolutely, or with respect to other areas). If the population size increases and effort increases accordingly, it is not very difficult to envision no change in survival probability if there is no increase in density (e.g. the distribution pattern simply expands spatially) or if the distribution (whether it is "schooling" or not) extends beyond the inshore fishing areas. Only recently have trawlers begun to concentrate on striped bass along the New York and New Jersey coasts, and it seems reasonable to expect that inshore fishing effort for striped bass will continue to provide the greatest catches of striped bass.

With regard to recreational fishing, ORNL should recognize that arguments similar to those above can be presented which show that the density-dependent mechanism proposed by the lab also relies heavily on schooling behavior, or increasing densities of striped bass with increasing population sizes. The response of sport fishermen to increased abundance of striped bass may not be the almost linear relationship which the lab implies, owing to restrictions on catchable sizes, response time, participation time, and capital.

Forecasts on Impact of Hudson River Striped Bass Population

Difficulties of modeling individual populations or species and not communities and ecosystems are well-recognized. Interspecific relationships clearly affect the striped bass populations in the

Hudson River and New York Bight. In light of the absence of any extensive consideration of interspecific relationships in the y-o-y and adult models, the accuracy of the models and their predictive abilities can be doubted. ORNL should discuss such possibilities and clearly state how interspecific relationships might alter the predictive abilities of the models, as applied to the striped bass population and other migratory and resident populations in the Hudson River. It is difficult to envision such relationships having no significant influence on the composition and types of biota in the Hudson River over 40 or 80 years.

Zone and Degree of Influence of the Hudson River Striped Bass Population

The lab presents results (Table V-23) of tagging studies of striped bass and fails to consider important factors which might have biased the results. ORNL should discuss the spatial distribution of tag-returns in light of known seaward reductions in commercial and recreational fishing effort. The lab should consider the possibility that some commercial fishermen are not likely to be responsive (deliberately or unintentionally) to tag-studies. This is especially true in New Jersey where trawlers have been known to take (illegally) large numbers of undersized striped bass from restricted waters.

The assumption that 90% of the striped bass in the Inner Zone are of Hudson River origin appears difficult to support. The validity of establishing the contribution of the Hudson River striped bass in the

Inner and Outer Zones on the basis of only 35 tagged recaptures is questionable. Whereas the lab indicates that the best estimate of the range of this "contribution is from 50 to 100%", it should make it clearly understood that 90% is a controversial value.

FES-APPENDIX B. SUPPLEMENTAL INFORMATION RELATING TO BIOLOGICAL MODELS

Striped Bass Young-Of-The-Year Model

Egg, Larvae, and Juvenile Distribution

The egg, larvae, and juvenile distribution is discussed thoroughly in Appendix B. Nevertheless, because of difficulties of sampling and limited data, it is difficult to establish confidence limits on these data, and hence on the results of the model. It is likely that this weakness will affect the applicant's model more because the applicant's model is, supposedly, more complex (three-dimensional) and would require better data.

Shoal Parameter

ORNL should give additional consideration to the method they are using to calculate the shoal parameter. The shoal parameter should reflect more than just a single ratio of the width to the depth. Other geometric factors such as average depth and hydraulic radius should be considered in establishing the value for the shoal parameter.

The ultimate selection of a shoaling parameter should incorporate ecological factors such as food availability, and should be verified through observed data on the shoaling tendency of juveniles.

The relationships between productivity and consumption of food in shoaling areas are not known, and until further studies are made it is impossible to model the shoaling tendency without assuming that the available food supply is independent of the rate of consumption. Also, there are behavioral factors which cannot be modeled.

Factors like temperature, salinity, and turbidity may significantly affect how an individual behaves in its environment; e.g., if the water temperature of a shoaling area is significantly higher than the water temperature in the river, the y-o-y fish may prefer to remain in a given location rather than leave in search of shoaling areas with greater food supplies as envisioned in the design of the model. In reality, the individuals may behave in very complex ways which may completely negate the results of the model.

Age Groups Population Generation (Transfer) Rates

Only salinity and temperature are considered as the important variables in natural growth rate and mortality rate. The food available is also an important variable in growth rate, an observation which is supported by ample data. To incorporate this into the model, the degree to which the food resources are saturated as a function of population density must be better understood. If the food supply is limiting, the growth rate should be smaller than the growth rate when the food supply is in excess. ORNL should discuss the dependency of growth rate on the food supply in the river.

Model Resolution

Planktonic organisms typically show considerable patchiness in their distribution. Because this patchiness is caused by weather conditions and other factors which cannot be predicted with confidence, it is essential that the size of the discrete elements be much larger than the characteristic length of the patchiness. Furthermore, the limit of the temporal resolution should be increased beyond one tidal cycle since the average weather conditions over a tidal cycle are highly variable from one tidal cycle to the next. A more reasonable temporal resolution limit would be 14 tidal cycles (one week).

Consideration should be given to the temporal fluctuations and spatial patchiness in the river to establish the limit of the temporal resolution and the length of the discrete elements. ORNL should discuss its conclusions in terms of the Appeal Board's finding that a model with high temporal resolution (three hours) best conforms to reality.

Striped Bass Life-Cycle Population Model

Compensation

McFadden (1972), in Indian Point 2 testimony, emphasized the importance of density-dependent factors operating on the striped bass population. He suggested that when the population is less dense, fish grow at a faster rate and become sexually mature at a younger age. The ORNL modelers ignore this by assuming growth rate and natural mortality for age classes 1-15 to be independent of population size. If McFadden is correct, the power plant could kill large numbers of y-o-y striped bass without a significant effect on the fishery; if ORNL is correct, a large kill at the power plant could reduce fish landings, and possibly have a long term effect on the population. A thorough investigation should be made of density-dependent compensatory mechanisms that operate on the age groups older than year zero and a discussion included in the FES. The discussion that is presented in inadequate.

It is stated that "One of the most important differences between the applicant's, intervenor's and staff's approaches [to modeling]...is concerned with the relative importance of natural density-dependent mechanisms that might act to compensate for losses from operation..." The staff position is that the applicant's approach is "erroneous" because it did not evolve from a proper conceptual development; the discussion goes on to point out some of the problems with the applicant's approach. After the applicant is criticized for lack of conceptual detail, the staff states that its position is that fishing, as opposed to the applicant's general approach, is the important compensatory mechanism. The staff's reason is stated simply as <u>opinion</u>. This section gives the reader the impression that the staff has the privilege to make assumptions and introduce opinions in its approach, but that the applicant must support its approach with detailed explanations. This section should be rewritten so that it does not give this impression.

Migration

The adult striped bass model treats the Hudson River population as a closed system, i.e., no interchange among Atlantic stocks. The literature indicates that some interchange does take place. ORNL should discuss the possibility of mixing of migratory stocks in terms of limits set on conclusions drawn from the closed-system model.

ENCLOSURE 2

ENVIRONMENTAL SPECIALISTS BRANCH
ADDITIONAL COMMENTS ON DRAFT FES
FOR INDIAN POINT 3

SUMMARY AND CONCLUSIONS

We suggest that the summary and conclusions section be reorganized along the following guidelines:

1. The section could be shortened if only the staff's results were included. All discussion of the applicant's results from research programs and modeling efforts need not be included here but rather in the FES text.

2. The summary of impacts could be clarified by organizing sub-sections for impacts with:

   a. Proposed once-through cooling at Unit #3;
   b. Proposed once-through cooling at Units #2 and #3;
   c. Proposed once-through of #1 and #3, closed #2;
   d. Above combinations with other plants except Cornwall;
   e. Above (a,b,c) combinations with all existing and proposed plants.

3. All discussion of closed-cycle alternative for #3 should be moved to paragraph 5.

4. All conclusions should be discussed in paragraph 4.

5. All conditions (Tech Specs requirements) should be moved to paragraph 9.

6. References to the text (section or page) are necessary because of the difficulties in condensing the voluminous technical discussion into clear concise summary statements. Portions of the summary and conclusions were unclear without referring to the text, e.g. items n(3)(d) and n(3)(g).

CHAPTER VII ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

In the final paragraph of Section B.4 (Biological Impacts), ORNL should discuss chlorination, as it contributes to "additional adverse impacts due to the operation of wet or natural-draft cooling towers."

CHAPTER VIII THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

In concluding that once-through cooling can significantly, but not irreversibly, reduce fishery yields, ORNL assumes that population sizes and fishery yields are synonomous. The lab should consider whether a market "deprived" of Hudson River striped bass for 40 years can then respond to an increase in abundance of striped bass in such a manner as to provide incentive for re-establishing traditional commercial fisheries. As has often been the case (e.g., the Hudson River American shad fishery) in competitive markets, alternative species replace dwindling resources, or alternative sources of a particular species are found, making it difficult to re-establish viable local commercial fisheries.

CHAPTER XI ALTERNATIVES TO PROPOSED ACTIONS AND BENEFIT-COST ANALYSIS OF ENVIRONMENTAL EFFECTS

Economic Impact of the Indian Point Plant On The Hudson River Spawned Striped Bass Fisheries

The units on the ordinate of Figure XI-3 should be changed to cost/trip. The linear function does not support assumptions made in Chapter V regarding "hard-core" fishermen. A "hyperbolic" curve would be more accurate.

Estimate of Hudson River Striped Bass Angler-Days

In considering the "salt-water factor" ORNL should discuss estimates in terms of their accuracy and reliability. It is essential that the lab consider the source (personal communcation, T. A. Phillips to R. S. Boyd, December 22, 1971) of information.

In applying the Zone Factor, 12-Year Factor, and Salt-Water Factor (Table XI-16), ORNL should discuss errors which might arise from applying general averages (over large regions) to specific states. It is assumed, albeit not stated, that regional averages can be applied to individual states. Application of results of the Salt-Water Angling Surveys to particular states is statistically unsound. (Deuel, personal communication.)

ORNL should discuss the assumption that population within a state is distributed in a manner which can be represented by use of a Zone Factor. The lab should provide supportive evidence to verify the accuracy of such an approach.

ORNL should consider how the average number of days fished per angler on the Atlantic Coast varies with climate, weather conditions, distribution and abundance of biota, and coastline topography. The lab assumes that the average of 12.2 days/angler-year can be applied accurately to states under consideration.

Commercial Landings of Striped Bass in the Hudson River Zone

ORNL should discuss the assumptions that commercial landings of striped bass from Long Island Sound are divided equally between the eastern and western halves, and that commercial landings for Ocean County, New Jersey, are divided equally in the northern and southern halves. Considering locations of major fishing ports and dockside facilities, these assumptions appear inaccurate.

The lab should explain why all of Marine District #6 (Figure XI-82) is designated as being in the Outer Zone, and why it hasn't been treated like Long Island Sound and Ocean County.

ORNL states (page XI-82) that there has not been an escalation of commercial striped bass fishing effort since 1961, and that it is therefore, valid to assume that effort expended in the commercial fishery will remain constant for the next 80 years. The bases for this assumption are somewhat unsound. Increasingly more effort has been directed toward inshore fishing in New York and New Jersey since the early 1960s. Landings of striped bass have increased during that time. Although it is accurate to say that the numbers of gears which actively pursue striped bass in waters of those states have not increased greatly, it is inaccurate to conclude that fishing effort directed specifically at striped bass has remained relatively unchanged. Stake, anchor, and runaround gill nets and inshore trawls have increased in number and taken increasingly more striped bass since the middle 1960s. The number of haul seines has remained relatively unchanged, but seasons and areas of fishing have been altered to take advantage of the recent abundance of striped bass in waters off New York and New Jersey. Landings of striped bass in New Jersey are dominated by inshore trawlers that direct much of their effort toward striped bass in late winter (Hamer, P. and E. LoVerde, personal communication). Although ORNL may be unable to predict allocation of fishing effort among resources in the future, it should avoid inaccurate assumptions.

In considering "Unit Costs" (p. XI-82), the lab should discuss reasons for selecting the retail price of striped bass (ca $.57/lb) as opposed to the unit price received by the fishermen at dockside (ca $.20-.25/lb in 1967 dollars). ORNL should distinguish between "values for the commercial fishery" and actual value of those resources exploited. A retail value of $.57/lb is not directly equatable to the dockside price received by the fishermen, nor to the actual profit derived by the fishermen from his fishing efforts. Using the lab approach, any marketable catch of striped bass, regardless of expenses incurred by the fishermen, represents a positive "value for the commercial fishery". Although economic aspects of fishery management are complex and difficult to model, they should nonetheless be recognized and discussed.

The statement in the final paragraph on page XI-98 is extremely important and should also appear in Chapter V, where it rightfully belongs.