Agenda Item #22
June 28-29, 1979

MEMORANDUM

To: Council, SSC, and AP

From: Jim H. Branson, Executive Director

Date: June 22, 1979

Subject: The Pacific Council's optimum yield paper

BACKGROUND INFORMATION

The Council has been asked to comment on an optimum yield paper developed by the Scientific and Statistical Committee of the Pacific Fishery Management Council.

The paper was reviewed by the Scientific and Statistical Committee at their May meeting. Their initial reaction was to support the general concept as presented but they questioned the legal adequacy of the proposal under the FCMA. They have scheduled a more thorough review of the paper for this meeting. The SSC report should contain their most recent recommendations.

In addition to the optimum yield paper, we have included a letter from Dr. Don Bevan to Terry Leitzell, dated February 20, 1979, on the use of optimum yield in the development of fishery management plans. It's a letter worth reading.

The paper in summary proposes that OY can be an average value and that the Act has no requirement to establish annual values for MSY or OY. The report encourages further exploration of the FCMA using this perception of MSY and OY.

COUNCIL ACTION

Nakatsu requested our response by July 1, 1979.

Agenda #22

JUNE 1979

UNIVERSITY OF WASHINGTON
SEATTLE, WASHINGTON 98195

College of Fisheries
WH-10

February 20, 1979

Mr. Terry L. Leitzell
Assistant Administrator for Fisheries
National Marine Fisheries Service
3300 Whitehaven Street,Page Bldg. #2
Washington, D.C. 20235

Dear Terry:

Some time ago two documents crossed my desk and their review prompts me to suggest a different approach to the use of Optimum Yield in the development of fishery management plans. The first paper was a speech by Congressman James G. Martin that I had found interesting and set aside for further study. The second document was a ruling by the NOAA Counsel which stated that Optimum Yield was not a quota but that it must be achieved and could not be exceeded. Although speaking about a subject in his field of chemistry Dr. Martin seems to have anticipated the OY ruling when he said:

> "I am concerned that their ... response will be dominated not by scientists, not by experts who understand the capabilities and limitations of science and who can interpret the meaning of evidence, but by those trained in the fields of law and public administration. I am afraid that, if left to themselves, their lack of scientific understanding will be conveniently replaced by their penchant for organizational orderliness. The essentials of technology will be obscured behind a facade of legal technicalities."

Without Congressman Martin's warning I might have passed the OY ruling off as just something to provide a good laugh at the next Council meeting. Of course, dealing with OY is a serious business since the law requires that we must provide a number. Fishery scientists are used to dealing with numbers, and what is equally important, and sometimes much more difficult to determine than the number, is the degree of error in the estimate of that number. Fishery scientists deal with uncertainty, which some of my lawyer friends consider a nice way of saying we don't really know what we're doing. There is truth to this, but at least we give some measure of the extent of our uncertainty. This dealing with uncertain numbers provides a particular problem if OY is a level of catch which must be obtained but cannot be exceeded. It means that it is a mathematical impossibility to achieve OY over the long run. It is as if asking a professor to be sure that all his students are above the average, or guaranteeing that I will not go over my boots if I wade across a river that averages two feet deep.

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We have two other problems in dealing with OY. Firstly, we may not know what it is until we have taken it and secondly, we may need to depart from it significantly in order to reach it. For example, in the Dungeness Crab Fishery only males are take at a size that removes only those that are not needed for the successful reproduction of the population. If this assumption is correct and we impose no fishing induced mortality on females, or sub-legal males, the Optimum Yield is what we can catch of legal sized males. Because of the great variability in recruitment caused by natural environmental factors, the estimate of the number of surplus males is difficult to forecast. We can estimate rather precisely the size at which they become surplus. Therefore, a fishery based upon size with some seasonal closures to protect female and sub-legal males from injury when molting, has little need for an exact estimate of Optimum Yield before the fishery takes place.

A similar situation exists in the stone crab fishery in the Gulf of Mexico where only the claws are taken and the crab returned to the water.

In another case, in a bottom fish fishery, you may have an under-utilized species in great abundance which we expect to develop in the future, such as the Dover Sole on the Pacific Coast. Yet we cannot develop the fishery for Dover Sole without taking Petrale Sole which are already below the MSY. In order to take the Optimum Yield of Dover Sole we must reduce the numbers of Petrale Sole, so we now are faced with yearly catches of Dover Sole that are less than the Optimum Yield until such time as we can develop the fishery. At the same time the Petrale catches must be greater than the final OY that we need to reach for the Petrale in order to fully utilize the Dover.

The question now is how best to handle OY in the development of Fishery Management Plans. Don McKernan made a suggestion the other day that I think merits further consideration. His idea is that we should do as the law specifies and set an OY appropriate to a particular population that we expect to achieve over a reasonable period of time. It is then a goal and an average and we recognize that short term fluctuations in the population may lead to allowable catches which are either over or under the Optimum Yield. Optimum Yield must be considered as an average and it may be a number of years even with a well-managed population to get to the OY level. I specifically do not suggest that we deal with some far away "great golden OY in the sky," but I do believe we must depart from within season changes in OY that require instant changes in levels of fishing.

In dealing with uncertain numbers we should not be concerned with deviations from that number which have no scientific meaning, and even less concerned if they do have meaning and we know the cause is not related to fishery removals. If we do this I believe we can be assured of much better understanding and cooperation from those we regulate when the information indicates that a reduction in fishery removals is necessary.

If the law cannot work this way, it is not performing as intended and must be changed.

To paraphrase Congressman Martin, "No, I'm not really in favor of a little bit of over-fishing, I'm only in favor of a little bit of common sense."

Sincerely yours,

Donald E. Bevan
Associate Dean

DEB/aw
CC: Hon. James Martin
Hon. John Martinis
Hon. Clem Tillion

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June 1979

PACIFIC FISHERY MANAGEMENT COUNCIL

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MAY 21 1979

MEMORANDUM

DATE: May 18, 1979

TO: Terry L. Leitzel, NMFS
Executive Directors
Regional Fishery Management Councils

FROM: Lorry M. Nakatsu, LMN
Executive Director

SUBJECT: Optimum Yield

Our Scientific and Statistical Committee drafted a statement on the interpretation of optimum yield and how it should be used in fishery management plans. The Committee has developed a profound and innovative approach which deserves some discussion and comment from NOAA and the other councils. We are interested in your thoughts on this document and would appreciate comments before July 1. The Pacific Council will discuss OY again at its July 12-13 meeting in Los Angeles.

LMN:wd
Attachment

Comments on O.Y.

At the request of the Council, the Scientific and Statistical Committee has reviewed the opinion of the General Counsel's office of NOAA regarding optimum yield. We urge that the Council not take issue with nor endorse the views expressed in the General Counsel's memorandum, because they do not provide the Council or the Management Teams with useful understanding of the role of OY in the fishery management process. The confusion over OY in our view, reflects a misunderstanding of the underlying biological processes that are involved in management and their relationship to those objectives associated with economic, sociological, or ecological goals. This lack of understanding has led to some rather confusing interpretations of the applications of OY under the Fishery Conservation and Management Act. It is the latter that needs clarification.

Inasmuch as Drs. Bevan and Alverson both played roles in the discussions that led to the incorporation of optimum yield into the FCMA, they have attempted to reconstruct some of the original thinking which led to the incorporation of OY into the Act. In addition, in order to provide some clarification and guidance, both to the Council and to the Management Teams, the SSC has (1) considered the qualitative and quantitative dimensions of OY as implied in the Act and (2), related and demonstrated the application of OY to historical management techniques. We urge the Pacific Council explore with NOAA and other Councils the utility of OY as conceived in the following discussion.

Optimum Yield as a Management Concept

OY began to emerge as a management concept at least a decade prior to the passage of the FCMA. The desirability of moving away from maximum sustainable yield as a single management objective was debated hotly in the literature

by the economists in the mid-60s and debated extensively in various international forums since that time. The economists found fault with MSY because it failed to accommodate economic principles in the management process. MSY as a management goal subsequently was attacked on the basis that single species models were inadequate to describe the processes ongoing in an ecosystem and, finally, that management for biological concepts only precluded consideration of important social, economic, political, and ecological concerns.

In order to encourage a more holistic management process, concepts of maximum economic yield, optimum sustainable population, and ultimately optimum yield evolved. A large number of people dealing with the drafting of the FCMA endorsed the concept of having a management process which would allow deviations from allowable biological yields. Hence, the introduction of the term "optimum yield." OY within the context of FCMA, was defined as "the amount of fish"

(A) which will provide the greatest overall benefit to the Nation, with particular reference to food production and recreational opportunities; and

(B) which is prescribed as such on the basis of the maximum sustainable yield from such fishery as modified by any relevant economic, social, or ecological factor."

There are several important implications of the introduction of OY as a management concept.

1. It was intended to provide for greater flexibility in achieving a variety of management goals.

2. It was described as a deviation from the MSY which, in itself, is an average value of the expected maximum yield that can be achieved under a specified conservation strategy over time.

3. The concept of OY was not introduced to require management of fishery resources based solely on quotas.

Quantitative and Qualitative Dimensions of OY

It is important to note that the deviation from MSY, which is an average long-term value, to OY explicitly implies that OY itself must be perceived as an average yield or amount based on achieving specific economic, socialogical, or ecological objectives over time. The root of our present dilemma arises from the fact that we have been attempting to consider OY as a specific numerical annual yield and as such we have trapped ourselves with the same problem as the manager attempting to achieve MSY by fixing annual yields that are equal to long-term average goals. The underlying problem results from the fact that the allowable biological catch from year-to-year must be varied to achieve MSY in terms of changes of stock sizes which are the product of natural variation and are not predictable by the application of static population models. Hence, OY should be considered or conceived in a similar fashion to MSY as a long-term yield goal. Year-to-year management strategies should be designed to approach that goal over time. Hence, specific management strategies for each year must be based on the allowable biological catch for that year modified by any relevant short term economic, sociological objective associated with long term management goals. We have clearly established in the development of management plans that an annual allowable biological catch (ABC) must be defined. This value is established as a basis of achieving long-term biological potential of the stock--that is, MSY.

In a similar way, the only reasonable approach to OY is to establish total allowable catch (TAC) values which should be specified by either qualitative amounts or as a numerical figure. This proposal would result in parallel concepts between MSY, OY, and allowable biological catch and TAC.

Consideration of OY in Establishing Total Allowable Level of Foreign Fishing

The optimum yield concept has also been clouded by its use in establishing

Total Allowable Level of Foreign Fishing (TALFF). Under the FCMA, the TALFF value must be established by subtracting U.S. capacity (DAH) from OY. Unfortunately, this ends up with the implication that OY, on a yearly basis, must be established as a fixed numerical value. Hence, for any fishery where there is likely to be a TALFF, it necessitates generating a numerical value from which U.S. capacity can be subtracted. This, in our view, has led to the perception that OY must be a fixed annual numerical quota and subsequently has led management teams to restrict their consideration of management objectives to quota management techniques which in many instances may not represent the best management techniques.

Application of OY in the Management Process

In those instances where fisheries are managed on the basis of a numerical quota the application of OY and the development of management plans is relatively more easily conceived and understood. Similarly, it fits into the procedure identified for establishing TALFF. It does not, however, accommodate management strategies not based on a quota system. In many fisheries, for example, the best strategy might be to establish yields on the size limit, mesh limitation, sex limitation, etc. Classic examples are the management of crab fisheries where management procedures frequently identified a target sex as well as a minimum size. In such fisheries, protection of the reproductive capability of the stocks is achieved through complete protection of females and an adequate number of reproductive males. Beyond these limits it may be desirable to harvest all of the remaining crab that is economically possible. In such fishery it is not feasible to identify the expected annual catches even though the long-term yield potential (MSY) can be estimated. The MSY value, however, is of little or no value in the year-to-year management process. The optimum yield may be of some use in terms of defining a strategy

associated with an economic, sociological, or ecological objective but attaining that objective can only be achieved by an effective year-to-year management strategy. Thus in the case of crab fisheries, the OY, which is a long-term average, can be estimated as a numerical value but the annual management strategy may well be to harvest all the crabs possible over 6-1/4 inches. The TAC, e.g., becomes all the crabs in 1979 over 6-1/4" that are actually harvested by the fleet. Its numerical value will not be known until the season is completed. Similar management strategies must be available for application in other fisheries. A trawl fishery, for example, might well set for a management goal an annual harvest amount of all of the English sole which can be taken with 4-1/2" stretch mesh web. Then MSY and OY values, both of which are long term average estimates, can be generated. The specific annual event requires definition of a TAC in a qualitative sense, which is described by the mesh limitation. Under this interpretation of OY the TAC or annual objective can take on the character of a numerical value or a descriptive management process which leads to a harvest amount. The TAC values should ultimately culminate in achieving the management plan OY goal.

Finally, some direction needs to be proposed to NOAA regarding the precision in estimating stock sizes and in undertaking the management process. Since we have interpreted OY as a long-term average goal, the yearly TAC values may clearly exceed or be substantially less than the long-term OY value. If TAC values cannot be greater than OY, we are guaranteed in not attaining OY over a period of time, since the sum of the deviations will result in the average catch being less than OY. In addition the yearly values must be considered as the best estimate of the strategy which will ultimately lead to OY. The estimate of yield for a fixed year will not be precise, and the capacity that controls

that yield may be even less precise. It must be recognized in the management process that it is not possible to achieve a high degree of precision in fixing annual catches and in controlling the harvest levels. Therefore, the management process must allow for adjustments on a year-to-year basis. If the TAC value is not attained in one year, a management strategy should be available to adjust in following years so that over the long run the optimum yield goal is achieved.

Summary

In summary, the SSC is of the opinion that OY as expressed in Sec. 3, Definitions, and Sec. 201 (d) of the FCMA requires the Council to identify an OY as a deviation from MSY and which is in itself an average long-term management goal. As such, specific annual management objectives require an estimate of the annual ABC which will lead to MSY and an annual TAC which will lead to OY. It is our view that the legislation recognizes the need for annual estimates that vary from longer-term goals (see Sec. 303(a)(4)) by requiring that a management plan assess and specify the capacity and the extent to which vessels of the U.S. on an annual basis will harvest the OY specified in Sec. (3) and the portions of such OY which on an annual basis will not be harvested by U.S. fishing vessels and can be made available to foreign fishing.

Note there is no requirement to establish annual values for MSY or OY. The ABC is calculated to determine the annual biological yield which will lead to MSY and the TAC as the harvest level which will culminate in OY. TALFF must be determined annually according to changing biological, economic, sociological, and ecological events which determine TAC and DAH. Hence, the expected TALFF for any one year will be TAC minus DAH. The average of TAC's should lead to OY.

In this sense, the long-term OY is achieved by adjusting to short-term events which are considered for the TAC set for each year. We perceive the following scenario:

1. Establish MSY.
2. Determine sociological, economic, and ecological goals and OY.
3. Each year establish ABC (based on a specific method of calculating the yield contained in the plan) in order to adjust for biological variation.
4. Each year establish TAC (based on specific criteria contained in the plan) to account for any deviation required from ABC to achieve sociological, economic, and ecological goals.
5. Each year compute DAH by applying the methodology set in the plan.
6. If DAH=OY do not allow foreign fishing even though in some years TAC will exceed OY.
7. If TALFF is allowed, calculate annual values through TAC minus DAH.

As such, MSY and OY would remain in the Plan as the generic level biological potential and management yield goal, respectively. ABC and TAC would be estimated annually (based on a specific method or criteria) but within or between season changes in TAC would not require plan change if they are adjustments consistent with the stated method and/or the OY goal. That is, new data on status of stocks might sharply increase or decrease ABC and hence TAC, but such changes would be consistent within the OY goal.

We encourage a further exploration and reading of the FCMA considering this perception of MSY and OY, the problems confronting managers resulting from

biological variation and the influence of variation on TALFF. Note we do not believe that MSY and OY must be determined annually but only that specific methods and criteria be laid down in the plan for calculating annual ABC and TAC which will result in achieving MSY/OY.