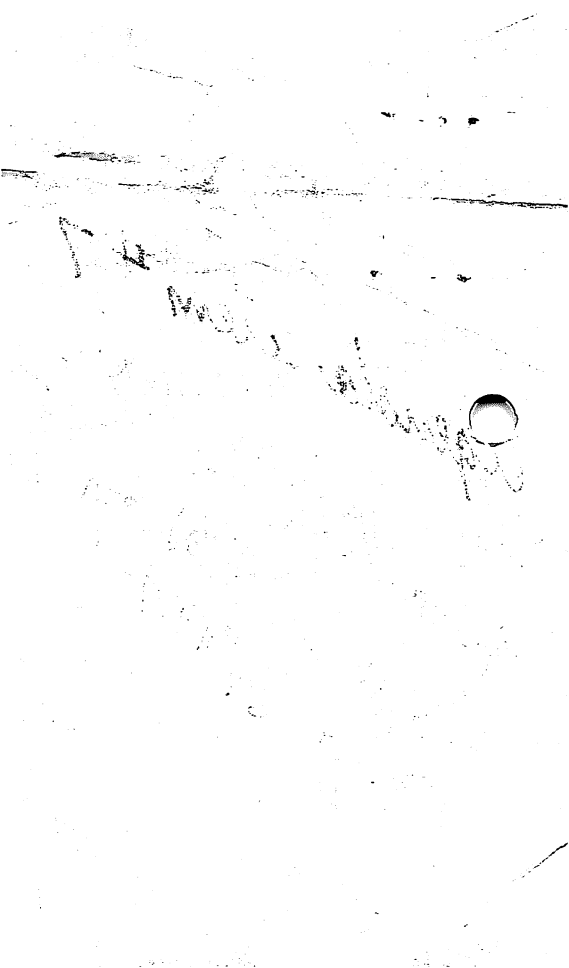


agenda item #7

Mailed to all
Council (50) on
Sept 6. 1977



MID-ATLANTIC FISHERY MANAGEMENT COUNCIL

File 100-01



Rm. 2115 Federal Building • North & New Streets • Dover, DE 19901

DAVID H. HART
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Vice Chairman

JOHN C. BRYSON, P.E.
Executive Director

August 17, 1977

Jim H. Branson
North Pacific Council
P.O. Box 3136DT
Anchorage, Alaska 99510

Dear Mr. Branson:

Enclosed please find a copy of a paper "Defining Objectives-The Basis for Fishery Management Plans", which was prepared by the Scientific & Statistical Committee of the Mid Atlantic Fishery Management Council and presented to the Council at their regular July 1977 meeting.

It is the belief of the Committee that this kind of presentation might aid the Council in the separation of goals and strategies for fisheries management when setting objectives for Fishery Management Plans.

At its August meeting the Committee agreed that this paper might be of interest to the other Councils and S & S Committees.

Sincerely,

Anne D. Williams
Statistician

cc: Dr. L.E. Cronin
Chairman, Mid Atlantic Council S & S Committee

cc: NPFC Council (50) (about 8-30-77)



DEFINING OBJECTIVES

The Basis for Fishery Management Plans

Prepared for the

Mid Atlantic Regional Fisheries Management Council

by the

Scientific and Statistical Committee

July, 1977

Scientific and Statistical Committee

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Introduction

Fishery management, or any kind of management, is merely the application of rational decisions that lead to a given objective. The process by which these decisions are made constitutes the management system; the parts of that system, integrated with the required manpower and equipment, make up an organization. Management experts, while they recognize the interdependence of an efficient organization and competent and motivated personnel, emphasize rational and understandable objectives as the prime factor in the success of a management enterprise. This paper will discuss the necessity of well-defined management objectives in creating fisheries management plans.

Properly stated objectives serve the twofold purpose of providing the basis for determining strategies and for judging the degree of successes or failures. That is, the Council must specifically determine what it wants to accomplish. This will be a difficult task because the management of a fishery for social purposes is highly complex. There will be almost without exception, conflicting objectives. The twofold problem of managing a fishery for combined commercial and sports catch is a good example.

The resolution of this problem is complicated by the fact that recreational fisheries usually operate outside the established market place, and quantifiable objectives are difficult to establish. Moreover, they must take into account not only the needs of the basic resource, the sport fish, but the circumstances in which the fishing recreation will be enjoyed at the same time. The fact that different anglers have varying concepts as to their objectives further complicates the issue. In general, the objective of recreational fisheries management is to provide the highest level of pleasure and satisfaction, in terms of numbers of fish available, size of individual fish, and for quality of the fishing ambience--the angling environment, that is possible in a given fishery.

When there are multiple objectives, two points readily become apparent. First, over some range of decision making there will be a conflict among objectives. If not, then there is really only a single objective problem, because managing to obtain one will automatically obtain the others. Second, because of these conflicts, rational management is not possible unless some relative weights are attached to each. That is, it will not be possible

to have any basis for setting strategies or for measuring success or failure unless there is some rule that tells us whether we are better off or worse off, and by how much, if a certain management decision will help to meet one objective but hinder the other.

The FCMA offers only the most general kind of management objectives. Optimum yield is maximum sustainable yield as modified by social, economic, and ecological factors. This definition is far too general to offer any assistance in selecting strategies or in measuring success. It is left to the Councils to select the specific objectives for optimal yield for their particular problems.

It is necessary to distinguish between management objectives and strategies to achieve them. Maximizing profits is an objective; using a specified advertising and pricing policy is a strategy. Likewise maximizing the net returns of the fishery or achieving a specified number of trophy catches are objectives; having seasonal quotas in specific areas can be a strategy to achieve the. Using strategies as goals leads to confusion. A manager should not set quotas just to be doing so, but rather to achieve some specific objective.

The Fishery Conservation and Management Act of 1976 (PL94-265) calls for two broad goals - conservation and management of fisheries. These are listed as separate goals but must be considered together in initial management plans. Conservation, as inferred from Section 2(A)(2), is maintenance of abundance of stocks above the "point where their survival is threatened". This point is the level below which recruitment failure may occur. Recruitment failure refers to conditions where annual additions to the stock from production and growth of young individuals fails repeatedly. The relationship between spawning stock and levels of recruitment is poorly defined due to the great data requirements and time series needed for defining such relationships, but is agreed by many scientists that at "low" stock sizes there is a direct relationship of spawning stock to recruitment. That is, a unit reduction in spawning stock is likely to cause a unit reduction in recruitment. A conservation objective, therefore, may be to maintain (or change to) a certain level of spawning stock which will insure adequate recruitment to the fishable stock. Conservation objectives are intended to provide a resource; these objectives do not consider the benefits to be obtained from utilizing the resource.

The main goal of the FCMA of 1976 is the management of fisheries. Fishery management is directed toward the use of a resource to provide the greatest overall benefit to the nation with particular reference to food production and recreation. It is not just management of fish but management of fishing, or management of people involved in fishing. In particular, the Act requires that the resource be used to:

1. promote domestic commercial and recreational fishing;
2. encourage the development of fisheries which are currently underutilized or not utilized;
3. permit foreign fishing consistent with the provisions of the Act;
4. provide, on a continuing basis, the optimum yield from each fishery;
5. promote efficiency in its utilization;

as well as other uses as deemed appropriate by the Councils.

Fishery management requires well defined social and economic objectives. From the standpoint of public policy there are no purely biological objectives; all fisheries management objectives are either social (includes political) or economic. Regulations that have been termed biological management, such as minimum size of fish landed, minimum mesh size, closed areas and seasons, etc., are not biological objectives but legitimate fishery management measures or tools, as they produce a product of a certain size, quality, or amount at a certain time, that provides benefits to some fishing sector.

Fishery management and conservation are not mutually exclusive; they must go hand in hand. One fisheries management practice that has been frequently used in the past has been that of regulating the fishing mortality and/or size of the fish caught to produce the greatest yield in weight for the available recruitment. For a given species of fish, the annual production as determined by growth and mortality is calculated and when this growth slows and the loss to natural mortality combines for a reduction in annual production per recruit the fish is caught and hopefully replaced by recruitment. This management practice has generally failed for marine species because the recruitment has not been maintained by management. The co fisheries or the northwest Atlantic are a good example of this failure. The yield per recruit management concept in itself is sound, but it must be accompanied by conservation to maintain the stock.

On the other hand, if the Council decides to, say, increase a stock size above the level that insures continued recruitment, this is no longer merely conservation. The use of surplus production must then be justified under a management strategy that provides the benefit to the nation as defined in PL 94-265. A stock size larger than that which insures continued flow of recruits may be justified for many reasons; increased probability of maintaining stock size, increased yield, availability, demise of other fisheries, price structure, efficient use of resources, etc. These are the management objectives that need defining by the Council. The S&S Committee can define the requirements of conservation and can suggest options for managing for optimum yield but the social decisions which override all of the economic and biological manipulation of the fishery must be made by the Council.

AN EXAMPLE

As an illustration of the nature of objectives in fishery management plans, consider the following hypothetical example. The purpose is to show the concept of management objectives. Imagine a purely domestic fishery where the only factor subject to control is the number of standard vessels to be used each period. (Ignoring for ease of exposition other factors such as changes in gear type, area and time of fishing, quotas, number of days fished, etc.) Assume that for the current year the maximum number of vessels that could be used is ten. The objectives chosen for purposes of this example concern: (1) the level of the net value of production from the commercial fishery, (2) the level of employment, (3) the number of trophy catches from an established sport fishery with a predicted amount of fishing effort, (4) the balance of payments in the fishery sector, (5) and the changes in the size of the fish stock. For ease of illustration dimensionless numbers are used for each of the parameters.

The necessity of management objectives can be demonstrated by Table 1. Without objectives it is impossible to make a rational choice as to how many boats should fish. If any one of the objectives is chosen, however, the management decision is straightforward. To maximize the net value of production, five vessels should be used; to maximize employment, ten should be used; to maximize the number to trophy catches, or to maximize the increase in stock size, no commercial fishing should be allowed; and in order to balance the international accounts, six vessels should be allowed. Other optimal solutions are possible for more general goals. For example, if the objective is to keep the balance of payments from falling below minus nine, then at least three vessels should be used. Similarly in order to keep the stock

Vessel	0	1	2	3	4	5	6	7	8	9	10
Net value of production	0	5	9	12	14	15	14	12	9	5	1
Commercial Employment	0	20	40	60	80	100	120	140	160	180	200
Number of trophy catches	20	19	17	14	10	5	1	0	0	0	0
Balance of payments	-18	-15	-12	-9	-6	-3	0	3	6	9	12
Changes in stock	7	6	5	4	3	2	1	0	-1	-2	-3

Table 1. Hypothetical Example of Conflicting Fishery Management Objectives.

from decreasing by more than one, the number of vessels cannot be higher than eight.

The selection of only one objective for fishery management will not be possible; the parties involved are too complex and diverse to permit this. Let us discuss some hypothetical examples of how to deal with this. When the only objectives are to maximize the increase in the size of the stock and the number of trophy sports catches, there is no real problem. The table shows there is no conflict between these goals. The number of vessels that achieves one will achieve the other. It does not matter which one is actually chosen.

This fortunate state of affairs is likely to be the exception rather than the rule. Consider the dual objective of maximizing the net value of production and the number of trophy catches. Increases in the number of vessels up to five will improve the former but impair the latter. Increases beyond five, however, will hurt both. The problem becomes one of selecting a number of vessels between zero and five. The understandable inclination to split the difference and use two or three is probably not useful without more specific information from the Council. If they determine that these two objectives were the important ones, then they must also provide information (or be willing to make decisions) concerning the trade-off between them. For example, if the Council says that each trophy catch is worth four-tenths (0.4) of a unit of the net value of production then the parameter of judgement is a weighted sum of the two as follows:

Vessels	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
Weighted	0+.4(20)	4+.4(19)	9+.4(17)	12+.4(14)	14+.4(10)
Sum	or	or	or	or	or
	8	12.6	15.8	17.8	18
Vessels	<u>5</u>				
Weighted	15+.4(5)				
Sum	or				
	17				

For example, with two vessels, the net value of production is nine, and when this is added to .4 of the 17 trophy catches, the sum is fifteen and eight tenths. Using this as a management objective, the proper number of vessels is four. If a higher weight were used the optimum number of vessels would obviously be less.

In some cases, the Council may be hesitant to provide a trade-off weight between two conflicting objectives. In this case there is an alternate way of obtaining an optimum yield. The selection of the objectives to be used is still a very important first step, however. In this example, the selection of the number of trophy catches and the value of production as the proper objectives makes it clear that the others will be ignored for decision-making purposes. Given this fact and the hesitance of the Council to provide a trade-off weight, the information in the table can be useful in making the final decision. The point of economic efficiency can be used as a zero point in providing information to the Council on the actual trade-off that will occur as the number of vessels is reduced from five to zero. It can be seen that as the number of vessels is reduced from five, the level that maximizes the net value of production drops, slowly at first and more rapidly as the number of boats decreases further. By the same token the number of trophy catches increases, rapidly at first and more slowly as the number of boats declines further. A decrease in vessels from five to four reduces the net value of production by one and increases the number of trophy catches by five. On the other hand, a decrease in boats from four to three reduces value of output by two numbers only, but they demonstrate the general way in which these changes will occur. Therefore, while the Council may feel that trophy catches are important and would be willing to trade-off a decrease in the value of commercial catch to obtain some, it obviously depends upon how much is being given up and how much is being gained. Given this information on the actual trade-offs, the Council will more than likely be able to determine a proper amount of fishing where they were not able to specify a trade-off value a priori.

The above example ignores many problems including foreign catches, the position of MSY, and the complex nature of the controllable inputs to a fishery. Nonetheless it does demonstrate the need for management objectives, how the nature of the objective determines the optimal amount of fishing, and ways to account for conflicting objectives. It also demonstrates that vast amounts of data will be necessary. In Table 1 it was possible to establish a measure of the degree of success in meeting the chosen objectives. This will be crucial as the Council develops plans. For each objective chosen there must be one or more parameters that provide information. Some will be difficult to derive and measure; other will be quite simple. The number of trophy catches may be easily counted, but a measure of the value to these fishermen for the experience while difficult to obtain may be more useful for direct

comparisons with other objectives. Also, to demonstrate how these parameters vary with various types of fishery regulation will not be easy; rough approximations may have to suffice. As information becomes available, the estimates of the relationships will become more descriptive of reality.

POSSIBLE OBJECTIVES

To assist the Council, the following list has been developed. It is not exhaustive but only suggestive. They are not all simultaneously feasible, indeed there are some outright contradictions. They may be useful as a guide in selecting objectives for specific Fisheries Management Plans according to the goals of the act as summarized above.

1. Provide consumers with a variety of high quality fishery products at minimum cost.
2. Maximize employment opportunities:
 - a. (1.) for present commercial fishermen or
(2.) for present and future commercial fishermen
 - b. (1.) for full-time fishermen or
(2.) for full-time and casual fishermen
 - c. (1.) at present levels of earnings or
(2.) at improved levels or earnings
 - d. (1.) under present conditions of freedom, risk and independence
(2.) under different conditions, e.g. special opportunities for American Indians.
3. Maintain employment opportunities for subsistence fishermen.
4. Minimize the costs to the taxpayers of development, research, management and enforcement for commercial and/or recreational fishing.
5. Use fishery resources to maximize income to the public treasury.
6. Achieve efficient allocation of capital and labor.
7. Minimize balance of payment deficits in trade of fishing products.
8. Maximize opportunities for recreational fishermen for one or more of the following:
 - a. (1.) trophy size of fish or
(2.) quantity of fish
 - b. widest diversity of species
 - c. highest quality (most enjoyable) experiences
 - d. (1.) present recreational fishermen
(2.) present and future recreational fishermen
 - e. the least cost.

9. Maximize contribution of recreational fishery to the national economy.
10. Maximize quantity of fishery food product for not only the U.S. consumer but also for all people in the world.
11. Maintain a diversified fishing industry.
12. Encourage centralization for fishing and processing.
13. Maintain a stock above the level where survival is threatened.