PART 6: ALTERNATIVE MANAGEMENT STRATEGIES

§610 Introduction

Management strategies are defined as approaches to achieving the management objectives. Strategies are comprised of management measures which are suited to the particular management approach. Alternatives may be defined for both strategies and the measures they contain. The alternative approaches represented by the various candidate strategies in this FMP reflect considerations for technical feasibility, data availability, practical implementation, and management objectives. Alternative measures are identified with specific reference to the selected management strategy. They reflect considerations for sufficiency in achieving the objective, desirability for implementation and practical applicability. In addition, alternative specifications of the various measures are possible and are evaluated in view of their resource and industry impacts. The following section (§620) contains a description of the strategy alternatives considered in this FMP. Section 630 discusses the narrowing of management strategy alternatives for the purpose of conducting the detailed bio-economic analysis which appears in Part 7.

§620 Description of Alternative Strategies

In view of the adopted management objective, four alternative management strategies can be identified. The four strategies discussed below are primarily defined in terms of the kinds of control measures that they employ to achieve the management objective. Because the overall objective calls for a long-term bio-economic approach to management, the alternative strategies are designed to control some aspect of the harvesting or exploitation of the resource so as to enhance prospects for long-term abundance and productivity. This in turn promotes the long-term viability and economic well being of the industry. To achieve this objective, the management program should be formulated and applied on an industry-wide basis, and not on the basis of separate, sub-regional management regimes. This policy determination reflects the various bioeconomic interrelationships in the sea scallop fishery, including the interregional nature of sea scallop processing and marketing. Further, this policy is appropriate given the demonstrated ability of most fleet sectors to exploit the resource throughout the region, and given that no biological basis exists for separating the sea scallop resource into separate stocks for management purposes.

In summary, the four alternative strategies considered by the Council are as follows:

1) to control total quantity of sea scallops landed (through, e.g., annual or seasonal quotas),

2) to control fishing practices in the sea scallop fishery (through, e.g., gear restrictions, cull size, closed areas, and seasons),

3) to control fishing effort in the sea scallop fishery (through, e.g., limiting entry, number of vessels, or fishing time), and

4) to combine two or more of the above strategies.

This section describes the alternatives and presents their advantages and disadvantages in order to provide a basis for comparison.

(1) To Control Total Quantity of Sea Scallops Landed:

This general strategy for managing the sea scallop fishery has been adopted for several other domestically managed fishery resources where increased long-term productivity has been a consideration. The strategy most often employs annual or seasonal quotas on landings as the control measure. In managing the sea scallop fishery, quotas would have to be based upon assessments of the immediate and future prospects of the resource and be manipulated over time in such a way as to enhance long-term productivity without unduly penalizing short-term economic opportunity (which may be presented by periodic strong recruitment).

The present capability for assessing the status of the sea scallop populations subject to management does not support estimates of absolute abundance or calculations of appropriate short-term levels of catch from each resource component. This is primarily due to the lack of an extended time-series of commercial catch-at-age data, as well as the lack of a basis for estimating recent levels of fishing mortality applied to the resource. Assessment procedures do, however, provide a strong basis for monitoring relative change in population abundance and structure.

Despite the lack of an analytical basis for calculating appropriate short-term quota levels, it is possible to use historic landings data to calculate long-term average catch, and use this value as the basis for establishing fixed quotas. In the context of the sea scallop fishery resource, a quota calculated in this way has the probable advantage of assuring a sustainable level of catch in the fishery by maintaining the viability of the resource. If, however, fishing practices change in such a way as to adversely impact the productivity of the resource, (e.g., by catching scallops at a smaller size) the quota may over-estimate a sustainable level of catch. Conversely, if fishing practices change so as to enhance the productivity of the resource (e.g., by catching scallops at a larger size), the quota will likely underestimate the level of catch which is actually sustainable. These observations are due to the fact that sea scallop resource productivity is a function of both year class structure and overall abundance. In addition, a fixed quota is not sensitive to current resource conditions and therefore precludes the possibility of either restricting catch when the resource may be in jeopardy or increasing catch to take economic advantage of unusually abundant year classes entering the fishery.

Finally, in a situation where vessel entry into and exit from the sea scallop fishery is not controlled, the existence of quotas may result in a

scramble to assure a share of the benefits. Unless mitigated by specific vessel limitations (i.e., trip or period limits), such behavior often results in operating inefficiencies, negative price effects (reduced revenue to the industry), and product scarcity during periods of closure. Whether quotas are implemented on an aggregated fleet-wide basis or at some level of fleet disaggregation, the administrative costs of implementing a quota can be significant.

(2) To Control Fishing Practices:

The general strategy of controlling fishing practices so as to reduce the exploitation of the sea scallop resource and thereby increase productivity implies the use of management measures such as gear restrictions (e.g., ring size in the dredge or number and/or size of dredges towed), cull-size, or closed areas and seasons. Of these measures, currently only cull-size control would be based on a satisfactory understanding of cause and effect so as to make the application of the measure meaningful. Measures such as dredge size or number and area/season closures attempt to effect the fishing effort applied to the fishery (exploitation). But, because they address only limited aspects of overall effort, and because little or no data exist to help quantify even this limited effect, the use of such measures is presently not meaningful.

Measures, such as ring size in the dredge or minimum cull size, attempt to control the portion of the population that is subject to fishing effort. Such a tactic is firmly grounded in what is known about the biology of sea scallops. It takes advantage of their growth characteristics and effectively allows the average scallop to reach a larger size before being captured (see §240). As a result, more production is generated by the sea scallop resource for each unit of effort applied. Unfortunately, the use of ring size control to achieve an increase in size at first capture is presently unrealistic because no useful relationship has ever been demonstrated between ring size and the size of the scallop retained. As a consequence, only the manual culling out of undersized scallops after they have been taken on board is an effective method of controlling the size of scallops harvested. Hand culling is a common practice in that sector of the fishery which shucks scallops at sea, and, therefore, the cull-size measure could be easily incorporated into normal fishing operations. However, hand culling is not a common practice in that sector of the fishery that lands scallops in the shell.

The control of minimum size in the sea scallop fishery has significant implications for the harvestable production from the resource. The yield per recruit analysis in §240 shows that significant increases in average individual scallop yield is possible by simply delaying average age at first capture by one year, which corresponds to an increase in meat weight (i.e., edible portion). Such increases in yield are, in part, dependent upon the effort being applied to the fishery. However, as an example, an increase of nearly 7% in average yield per scallop (more specifically "yield per recruit") would be associated with a change in average meat count from 30 to 25 on Georges Bank under applied effort conditions (relating to actual fishing mortality) that have occurred in the past.

A major advantage associated with cull-size control (i.e., minimum shell size or meat count) is that the effect on average individual scallop yield (yield per recruit) is direct, resulting in relatively consistent increases in yield over the range of effort that has been observed, or might be expected, in the sea scallop fishery. Absolute increases in average individual scallop yield vary with applied effort (i.e., fishing mortality rate); however, even if effort were to remain at recent high levels, increases in average individual scallop yield would still be realized.

Other biological benefits of a cull-size measure are due to increased reproductive potential. By delaying capture until an older age, scallops which are just beginning to contribute significantly to spawning remain in the population. Although a stock recruitment relationship has not been demonstrated for sea scallops, the increase in scallop fecundity with age may provide a buffer against recruitment overfishing.

Finally, the imposition of controls on fishing practices has implications for administrative costs. Depending on the measure selected, both shore-side and at-sea enforcement costs are likely to be incurred. In addition, costs that may be borne by the industry associated with gear acquisition or fishing inefficiency should be assessed in evaluating this strategy alternative.

(3) To Control Fishing Effort:

The general strategy of controlling fishing effort to increase the long-term productivity of the sea scallop resource implies the use of management measures such as a limit on the number of fishing days available in a given year or a limit on the number of participating vessels. In theory, such effort control measures are more efficient at limiting exploitation of the resource (to enhance productivity) than are quota measures. They provide a more direct control on the rate of fishing mortality without acting to deny the opportunity for the industry to take advantage of increased catch rates that come with natural fluctuations in resource abundance. Further, effective control on fishing mortality rate is an important consideration in evaluating the effectiveness or benefits of measures directed at age-at-first-capture (or cull size as discussed above).

In practice, however, successful implementation of effort control measures currently suffers from several important shortcomings. First, as with controls on gear configuration, direct vessel effort control represents only a portion of those factors which influence exploitation; gear/vessel efficiency and size (age)-at-first-capture must be simultaneously considered. Second, historic effort data are not available for all fishery components, and are not adjusted (where available) for changes in vessel/gear configuration and efficiency over time. Most importantly, there is currently very little basis for accurately assessing the actual fishing mortality which is being generated by the scallop fleet at any given time.

Notwithstanding these limitations, broad-based control on applied effort is likely to result in long-term benefits to the resource, and effort control

is complementary to control on size-at-first-capture. However, the immediate imposition of an effort control measure is not essential to assure long-term benefits from control on age-at-first-capture, so long as some form of fishing mortality control is adopted or fishing mortality does not substantially increase.

(4) To Combine Two or More of the Above Strategies:

The discussion presented above under each of the strategy alternatives has supported the notion of combining different types of control measures to affect the long-term productivity of the resource in a more efficient or desirable way. In support of a multiple year management program, such as is envisioned for sea scallops to achieve the stated objective, two options exist for combined measure implementation:

(a) initially implement control measures which are technically feasible, analytically supportable, and acceptable, and optionally delay other measures which require further study, or

(b) postpone implementation of all control measures until all acceptable measures are technically feasible and their joint interactions are fully evaluated.

The management program could include immediate implementation of administrative and data gathering measures, regardless of which option was selected.

Various combinations of quota control, gear control, cull size, and vessel effort control measures can be considered as candidate options for implementation under (a) or (b). However, limitations on our knowledge and understanding of benefits to the resource, impacts on the industry, mode of implementation, or technical feasibility will effect both the desirability of individual combinations and the timing of their implementation.

§630 Selection of Strategy Alternative for Detailed Analysis

The selection of a strategy alternative(s) for detailed analysis in the Sea Scallop FMP is based upon an evaluation of the four general strategies discussed in §620. The evaluation presented in Table 631 was conducted only for the first three alternative strategies (the fourth being a combination of the others) with reference to the following four criteria:

1) compatibility with the overall objective;

2) feasibility for implementation;

3) minimization of costs to the industry; and

4) minimization of administrative and enforcement costs.

Table 631: Evaluation of Strategy Alternatives

Generalized Strategy	Criteria	Rating[1]	Comment
1. Control on Total Quantity: (e.g., catch control)	Compatability with Objective	G	- Control on Quantity landed is generally efficient and relevant to the objective, but must be tied closely to current stock assessments in order to avoid sub-optimal harvests or overexploitation.
	Feasibility for Implementation	P	- Technical knowledge of resource does not support establishment of a responsive catch control system; only fixed catch control is possible.
	Minimum of Costs to Industry	P	- Fixed catch limitations likely to deny short-term benefit from fluctuations in abundance and result in short-term loss of revenue.
			- Catch limitations encourage "scramble" behavior, result in economically inefficient use of the resource.
	Min. of Admin./Enforcement Costs	F	- Administration and monitoring of catch limitations impose reasonable costs.
2. Control on Fishing Practices: (e.g., age at entry controls such as gear configuration, minimum size or meat count)	Compatability with Objective	F	- Controls affect some aspect of overall resource exploitation to enhance resource productivity, but less effective than either catch or effort control.
	Feasibility for Implementation	F-G	- No basis for implementing control on gear configuration.
			- Measures controlling minimum size or meat count are feasible for implementation and closely related to considerations for increased yield per recruit and stock structure.
			- Benefit for achievement of objective is, in part, a function of prevailing fishing mortality (effort).
	Minimum of Costs to Industry	F	- Feasible control on minimum size or meat count constitute accepted practice in the industry, but may result in short-term harvesting inefficiency.
	Min. of Admin./Enforcement Costs	F	- Administration and monitoring of controls on fishing practices impose reasonable costs.
3. Control on Fishing Effort: (e.g., control on total days fished or participating vessels)	Compatability with Objective	G	- Effort control is generally efficient and relevant to the objective, but dependent upon ability to relate fleet effort to fishing mortality.
	Feasibility for Implementation	P	- Effort data characterizing the overall harvesting sectors is unavailable, but where data are available for certain sectors or resource areas, they are not standardized.
			- Data describing allocation of effort among resource components is incomplete.
			- Data relating fishing effort to fishing mortality is preliminary and incomplete.
			- Insufficient basis for a complete examination of effort based management options at this time.
	Minimum of Costs to Industry	-	- Candidate options not available for evaluation.
	Min. of Admin./Enforcement Costs	-	- Candidate options not available for evaluation.

[1] G = Good, F = Fair, P = Poor; These ratings are relevant only to the management of the sea scallop resources off the Northeast coast of the United States.

The alternative strategies are rated qualitatively [i.e., good (G), fair (F) and poor (P)] against each of the above criteria.

An examination of the information summarized in Table 631 indicates that control on fishing effort is not feasible at this time, and control on quantity landed is not sufficiently supported by our current ability to assess resource abundance to warrant its adoption as an overall management strategy. As a consequence, control on fishing practices, and more specifically control on minimum size or meat count, is adopted as the principal management strategy. It is recognized, however, that in light of the biological analysis presented in §240 and the discussion in §620, minimum size or meat count control may not be sufficient to achieve the overall objective in the long run. That is, the achievement of the overall management objective is partially related to the level of fishing mortality witnessed by the resource over the duration of the management program.

It is not currently possible to devise direct effort control measures that will affect fishing mortality in a manner that is complementary to the effect of minimum size or meat count control. However, the detailed, long-run analysis of alternative specifications of the management measures (see Part 7) must be undertaken in the context of various assumed levels of long-term fishing mortality so that relative benefits may be properly evaluated. On the other hand, the detailed, short-run analysis (examining the first two years of program implementation) will be conducted without explicit reference to any level of fishing mortality other than that currently estimated for each fishery resource area.

Therefore, the following 12 strategy specifications are defined for long-term analysis purposes in Part 7 of this FMP, where four meat count options are simultaneously evaluated with three (conveniently defined) effort levels:

Age-at-Entry Meat Count Measure Specification	Effort Specification: Historical Avg. Level	Intermediate Level	Biologically Optimal Level [F(max)]
Meats/lb. (#1)	SS1	SS2	SS3
Meats/lb. (#2)	SS4	SS5	SS6
Meats/lb. (#3)	SS7	SS8	SS9
Meats/lb. (#4)	SS10	SS11	SS12

For the purposes of the short-term (2 year) analysis in Part 7, three strategy specifications are defined. These specifications consider meat count only, but allow for a change in specification following the first year of implementation. Further details of this analysis are presented in Part 7.