Considerations for Regional Swordfish Management

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ABSTRACT

This paper presents an overview of the current status of the western North Atlantic swordfish stock. Considerations for cooperative management are presented, utilizing the U.S. Fishery Management Council Plan as an example.

INTRODUCTION

A commercial longline fishery for swordfish (*Xiphias gladius*) began off the northeastern United States and Canadian Maritime Provinces in the 1960's. Although some U.S. vessels migrated to the Gulf of Mexico in winter, until the mid 1970's, most landings came from northern waters. In 1975, a swordfish fishery developed in the Straits of Florida. Innovations in gear and technology produced quite high catch rates which encouraged more boats to enter the fishery, and by 1980 an estimated 200 boats were engaged in the fishery year round along the Florida East Coast. These vessels were relatively small, usually 35 to 50 ft long, and fished an average of 10 miles of what today would be considered relatively crude gear.

Encouraged by catch rates off Florida that averaged more than 750 pounds dressed weight per night, the fishery began expanding into the Gulf of Mexico and along the entire East Coast of the United States. Soon catches began to decline and many boats dropped out of the fishery. The boats that remained generally were large enough to range widely in search of concentrations of swordfish and had the ability to fish larger amounts of increasingly more sophisticated gear. Increased prices, longer trips to more distant waters, and sets of up to 40 miles or more of gear per night helped offset declining catch rates. However, catch rates and average size of fish in the catch continued to decline in most areas and vessels either dropped out of the fishery, began targeting tuna, or began ranging even more widely in search of concentrations of swordfish.

STATUS OF THE STOCKS

In April, 1986 the Southeast Fisheries Center of the National Marine Fisheries Service convened a Swordfish Stock Assessment Workshop. The final report from that workshop indicates that since 1981, surplus production has exceeded total catch, and that at present levels of fishing mortality, stock biomass is increasing (Figure 1). These results are derived from a "tuned" Virtual Population Analysis (VPA). The index of abundance used to tune the VPA was "catch per trip of fish greater than 130 pounds dressed weight". Since this index does not fully account for improvements in fishing gear or methods or in amounts of gear or length of trip, the results will overestimate present stock size and underestimate fishing mortality. While the direction of bias is known, the degree will not be known until a more realistic index of abundance is available. Another assumption of the analysis is that catchability of partially recruited age classes (ages 0, 1, and 2) has remained constant since 1978. Since

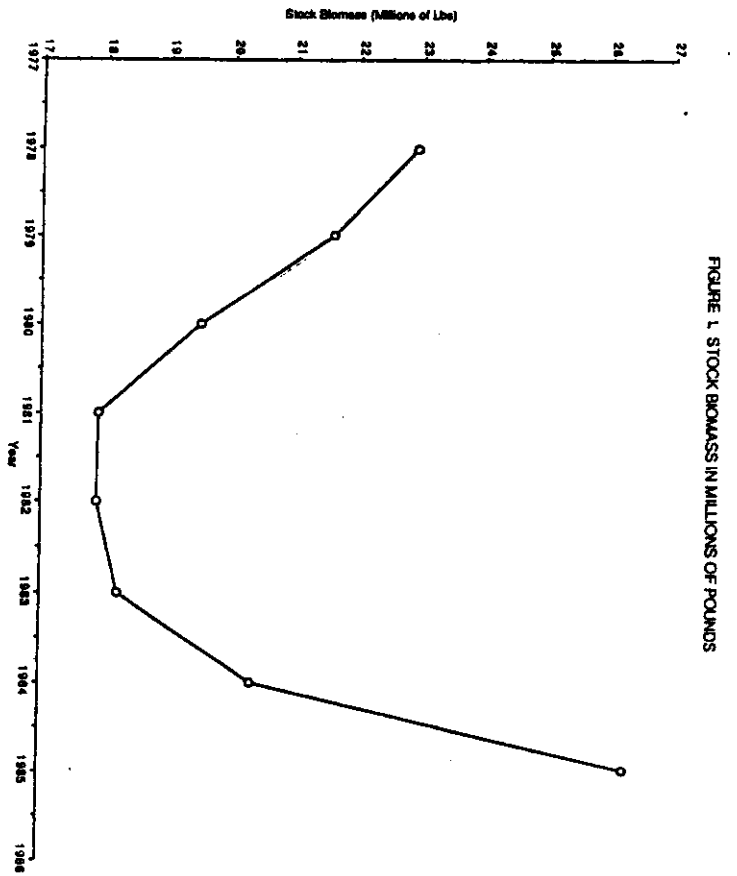

Figure 1. Stock biomass in millions of pounds.

most of the estimated production derives from the estimated number of fish in the partially recruited age classes, the constant catchability assumption is quite critical. Other things being equal, an increased catch of small fish will be interpreted by the model as an increase in recruitment. Figure 2 shows the catch in numbers of adults (age 5 and over) and Figure 3 shows the catch of recruits (age 0) from 1978 to 1985. A sharp decline in the catch of adults and a concurrent increase in the catch of age 0's since 1978 can be clearly seen. Stock size estimates derived from the VPA for various age groups are shown in Figure 4.

A yield per recruit analysis indicated that at the best estimate of natural mortality (M=0.1), present fishing mortality was almost three times the level that would produce maximum yields (F max) at the present size at recruitment (Figure 5), and present fishing mortality is the lowest it has been since 1978 (the first year of the analysis). Yield per recruit models assume that the population is in equilibrium and that recruitment is constant. If the VPA is correct, then rather than being constant, recruitment has increased every year since 1981. Thus, it is not known whether these results are representative of the present status of the stock.

FISHERY MANAGEMENT PLAN OBJECTIVES

The objectives of the Councils' Swordfish Fishery Management Plan (SAFMC, 1985) are as follows:

1. The economic objective is to maintain high landings in the form of larger fish that are preferred in the market. This is to be accomplished by controlling the harvest of smaller fish.
2. The biological objectives are to prevent or reduce growth overfishing and to create a buffer against possible recruitment overfishing. This also is accomplished by maintaining a sufficient number of larger fish by controlling the harvest of smaller fish.
3. Obtain the necessary scientific information to continually monitor and refine the management of the swordfish fishery. This is accomplished by an onboard technician program on a sample number of commercial boats.
4. Monitor competition for space and user group confilicts for future management measures. This is also accomplished by the onboard technician program.
5. Minimize the impacts of foreign fishing on our domestic swordfish fishery. This is accomplished by minimizing the swordfish bycatch of foreign longliners and squid trawls consistent with the requirement to allow opportunities to harvest tuna or catch squid under a Governing International Fisheries Agreement (GIFA).

The Councils have established Scientific and Statistical Committees composed of individuals with recognized scientific expertise in various fields related to fisheries management. The Scientifis and Statistical Committee of the South Atlantic Council reviewed the 1986 assessment report and noted that the swordfish fishery appears to be fully utilized. Further, the proportion of larger fish (age 5+) in the catch is declining, and the proportion of recruits in the catch is increasing. Because of the VPA methodology, they concluded that the results for the last three years (1983-85) are unreliable and must be disregarded in management decisions. Omitting these three years indicates no trend in recruitment from 1978 through 1982. They further conclude that with apparently

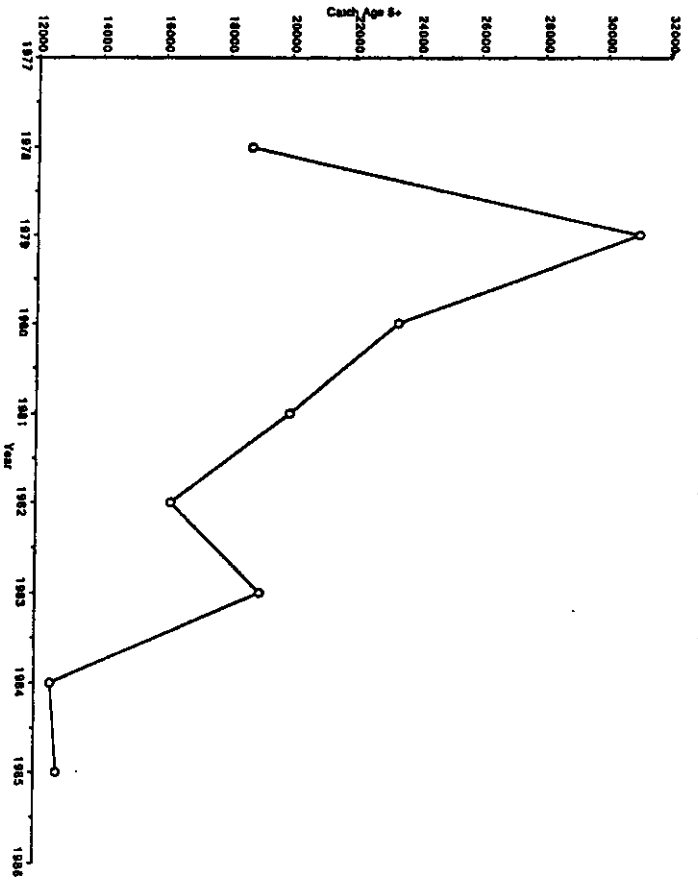

Figure 2. Catch of adults (ages 5 and over).

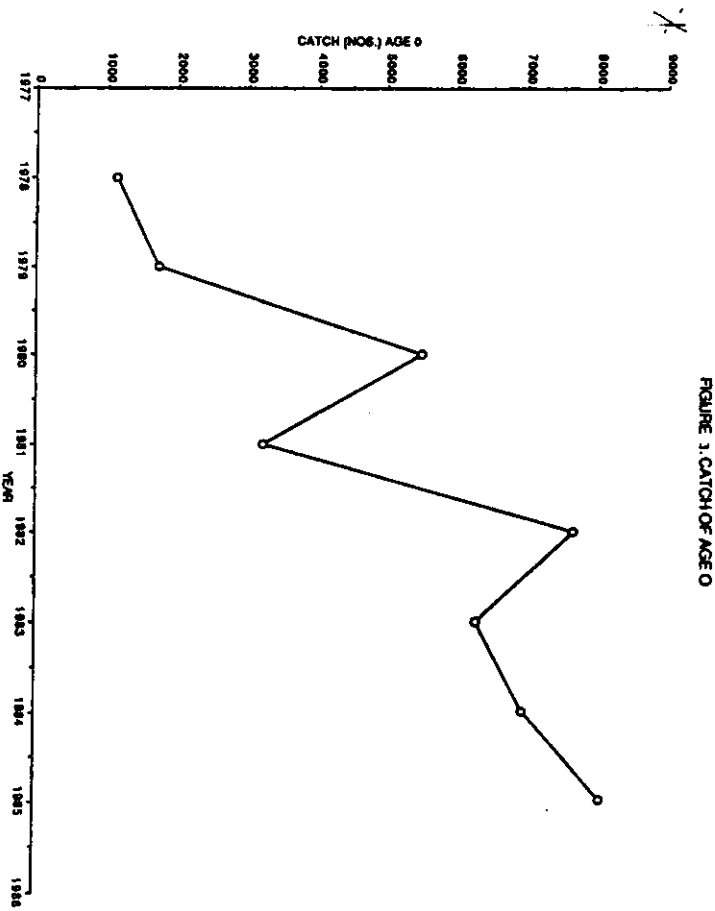

Figure 3. Catch of age 0.

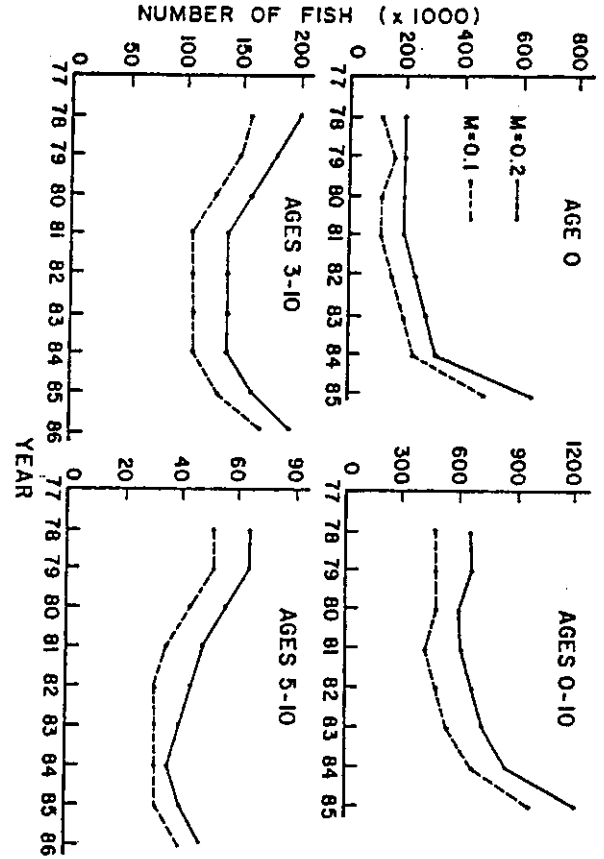

Figure 4. Stock size estimates.

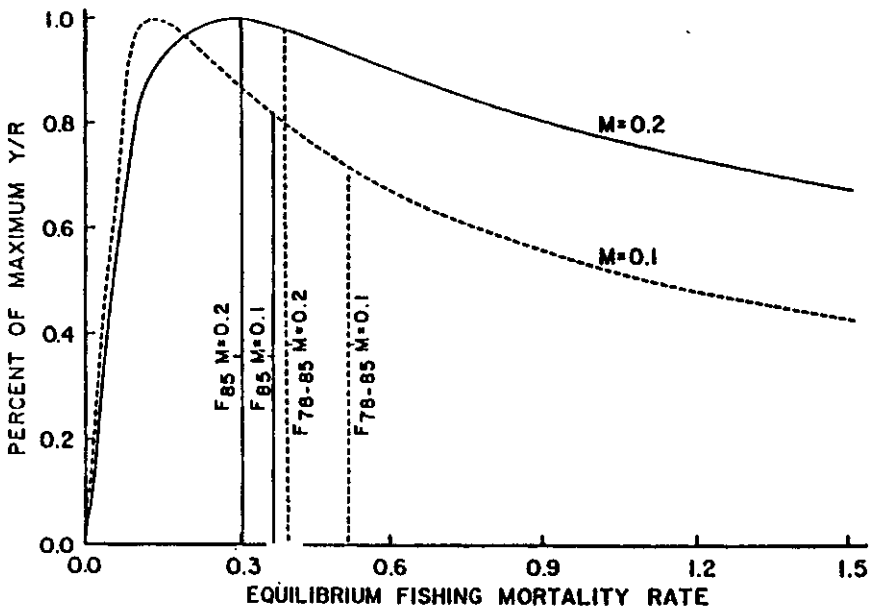

Figure 5. Relative yield-per-recruit for swordfish using natural mortality rates (M) of 0.1 and 0.2 and assuming the partial recruitment vector used in the VPA and a growth rate for large fish (over 205 lb) of 35 lb per year.

constant recruitment and decline in older fish, the plan is not meeting Objective 1 which is "to maintain high landings in the form of larger fish." With regards to Objective 2 they commented that although there is no evidence of recruitment failure, if the proportion of larger fish in the catch continues to decline, then recruitment failure becomes a possibility and if the decline continues Objective 2 will not be met.

The question now becomes "How best to accomplish these objectives given the varying interests of the five Councils?" Initially, plan development was stalled in attempting to accomodate the divergent management approaches of the "northern" and "southern" Councils. The New England and Mid-Atlantic Councils had a well developed fishery in northern waters primarily targeting large fish. Management in their fishermen's eyes should restrict harvest of juveniles in southern waters. The South Atlantic and Gulf Councils had developing fisheries in their waters with a higher percentage of smaller fish. Management in their fishermen's eyes should protect the large spawners being caught in northern waters. The Caribbean Council had no fishery in their waters but did not want to preclude the opportunity to develop a fishery if swordfish were present in sufficient numbers.

The variable season closure (VSC) concept served as a compromise whereby time and area closures that minimize and equitably distribute the negative impacts associated with the undesirable but necessary delay in the harvest of large fish to achieve the positive impacts of delaying the harvest of small fish. The VSC was designed to indirectly regulate the catch of swordfish under 50 pounds dressed weight by closing times and areas when concentrations of these small fish are caught. Ideally, the best method to control the harvest of smaller fish is directly with a minimum size limit that requires small fish to be released. Unfortunately this is not possible at this time. Available information indicates that there are no fishing strategies (e.g. hook size, location) that will selectively avoid small fish. Most swordfish hooked on longlines are landed dead. Time and area closures are presently the only way to delay the harvest of small fish until they are larger, when more pounds can be landed at a higher value per pound because larger swordfish are preferred in the market. The disadvantage of time and area closures is that they delay the harvest of some large fish as well as small fish.

When the Fishery Management Plan was submitted to the Secretary of Commerce for approval (1985), the fishery was believed to be in or near a state of growth overfishing as measured by yield per recruit analysis. The only available yield per recruit analysis at that time (Berkeley and Houde, 1981) indicated that, in 1980, the female component of the stock was fully exploited. Since females grow much larger than males, contribute substantially more biomass to the total yield, and determine spawning potential of the stock, the Councils considered it prudent to set 1980 as the base year. Thus, the VSC attempts to adjust closure lengths so that next year's catch of small swordfish will not exceed the number caught in 1980. To calculate the VSC calendars, the number of small fish harvested in 1980 (the base year) is estimated. Likewise, the number of small fish harvested in the most recent year (1985) is calculated. The difference is expressed as a percentage and is the required overall reduction necessary to achieve optimum yield. This percentage, multiplied by the number of small fish estimated to have been harvested in each management area (New England & Mid-Atlantic, South Atlantic to the Florida-Georgia border, Florida

East Coast, Gulf of Mexico, and Caribbean) is the number of small fish by which each area's catch must be reduced (Table 1). Tabulating each area's small fish landings by month then allows the necessary reduction in number of small fish to be expressed as an equivalent number of days (Table 2).

Table 1. Small fish landings by area and necessary reduction.

	1980 Small Fish		1985 Small Fish		Target Reductions
	%<50 lb	No.<50 lb	%<50 lb	No.<50 lb	No.<50 lb
New England & Mid-Atlantic	28.5	7,839	38.8	14,819	1,429
South Atlantic	45.6	5,537	69.2	5,788	558
Florida East Coast	36.6	9,605	47.7	11,986	1,156
Gulf of Mexico	57.1	13,244	53.4	6,263	604
Caribbean	—	—	18.4	1,235	119
TOTALS		36,225		40,091	3,866

INCREASE = 3,866
SWORDFISH % REDUCTION = 9.64%

Table 2. Variable season closures for 1986 with various starting dates.

	Target Reductions No. < 50 lb	September 1 No. Days	October 1 No. Days	November 1 No. Days	December 1 No. Days
New England & Mid-Atlantic	1,429	11	13	27	165
South Atlantic	558	16	14	181	155
Florida East Coast	1,156	36	45	54	44
Gulf of Mexico	604	71	59	46	38
Caribbean	119	91	61	34	15
TOTALS	3,866				

OPTIONS FOR CARIBBEAN MANAGEMENT

Management options that may prove beneficial for the Caribbean include:

1. Manage the entire Caribbean fishery based on the Caribbean Council's calculated closures as reflected by fish landed in Puerto Rico and the U.S. Virgin Islands.
2. Identify areas (if any) within the Caribbean with distinct fishing patterns and manage these separately based on the VSC concept.
3. Request closure of areas with very high percentages of small fish (*e.g.*, South Atlantic and Gulf of Mexico).

POSSIBLE MECHANISMS TO IMPLEMENT A CARIBBEAN MANAGEMENT REGIME

Mechanisms that are available to implement a management regime in the Caribbean area include the following:

1. Utilize existing organizations (*e.g.*, ICCAT, CARICOM, WECAF, Lesser Antillees Committee, OECS).
2. Cooperative management based on voluntary compliance coordinated through GCFI.
3. Manage as individual countries.

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