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A Case Study of the Impact of Recent Management Measures on Overall US Atlantic Longline Fishing Capacity and Effort

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1.0 Introduction

Upon declaration of an Exclusive Economic Zone (EEZ) in 1976, the USA established a policy promoting growth in domestic fishing capacity. By the early 1990s, this policy had resulted in the phase-out of foreign operations within the EEZ and significant increases domestic production and capacity. The programs designed to promote development of the USA fishing industry resulted in growth in domestic fishing capacities that exceeded the level needed to extract optimal harvests from a number of the nation's marine fisheries resources and also resulted in the need for management actions to limit harvest and capacity (Hogarth, 2001)[1]

This paper provides a brief case study of recent management actions taken regarding the USA Atlantic pelagic longline fleet and their combined effect on several indicators of fleet effort and capacity for harvesting swordfish. The USA Atlantic pelagic longline fishery started in the 1960s, primarily targeting swordfish, and has since diversified to its present form to target different species depending on time and area of abundance of desirable species regularly taken by the

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[1] Programs which fostered this growth in harvesting capacity included those which encouraged engagement in fisheries previously dominated by foreign vessels, including "underutilized" species in USA markets; tax credits, tax deferrals, loans, and loan guarantees which stimulated spending on new vessel construction through the mid-1980s and also stimulated purchase, repair, and refitting of fishing vessels; direct grant programs which provided support for new product development and other projects and allocations and trade policies to promote foreign market opportunities for USA producers.

gear (Hoey and Moore 1999). After its start, the range of the longline fishery quickly expanded and increased the volume of fish caught, becoming the dominant USA gear for harvesting north Atlantic swordfish by the mid-1960s (Figure 1).

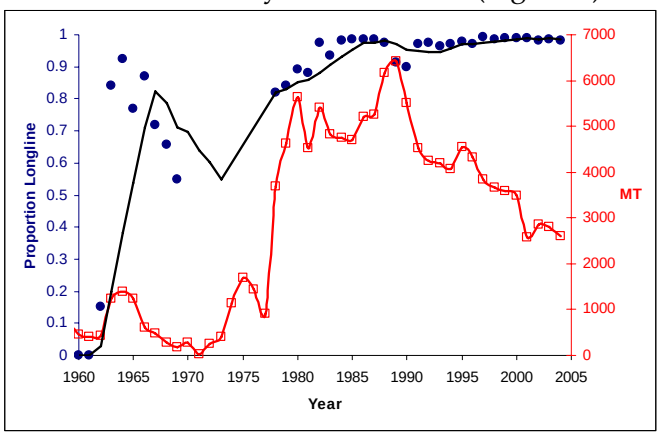


Figure 1. Evolution of USA north Atlantic swordfish catch (mt whole weight, open squares) with annual proportional contribution by longline gear (closed circles) and 5-year running average proportional longline catch (soid line).

In 1971, restrictions on tissue mercury content in swordfish for sale in the USA were established which lead to decreased landings of swordfish worldwide. But in 1978, the permissible maximum level was raised, which revitalized the USA fishery and landings. At the same time, methods of targeting and efficiency in catching swordfish evolved through changes in gear, fishing strategies, and the areas and times of concentrating effort.

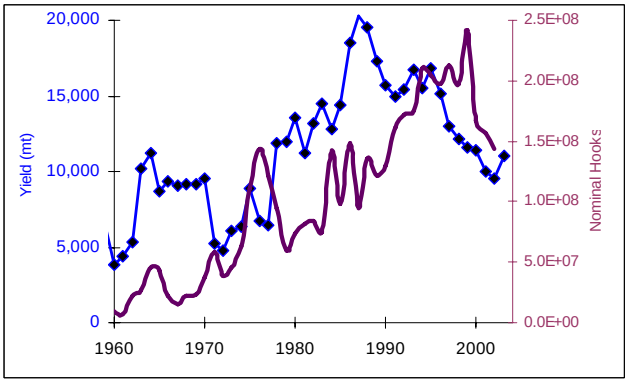


Figure 2. Evolution of north Atlantic swordfish catch (mt whole weight, closed diamonds) with the reported level of nominal hooks fished in the north Atlantic from 1960-2003 (soid line).

North Atlantic-wide, the volume of catch taken and longline fishing effort expended followed a similar pattern (Figure 2) to that of the USA. Resource status evaluations of north Atlantic swordfish, carried out by the International Commission for the Conservation of Atlantic Tunas (ICCAT) Standing Committee on Research and Statistics (SCRS), indicated a pattern of rapid increase in fishing mortality leading to a period of overexploitation and then followed by a period of rebuilding after management actions were agreed by ICCAT (Figure 3). The pattern of evolution of effort used to harvest swordfish is somewhat different than the nominal pattern, since not all of the effort expended is targeted at swordfish, but the general pattern is similar.

2.0 Management Measures

ICCAT first agreed to conservation measures for Atlantic swordfish in 1990, after receiving scientific advice from SCRS, to take measures to reduce fishing mortality. Amongst the measures agreed was an Atlantic-wide minimum size of 25 kg live weight (125 cm lower jaw fork length), with a tolerance of not more than 15% of the number of fish landed. Additionally, ICCAT encouraged Contracting Parties to take other

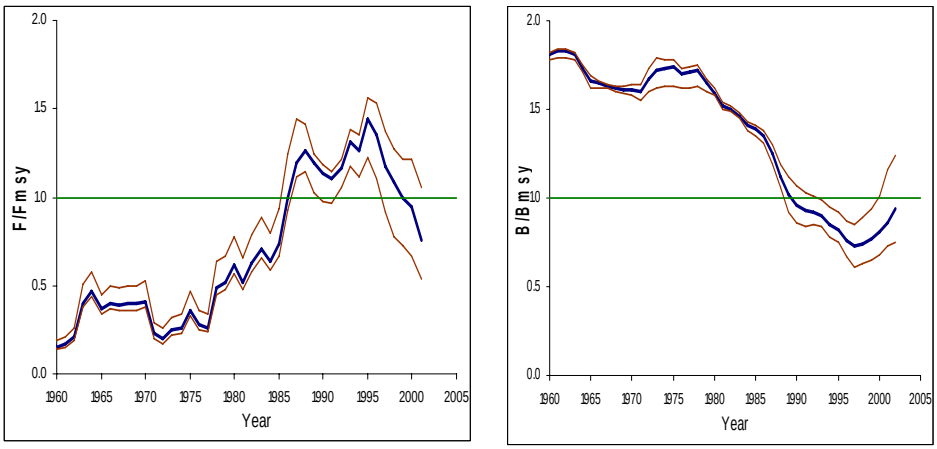


Figure 3. Estimates of fishing mortality rate and north Atlantic swordfish exploitable biomass expressed relative to MSY benchmarks from the most recent SCRS swordfish stock assessment. Heavy lines represent median trajectories and thin lines 90% bootstrap confidence bounds for the assessment (SCRS 2003).

appropriate measures within their national jurisdictions to protect small swordfish, including, but not limited to, the establishment of time and area closures. Following additional stock status evaluations wherein SCRS advised that additional management measures would be needed to stop the decline in resource status and subsequently to initiate rebuilding of north Atlantic swordfish to a level that could produce MSY, at its 1994 meeting, ICCAT first established total allowable catch (TAC) levels for nations fishing for north Atlantic swordfish to stem the decline in stock abundance. Subsequently, in 1999, ICCAT further agreed to further lower TAC levels in order to initiate rebuilding and by 2003, after SCRS advised of a measurable improvement in stock status, ICCAT increased TAC to about the MSY level, but also agreed on the need to maintain protection of juvenile swordfish to avoid reinitiating decline in stock abundance.

In the mid-1980's the USA implemented a permit system which led to limiting access to the pelagic longline fishery catching swordfish as a step toward managing capacity and fishing effort within the fleet. In 1991, minimum size restrictions, in conformity with ICCAT agreements, were instituted. By 1999, a number of additional controls were imposed including annual TACs, and regulations to aid in tracking swordfish trade, as well as a prohibition on importing swordfish less than the minimum size. As ICCAT agreed to a rebuilding scheme for north Atlantic swordfish in 1999, the USA TAC levels were correspondingly reduced for 2000-2002, and after rebuilding was observed, the overall and the corresponding USA TAC was subsequently increased.

The minimum size regulations placed on the USA fishery resulted in volumes of dead discarded fish higher than the agreed tolerance level at ICCAT. Total USA catch in 1997 and for the following 3 years, exceeded TAC (although landed catch was generally at or below TAC), and seasonal closures were applied to further constrain catch. In order to further protect juvenile swordfish and to avoid unwanted bycatch of billfish and other species, beginning in 2001, USA pelagic longline fishing was prohibited or restricted in the five areas and times shown in Figure 4. The three southern-most areas, (Charleston Bump, Florida East Coast, and Desoto Canyon), were selected, at least in part, to reduce the catch of swordfish < 125 cm and

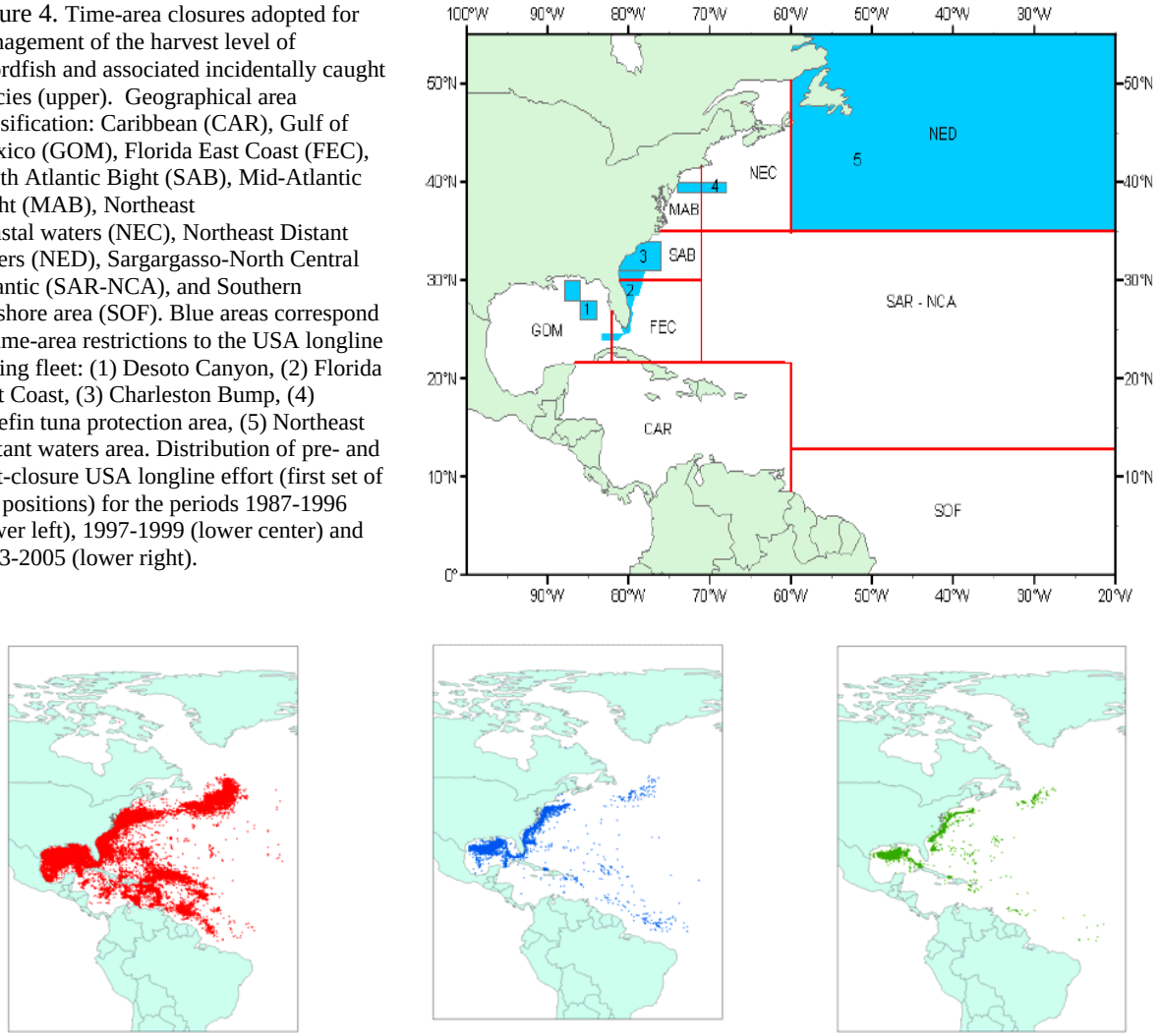


Figure 4. Time-area closures adopted for management of the harvest level of swordfish and associated incidentally caught species (upper). Geographical area classification: Caribbean (CAR), Gulf of Mexico (GOM), Florida East Coast (FEC), South Atlantic Bight (SAB), Mid-Atlantic Bight (MAB), Northeast Coastal waters (NEC), Northeast Distant waters (NED), Sargargasso-North Central Atlantic (SAR-NCA), and Southern Offshore area (SOF). Blue areas correspond to time-area restrictions to the USA longline fishing fleet: (1) Desoto Canyon, (2) Florida East Coast, (3) Charleston Bump, (4) Bluefin tuna protection area, (5) Northeast Distant waters area. Distribution of pre- and post-closure USA longline effort (first set of trip positions) for the periods 1987-1996 (lower left), 1997-1999 (lower center) and 2003-2005 (lower right).

other bycatch. A bluefin tuna area was closed primarily to reduce the catch of bluefin smaller than legal size permitted for sale by USA fishers. Longline vessels were allowed to fish in the Northeast Distant area if they participated in a turtle bycatch study and carried an observer. In 2002 the Northeast Distant area was closed all year to vessels not participating in the turtle study. This fishing area has subsequently been re-opened to USA longline fishing vessels which carry observers and have agreed to utilize fishing methods designed to reduce interaction rates with and serious injuries to sea turtles (see Watson *et.al.* 2003 for a description and of these methods and Scott, *et.al*. PA13/A8, this volume, for more information).

3.0 Change in Effort, Performance and Capacity

Over the past decade, there has been a measurable decline in various measures of US Atlantic pelagic longline fishing effort and capacity, which correlates with the suite of management measures described above that have been imposed to limit harvest of swordfish to levels agreed

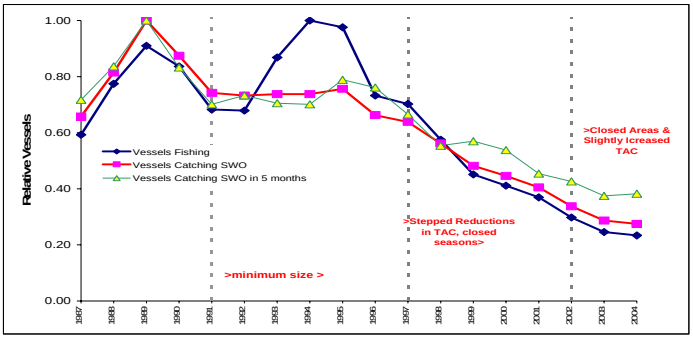
and to mitigate interactions with various incidentally caught species. Over the past few years, USA vessels have not achieved TAC, although volumes of dead discarded fish (mainly of undersized fish) remained. Although catch rates have increased, fishery participants attribute the recent lower than TAC harvest levels to reduced access and lower participation levels in the fishery.

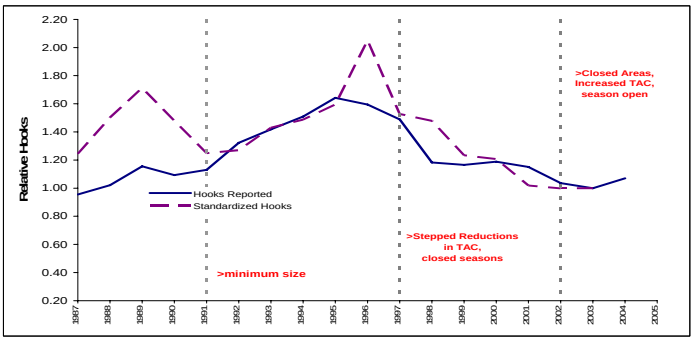
Table 1. Logbook reported annual USA Atlantic pelagic longline effort and capacity measures from 1987-2004.

YEAR	Vessels which FISHED	Vessels Which CAUGHT SWORDFISH	Vessels which CAUGHT SWORDFISH IN 5 MONTHS	HOOKS REPORTED
1987	297	273	180	6,558,426
1988	388	338	210	7,009,358
1989	456	415	251	7,927,401
1990	419	363	209	7,500,095
1991	342	308	176	7,754,127
1992	340	304	184	9,076,717
1993	435	306	177	9,735,806
1994	501	306	176	10,351,805
1995	489	314	198	11,270,539
1996	367	275	191	10,944,660
1997	352	265	167	10,213,780
1998	288	233	139	8,120,273
1999	226	200	143	7,996,685
2000	206	185	135	8,158,390
2001	185	168	114	7,897,037
2002	149	140	107	7,107,958
2003	123	119	94	6,862,091
2004	117	114	96	7,345,048

The number of longline vessels in the U.S. fishery catching and targeting swordfish has declined steadily since the mid 1990's (Table 1, Figure 5). First imposition of TAC in the face of minimum size restrictions already in place correlates with a decline in fishing effort and capacity which has carried through to the most recent period during which closed areas and times have also been implemented. While the imposition of closed areas have had an additional affect on catch and effort (Figure 6) it is generally not possible to separate the relative impacts of the minimum size, TAC and time area closures in terms of contributions to the overall reductions in catch of undersized fish nor in effort since the measures acted in combination. There was some overall reduction in effort, reported in hooks fished during the period which corresponds to the periods when specific areas were closed to fishing. Some of the effort previously reported from the Florida East Coast fishing area appears to have redistributed into the Gulf of Mexico and up to the south Atlantic and Mid Atlantic Bights. Although the metric, tons of swordfish < 125 cm estimated caught, increased in some areas compared to the 1997-99 average, notably the Caribbean and the Gulf of Mexico, the overall change in estimates was a reduction of approximately 50% in the years since implementation of time-area closures, but an

overall additional effort level (in hooks) reduction of about 10% compared to the 3-year average just prior to implementation of the closed areas.





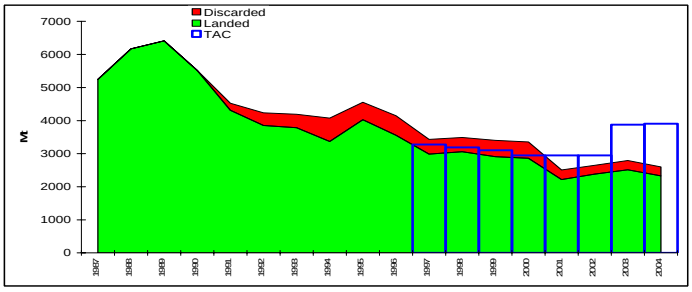
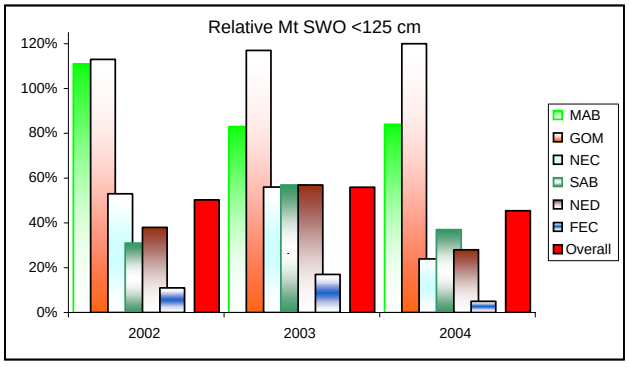


Figure 5. The pattern of change in USA longline fishing vessels fishing based on various measures, including vessels reported fishing, vessels catching swordfish, and vessels catching swordfish in 5 months. Values are reported on a relative scale with respect to maximums (see Table 1), upper. The pattern of change in USA longline hooks fished based on two measures: nominal hooks fished and standardized hooks fished, expressed relative to the 2003 values reported or estimated (center). Pattern in USA landed and discarded catch of north Atlantic Swordfish with TAC levels indicated (lower).



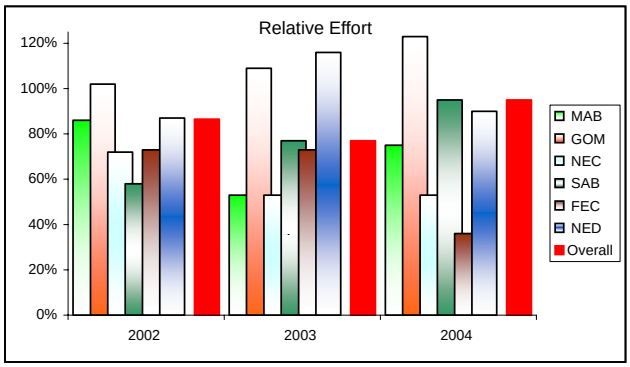


Figure 6. Change in volumes of undersize swordfish catch (upper) and nominal effort expended by fine-scale areas where time-area closures were imposed. Values expressed are relative to the 1997-199 period which preceeded the time-area closures. See Figure 4 for area and closure definitions.

Undoubtedly, other factors influence both the catch and effort expended in the fishery, but both the value of the catch and the cost of obtaining it are primary. Over the period of the time-series here there have been notable changes in the volumes landed per vessel and the ex-vessel prices paid for swordfish, which has lead the fishery to diversify toward other species of tunas or related species (Figure 7). At the same time costs of obtaining catch have increased, most notably in the past few years .

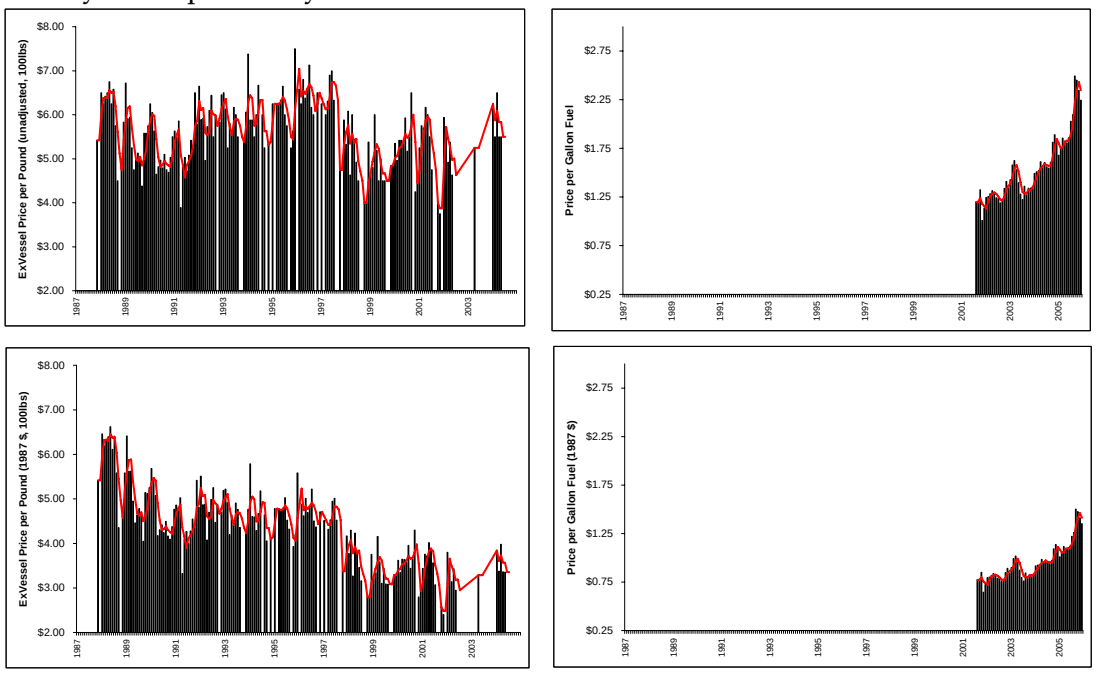


Figure 6. Left hand panels:1987-2004 monthly ex-vessel average price information for Florida swordfish 100 lbs or greater at the Fulton Fish Market (New York), both unadjusted (upper) and inflation adjusted (1987 constant dollars) with associated 3-month running averages. Prior to 1998 prices remained relatively stable, but declined thereafter with a slight up-swing in the most recent period. Right hand panels: monthly average price per gallon of fuel reported to the Atlantic pelagic logbook system for the period 2001 (Aug)-2005.; both unadjusted (upper) and inflation adjusted (1987 constant dollars) with associated 3-month running averages.

4.0 Could Fleet-wide Efficiencies Improve?

Analysis of individual vessel performance in terms of per hook productivity indicates a relatively wide range of variability within the fleet owing to a variety of factors, among which is the operating style of the vessel, the particular area fished, the degree of targeting for swordfish and the size of the set made. Methods applied to 'standardize' the effort used by the fleet to remove the effects of area, time, targeting and vessel characteristics independent of stock abundance (*e.g.* Ortiz and Scott 2003) provide a basis for estimating the potential performance of the fleet if it were possible to increase the average per hook productivity to the levels associated with the highest efficiency fishing strategies. Given the most recent estimate of stock status, current (2003) biomass is at approximately the level which could produce MSY and the average per hook performance required to achieve the optimal removal equates to about a 50% increase from the 2004 average performance based on effort reported in Table 1, if effort (in nominal

hooks) were to remain level. From the analysis of Ortiz and Scott (2003), there appears to be potential to improve average per hook efficiency by this amount or more, if a higher proportion of the fleet were to fish in more efficient ways (Figure 7). The degree to which this potential could be realized is unknown.

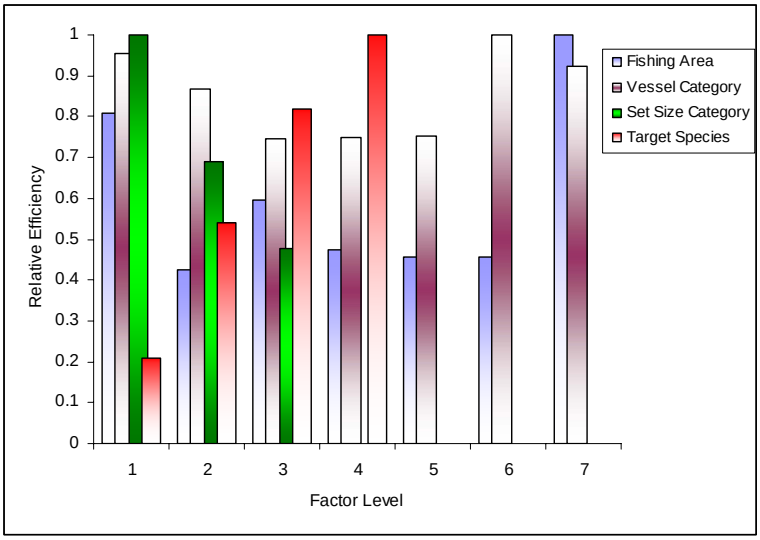


Figure 7. Relative efficiency estimates of factors important in explaining variability of swordfish catch rates in the USA fleet, independent of swordfish abundance. A value of 1 corresponds to the highest average level estimated for the vessel trips categorized (see Ortiz and Scott 2003).

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