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## FIRST OBSERVATIONS ON THE RE-ESTABLISHED SOUTHEAST FLORIDA RECREATIONAL SWORDFISH TOURNAMENT FISHERY

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**ABSTRACT:** *Recreational tournaments for swordfish (*Xiphias gladius*) existed in the Florida Straits between 1977 and 1983 before disappearing due to low catch rates and an overexploitation of the stock. The first recent swordfish tournament occurred in 2001 off southeast Florida with 13 participating vessels. In 2002, three swordfish tournaments were observed and anglers were interviewed to determine catch and gear characteristics of the re-established recreational fishery. A total of 156 vessels participated in these three tournaments, catching 112 swordfish and hooking an additional 48 animals. The combination of the recovery of the North Atlantic swordfish stock and the continuation of the 2001 closure of the Florida Straits to commercial pelagic longline fishing gear is expected to result in the continued expansion of the southeast Florida recreational swordfish fishery.*

**Key Words:** swordfish, recreational fishery, southeast Florida, tournament

THE SWORDFISH (*Xiphias gladius* Linnaeus) is an oceandromous species found worldwide in temperate and tropical pelagic waters. It is one of 30 pelagic fishes known collectively as Highly Migratory Species (HMS) listed in Annex I of the 1982 United Nations Convention on the Law of the Sea. These species undergo large-scale migrations believed to be related to feeding or reproduction (Mather et al., 1975), which often cross multiple international boundaries within the course of a calendar year. Many of these species, such as the large tunas (*Thunnus* spp.) and the swordfish have high economic value and are targeted by well-developed and highly advanced commercial and recreational fisheries.

HMS fisheries management in the Atlantic Ocean is complex. Internationally, these fisheries are managed under the auspices of the International Commission for the Conservation of Atlantic Tunas (ICCAT) which is based in Madrid, Spain. In the U.S., under the authorization of the Atlantic Tunas Convention Act and the Magnuson-Stevens Fishery Conservation and Management Act (Sustainable Fisheries Act), the Highly Migratory Species Management Division of the National Marine Fisheries Service (NMFS) is

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responsible for managing all HMS species including sharks. NMFS' HMS Management Division is responsible for implementing ICCAT recommendations, developing fishery management plans (FMPs), and associated regulations. In 1996, the North Atlantic Ocean swordfish stock was assessed by ICCAT to have a  $Biomass_{1996}/Biomass_{Maximum\ Sustainable\ Yield}$  ( $B_{1996}/B_{MSY}$ ) ratio of 0.58 (ICCAT, 1999), indicating the stock was overfished. Based on this assessment, concerns of high juvenile swordfish bycatch rates in southeast waters, and to help rebuild the North Atlantic swordfish stock, NMFS implemented regulations which closed the waters off the east coast of Florida to commercial pelagic longline fishing on April 1, 2001. In 2002, ICCAT reassessed the swordfish stock and results suggested that there has been a gradual improvement in the population resulting primarily from strong year-class recruitment since 1996 (ICCAT, 1999). Presently, the North Atlantic swordfish stock is considered nearly rebuilt, with the  $B_{2006}/B_{MSY}$  ratio at 0.99 and an estimated current yield equal to or less than replacement yield (ICCAT, 2006).

Recreational fishing for swordfish was established in New England waters during the 1920s (Crandall, 1926). During the 1960s, approximately 50 swordfish were caught annually with rod-and-reel recreational fishing gear (NMFS, 1999). At that time, the fishery was prosecuted during daylight hours and usually involved casting to large swordfish basking on the surface. In 1976, using techniques adapted from the exile Cuban pelagic longline fishing community, the first recorded swordfish caught at night by a directed recreational fisherman was landed in Miami, Florida (Dunaway, 1976). The popularity of the fishery grew rapidly and the world's first night-time swordfish tournament – the *Miami Swordfish Tournament* – was organized in Miami, Florida in 1977. During this tournament, 27 vessels landed a total of 86 swordfish ranging from 86.2 to 222.7 kg (190 to 491 pounds). However, because recreational swordfish catch rates began to decline shortly thereafter, and there was an increase in commercial fishing effort, the popularity of fishing for the species decreased. The last southeast Florida swordfish tournament in this early period occurred in 1983 (Leech, 2002).

According to the NMFS Marine Recreational Fisheries Statistics Survey (MRFSS), no recreationally caught swordfish from the U.S. east coast were reported from 1994 through 1997. Based on NMFS tournament information, no swordfish were reported caught by recreational anglers along the Atlantic coast of Florida during 1994 and 1995. However, the NMFS Large Pelagic Survey (LPS) did report 16 swordfish in 1996, 10 of which were retained and six released alive. In 1998, the LPS reported six swordfish, only one of which was retained.

Although directed recreational swordfish angling has been conducted off the southeast coast of Florida since 1976, the popularity for this fishery has been growing recently with the redevelopment of organized swordfish tournaments and increased media attention to the recreational catches. In August 2001, the first tournament targeting swordfish since 1983 was held in

Fort Lauderdale, Florida. Eighteen vessels and approximately 40 individuals participated in the *Sword Lords* tournament, landing three fish and releasing approximately 12 more (Leech, 2007). In 2002, there were three swordfish tournaments held off the southeast Florida coast, with the *Sword Lords II* swordfish tournament on 24 August becoming the largest directed swordfish tournament in history (Leech, 2002).

Currently, the United States, Venezuela, and New Zealand are the only countries that have a well-established recreational swordfish fishery. With the recent increase in effort, interest, and lack of information about the domestic recreational swordfish fishery, we initiated a preliminary investigation of the recreational swordfish fishery off the southeast coast of Florida. This paper describes the results of three directed swordfish tournaments held in southeast Florida during the summer of 2002 and provides a description of the recreational fishery during this period.

**MATERIALS AND METHODS—Data collection**—Information for this study was obtained through recreational swordfish tournament observations. From July through September 2002, a total of three tournaments were documented. The tournaments were all based in south Florida; two in Lighthouse Point and the other in Fort Lauderdale. Information gathered for this report was obtained by a combination of three methods: voluntary direct observation of recreational swordfish tournaments, voluntary dockside interview of recreational swordfish tournament participants, and lastly through a voluntary telephone interview with a recreational swordfish tournament director. Voluntary at-sea observation was established by initiating and developing contact with recreational swordfish tournament organizers in the south Florida region prior to each tournament. One day prior to the tournament, the fishery observer would attend the captains' meeting to conduct public relations, outreach, and education.

Direct at-sea observation of recreational swordfish tournaments was conducted by a fishery observer during 24 August and 28 September 2002. While onboard the tournament committee vessel, the fishery observer collected information on fishing gear, fishing technique, location, bottom depth, mean drift speed, start/end time, sea/atmospheric conditions, and biological information on swordfish catch. Estimated sizes, weights, and time of release of all swordfish hooked, landed, and released were obtained by radio communication between the committee vessel and tournament participants. As required under the tournament rules, all tournament participants were required to radio-in all swordfish hooked (broken off and lost), caught ("landed"), and retained to the committee vessel. All swordfish caught and released were also required to be photographed for verification purposes. In addition, all participants were required to estimate the size or weight of each swordfish released. The committee vessel would then confirm the catch as well as document the time of capture. Upon return to the dock, all swordfish landed were measured, weighed, and sexed. To collect economic and effort information, tournament organizers were interviewed on the conclusion of each tournament. Information gathered consisted of the number of vessels and participants, entry fee costs, and prizes awarded.

To collect fishery characterization information, voluntary dockside interviews of recreational swordfish tournament anglers were conducted during the weigh-out period at the end of each tournament. Dock interviews were conducted only with anglers that landed swordfish because anglers who did not catch any swordfish usually were not present at the weigh-out. Each dockside angler interview consisted of inquiring about fishing gear, fishing technique, and any biological information or experience that anglers volunteered. All of the anglers that were requested to participate fully cooperated with the survey.

For the 27 July tournament, information was obtained through a voluntary telephone interview of the recreational swordfish tournament organizer. Information obtained consisted of the number of vessels and participants, entry fee, and prizes awarded. Additional information

TABLE 1. Tournament details for three sampled recreational swordfish tournaments in southeast Florida during 2002. Number of anglers is approximate. Number of swordfish hooked was only assessed for third tournament.

Tournament and location	Date	Number of vessels	Number of anglers	Entry fee	Total prizes	Number retained	Number landed	Number hooked
<i>Darkside I</i> Lighthouse Point, FL	27 July	33	125	\$200	\$8,880	8	42	*
<i>Sword Lords II</i> Fort Lauderdale, FL	24 August	72	275	\$220	\$18,214	13	14	*
<i>Darkside II</i> Lighthouse Point, FL	28 September	51	175	\$220	\$12,729	5	30	48

\*Not assessed

consisted of the number of swordfish landed, sizes and weights of swordfish landed, number of hook-ups and releases, estimated sizes, and times of catches or releases.

*Data analysis*—In pelagic recreational fisheries, several terms are used to describe the disposition of individual fish. For the purposes of this study, the definition of “hooked” is a fish that was on the line for any amount of time. A “landed” fish is one that was caught and brought alongside the vessel close enough for an angler to touch the leader (the presumption is that the fish is then “captured” and could be retained, if desired). In these tournaments, individual fish must be “landed” in order for them to be counted as “released.” Any fish that is killed and brought to the dock is “retained.”

Frequency distributions were generated for all retained swordfish. All fish hooked during these nighttime tournaments were assumed to be swordfish. Success rate was calculated by dividing the total number of swordfish caught (the total of released and retained animals) by the total number of vessels fishing. The hooked per unit effort (HPUE) index (see Prince et al., 1990) was used to estimate relative abundance as used by the NMFS Southeast Fisheries Science Center for monitoring other billfish tournaments. Catch per unit effort (CPUE) was calculated by dividing the total number of swordfish caught (the total of released and retained animals) by the total number of hours drifted. CPUE was raised to 100 hours of effort in order to compare to other billfish relative abundance values. Relative abundance was estimated by dividing the total number of swordfish caught (the total of released and retained animals) by the mean number of nautical miles drifted. Summary statistics were calculated for the recreational fishing gear configurations employed during these tournaments.

All statistical analyses were conducted with SAS (v. 9.0; SAS Institute, Inc.; Cary, NC, USA). Local sunset and moonrise times were obtained with the TIDES AND CURRENTS program (v. 2.00; Nautical Software, Inc.; Beaverton, OR, USA).

**RESULTS**—In 2002, three south Florida swordfish tournaments were documented (Table 1). The *Darkside I* tournament occurred on 27 July and was based in Lighthouse Point, Florida. The *Sword Lords II* tournament occurred on 24 August and was based in Fort Lauderdale, Florida. The third tournament was the *Darkside II* tournament, also based in Lighthouse Point, occurred on 28 September. Information was collected by phone interview for the *Darkside I* tournament, while the *Sword Lords II* and *Darkside II* tournaments were both observed.

A total of 156 vessels and we estimated, using an average of 3–4 fishermen per vessel, that 468–624 individuals participated in these tournaments. We were

TABLE 2. Characteristics of recreational swordfish fishing gear used during three southeast Florida swordfish tournaments in 2002.

Gear characteristic	Typical use and range
Line test strength	80 pounds; 50–100 pounds (36.2 kg; 22.6–45.3 kg)
Hook size	10/0 J-style; 9/0–11/0
Leader length	7.6 m; 1.8–7.6 m (25 feet; 6–25 feet)
Leader test Strength	250 pounds; 100–300 pounds (113.4 kg; 45.3–136 kg)
Leader weight	20 ounces; 20–24 ounces (0.5 kg; 0.5–0.6 kg)
Targeted fishing depth	60.9 m; 22.8–121.9 m (200 feet; 75–400 feet)

unable to obtain an exact number of participants since tournament organizers only record the number of vessels. A total of 27 recreational tournament swordfish anglers were interviewed at dockside, and all anglers interviewed were receptive to being interviewed. Comparing fishing technique and gear information collected by dockside interviews to shipboard-observer information, dockside-collected angler information appeared to be consistent with data collected during the shipboard-observed trip.

Typical swordfish tournament fishing gear consisted of a stout blue marlin-type rod, usually rigged with 80 pound test (45.3 kg) monofilament line and a 250 pound test (113.4 kg) monofilament leader approximately 7.6 m (25 feet) in length, although other configurations were used (see Table 2). A lead weight was tied to the leader with waxed floss 4.5–6.0 m (15–20 feet) above the hook. One small battery-powered strobe or LED light was typically used 1.5–3.0 m (5–10 feet) above the hook. J-style hooks were the most common type used in these tournaments, ranging in size from 9/0 to 11/0. Bait was predominantly live blue runners (*Caranx crysos* Mitchell) or dead squid (*Illex* spp.), although live bigeye scad (“goggle-eyes”; *Selar crumenophthalmus* Bloch) were also used. Live baits were bridled directly to the hook with waxed floss. Three or four rods were used by each vessel to target various depths ranging from 22.8–121.9 m (75 to 400 feet). Inflated latex balloons with a chemical lightstick for visibility were commonly used to identify the baits floating away from the vessels and to keep baits at the desired depths. On the deep-line rod (the rod with the line set at the greatest depth), generally no balloon was used.

During the 2002 tournament season, recreational swordfish anglers fished in the Florida Straits off the southeast coast of Florida since the Gulf Stream current was in close proximity to southeast Florida, which was the lower parallel of the recreational swordfish fishing grounds (see Fig. 1). The fishing grounds were only approximately 37 km (20 nautical miles (nmi)) from the Port Everglades Inlet (Fort Lauderdale) and 52 km (28 nmi) from the Hillsboro Inlet (Lighthouse Point). Anglers targeting swordfish preferred to fish in waters with bottom depths of 400–500 m (1300–1600 feet). The majority of fishing vessels were fiberglass, center console-design V-hull models powered by a single or dual outboard motor setup. The vessels in these tournaments ranged in length from 6–15 m (19–50 feet).

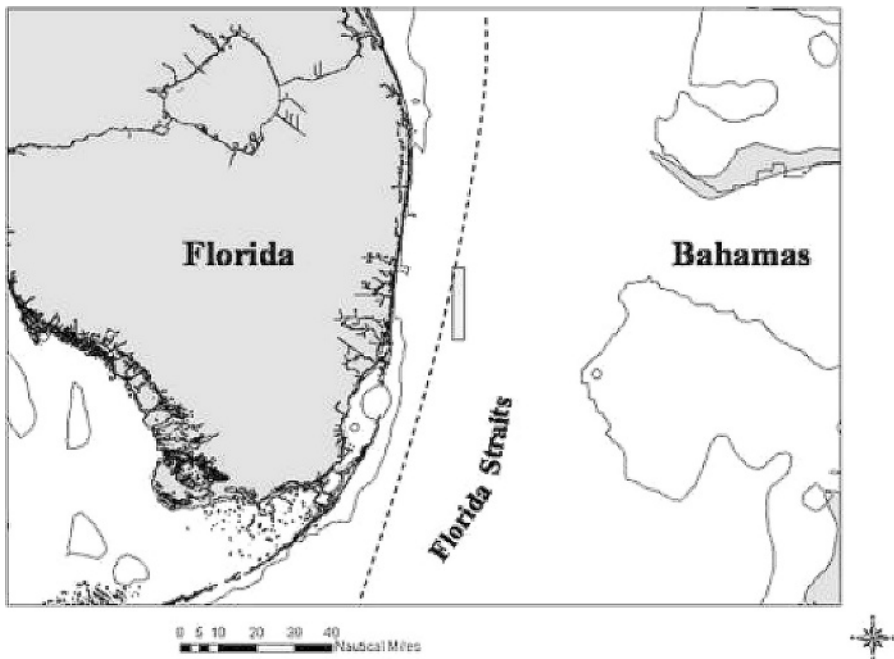


FIG. 1. Approximate location of the recreational swordfish grounds (shaded rectangular box) fished during three swordfish tournaments in southeast Florida during 2002. Dashed line represents approximate location of the axis of the Gulf Stream. Solid offshore lines represent the 20m depth contours.

Based on tournament angler interviews, all swordfishing took place at night and anglers not catching bait first generally left port just before sunset. Anglers also reported that fishing activities usually correlated with moon phase. Specifically, the amount of moonlight is thought to affect the swordfish catch rates and the fishermen modify their fishing techniques to compensate. The best fishing is considered to occur on the brightest nights (full moon), when swordfish are closer to the surface. During the full moon, baits were deployed deeper than during a new moon, when the baits were set closer to the surface. Wind is another factor that reportedly affected catch rates; a strong north or northeast wind reportedly negatively affected catch rates in southeast Florida such that local anglers preferred to fish for swordfish during a light south or southwest wind. Anglers also commented anecdotally that bioluminescence in the water positively affected catch rates.

A typical night of swordfish fishing consisted of approximately one hour of traveling time to the fishing grounds, setting three or four fishing lines, and then drift fishing with the current. After three or four hours of fishing, the vessel would retrieve all the lines and steam south to fish either the same general location or move to a new location. Baits were checked approximately every hour. Because the Gulf Stream current is very strong in this area and

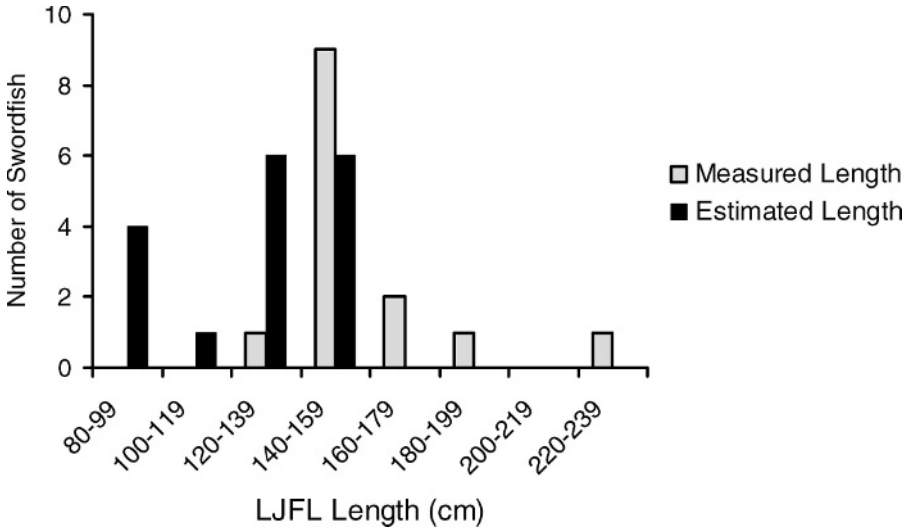


FIG. 2. Combined lower jaw fork length (LJFL) length frequencies for retained (measured) and released (estimated) swordfish caught in three southeast Florida recreational swordfish tournaments during 2002.

travels north at approximately 3.5 knots (nmi per hour), anglers would normally retrieve all the lines and travel south two or three times per night after drifting for three or four hours. Anglers then returned to port just before sunrise after approximately 12 hours of fishing. Outside of tournaments, local southeast Florida swordfish anglers reported that about 10 vessels target swordfish during the week and about 30 vessels fish during the weekends.

All three tournaments were held at night and all vessels landing swordfish were required to be present at the weigh-out station prior to sunrise. Each tournament was a one day (24-hour) event. A total of 112 swordfish were reported during the three monitored tournaments (Table 1). Of these, a total of 26 swordfish were retained and 86 released, resulting in an overall release rate of 76.8%. Data from the September tournament indicated that an additional 48 swordfish were hooked, but not landed. No bycatch other than small swordfish under the minimum size was observed in any of the tournaments.

The mean length of swordfish retained was 159.1 cm lower jaw fork length (Fig. 2; S.D.  $\pm 26.4$ ; range: 127–228 cm LJFL). The mean weight for swordfish retained was 62.5 kg (S.D.  $\pm 31.4$ ; range: 35.4–144.2 kg). The mean estimated weight for released swordfish was 19.4 kg (S.D.  $\pm 4.1$ ; range: 13.6–31.7 kg). Catch-at-size data for both retained and released animals (measured and estimated lengths, respectively) is shown in Figure 2. Lengths of retained swordfish were not significantly different among tournaments for the (ANOVA;  $F = 0.32$ ,  $P = 0.7283$ ).

The time-at-capture data indicated that during August, 62% of the fishing success occurred within four hours of the sunset (19:48) and moonrise (21:12)



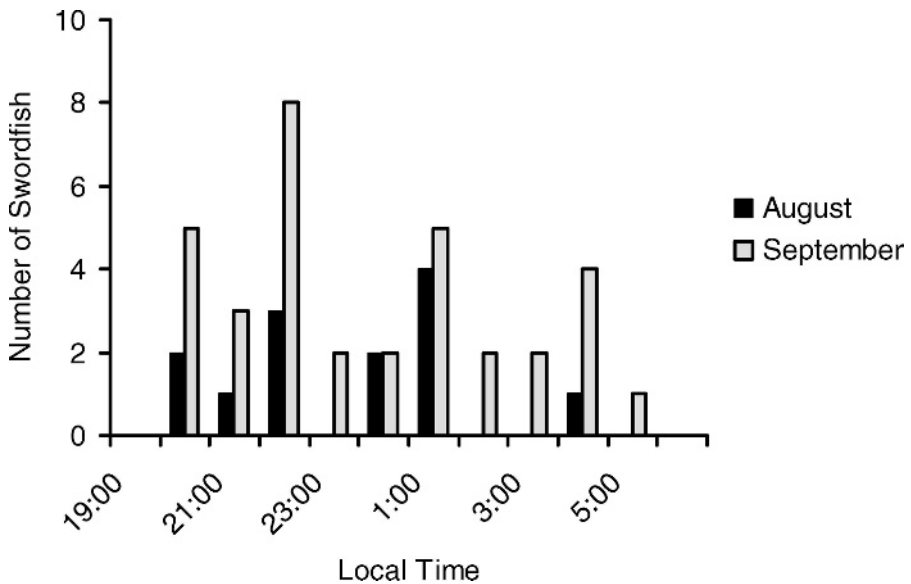


FIG. 3. Time of catch for two recreational swordfish tournaments in southeast Florida during 2002. Similar data were unavailable for the July 2002 tournament.

period. In September, 59% of the fishing success also occurred within four hours of the sunset (19:11) and moonrise (23:51) period (Fig. 3). Time-at-capture data were not available for the July tournament.

The overall fishing success rate for swordfish in these tournaments was 86% and the number of swordfish hooked per unit of effort (HPUE) was 0.0615-swordfish/hour or 6.15 swordfish per 100 hours drifting. The catch per unit effort (CPUE) was 0.0143-swordfish landed/hour or 1.43 fish per 100 hours drifting. The total number of hours drifted for the three tournaments combined was 1,821 hours. The overall relative abundance during this period was 0.0154 swordfish hooked/nmi drifted or 1.54 swordfish/100 nmi drifted.

The official prizes for these three tournaments totaled \$29,282, which included first, second, and third place awards; one tournament also awarded a small fourth place prize. The average value of first place awards was \$4,762. All three tournaments also included at least one of the so-called “calcuttas” (optional prizes which consist of voluntary contributions from participating anglers, with the winner in the contributor pool claiming the combined contribution total; NMFS, 1998). Including the various calcutta pools, the total amount of award monies at these three tournaments increased to \$39,822.

**DISCUSSION**—Adaptations of gear and techniques from both the istiophorid billfish recreational fishery and the artisanal Cuban longline fishery have helped recreational swordfish anglers become more proficient in targeting

swordfish off southeastern Florida. Additional reporting of the fishery in popular fishing magazines and the press has resulted in an apparent increase in recreational effort in the traditional recreational swordfish grounds. These tournaments represent the renewed utilization of this swordfish resource.

The organizers for all three tournaments implemented a 139.7 cm (55-inch) LJFL minimum size requirement for all retained swordfish, even though contemporary federal regulations only required a minimum LJFL length of 119.4 cm (46.8 inches). The average length of retained swordfish was well above the tournament minimum. However, the average weight of the animals retained in 2002 was 62.5 kg (137.9 pounds), which is well under the average weights of the swordfish retained during the 1977 and 1978 *Miami Swordfish Tournaments* at 85.2 kg (187.9 pounds) and 68.4 kg (150.9 pounds) respectively (Berkeley et al., 1978).

Our results suggest that recreational fishing effort will continue to increase with increased fishing success rates and organized tournaments. There also appears to be a direct correlation between an increase in tournament participants and the amounts of prize money awarded, especially with the optional calcuttas. Calcutta prizes are generally not reported as part of the official tournament reporting, but if added to the place prizes, the optional calcutta pools constituted an average of 26.2% of the total tournament awards.

The results from these three tournaments also found that swordfish relative abundance values for recreational tournament swordfish fishing during 2002 were much higher than published results for other billfish (e.g., Avrigan and Pristas, 1995). With decreasing recreational catch rates of other billfishes, it is possible that fishing effort for swordfish may increase by the charter boat industry as the industry begins to target swordfish instead of some of the other billfishes. Thus, it is essential that the monitoring of the recreational swordfish fishery continue.

The HPUE for blue marlin (*Makaira nigricans* Lacepède) caught during tournament fishing in 1993 was 2.3 fish per 100-hrs-trolling, while white marlin (*Tetrapturus albidus* Poey) HPUE was 0.85 and sailfish (*Istiophorus platypterus* Latreille) 0.3 during the same period (Avrigan and Pristas, 1995). In contrast, the swordfish HPUE during the three tournaments was 6.15 fish per 100-hrs-trolling. The average weight for tournament landed swordfish was 62.6 kg, which is greater than both for white marlin and sailfish, but less than that for blue marlin (Venizelos, 2003).

The average released swordfish in these three tournaments weighed approximately 19.5 kg, and the condition of the fish upon release is simply listed as "alive." However, additional data are needed to better understand the relationships between hooked fish condition, release condition, and if there is any type of hook type function regarding fish size or the condition of the fish at release. Such relationships have been reported for other large pelagic fishes in recreational fisheries in the western North Atlantic (e.g., on white marlin in Horodysky and Graves (2005)). The discovery and encouragement of techniques that promote the survival of released swordfish is important for

swordfish population management and the continuation of this recreational fishery.

While anecdotal reports from swordfish anglers also suggest a correlation between fishing action and sunset or moonrise, which would be consistent with crepuscular feeding behavior, hook time data collected aboard a commercial pelagic longline vessel do not support this contention, even given the assumption that all hooked animals were swordfish. In 2004, using electronic hook time-recorders in the Florida Straits off the lower Florida Keys during commercial pelagic longline fishing operations, Kerstetter (2005) found that swordfish (as well as other bycatch fishes) would strike the baits throughout the night.

The collection of biological and statistical data from swordfish in the Florida Straits was curtailed by the closure of the Florida Straits to commercial pelagic longline fishing operations. These area-specific datasets, such as the juvenile abundance index, were traditionally used by ICCAT for swordfish stock assessments. However, limited replacement of these catch rate data could occur with the assistance of the southeast Florida recreational swordfish fishing community.

The cooperation of fishermen was voluntary during this survey. Several vessel captains indicated that they would agree to carry an observer during future tournaments or on non-tournament fishing nights. The experience of collecting data from these three tournaments suggests that future tournament information could also be easily obtained. There also remain ample opportunities for other cooperative scientific work, such as conventional tagging of released swordfish using tags and scientific assistance from the NMFS Cooperative Tagging Center at the Miami Laboratory.

Future studies of this type may also provide valuable information on the economics of this swordfish-directed fishery. According to Ditton and Stoll (2003), the estimated direct expenditures by U.S. Atlantic recreational billfish anglers surpass \$15.3 million annually, or approximately \$2,105 per trip. Although much of that estimated cost is from the chartering of a vessel and captain, the similarities in such equipment as fishing tackle and vessels suggest that it is probable that some participants and expenditures from the larger istiophorid billfish recreational fishery also carry over into the swordfish recreational fishery. However, to date there have been no studies of the economic impact of the southeast Florida recreational swordfish fishery.

The NMFS Southeast Fisheries Science Center has been monitoring the billfish recreational fishery for over 20 years through a combination of tournament monitoring and cooperative efforts with the recreational fishing sector. Currently, the NMFS HMS Management Division monitors swordfish tournaments by requiring tournament organizers to register their tournaments with the NMFS Recreational Billfish Survey (RBS) Program (see Venizelos, 2003). After each tournament, and if selected for reporting, the director is only required to submit biological information to the RBS on 1) the number of fish retained, 2) the number tagged and released, 3) the number released without

a tag, and 4) the number released dead. Additional information for this fishery can likely be obtained through cooperative efforts with the recreational sector. For stock assessment purposes, we advocate the establishment of a time-series of tournament information for swordfish.

We believe many of the current research approaches by the Southeast Fisheries Science Center in its ability to monitor the istiophorid billfishes can be adapted to the swordfish fishery. Because of the importance of adhering to the present rebuilding plan for swordfish, it is also important that the HMS Management Division expand its efforts to monitor the recreational swordfish fishery. The information gathered from this fishery may also be valuable for use in future stock assessments, especially if combined in a long time-series dataset. The specific monitoring of the southeast Florida recreational swordfish fishery may also provide more useful information for management purposes than that provided by the MRFSS and LPS programs, which historically have shown problems with rare-event species such as istiophorid billfish and swordfish (see NRC, 2006).

Information gathered by the monitoring of swordfish tournaments in southeast Florida was an appropriate approach to gathering a general, preliminary overview of this fishery. However, we believe the data reporting requirements under the RBS program are minimal and should be expanded. More detailed data could be obtained with the regular use of trained fishery observers. Historically, the use of federal fishery observers for gathering fishery characterization and stock assessment information while aboard commercial vessels has been a standard technique. As recreational fishing effort continues to rise, the use of fishery observers, such as in this study, should be implemented. Similar applications exist for recreational fisheries, such as those for swordfish, and NMFS already allows for voluntary observer coverage in recreational HMS fisheries (NMFS, 1999). The information gathered from even a volunteer observer program, such as the International Game Fish Association's "Certified Observer Program" (Schratweiser, 2006), may help guide the development of fishing technologies and practices that could assess and mitigate the extent of post-release mortality associated with the recreational swordfish fishery.

One of the many goals of the HMS Management Division is to expand its research efforts by working closely with key constituents who are involved in the recreational swordfish fishery. These results demonstrate that useful information can be obtained with the cooperative assistance of the recreational fishery. Future work with this fishery is currently underway to better document the changes in gear and techniques over time. Effective domestic management of swordfish will likely involve future cooperative efforts with those anglers who participate in this fishery.

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