CHAPTER 2.1.8.1: SAILFISH	**AUTHORS: F. AROCHA and M. ORTIZ**	**LAST UPDATE: Sept. 4, 2006**

2.1.8.1 Description of Sailfish (SAI)

1. Names

1.a Classification and taxonomy

Species name: *Istiophorus albicans* (Latreille 1804)
Synonyms in use: *Istiophorus platypterus*
ICCAT species code: SAI
ICCAT names: Atlantic sailfish (English), Voiliere de l'Atlantique (French), Pez vela del Atlántico (Spanish)

According to Nakamura (1985), Atlantic sailfish is classified as follows:

- Phylum: Chordata
- Subphylum: Vertebrata
- Superclass: Gnathostomata
- Class: Osteichthyes
- Subclass: Actinopterygii
- Order: Perciformes
- Suborder: Xiphioidei
- Family: Istiophoridae

1.b Common names

List of vernacular names used according to ICCAT and Fishbase (www.fishbase.org). Those with (*) are national standard names according to a survey conducted by ICCAT. The list is not exhaustive and some local names might not be included.

Azores Islands: Atlantic sailfish
Barbados: Sailfish
Benin: Ajètè-abadanon
Brazil: Agulhão-bandeira, Agulhão de vela
Canada: Sailfish
Cape Verde: Peixe-vela, Veleiro
China: 大西洋旗魚
Côte d'Ivoire: Voilier
Cuba: Aguja voladora, Aguja de abanico, Voladeira
Denmark: Atlantisk sejlfisk
Dominican Republic: Aguja
Finland: Atlantinpurjekala
France: Voilier de l'Atlantique
Germany: Segelfisch
Greece: Ιστιοφόρος Ατλαντικού
Italy: Pesce vela
Japan: Nishibashookajiki
Korea: Dot-sae-chi
Martinique: Voilier de l'Atlantique, Mere balaou
Mexico: Pez vela, Volador
Morocco: Espadon
Netherlands Antilles: Balau wairu, Balau di bandera

Norway: Atlantisk seilfisk
Portugal: Espardarte veleiro, Peixe de vela
Puerto Rico: Sailfish
Russian Fed: Atlanticheskii parusnik, Parusnik-ryba
Senegal: Espadon voilier
South Africa: Seilvis, Sailfish
Spain: Pez vela del Atlántico
Trinidad y Tobago: Sailfish
Uruguay: Pez vela
United Kingdom: Atlantic sailfish
United States of America: Atlantic sailfish
Venezuela: Pez vela, Palagar

2. Identification

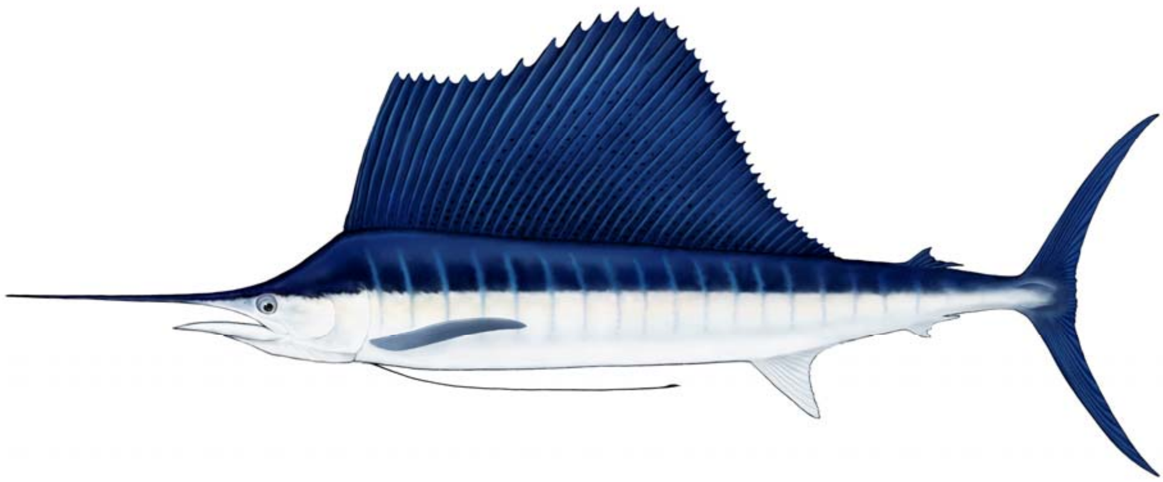

Figure 1. Drawing of an adult sailfish by Les Gallagher (Les Gallagher: fishpics).

Characteristics of **Istiophorus albicans** (see **Figure 1** and **Figure 2**)

Sailfish is one of the mid-size billfish species. The maximal length was reported by Nakamura (1985) in 315 cm, 58 kg in weight from recorded measurements of sport-fishermen in Walker Bay, Bahamas in 1950. Common sizes are 160-180 cm, up to 230 cm lower jaw to fork length (LJFL).

Regarding age, Chiang et al. (2004) estimated maximum ages of 12 years for females and 11 years for males using dorsal fin spine sections from sailfish in the waters east of Chinese Taipei. Tagging experiments have shown that the longest time–at large of Atlantic sailfish ever recorded was 17 years (Ortiz *et al.* 2003).

External:

- Elongated and very compressed body covered with sparsely imbedded scales with blunt point.
- Upper jaw prolonged into a slender stout spear with round cross-section.
- First dorsal fin large, sail-like, considerably higher than body depth throughout most of its length, highest at mid-fin, second dorsal fin small.
- Pelvic fins very long and narrow, extending 2/3-3/4 length of body, almost reaching anal opening.
- Caudal peduncle with double keels on each side, with a caudal notch on the dorsal and ventral surface.
- Caudal fin of young specimens longer than those of Indo-Pacific sailfish.
- Two separated anal fins, first anal 15-15 rays, and second anal fin with 6-7 rays.
- Dorsal spines: 42-47 rays in first fin, 6-7 rays in second fin.
- Single lateral line visible, curved above pectoral fin, then straight towards tail.

- Anal opening close to anterior origin of first anal fin.
- Vertebrae: 12 precaudal plus 12 caudal.
- No gillrakers, jaws and palatines with small teeth in adults.

Color:

- Dark blue on dorsal side, blue splattered with brown laterally, and silvery white ventrally; several rows of longitudinal stripes on sides, each stripe composed of many light round dots.
- First dorsal fin membrane blue-black, covered with many small round dark spots, bases of first and second anal fins silvery white, remaining fins blackish or dark blue.

Internal:

- Gonads are symmetrical.
- Swimming bladder present, made up of many bubble-shaped, small chambers.

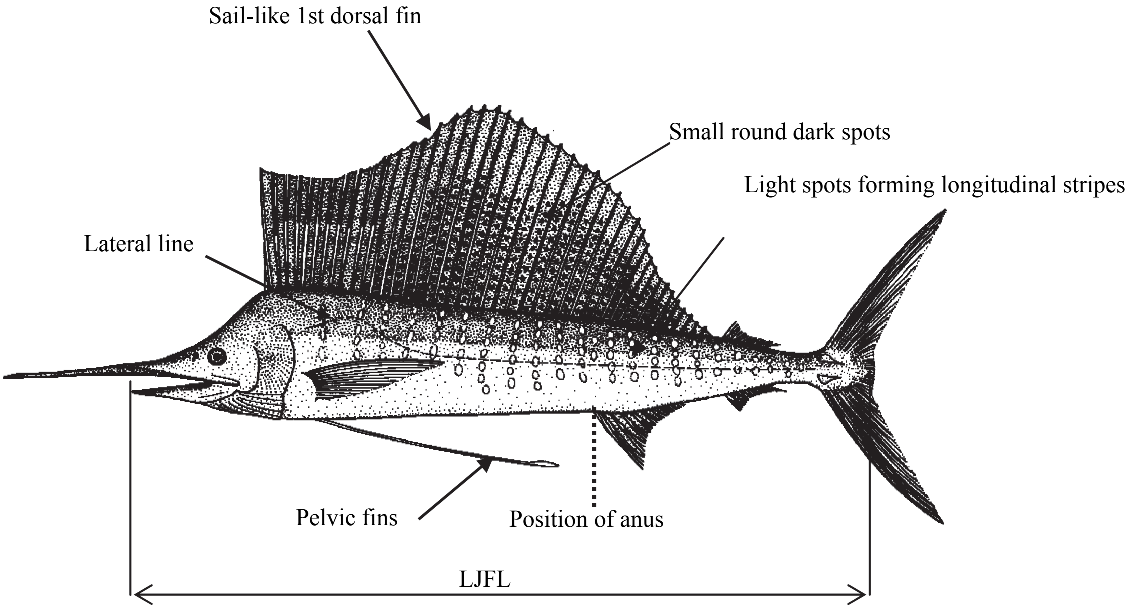

Figure 2. Synthesis of the most outstanding characteristics of *Istiophorus albicans* (image by FAO).

External characteristics of Atlantic sailfish larvae

- Yolk-sac larvae unknown.
- Smallest known larvae are 3.6 mm SL (Gehringer 1956). Body short and deep, snout short, eyes are large. Presence of large spine over eyes, and large preopercular spines. Pigmentation consists of chromatophores of any number and shape in lower jaw, as well on dorsal surface of braincase. Pigmentation increases as larvae grow. The head is big, representing around 40% of standard length. Teeth are large and tusk-like.
- Larvae >10 mm SL, show elongation of snout, sail-like dorsal fin develops, preopercular spines reduce in size and disappear, caudal fin forks, pelvic fins become large. Pigmentation on dorsal fin develops from scattering chromatophores at central portion and extends as larvae grow (Gehringer 1956).
- Juveniles (>25 mm SL), show proportional increase of snout with body, fang-like teeth disappear, eye diameter becomes smaller, head spines become short and disappear with growth, first dorsal fin increases in height, pelvic fins long and narrow, lateral line becomes visible, scales become dermal spines (Gehringer 1956).

3. Biology and population studies

3.a Habitat preferences

Sailfish is an epipelagic and coastal to oceanic species, often found above the thermocline. It is the least oceanic of the Atlantic billfishes, it shows a strong tendency to approach continental coasts, islands and reefs (de Sylva 1974; Nakamura 1985).

In the western central Atlantic, in Florida (USA) waters, offshore waters of the Gulf of Mexico and the Caribbean Sea, sailfish are found in schools during the months of winter. In the summer, Florida (USA) fish display a more northward dispersion along the eastern coast of the United States, moving north along the inside edge of the Gulf Stream.

In the eastern central Atlantic, sailfish displacement north and south along the coast of West Africa seems to be associated to the 28°C water isotherm, where fish move northward during spring and seem to return south during the autumn. The period of increased abundances of sailfish coincides with the period of warmest surface water temperature (28°C) (N'goran *et al.* 2001).

Temperature preferences for sailfish appear to be associated with the seasonal movement of the 28°C water isotherm.

Depth distribution, from telemetry, ultrasonic tag and PSAT data, indicate that sailfish spends most of the time in warm near surface waters (10-20 m) in the northwestern Atlantic and in the Arabian Gulf (Jolley and Irby 1979; Hoolihan 2005). Results from the tagging study in the Atlantic indicated that the species display frequent short duration vertical dives from surface waters to depths of 200-250 m.

Dissolved oxygen requirements for billfishes are poorly known. However, Prince and Goodyear (2006) proposed that the minimal oxygen concentration for billfish is 3.5 ml/l, defining it as the hypoxic threshold for these species. Their contention was partly supported by measurements of oxygen consumption of juvenile sailfish which indicated that this species has the high oxygen consumption and associated metabolic rates typical of tropical tunas (Idrisi *et al.* 2002; Brill 1996).

3.b Growth

Sailfish age determination and growth have been studied by means of different methodologies (i.e. otholiths, spines, size frequency analysis and tagging). Depending on the authors and the methodology used, lengths of Atlantic sailfish at estimated age 1 range from 108.9 to 141.5 cm LJFL (Jolley 1977; Hedgepeth and Jolley 1983). Sailfish grow rapidly in early years, larvae grow exponentially at a daily instantaneous growth rate of 0.137 (Luthy 2004); while adults have an estimate of longevity of 13-15+ years based on the longest time at large of a tagged recaptured fish and by validating the ridge structures in sagittal otoliths (Prince *et al.* 1986; Ortiz *et al.* 2003). Sailfish can reach up to 230 cm LJFL, and exhibits sexually dimorphic growth patterns, females grow larger than males (Nakamura 1985).

Recent studies in Indo-Pacific sailfish using dorsal and anal fin spines for age and growth determination have proven successful. Results validate growth band formation once a year (Chiang *et al.* 2004; Hoolihan 2006). A comprehensive study based on 1166 spine readings from Indo-Pacific sailfish between 78 and 232 cm LJFL yielded sex specific growth functions (Chiang et al. 2004). Results demonstrated that length at age for Indo-Pacific sailfish follows the Richards function with parameter estimates for females: $L_\infty = 343.8$ cm; $K = 0.011$; $t_0 = -0.468$; $m = -1.639$, and for males: $L_\infty = 294.0$ cm; $K = 0.023$; $t_0 = -0.704$; $m = -1.288$.

There is no existing growth model adopted by ICCAT for Atlantic sailfish.

3.c Length-Weight relationship

Until 1992, the sex specific length-weight relationships adopted by ICCAT were the ones developed by Prince and Lee (1989), based on male fish that ranged from 127.8 to 177.8 cm LJFL, and female fish that ranged from 101.1 to 200.7 cm LJFL. Later, in the second Billfish Workshop, Prager *et al.* (1994, 1995) revised existing data on length and weight to produce new equations for the length-weight and weight-length conversions, and created a new set of equations to estimate LJFL from several length measurements. The new length-weight relationships adopted by the ICCAT Billfish Workshop for the sailfish stock are shown in **Table 1**.

Table 1. Different sailfish length-weight relationships currently used by ICCAT.

Equation	Reference	N	Sex	LJFL range (cm)
$RWT = 1.6922 \times 10^{-6} LJFL^{3.1879}$	Prager *et al.* (1995)	907	Male	27.1-188.0
$RWT = 1.1441 \times 10^{-6} LJFL^{3.2683}$		1280	Female	27.1-204.5
$RWT = 1.2869 \times 10^{-6} LJFL^{3.2439}$		2187	Combined sex	27.1-204.5

3.d Maturity

In general, there is a lack of exhaustive studies on sailfish sexual maturity. Jolley (1977) ascribe that sailfish attains sexual maturity between 13 to 18 kg (147-160 cm LJFL), and males attain maturity at about 10 kg (135.7 cm LJFL). Recently, Arocha and Marcano (2006) estimated that 50% of the females are mature at 180.2 cm LJFL based on macroscopic and microscopic assessment of gonad samples caught between 5°N and 25°N.

In the Mexican Pacific coast, Hernandez and Ramírez (1998) estimated that 50% of the females mature at 175 cm EOFL (198.5 cm LJFL) based on histological analysis of gonads.

The available sexual maturity estimates for the Atlantic sailfish stock are shown in **Table 2**.

Table 2. Different sexual maturity estimates available for sailfish stock in the Atlantic.

Maturity	*Reference*
50% of female fish mature at 180.2 cm LJFL	Arocha and Marcano (2006)
First maturity of female fish 147-160 cm LJFL	Jolley (1977)
First maturity of male fish at 135.7 cm LJFL	Jolley (1977)

3.e Sex ratio

In a recent study on the biology of billfish in the western central Atlantic (5°N-25°N), sex ratio at size of sailfish (n=27414) displayed a seasonal pattern between trimesters (Arocha 2006). Within the Caribbean Sea, during the second and third trimesters, the proportion of females is around 10% at sizes between 145 and 165 cm LJFL. For sizes >170 cm LJFL, the proportion of females increases from 20% to 100% in the larger fish. In the first trimester, the proportion of females is between 40 and 50% for sizes between 175 and 200 cm LJFL; while in the fourth trimester, the proportion of females for sizes >175 cm LJFL increases from 40 to 100% in the larger fish. In the Atlantic side, south of the Island of Barbados (13°N-5°N), the proportion of females is between 40% and 60 % for female sizes between 155 and 185 cm LJFL, beyond this size most fish are females. However, the sex ratio issue has not been formally addressed in ICCAT's Billfish Workshops.

3.f Reproduction and first life stages

As the rest of the billfishes, sailfish do not show apparent sexual dimorphism in color pattern or external morphological characters.

Spawning

Sailfish are batch spawners, shedding batches of hydrated oocytes, in separate spawning events (de Sylva and Breder 1997), most likely directly into the sea where fertilization occurs.

Spawning occurs in roughly the same environment they normally inhabit. Sailfish spawning areas in the Atlantic are mainly found in the tropical areas of both hemispheres.

Spawning grounds in the Atlantic are poorly known. In the North Atlantic, spawning females have been found in shallow waters of the Straits of Florida (USA), and larvae have been collected in the same area but over deeper waters (de Sylva and Breder 1997; Post *et al.* 1997; Luthy 2004). In the southeastern Caribbean Sea and in the western central Atlantic between 13°N and 5°N, spawning females with hydrated oocytes in their gonads have been recorded off the Venezuelan coast and off the coasts of Guyana and Suriname (Arocha and Marcano 2006). In the southwest Atlantic, spawning occurs off the southern coast of Brazil between 20° and 27°S (Hazin *et al.* 1994; Amorim *et al.* 1998). In the east Atlantic, sexually active fish have been recorded from the waters of Senegal (Limouzy and Cayre 1981).

Spawning of Atlantic sailfish takes place almost year round. In the North Atlantic, reproduction events take place in different seasons. In the Straits of Florida and adjacent waters, spawning occurs from April to October, but seem to peak in late summer and early fall. In the southeastern Caribbean Sea and in the western central Atlantic between 13°N and 5°N, spawning is recorded from June through December in the Caribbean, and from February to September in the western central Atlantic. In the southwest Atlantic, reproduction events take place from November/December through February. In the eastern central Atlantic, spawning occur during July-August.

Eggs and larvae

Eggs are pelagic, spherical and transparent; whole hydrated oocytes are between 0.9-1.4 mm in diameter (Arocha 2006). Yolk is not homogeneous (de Sylva and Breder 1997).

Yolk-sac larvae unknown, but could be around 2 mm SL. Smallest known larvae of Atlantic sailfish are 2.8 mm SL, and were caught in the Straits of Florida (USA) from May through September (Luthy 2004).

Recruitment

Knowledge of the early life stages in billfishes is very scarce. In Atlantic sailfish, the larval period is short due to fast growth during this period, in which it grows at a daily instantaneous growth rate of 0.14 (Luthy 2004).

From 2.8 to 17.3 mm SL sailfish larvae are caught by ichthyoplankton and neuston nets (Luthy 2004). Post larvae, >100 mm SL, are occasionally collected by nightlight and dip net, and on stomach contents of tunas, and other billfish.

Young (immature) sailfish first appears in the catches when they are around 75 cm LJFL. From this time on, it is easier to know their migratory movements both by observing the fisheries and by tagging experiments.

3.g Migrations

Sailfish display restricted movements in the Atlantic, as revealed by the release-recovery vector of tagged recaptured fish, with no transatlantic, trans-equatorial, nor intercontinental movements (**Figure 3**). However, based on minimum travelled distance in tagged-recaptured fish, it was suggested that sailfish in different areas make either cyclic annual movements, exhibit some degree of fidelity, or some combination of the two (Ortiz et al. 2003). Nevertheless, sailfish migration routes are still uncertain.

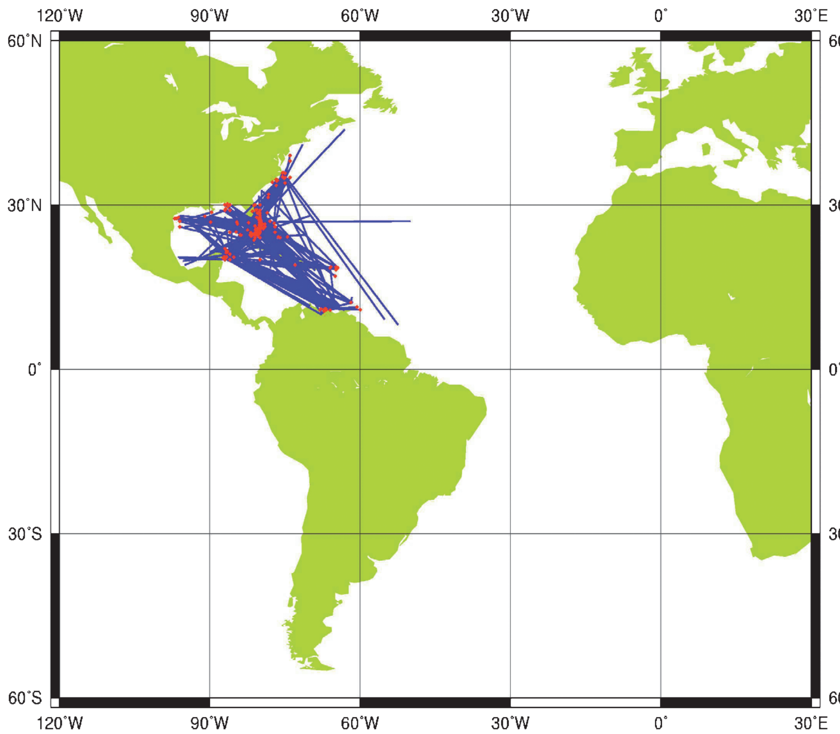

Figure 3. Horizontal displacement of 1702 tagged and recovered sailfish (Ortiz *et al.* 2003).

The western North Atlantic is where most of the tag and release of sailfish has taken place. Significant movements are observed between the Straits of Florida and adjacent waters, and the Gulf of Mexico and the area near Cape Hatteras (35°N). Also, between the Yucatan Channel and Venezuelan waters, a strong movement is apparent. In general, most of the tagged recapture fish has occurred in the same general area as the point of release. The longest movement recorded was from sailfish tagged and released in the U.S. northeast coast, and recaptured off Suriname after 332 days at large and travelled distance of 3861 km (Ortiz *et al.* 2003).

In recent years there has been an increase in tag and release of Atlantic sailfish in throughout the central Atlantic and the southwest Atlantic (Brazil), but have not yielded results to improve the current knowledge about sailfish movement patterns.

3.h Diet

Adult sailfish are apex predators and they opportunistically prey on schooling stocks of halfbeaks, jacks, small tunas, and cephalopods. Larvae sailfish feed on copepods, and shift to fish when they reach 6.0 mm SL. Adult sailfish in the Straits of Florida and adjacent waters feed on little thunny, *Euthynnus aletteratus*, halfbeaks *Hemiramphus sp*, cutlassfish, *Trichurus lepturus*, rudderfish, *Strongylura notatus*, jacks, *Caranx rubber*, and cephalopods like the squid *Ommastrephes bartrami*, and the octopod *Argonauta argo* (Nakamura 1985). Other authors have found that in the southern Caribbean Sea, sailfish diet is composed mainly of the scombrids, *Scomber sp* and *Auxis sp*, followed by *Sardinella aurita*, and *Dactylopterus volitans* (Garcia de los Salmones *et al.* 1989).

In the North and tropical Atlantic, about 75% of the diet was of fish prey and the rest was composed of cephalopods. Among prey fish, species of the families Bramidae followed by the Gempylidae comprised roughly over 70% in importance (Satoh *et al.* 2004).

In the western equatorial Atlantic, the most important prey fish for sailfish was the pomfret, *Brama brama*, the snake mackerel, *Gempylus serpens*, and *Dactylopterus volitans*. Among the cephalopod prey, the squids, *Ornithoteuthis antillarum*, *Omastrephes bartrami*, *Hyaloteuthis pelagica*, and the octopod *Tremoctopus violaceus* were the most important prey items (Junior *et al.* 2004).

3.i Physiology

Billfishes, like tunas, have anatomical and physiological adaptations for continuous swimming, and cranial endothermy (brain and eyes) which facilitate foraging at different depths. Sailfish, like the other billfishes, feature a thermogenic organ situated beneath the brain and close to the eyes that generates and maintains elevated temperatures in the cranial region (Block 1986). This thermogenic organ or 'brain heater' facilitates the deep diving behaviour in marlins and sailfish by permitting ocular and physical functions at low temperatures.

Regarding swimming speed, the available data come from analysis of distances calculated from electronic tagging technology data on adult sailfish (Jolley and Irby 1979; Hoolihan 2005). Average displacements were estimated between 0.29 and 1.00 m/seg (Atlantic sailfish), and between 0.42 and 2.10 m/seg (Indo-Pacific sailfish) from point of release.

3.j Behaviour

Advances in research behaviour of billfishes have been slow due to the difficulty of holding them in captivity and the lack tracking technology for long term monitoring (Holland 2003). However, traditional tags and PSAT information, along with biological information on spawning areas and season, as well as feeding habit information can help in identify reproductive behaviour patterns.

Sailfish, unlike marlins, appear to be schooling fish. However, the behaviour appears to be seasonal. In the Straits of Florida, fish congregate in schools during the winter, but during the summer, when fish move north, sailfish display a scattered distribution along the eastern United States coast. It has also been suggested that sailfish form schools when prey are abundant schooling fish (e.g., clupeids), but as prey disperses, so do sailfish schools (Voss 1972).

In the southeastern Caribbean Sea and adjacent waters (Atlantic side: 13°N-5°N), movement trajectories from tagged recaptured fish show movement between the southeastern Caribbean and the area off Suriname, areas where reproductive events occurs almost year round (Arocha and Marcano 2006). Prey abundance is almost constant in the area due to the seasonal upwelling (northeastern Venezuela) in winter and river run off (Orinoco River) in summer (Freon and Mendoza 2003), which concentrate prey in seasonal fronts throughout the area. The constant prey availability in the area may allow sailfish to restore energy lost to spawning almost year round, as well as build up energy for a protracted spawning season.

3.k Natural mortality

No reliable estimates of natural mortality rates are available. Tagging data are insufficient for that effort. Estimating M from growth parameters is limited because they have not been estimated. Natural mortality based on the estimated longevity would rand range from 0.15 to 0.30. However, based upon body size, behaviour, and physiology, estimates of adult fish would likely be fairly low (Anon. 1994, 1998).

3.l Conversion factors

ICCAT's databases and analyses make use of a number of formulae to convert between different types of measurements. In the case of sailfish, relationships are shown in **Table 3** (see also "Length-Weight relationship" section).

Table 3. Conversion factors for sailfish.

Equation	*Sex*	*N*	*Length range (cm)*	*Reference*
$LJFL = 32.188 + TL \times 0.623$	Female	83	120-260	Prager *et al.* (1995)
$LJFL = 21.961 + TL \times 0.657$	Male	52	110-245	
$LJFL = 18.171 + TL \times 0.686$	Combined sex	142	40-270	
$LJFL = 120.170 + PAL \times 0.798$	Female	652	30-90	
$LJFL = 111.175 + PAL \times 0.907$	Male	455	35-80	
$LJFL = 107.196 + PAL \times 0.999$	Combined sex	1553	30-100	
$LJFL = 36.766 + PFL \times 1.025$	Female	728	75-175	
$LJFL = 34.211 + PFL \times 1.043$	Male	484	90-150	
$LJFL = 29.441 + PFL \times 1.083$	Combined sex	1810	75-180	
$LJFL = 44.570 + PDL \times 1.268$	Female	113	55-120	
$LJFL = 19.074 + PDL \times 1.526$	Male	42	75-110	
$LJFL = 38.322 + PDL \times 1.332$	Combined sex	330	55-120	
$LJFL = 18.235 + EOFL \times 1.015$	Female	58	85-175	
$LJFL = 21.707 + EOFL \times 0.987$	Male	27	105-155	
$LJFL = 11.240 + EOFL \times 1.076$	Combined sex	251	85-175	
$LJFL = 39.104 + DFL \times 0.951$	Female	59	75-165	
$LJFL = 1.555 + DFL \times 1.221$	Male	21	110-145	
$LJFL = 38.438 + DFL \times 0.958$	Combined sex	252	75-165	
$DWT = 1.20 \times RWT$	Combined sex	-	-	ICCAT Manual 1990

(TL: Total length; PAL: Pectoral-anus length; PFL: Pectoral-fork length; PDL: Pectoral-second dorsal length; EOFL: Eye orbit-fork length; DFL: Dorsal-fork length; DWT: Dressed weight).

4. Distribution and exploitation

4.a Geographical distribution

Sailfish has a circumtropical distribution. In the Atlantic Ocean, is widely distributed in subtropical and tropical waters of the Atlantic Ocean, and occasionally in Atlantic temperate waters and in the Mediterranean Sea. Geographical limits based on commercial catches are from 40ºN to 40ºS in the west Atlantic, and from 50ºN to about 40ºS, but they are less abundant in waters of the central North Atlantic (25° to 40 ºN) and the south central Atlantic (25° to 40ºS) (**Figure 4**).

Adults (>150 cm LJFL) appear in subtropical and tropical waters while juvenile sailfish (<100 cm LJFL) are found in tropical waters. The larger size classes (>200 cm LJFL) are more common in the east central Atlantic.

Distribution in the Atlantic Ocean: in the western Atlantic, concentrations are present in the United States southeast coast, in the Gulf of Mexico, the north and eastern Caribbean Sea, the western equatorial area, and along the Brazilian coast through to the area off Rio de Janeiro and Santos. In the eastern Atlantic, important concentrations are off the coast of Senegal, and to the Gulf of Guinea (Ghana and Côte d'Ivoire).

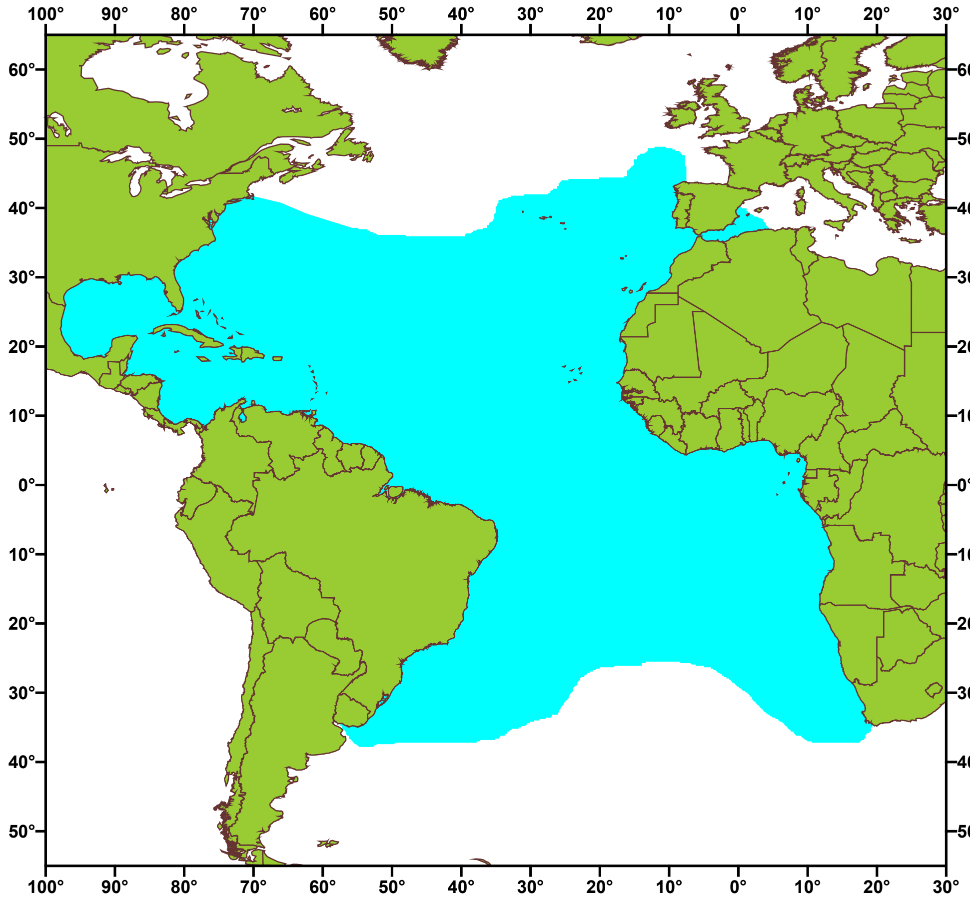

Figure 4. Geographical distribution of sailfish from reported catches between 1970 and 2004 (source ICCAT).

4.b Populations/Stock structure

In the Atlantic Ocean, sailfish has historically been managed as a separate eastern and western stock, with an arbitrary boundary at 30°W. The stock boundary was based on the distribution of catch, tag release and recapture information and morphological data (Anon. 2002).

There has been substantial effort in tagging Atlantic sailfish (over 100.000 tagged fish by 2001), but most of the effort was executed in the western Atlantic. Still no trans-Atlantic movements have been recorded. In addition, morphological data suggest that East Atlantic sailfish are different from those in the west, by reaching larger sizes and presenting a different colour pattern in the dorsal fin. However, these differences may not represent different genetic stocks.

Recently, McDowell and Graves (2002) examined the possibility of stock structuring in the Atlantic using mitochondrial and nuclear markers. Results revealed no evidence of stock structuring of sailfish within the Atlantic. Based on the available information, ICCAT continues to recognize an east and west stock for Atlantic sailfish (Anon. 2002).

4.c Description of fisheries: Catches and effort

Sailfish is a primary target of recreational and sport fisheries around the world, and because of its coastal habitat preference, it is one of the most common billfish caught by this fishery. There is an artisanal fishery targeting billfishes that catch and land sailfish. Sailfish is the most common billfish caught and marketed in the Caribbean islands, in Barbados for example it accounts for 73% of the billfish catch (Mohammed *et al.* 2003). These fisheries are congregated in the tropical areas of the Atlantic, in the Caribbean Islands and off the coast of Venezuela and Brazil in the western Atlantic, and off the African coast from Senegal to the Gulf of Guinea. These artisanal fisheries use surface drift gillnets primarily in the African coast and surface longlines in the Caribbean region. As with most billfish species, sailfish are also caught as by-catch in the pelagic longline and purse-seine tuna fisheries in the Atlantic Ocean (**Figures 5 and 6**).

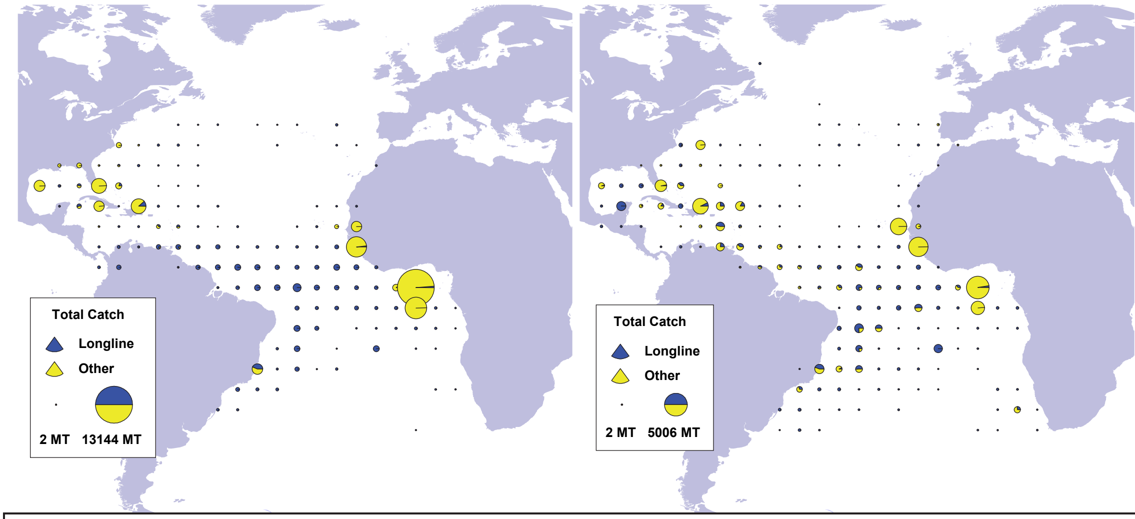

Figure 5. Distribution of sailfish in the Atlantic Ocean for 1980-1989 (left) and 1990-1999 (right) disaggregated by mail fishing gears, longline and others.

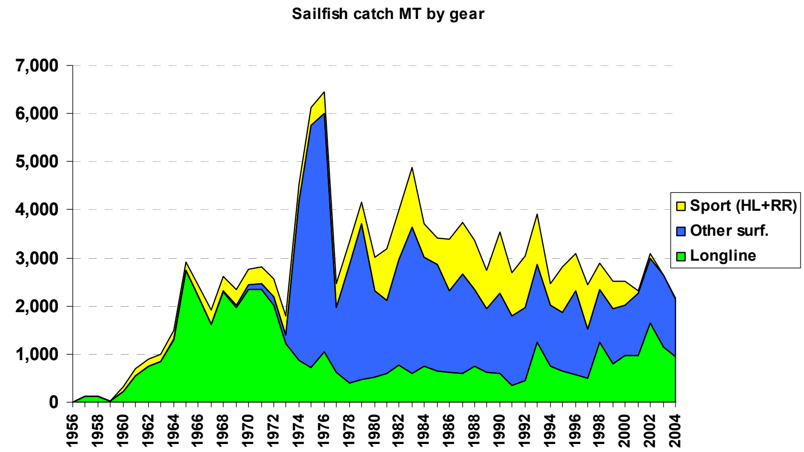

Figure 6. Catch trend of Atlantic sailfish east and west stocks by major gear groups.

East Atlantic

Sailfish catch in the east Atlantic increased with the introduction of the pelagic longline fleets in the late 1950s. Catches average about 1,500 t in the 1960s, and reached the highest peak in 1975/6 with catches over 5,000 t, then catches declined in following years, oscillating between 2,000 and 3,000 t. By the 1990s, catches were below 2,000 t and in the latest years they have been just above 1,000 t. Catches have declined particularly for the recreational fisheries in part due to management regulations and the introduction of catch-&-release practices.

West Atlantic

In the West Atlantic, catches of sailfish also increased with the expansion of the longline fleets in the 1960s. It reached a peak catch of 1,800 t in 1970, since then catches declined and remained constant at about 1,000 t until the mid-1990s. An increase of sailfish catches occurred after 1990, with the highest values reached in 1997 and 2,002 (1900 t), surpassing the catches of east Atlantic sailfish until 2002. By 2003 reported catches declined to about 1,000 t in the West Atlantic (**Figure 7**).

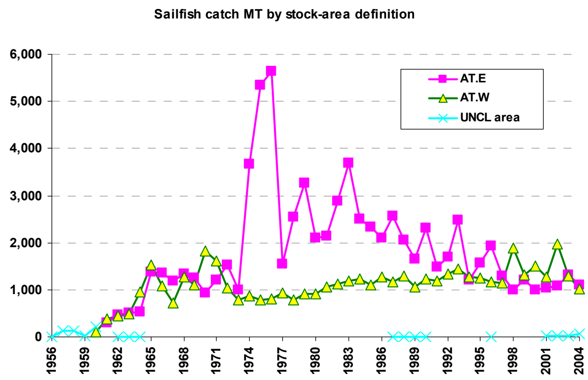

Figure 7. Catch trend of east Atlantic sailfish and West Atlantic sailfish stocks.

4.d Catch-at-size

There are no estimates of catch at age for Atlantic sailfish stocks. However a relative large size sample has been collected from the main fisheries (**Figure 8**). Size frequency distributions show that longline catches smaller sailfish compared to gillnet and recreational fisheries with a median size of 160 cm LJFL and 80% percentile between 145 cm and 180 cm LJFL. Gillnet caught sailfish, show a median size of 175 cm LJFL and 80% percentile between 160 cm and 195 cm LJFL, while recreational gears show a median size of 180 cm LJFL and 80% percentile between 165 cm and 195 cm LJFL.

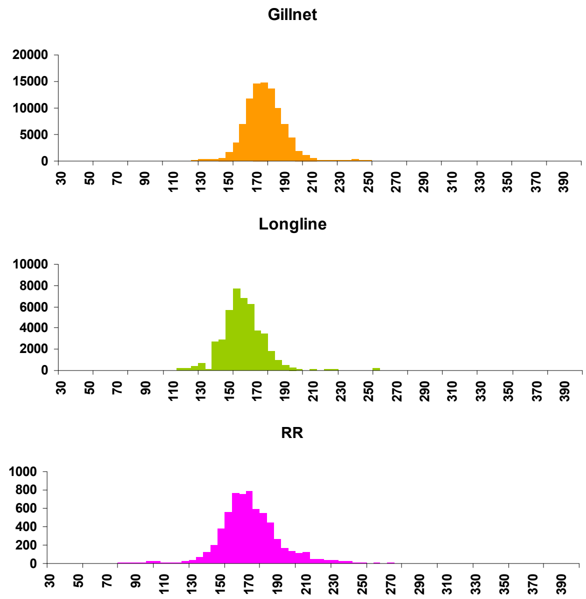

Figure 8. Size (LJFL cm) frequency of sailfish by major gears.

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