

UPDATE OF INPUT DATA (CATCH AND SIZE) FOR THE ATLANTIC SAILFISH (*ISTIOPHORUS ALBICANS*) STOCK ASSESSMENT MODELS 2023

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SUMMARY

The Billfish Species Group (BILSG) scheduled to carry out an evaluation of the East and West Atlantic sailfish stocks in 2023. In preparation, the BILSG established a modelers team to advance preliminary analyses for the assessment meeting. The BILSG requested the Secretariat to provide input data of catch and size until 2021 for Stock Synthesis and Surplus Production models based on the preliminary fleet structure used in 2016. This document summarizes the revision and update of the available detailed catch and size data per fleet up to 2021.

RÉSUMÉ

Le Groupe d'espèces sur les istiophoridés (BILSG) a prévu de réaliser une évaluation des stocks de voiliers de l'Atlantique Est et Ouest en 2023. En vue de sa préparation, la réunion du Groupe d'espèces sur les istiophoridés (BILSG) a mis en place une équipe de modélisateurs chargée d'effectuer des analyses préliminaires en vue de la réunion d'évaluation des stocks. Le BILSG a demandé au Secrétariat de l'ICCAT de fournir des données d'entrée de capture et de taille jusqu'en 2021 pour les modèles Stock Synthesis et les modèles de production excédentaire, sur la base de la structure préliminaire de la flottille utilisée en 2016. Le présent document résume la révision et la mise à jour des données détaillées de capture et de taille disponibles par flottille jusqu'en 2021.

RESUMEN

El Grupo de especies de istiofóridos (BILSG) programó realizar una evaluación de los stocks de pez vela del Atlántico este y oeste en 2023. Durante su preparación, la reunión del Grupo de especies de istiofóridos (BILSG) estableció un equipo de modeladores para avanzar en los análisis preliminares para la reunión de evaluación de stock. El BILSG solicitó a la Secretaría de ICCAT que facilitara datos de entrada de captura y talla hasta 2021 para el modelo Stock Synthesis y el modelo de producción excedente sobre la base de la estructura preliminar de la flota utilizada en 2016. Este documento resume la revisión y la actualización de los datos detallados disponibles de captura y talla por flota hasta 2021.

KEYWORDS

CATDIS, fleet structure, East West Atlantic sailfish, size, Stock Synthesis

Introduction

One of the main 2023 objectives of the Billfish Species Group (BILSG) is to carry out an assessment evaluation of the East and West Atlantic sailfish (SAI) stocks (Anon., 2021a). These stocks were last evaluated in 2016 with catch and indices of abundance data until 2014. (Anon., 2016). The BILSG assessment's workplan included using Surplus Production and Catch integrated (Stock Synthesis) statistical models, for which a fleet structure similar to the one used in 2016 has been initially proposed.

This document provides updates of catch and size data of East and West Atlantic sailfish by year and fleet as the input data in Stock Synthesis, as requested by the SCRS (Anon., 2022).

Data and Methods

This document used the fleet structure shown in **Table 1** based on a preliminary version used in the 2016 West Atlantic SAI fleet structure (Anon., 2016). The fleets include the main gear types used for catching sailfish in both stocks and include longlines, rod and reel, gillnets, purse seine, and other surface gears (trolling, and hand lines). Purse seine catches are mainly restricted to the East stock. Furthermore the longline fleet was separated into two fleets, i) surface longline fleets, and b) deep longline fleets (Japan after 1970, Chinese Taipei after 1975, and Korea after 1980). The split between surface and deep longline tries to reflect the period of transition from surface target operations (yellowfin tuna (YFT), albacore (ALB)) to deep longline operations targeting bigeye tuna (BET) primarily on these high seas fleets.

Task 1 nominal catch (T1NC), estimated catches by year/trimester and a 5x5 square grid (CATDIS), and Task 2 size frequencies (T2SZ) data were used to prepare catch and size data (1956-2021) by year and fleet structure (**Tables 2 and 3**). Total catches were revised by May 5, 2023, following the suggested deadline for the input data by the BILSG, and the updated catch includes the gillnet catches from Venezuela artisanal fisheries for the 2015-2021 years.

T2SZ data between 1970 and 2021 was extracted in April 2023 from the ICCAT database including updates of size data from the Venezuela fisheries (gillnets and longline) 2015 – 2021 provided by national scientists. After data quality control filtering by the following two steps, the length composition was provided with a 5 cm bin by year and fleet. The detailed quality control filtering steps on the size data are as follows.

Size data quality control filtering Step 1:

- Exclude catch-at-size (CAS) data
- Exclude weight data: unit=Kg, or FreqTypeCode=WGT or HGTW
- Exclude Age data (AGE)
- Check Frequency Distribution Size Sample: Year-FleetID

Size data quality control filtering Step 2:

- Fish with standardized size (LJSFL) with less than 30 cm or larger than 350 cm were considered outliers.
- Set minimum of 40 fish measurements in each Frequency Distribution Size Sample (Year- FleetID)
- Outliers for Kurtosis and Skewness about 97.5% percentiles for each size frequency distribution sample
- Revise individual records for size corrections or errors.

During the revision it was noted that size data from Brazil longline fleets included samples collected from the East stock, although no Brazilian catch has been reported from the East Atlantic SAI stock, following the recommendations from national scientists, these size samples were excluded.

Results and Discussions

Atlantic sailfish have been exploited by surface fisheries (mainly gillnet, rod and reel) and as bycatch of the high seas' longline fleets (**Figure 1**). For the East Atlantic sailfish (E-SAI) stock the reported landings increased rapidly and reached the historical record in 1964 above 5,000 t. After this peak in the mid-1960s, catch gradually decreased in the 1980s to about 2,000 t and 1,000 t in the 1990s. In the early 2000s catches increased again to about 2,500 t but since 2009 catches decreased again to just above 1,000 t in 2018. For the E-SAI catches from artisanal fisheries (gillnets and rod & reel) account for about 50% of the total catch. For the West Atlantic sailfish (W-SAI) stock, catches steadily increased from the 1960s to the early 2000s reaching about 2,000 t. From 2002 catches declined to about 1000's t in 2014, in the latest years, catches increased to about 1,500 t. In comparison with the E-SAI stock, in the W-SAI stock most of the catch is taken by the surface longline gears.

After screening anomalies and/or errors, 106,115 (E-SAI) and 192,958 (W-SAI) individual length measurements were available between 1971 and 2021 (**Figure 2**). **Figure 3** provides an overview of the sailfish size data (T2SZ) distributions by year, flag, main gear, size measure type, and size interval reported by CPCs. All size measures were standardized to the low jaw straight fork length (LJSFL) unit in cm using current SCRS size conversion factors (REF ICCAT manual). **Figure 4** summarizes the available size data by month, stock, sample area, and geographic strata reported by CPCs. A consistent number of size data has been available since the 1900s (**Figure 3**), and data have been submitted mainly by Venezuela, Côte d'Ivoire, Brazil, Mexico, Senegal, and Chinese Taipei. **Figure 5** shows a map with the geographic distribution of the sailfish size samples available by stock. For the W-SAI stock, most samples come from the Gulf of Mexico and the eastern Caribbean and the northern South America coast, for the E-SAI stock, most samples are from the Gulf of Guinea and the eastern Atlantic tropical area. Size data were provided mostly in straight fork length (LJSFL) in 1 or 5 cm size intervals, and the main gear types were gillnet and longline. After removing some data in the first step, several statistics (standard deviation, kurtosis, skewness, number of samples) were revised in the second step of data quality control (**Figure 6**).

Overall size frequency distribution showed a unimodal distribution with a mean at about 176 and 164 cm LJSFL for the East and West sailfish stocks, respectively (**Figure 8**). Noticeably, the mean size of the E-SAI has been consistently larger than the W-SAI, there is however, a wider range of size for both stocks, with 95 percentiles ranging from 136 to 206 cm LJSFL (E-SAI) and 139 to 187 cm LJSFL (W-SAI), respectively.

Size distributions by main gear type show availability over most of the years since the 1970s for longline and since the 1980s for gillnet fleets (E-SAI), or rod & reel (W-SAI) (**Figure 8**). Mean sizes from most of the fishing gears are similar, but in general larger for E-SAI fleets compared to the W-SAI fleets (**Figure 8**). Comparisons of size distributions within fleets are available in **Figures 9 – 10**.

As indicated before, the longline fleets were further split into longline fleets targeting deeper species (i.e. bigeye tuna) and more surface-oriented longline targets for species like YFT, swordfish (SWO), and ALB. **Figure 11** shows a comparison of the size distribution of deep vs surface longline fleets by stock, in general, no size difference is apparent for sailfish stocks.

References

Anon. 2016. Report of the 2016 Sailfish Stock Assessment (Miami, USA - 30 May to 3 June 2016). Collect Vol. Sci. Pap. ICCAT 73(5): 1579-1684.

Table 1. Fleet structure for east and west Atlantic sailfish proposal for use with assessment models based on structure used in 2016.

East		Catch		Sz samples		Gear	Flags
Fleet ID	Fleet Name	Yr start	Yr last	Yr start	Yr last		
1	E-GILL	1973	2021	1984	2019	Gillnet	Benin, Côte d'Ivoire, Gabon, Ghana, Liberia, Senegal, Togo
2	E-R&R	1967	2021	1981	2017	R&R	Côte d'Ivoire, EU-Portugal, Gabon, Guinea Ecuatorial, Senegal
3	E-PS	1963	2021	2020	2020	Purse seine	Cape Verde, Curaçao, El Salvador, EU-España, EU-France, Mixed flags (FR+ES), Panama, Senegal
4	E-SUR	1976	2020	2008	2019	Surface gears	Korea Rep, Namibia, S Tomé e Príncipe, Senegal
5	E-OTH	1981	2021			Others	Benin, Côte d'Ivoire, EU-Portugal, Gabon, Great Britain, S Tomé e Príncipe, Senegal
6	E-LLDeep	1970	2021	1974	2021	longline	Japan, Korea Rep
7	E-LLSurf	1957	2021	1993	2021	longline	Belize, Brazil, Cape Verde, China PR, Chinese Taipei, Côte d'Ivoire, Cuba, EU-España, EU-Portugal, Honduras, Japan, Korea Rep, Maroc, Namibia, NEI (BIL), NEI (ETRO), Panama, Russian Federation, S Tomé e Príncipe, Senegal, Sierra Leone, South Africa, St Vincent and Grenadines, USSR
West							
11	W-GILL	1991	2021	1991	2022	Gillnet	Brazil, Venezuela
12	W-R&R	1960	2021	1971	2021	R&R	Barbados, Brazil, Dominica, EU-France, Trinidad and Tobago, USA, Venezuela
13	W-PS	2001	2011			Purse seine	Brazil, USA
14	W-SUR	2001	2021			Surface gears	Dominica, Grenada, Saint Kitts and Nevis, St Vincent and Grenadines, Sta Lucia
15	W-OTH	1970	2020			Others	Aruba, Brazil, Curaçao, Dominica, Dominican Republic, St Vincent and Grenadines, Sta Lucia, Trinidad and Tobago, USA
16	W-LLDeep	1970	2021	1971	2021	longline	Japan, Korea Rep
17	W-LLSurf	1956	2021	1971	2021	longline	Barbados, Belize, Brazil, China PR, Chinese Taipei, Costa Rica, Côte d'Ivoire, Cuba, Dominica, Dominican Republic, EU-España, EU-France, EU-Portugal, Grenada, Japan, Korea Rep, Mexico, NEI (BIL), NEI (ETRO), Panama, Seychelles, St Vincent and Grenadines, Trinidad and Tobago, UK-British Virgin Islands, USA, Venezuela

Table 2. Catch (t) by fleet ID for the East Atlantic sailfish stock 1957-2021.

YearC	1 E-GILL	2 E-R&R	3 E-PS	4 E-SUR	5 E-OTH	6 E-LLDeep	7 E-LLSurf	Grand Total
1957							71.13	71.13
1958							32.39	32.39
1959							4.21	4.21
1960							49.83	49.83
1961							173.12	173.12
1962							217.67	217.67
1963			2.00				228.46	230.46
1964			4.00				260.23	264.23
1965			4.00				793.36	797.36
1966			11.00				528.73	539.73
1967		76.00	18.00				753.53	847.53
1968		76.00	36.00				808.43	920.43
1969		81.00	46.00				834.58	961.58
1970		87.00	67.00			42.12	431.52	627.65
1971		112.00	93.00			53.93	657.54	916.47
1972		122.00	143.00			40.34	564.90	870.24
1973	2.00	144.00	148.00			19.71	356.32	670.02
1974	3,040.00	107.00	235.00			4.69	186.55	3,573.24
1975	4,726.00	122.00	256.00			21.77	152.65	5,278.42
1976	4,517.00	189.00	327.00	14.00		30.26	321.05	5,398.31
1977	764.00	160.00	400.00			13.07	119.65	1,456.72
1978	1,885.00	143.00	405.00			5.24	91.26	2,529.50
1979	2,691.00	107.00	375.00			12.96	43.79	3,229.75
1980	1,191.00	325.00	432.00			41.68	79.00	2,068.68
1981	926.00	497.00	504.00		2.00	36.60	116.00	2,081.60
1982	1,475.00	568.00	521.00		3.00	57.79	171.00	2,795.79
1983	2,462.50	506.00	499.00			31.49	207.00	3,705.99
1984	1,750.00	161.00	354.00		3.00	58.17	119.00	2,445.17
1985	1,576.00	240.00	364.00			63.37	26.00	2,269.37
1986	990.20	571.00	403.00	1.00		33.38	66.00	2,064.58
1987	1,467.00	584.00	394.00	9.00		25.26	73.69	2,552.96
1988	948.00	537.00	408.00	123.00		38.52	54.39	2,108.91
1989	536.36	445.00	432.00	184.70		41.20	70.85	1,710.11
1990	503.98	957.21	595.00	149.70		48.07	61.20	2,315.16
1991	530.82	428.57	174.00	111.56		32.16	197.33	1,474.43
1992	401.24	692.46	150.00	218.34	13.69	97.32	202.97	1,776.01
1993	757.84	448.23	182.00	92.05	2.21	185.35	146.68	1,814.35
1994	529.45	66.68	160.00	177.86	3.51	88.05	145.87	1,171.42
1995	584.92	135.02	128.00	121.16	1.62	115.17	145.39	1,231.27
1996	722.35	181.79	97.00	147.95	2.24	82.70	646.35	1,880.38
1997	323.80	487.53	115.00	198.18	6.76	79.00	137.02	1,347.29
1998	552.85	227.51	141.00	165.05	0.54	101.60	173.87	1,362.41
1999	548.55	186.34	135.00	185.04	14.33	82.33	190.11	1,341.70
2000	509.38	551.15	357.49	349.55	14.70	70.75	127.12	1,980.14
2001	772.78	767.34	399.58	291.86	5.36	55.52	512.67	2,805.10
2002	866.07	98.09	365.35	259.40	5.50	81.44	673.89	2,349.74
2003	930.85	281.55	413.16	473.03	43.15	71.10	425.68	2,638.53
2004	840.87	219.43	336.38	858.54	21.11	85.01	250.24	2,611.58
2005	828.74	143.49	263.62	641.32	23.84	75.12	243.45	2,219.58
2006	540.42	46.10	274.22	469.78	4.90	98.63	481.50	1,915.55
2007	690.04	188.51	204.64	896.40	7.17	253.04	336.93	2,576.72
2008	969.69	108.00	250.96	272.00		319.45	309.04	2,229.13
2009	467.36	575.00	307.89	137.00	19.45	174.86	447.56	2,129.11
2010	485.72	438.55	265.02	121.00	27.98	136.31	377.97	1,852.56
2011	444.98	135.94	275.00	124.00	25.77	204.96	342.03	1,552.69
2012	477.41	57.72	275.00	231.00	1.70	217.39	330.98	1,591.20
2013	321.38	128.31	275.00	156.37	0.78	118.06	338.84	1,338.73
2014	316.66	10.14	275.00	134.00	4.14	85.65	337.64	1,163.23
2015	158.35	55.91	275.00	312.00	3.35	65.86	375.52	1,245.99
2016	649.62		7.49	424.83	0.36	82.38	274.41	1,439.08
2017	812.49	94.00	20.71	339.23	5.05	88.96	270.48	1,630.92
2018	176.73	0.04	11.01	246.23	1.79	79.09	430.90	945.81
2019	742.03	2.03	33.80	264.34	6.58	91.74	878.60	2,019.12
2020	751.74	49.74	9.33	1.09	25.67	104.92	254.64	1,197.13
2021	746.54	537.14	2.91		0.60	57.48	197.64	1,542.32

Table 2. Catch (t) by fleet ID for the West Atlantic sailfish stock 1956-2021.

YearC	11 W-GILL	12 W-R&R	13 W-PS	14 W-SUR	15 W-OTH	16 W-LLDeep	17 W-LLSurf	Grand Total
1956							0.66	0.66
1957							24.02	24.02
1958							66.20	66.20
1959							5.28	5.28
1960		111.00					65.43	176.43
1961		133.00					217.24	350.24
1962		147.00					216.64	363.64
1963		159.00					195.35	354.35
1964		177.00					356.39	533.39
1965		191.00					787.93	978.93
1966		205.00					444.49	649.49
1967		211.00					482.28	693.28
1968		218.00					653.37	871.37
1969		236.00					516.31	752.31
1970		232.00			28.00	205.04	793.30	1,258.34
1971		239.00			28.00	234.08	742.05	1,243.13
1972		243.00			28.00	93.20	440.26	804.46
1973		245.00			28.00	59.98	315.54	648.52
1974		255.00			38.00	77.59	382.04	752.62
1975		258.00			38.00	99.54	336.86	732.40
1976		266.00			110.00	131.56	344.06	851.62
1977		339.00			167.00	15.57	378.25	899.82
1978		338.00			141.00	7.06	292.75	778.81
1979		350.00			135.00	9.42	372.66	867.07
1980		368.00			148.00	43.26	282.00	841.26
1981		561.10			51.00	78.37	278.00	968.47
1982		474.50			146.40	99.50	322.00	1,042.40
1983		734.74			104.00	42.57	304.62	1,185.93
1984		536.00			107.00	60.84	446.69	1,150.53
1985		312.60			110.00	60.29	521.09	1,003.99
1986	24.00	496.32			60.00	37.06	634.20	1,251.58
1987		490.70			83.10	12.66	606.53	1,192.99
1988		471.30			94.00	98.29	478.99	1,142.58
1989		352.05			70.69	108.92	520.19	1,051.85
1990		266.80			251.12	69.51	647.41	1,234.84
1991	41.00	371.23			52.35	63.61	698.04	1,226.22
1992	25.00	333.29			150.00	18.64	936.10	1,463.03
1993	60.00	232.70			100.00	115.65	905.65	1,413.99
1994	65.00	216.90			160.00	128.98	550.02	1,120.90
1995	41.00	347.60			215.00	25.31	584.86	1,213.77
1996	98.00	230.00			292.00	34.29	488.25	1,142.53
1997	113.97	350.10			95.00	23.50	674.27	1,256.83
1998	182.00	267.10			105.16	67.61	993.09	1,614.97
1999	140.00	163.00			104.00	26.53	1,146.79	1,580.32
2000	71.00	76.20			92.00	23.02	1,733.47	1,995.69
2001	63.60	60.48	0.11	2.00		36.12	1,634.85	1,797.17
2002	88.40	105.98			222.63	34.75	1,608.63	2,060.39
2003	93.20	0.28		0.33	238.00	22.54	1,143.67	1,498.01
2004	121.59	0.24		1.46	325.78	13.70	1,264.17	1,726.93
2005	130.84	0.09			0.47	42.90	1,664.81	1,839.10
2006	135.00	1.77		1.20	58.21	9.40	1,733.07	1,938.64
2007	185.88	5.53		2.54	59.93	15.21	1,292.64	1,561.74
2008	113.00	7.00		3.90	192.94	42.66	1,373.79	1,733.30
2009	96.40	4.03		0.80	360.52	53.98	1,109.94	1,625.68
2010	88.72	1.66		1.88	1.27	41.29	1,094.63	1,229.45
2011	92.33	9.71	1.15	1.68	6.37	60.65	1,164.35	1,336.23
2012	139.37	19.23		2.94	11.65	45.70	1,057.80	1,276.69
2013	78.86	6.91		1.87	5.55	14.46	878.61	986.27
2014	98.06	11.82		2.69	5.55	14.50	731.21	863.83
2015	61.09	5.32		1.31		17.74	906.43	991.89
2016	48.71	14.88		2.50	5.55	18.18	1,300.61	1,390.44
2017	130.12	12.53		6.22	5.55	12.40	1,242.59	1,409.40
2018	127.53	5.96		4.18	5.55	8.51	1,500.75	1,652.48
2019	90.03	4.82		0.64	5.55	22.19	1,331.16	1,454.39
2020	27.47	2.04		2.80	7.89	12.46	1,675.39	1,728.05
2021	98.90	8.28		0.76		15.22	776.82	899.99

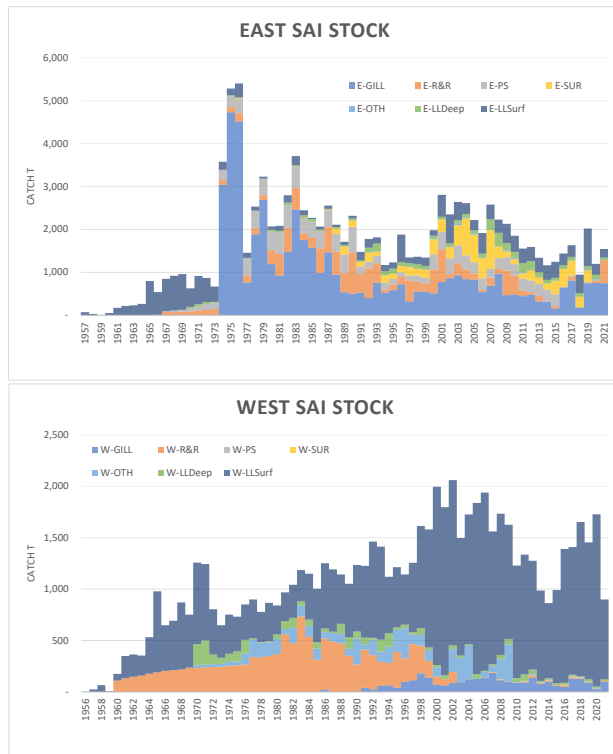


Figure 1. Yearly catch (t) of East and West Atlantic sailfish by fleet.

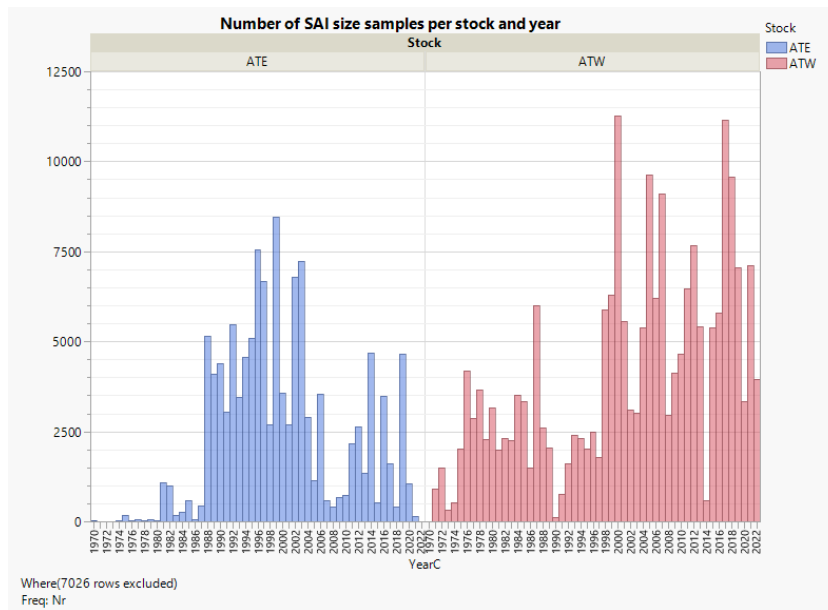


Figure 2. Number of size samples available for the Atlantic sailfish stocks by year.

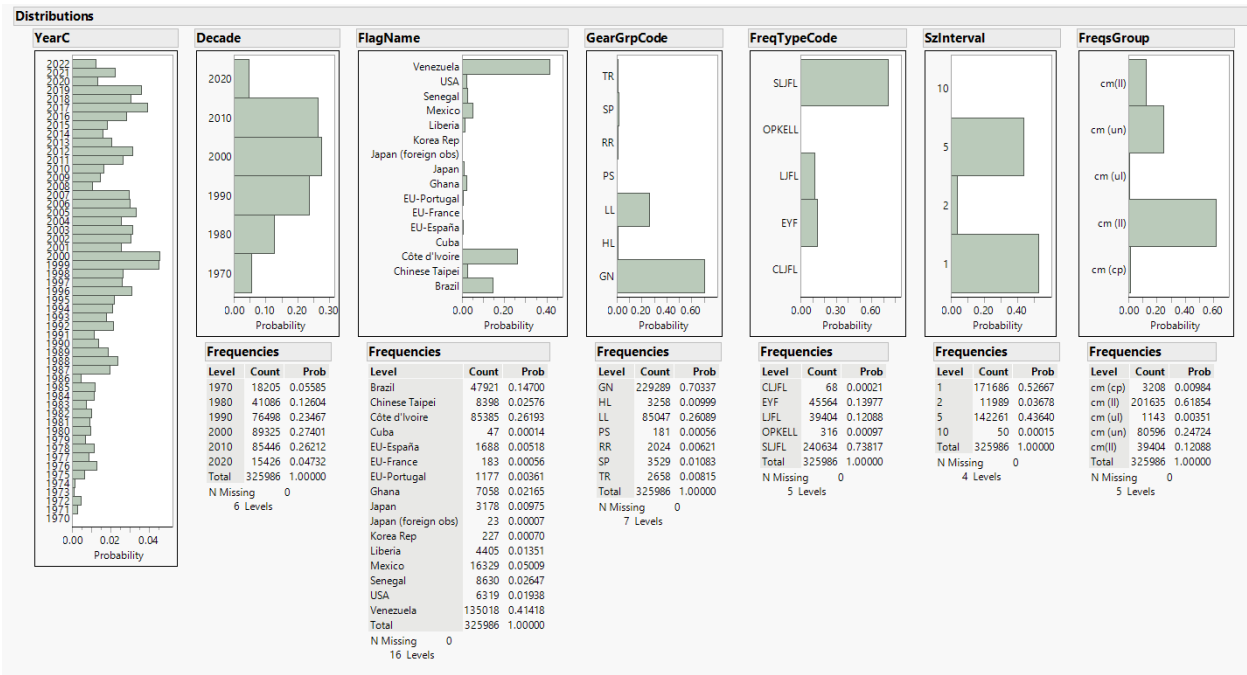


Figure 3. Sailfish task 2sz data available by year, flag, and gear, and distributions of size interval, measure type and frequency group reported.

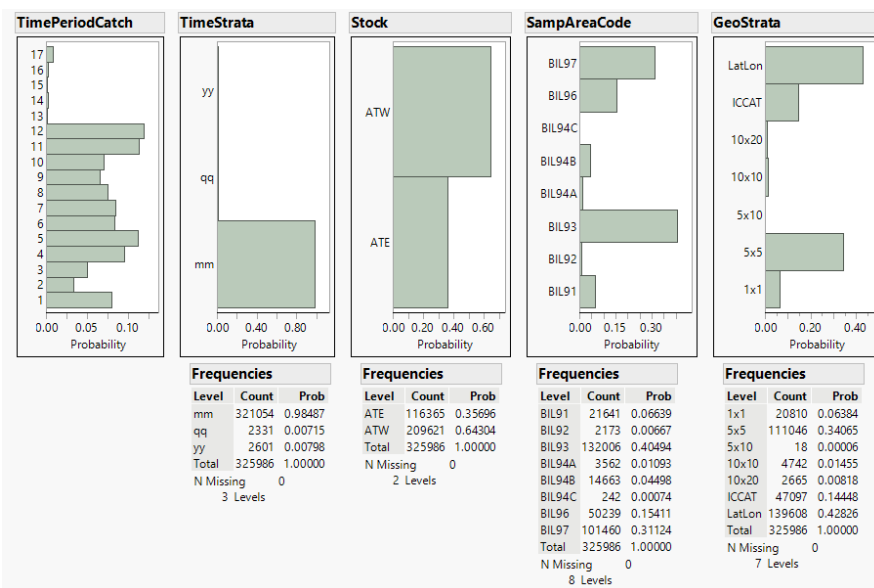


Figure 4. Sailfish size data distributions by stock, time period, sampling area and area strata (Geostrata) reported.

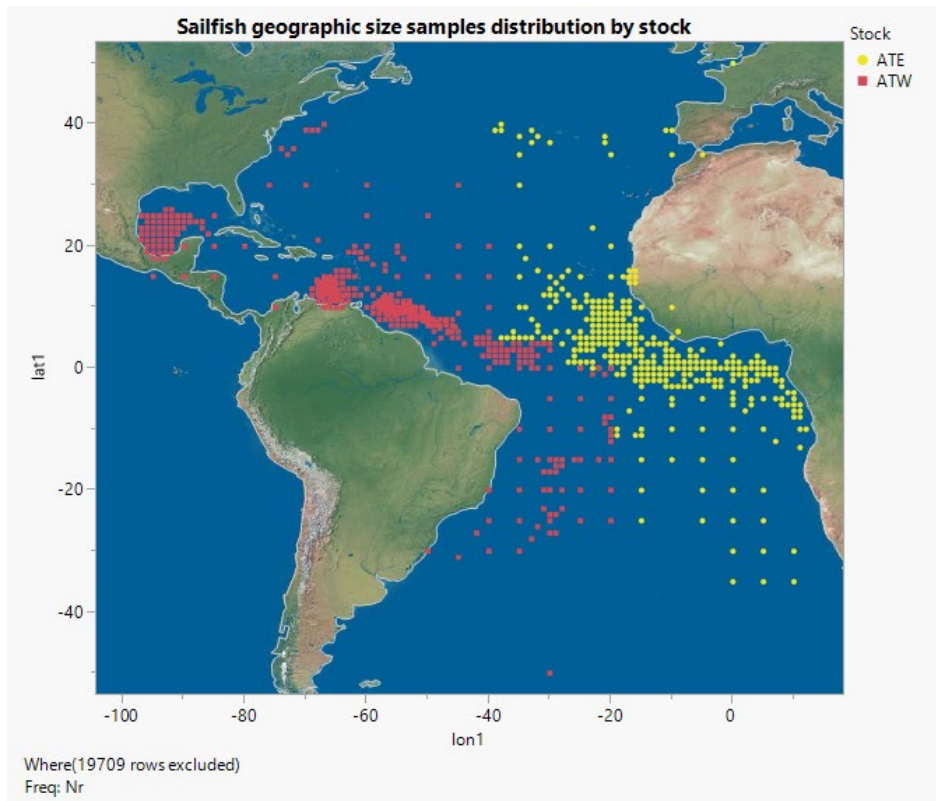


Figure 5. Sailfish geographic size data distributions by stock.

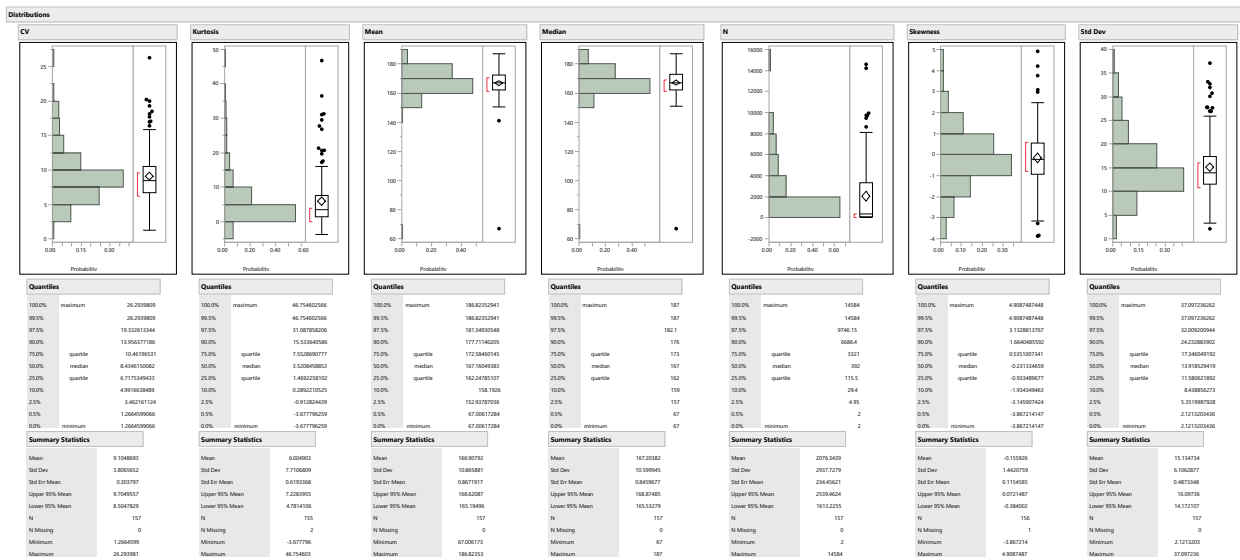


Figure 6. Summary statistics for the size frequency distribution of sailfish by fleet ID, stock and year. A minimum number of samples (30) per distribution and the kurtosis, skewness, and CV 2,5% and 97,5% quantiles were used to define outliers.

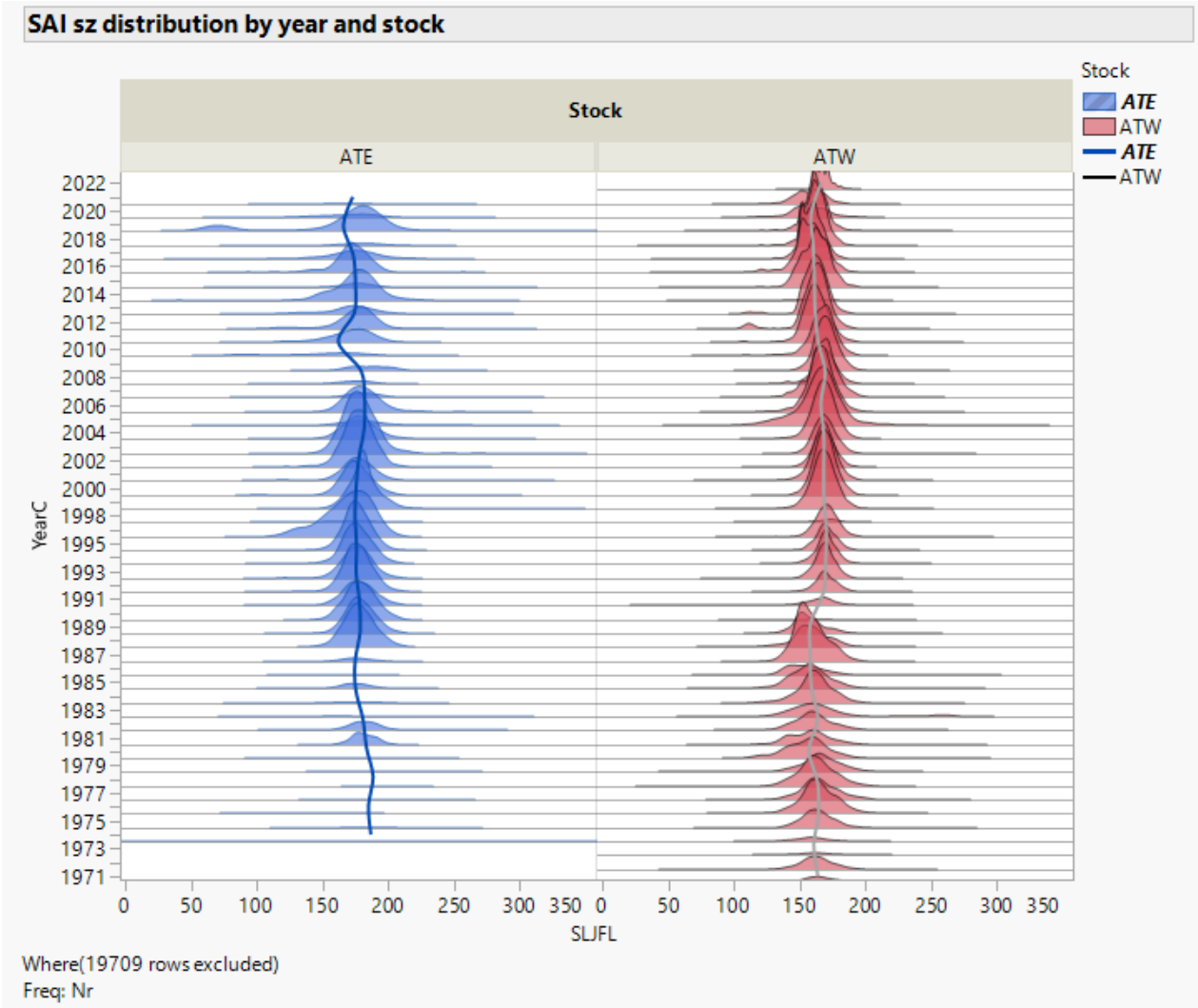


Figure 7. Overall sailfish size (LJSFL cm) distribution by stock and year.



Figure 8. Sailfish size distribution by main gear type, stock and year.



Figure 9. East sailfish annual size distributions by fleet_ID (each plot) and main flag/fleet within each fleet ID.

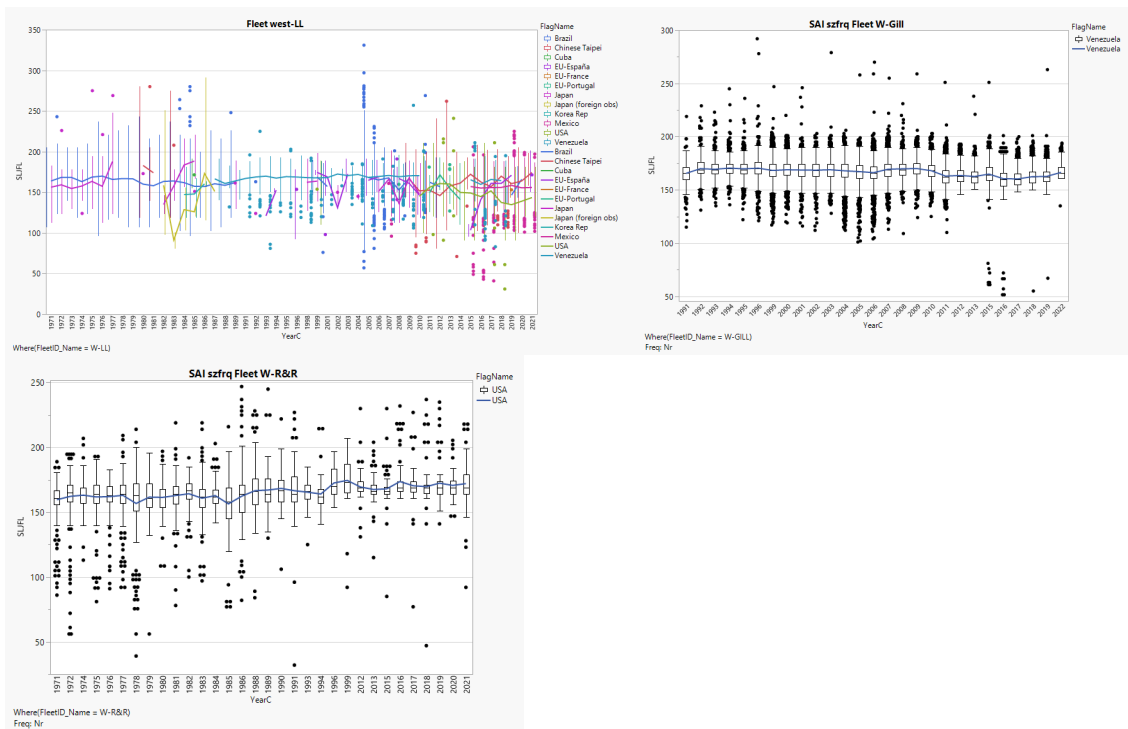


Figure 10. West sailfish annual size distributions by fleet_ID (each plot) and main flag/fleet within each fleet ID.

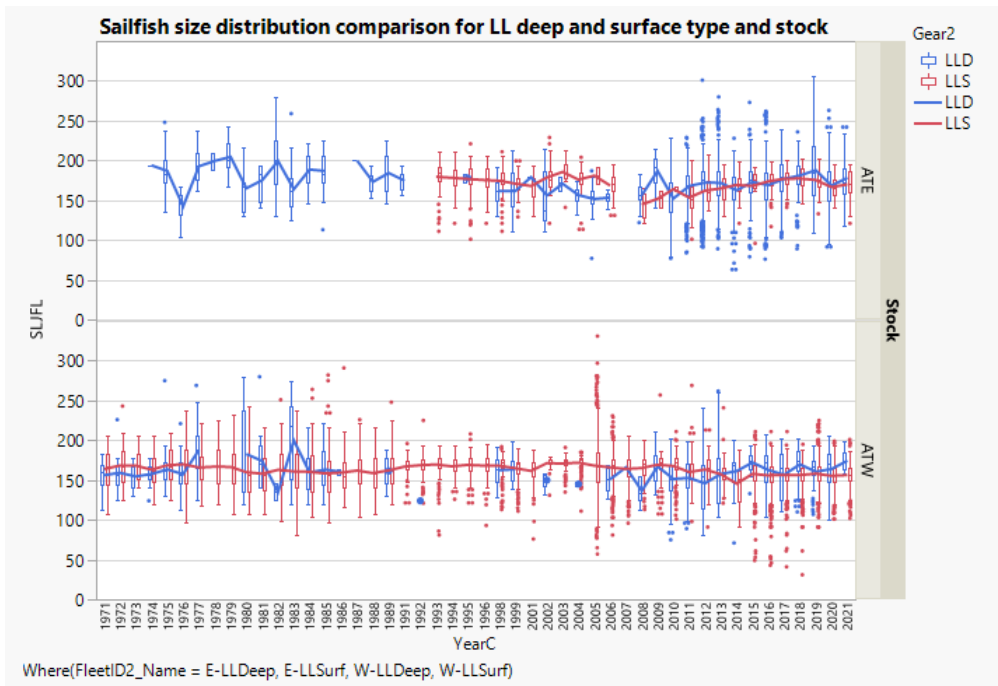


Figure 11. Sailfish size distribution of the longline fleets targeting deep (LLD) or surface (LLS) species by year and stock.