

UPDATE OF INPUT DATA (CATCH AND SIZE) FOR THE ATLANTIC BLUE SHARK (*PRIONACE GLAUCA*) STOCK ASSESSMENT MODELS 2023

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SUMMARY

The Sharks Species Group (SHKSG) is scheduled to evaluate the North and South Atlantic blue shark stocks in 2023. During the Data Preparatory meeting, the SHKSG requested that the Secretariat provide input catch and size data 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

Il est prévu que le Groupe d'espèces sur les requins (SHKSG) évalue les stocks de requin peau bleue de l'Atlantique Nord et Sud en 2023. Au cours de la réunion de préparation des données, le SHKSG a demandé au Secrétariat de fournir les données d'entrée de captures et de tailles jusqu'en 2021 pour le modèle Stock Synthesis et le modèle de production excédentaire, basées sur la structure préliminaire des flottilles 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

Está previsto que el Grupo de especies de tiburones (SHKSG) evalúe los stocks de tiburón azul del Atlántico norte y sur en 2023. Durante la reunión de preparación de datos, el SHKSG solicitó a la Secretaría que facilitase 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

Catch, fleet structure, blue shark, size, Stock Synthesis

Introduction

One of the main 2023 objectives of the Sharks Species Group (SHKSG) is to carry out an assessment evaluation of the North and South Atlantic blue shark (BSH) stocks (Anon., 2021a). These stocks were last evaluated in 2015 with catch and indices of abundance data until 2013. (Anon., 2016). The SHKSG 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 2015 has been initially proposed.

Data and Methods

This document used the fleet structure shown in **Table 1** based on a preliminary version used in the 2015 North Atlantic blue shark (N-BSH) fleet structure (Anon., 2016). The fleets include the main gear type longline (99.4%) used for catching blue shark in both stocks, few catches have been reported with other fishing gears which were pooled into a single fleet "others". The longline catches were separated by main flag fleets, considering whether blue sharks are a target or a bycatch species. During previous assessments (Anon., 2016) the SHKSG has thoroughly reviewed the official catch reports (Task 1 NC) and estimated the total removals for both north and south BSH stocks until 2013. The Group decided to use the 2016 Stock assessment estimates of total removals and add from 2014 to 2021 the catches reported in Task 1 NC, no additional reviews or estimations were done by the Group. However, the Group recommended that CPCs revise their Task 1 catch series and submit updates if necessary, prior to the assessment meeting. **Tables 2** and **3** show the total catch removals for north and south BSH, respectively and **Figure 1** presents a comparison of the official Task 1 NC reports (1971 – 2021) compared with the SHKSG estimated total removal by stock unit.

For the N-BSH 10 fleets were initially considered (**Table 1**) with fleet FN10 including all other gears and catches not included in Fleets FN1 to FN9. The fleets of EU-Spain and EU-Portugal were split following the Group recommendation during the data preparatory meeting (Anon., 2023). **Figures 2** and **3** show the catch distribution by fleet for the N-BSH and S-BSH, respectively. Total removals represent the catch information available until May 30th 2023, and were provided to the modelers team for the initial analyses.

The ICCAT Secretariat has received data on size from blue shark fisheries from 1992 to 2021 (Task 2SZ), a total of 266,046 records that represent 1,194,818 measured individuals. **Figure 4** shows an overall distribution of BSH size data by year and flag, while **Figure 5** shows the spatial distribution of these size samples. Only size observations from the north and south stocks were included. Since 2000, reports of fisheries statistics both catches and size distribution has improved, including recent updates of sex information as requested by the SCRS (**Figure 6**).

During the 2015 blue shark assessment, the SHKSG also reviewed extensively the size data and compiled size information from national observer programs not previously available. At the data preparatory meeting, it was discussed the available size data and the Group recommended:

- To use the 2015 stock assessment size input data as a primary source of data if no else is available for the period 1971 – 2013.
- For CPCs that have submitted reviews and updates on BSH size data, use this information as a primary source. These included updates from EU-Spain, Brazil, Venezuela, Japan, and Chinese Taipei.
- After 2014, size data should be from the ICCAT Task 2SZ information, if no other source is available.

Following these indications, the BSH size data was compiled including the size matrices from the 2015 stock assessment, ICCAT Task 2Sz, and the updates provided by CPCs during and after the data preparatory meeting (**Figure 7**). As indicated in **Figure 7** there is an overlap between blue shark size data from different sources, therefore, to avoid potential duplication of information, a decision algorithm (**Figure 8**) was implemented following the Group's recommendations to create the size frequency input by fleet and year for the Stock Synthesis.

Results and Discussions

Atlantic blue sharks have been exploited since the 1970s by longline fleets mainly as target species or as a bycatch of the high-seas longline fleets (**Figure 6**). However, the official reports of shark catches as a general group or by species (i.e. Task 1 NC), started really after the 1990s following the specific request by the ICCAT Commission. Therefore, during previous assessments catch history of sharks in particular of blue sharks by stock unit has been estimated by the SHKSG using different methodologies (Anon., 2016; Anon., 2016b). The Group decided that the

catch series estimated for the 2015 assessment (1971 – 2013) represented the best estimate of total removals for both the north and south BSH stocks. After 2010 the catch series from Task 1 NC and the Group's estimates match closely, thus for the period 2014 to 2021, it was agreed to use the official reports of Task 1 NC removals without further estimations.

For the N-BSH stock about 70 to 80% of the catches are from the Fleet ID FN1 (EU-Spain) where blue shark is a target species, followed by the catches of fleets FN2 (Japan) and FN10 (Others) with about 10% catches by each fleet, while the rest of the fleets account for about 5 to 8% of the removals. With the S-BSH stock, catches are more evenly distributed among fleets, with the fleet ID FS1 (EU-Spain) accounting for about 35 to 40% of the catches since 1987, while Fleet FS3 (Chinese Taipei) and FS4 (Japan) account on average 50% to 70% in the early years (1971 – 1987), and about 20% thereafter. In the South Atlantic, other fleets' catches are on average 10 to 15% of the annual removals, noticeable is the increase percent of catches from the fleet FS11 (EU-Portugal) since 2000.

The available size data for blue sharks includes over 1,87 million measurements since 1992. However, the different sources of BSH size data overlap in years with a clear potential for duplicated information. During the data preparatory meeting, the SHKSG agreed to a protocol for selecting blue shark size data, as indicated in the data section. The size data matrices used in the 2015 assessment were extensively reviewed by the Group and were included as provided, similarly for blue shark size data provided by CPCs during or after the data preparatory meeting were also included as provided, standardizing to a common measurement unit of straight fork length SFL. Finally, the size data from the ICCAT Task 2SZ database were reviewed, and standardized, and outliers were excluded. Size frequency samples by fleet-year were generated when 30 or more measures were available for a given stock and fleet-year combination.

After combining all size data sources, the algorithm for inclusion (**Figure 8**) was applied to generate the size frequency matrix for inputs by stock, fleet ID, sex, and year in 5 cm bin size (lower limit) from 15 to 425 cm size range. The SHKSG requested two size-matrix types by sex; a) combined all sex (including unknown sex specimens) and b) by sex males and females only. Sex identification is more prevalent for size data of the N-BSH stock, about 80% of size records have the gender of the shark measured, while for the S-BSH only 62% of the size data provide the gender (**Figure 9**). **Figure 10** shows the annual size trends (all fleets) by sex and stock from the ICCAT task 2SZ information. For the N-BSH there are minor differences in the mean size of males and females, while the variance is much larger, for individuals of unknown sex, mean size shows higher annual variability, but the overall dispersion is similar to the size data with sex information. In the S-BSH, also minor differences in the mean annual size by sex between male and female sharks were seen, while more noticeable is the annual mean size variation for unknown-sex individuals.

Figures 11 and 12 show the mean size annual trend by fleet for the north and south blue shark stocks, respectively. The N-BSH fleets FN1, FN2, FN4, FN5, FN9, and FN10 have relatively good coverage by years of size information, while fleets FN8 and FN7 have only a few years of size information. Overall there is large dispersion, e.g. size range expands from 50 to 300 SFL cm for most of the fleets in almost all years, with some differences in the mean size among fleets. In the S-BSH fleets FS1, FS4, FS5, and FS3 have a higher number of years with size information, while fleet FS7 and FS9 have only a few years of size data. There is also a wide size range for most fleets, with sizes from 50 to 350 SFL cm and some variability in mean size by year. Mean size trends are shown in **Figure 13** for fleets with a sufficient number of years of size data, for the N-BSH the smallest mean size is reported from Fleet FN1 (EU-Spain) with an average of mean size around 140 cm SFL, while the FN9 (EU-Portugal) and FN5 (Venezuela) overall catch the largest mean size blue sharks. For the S-BSH, annual mean size trends indicate that fleets FS5 (Uruguay) and FS4 (Japan) catch on average the smallest size blue sharks, while fleets FS1 (EU-Spain) and FS3 (Chinese Taipei) catch the largest mean-size blue sharks (**Figure 13**). Finally, **Figures 14 and 15** show the annual size distribution trends of blue sharks by sex and fleet for the North and South stocks, respectively.

References

- Anon. 2016. Report of the 2015 ICCAT blue shark stock assessment session (Oceanario de Lisboa, Lisbon Portugal 27 – 31 July 2015). SCRS/2015/018 Collect. Vol. Sci. Pap. ICCAT, 72(4): 866-1019 (2016).
- Anon. 2016b. 2015 Blue shark data preparatory meeting. (Tenerife, Spain March 23 to 27, 2015). Collect. Vol. Sci. Pap. ICCAT, 72(4): 793-865.
- Anon. 2023. Report of the ICCAT 2023 Blue Shark Data Preparatory Meeting (Hybrid, Olhão, Portugal, 17-21 April 2023). Collect. Vol. Sci. Pap. ICCAT, 80(4): 1-82.

Table 1. Fleet structure for North and South Atlantic blue shark proposal for use with assessment models based on the fleet structure used in 2015.

Stock	Fleet ID	Gear	Flags
North	FN1	LL	EU Spain
	FN2	LL	Japan
	FN3	LL	Chinese Taipei
	FN4	LL	USA
	FN5	LL	Venezuela
	FN6	LL	Canada
	FN7	LL	China
	FN8	LL	Belize
	FN9	LL	EU Portugal
	FN10	LL/Other	Others
South	FS1	LL	EU Spain
	FS2	LL	Brazil
	FS3	LL	Chinese Taipei
	FS4	LL	Japan
	FS5	LL	Uruguay
	FS6	LL	Namibia
	FS7	LL	China
	FS8	LL	South Africa
	FS9	LL	Belize
	FS10	LL / Oth	Others
	FS11	LL	EU Portugal

Table 2. Catch (t) by fleet ID for the North Atlantic blue shark stock 1971 – 2021. This matrix represents the Group best estimates of total removals, see text for details.

Sum of Qty_t		Fleet_ID_SS3											Grand Total
Stock	YearC	FN1	FN2	FN3	FN4	FN5	FN6	FN7	FN8	FN9	FN10		
ATN	1971	14,085.24	1,257.87	737.79	-	-	-	-	-	-	-	0	16,080.90
	1972	13,360.99	1,674.82	932.29	-	-	-	-	-	-	-	0	15,968.10
	1973	15,954.11	653.64	901.07	-	-	-	-	-	-	-	0	17,508.82
	1974	12,041.54	3,421.98	740.45	-	-	1.52	-	-	-	-	0	16,205.49
	1975	15,596.15	4,380.45	658.98	-	-	15.92	-	-	-	-	0	20,651.50
	1976	11,721.05	1,130.01	800.47	-	-	11.37	-	-	-	-	0	13,662.90
	1977	13,773.06	3,295.02	742.17	-	-	85.67	-	-	-	-	0	17,895.93
	1978	15,030.08	3,368.29	734.21	-	-	1,754.40	-	-	4.00	-	0	20,890.99
	1979	10,747.07	924.00	701.74	-	-	2,251.76	-	-	12.00	-	0	14,636.56
	1980	15,858.38	4,902.49	648.92	-	-	1,360.15	-	-	12.00	-	0	22,781.94
	1981	16,703.32	6,342.45	404.00	204.27	-	410.93	-	-	10.00	-	0	24,074.97
	1982	18,955.13	5,331.14	880.00	155.62	-	410.93	-	-	8.80	-	0	25,741.62
	1983	29,552.35	3,460.67	919.00	605.27	-	727.84	-	-	8.00	-	0	35,273.14
	1984	26,284.95	2,455.01	970.00	106.97	-	352.55	-	-	14.00	29.1361246	30,212.61	
	1985	30,930.08	3,650.34	868.00	340.98	-	416.99	-	-	39.00	62.4345528	36,307.82	
	1986	40,424.29	2,928.40	1,175.00	1,112.34	10.61	320.00	-	-	50.00	1864.71198	47,885.36	
	1987	46,343.09	2,975.08	440.00	1,400.47	14.78	147.00	-	-	67.00	4095.70666	55,483.13	
	1988	39,958.11	2,388.19	248.00	776.09	8.19	968.00	-	-	91.00	2547.32975	46,984.91	
	1989	23,708.48	4,532.70	165.00	750.52	8.62	978.00	-	-	81.00	1215.39263	31,439.71	
	1990	23,874.97	3,599.22	1,174.00	828.68	9.16	680.00	-	-	132.60	1387	31,685.64	
	1991	27,079.95	3,579.60	2,675.00	1,080.14	7.14	774.00	-	-	188.00	2257	37,640.82	
	1992	26,434.79	4,509.07	2,025.00	399.20	23.94	1,277.00	-	-	277.00	1583	36,528.99	
	1993	26,605.44	5,942.43	1,428.00	1,816.37	22.83	1,702.00	22.00	-	322.00	5726	43,587.07	
	1994	25,086.20	2,526.12	2,684.00	601.09	18.30	1,260.00	46.00	-	351.34	4669	37,242.05	
	1995	28,919.68	2,813.01	1,569.00	641.04	15.62	1,494.00	68.00	-	282.82	4722	40,525.17	
	1996	22,971.75	4,179.26	2,004.00	986.75	5.51	528.00	65.60	-	282.00	4843	35,865.86	
	1997	24,497.43	4,191.43	1,479.00	391.12	27.34	831.00	23.20	-	214.50	2630	34,285.02	
	1998	22,504.26	3,460.87	893.00	446.96	7.31	612.00	73.20	-	166.30	2440.401	30,604.30	
	1999	21,811.27	3,149.59	1,177.00	316.77	47.40	547.00	128.00	-	481.88	2226.59	29,885.50	
	2000	24,111.92	2,838.40	1,157.00	428.52	43.34	624.00	136.00	-	446.80	2081	31,866.97	
	2001	17,361.73	2,723.72	906.00	145.24	47.11	1,162.00	300.00	-	289.37	2109.9	25,045.08	
	2002	15,665.91	1,890.03	1,108.00	67.87	29.04	836.00	168.00	-	712.72	2264.6	22,742.17	
	2003	15,974.54	3,097.72	1,449.00	-	39.55	346.00	240.00	-	70.96	5642.796	26,860.58	
	2004	17,313.89	3,194.83	1,378.00	71.57	9.95	965.00	192.00	-	115.65	2024.64548	25,265.52	
	2005	15,006.08	3,530.98	857.00	67.90	27.73	1,134.00	232.00	-	126.72	4027.016	25,009.43	
	2006	15,463.63	2,824.18	364.00	46.98	11.63	977.00	256.00	-	358.03	4337.882	24,639.33	
	2007	17,038.47	2,270.99	292.00	54.32	19.25	843.00	367.00	-	1,108.46	5283.25778	27,276.75	
	2008	20,787.81	3,186.59	109.57	137.32	8.14	-	109.00	-	873.77	6166.767	31,378.98	
	2009	24,465.47	2,942.14	72.94	107.11	72.77	-	88.00	113.82	2,020.99	6251.55978	36,134.81	
	2010	26,094.31	2,755.04	98.51	176.11	75.04	-	52.84	460.53	198.29	8261.08292	38,171.76	
	2011	27,988.17	2,147.89	148.30	271.31	117.80	-	108.83	1,039.17	676.35	6509.1274	39,006.94	
	2012	28,665.76	2,256.35	115.12	162.27	98.39	-	97.62	902.52	538.96	3767.776	36,604.76	
	2013	28,562.01	1,353.72	135.02	263.77	51.61	-	326.72	1,216.15	1,144.52	3694.375	36,747.90	
	2014	29,041.14	3,286.88	83.14	165.79	115.68	0.64	177.72	391.86	1,810.85	3059.526	38,133.22	
	2015	30,078.30	4,011.13	238.07	114.15	130.42	5.54	1.24	4.28	1,748.49	3859.15	40,190.77	
	2016	29,018.73	4,217.09	286.56	74.05	117.47	16.03	27.28	5.74	2,503.53	7819.01375	44,085.49	
	2017	27,316.48	4,443.85	75.63	66.68	107.68	32.01	2.44	201.09	2,094.35	5664.246	40,004.46	
	2018	21,684.72	4,111.12	153.10	30.14	112.44	70.91	5.69	316.60	2,299.44	5194.57301	33,978.73	
	2019	16,314.20	3,855.22	38.49	36.27	55.96	3.91	17.93	368.90	2,014.08	4507.32858	27,212.29	
	2020	12,324.85	2,289.79	73.60	32.17	59.01	193.31	65.44	300.68	1,972.23	3836.27505	21,147.36	
	2021	13,124.58	1,985.26	53.37	34.45	10.97	173.18	2.21	349.43	1,814.70	4299.98405	21,848.13	

Table 3. Catch (t) by fleet ID for the South Atlantic blue shark stock 1971 – 2021. This matrix represents the Group best estimates of total removals, see text for details.

Stock	YearC	Fleet_ID_SS3											Grand Total	
		FS1	FS2	FS3	FS4	FS5	FS6	FS7	FS8	FS9	FS10	FS11		
ATS	1971	-	87.04	3,512.92	1,132.36	-	-	-	-	-	-	-	-	4,732.32
	1972	-	68.39	4,439.01	759.70	-	-	-	-	-	-	-	-	5,267.10
	1973	-	90.99	4,290.35	2,478.94	-	-	-	-	-	-	-	-	6,860.29
	1974	-	262.81	3,525.59	666.01	-	-	-	-	-	-	-	-	4,454.40
	1975	-	290.50	3,137.68	643.08	-	-	-	-	-	-	-	-	4,071.27
	1976	-	206.29	3,811.35	488.87	-	-	-	-	-	-	-	-	4,506.51
	1977	-	217.03	3,533.80	5,764.68	-	-	-	-	-	-	-	-	9,515.50
	1978	-	207.42	3,495.90	6,800.44	-	-	-	-	-	-	-	-	10,503.76
	1979	-	293.89	3,341.26	7,627.67	-	-	-	-	-	-	-	-	11,262.82
	1980	-	892.41	3,089.75	8,655.38	-	-	-	-	-	-	-	-	12,637.55
	1981	-	369.62	3,048.00	4,441.91	64.45	-	-	-	-	-	-	-	7,923.99
	1982	-	575.35	3,187.00	9,579.35	233.90	-	-	-	-	-	-	-	13,575.59
	1983	-	441.40	2,235.00	2,813.28	460.01	-	-	-	-	-	-	-	5,949.69
	1984	-	263.94	1,438.00	7,601.39	655.49	-	-	-	-	-	-	-	9,958.82
	1985	-	317.63	1,666.00	6,155.67	361.54	-	-	-	-	-	-	-	8,500.83
	1986	-	425.01	3,733.00	7,716.97	128.04	-	-	-	-	-	-	-	12,003.02
	1987	-	535.22	4,260.00	4,706.75	84.62	-	-	-	-	-	-	-	9,586.59
	1988	5,194.88	656.73	3,992.00	7,016.24	68.09	-	-	-	-	-	-	-	16,927.93
	1989	9,135.08	660.12	5,338.00	6,806.85	56.84	-	-	-	-	-	-	-	21,996.89
	1990	7,291.51	958.53	8,798.00	8,058.33	78.57	-	-	-	-	-	-	-	25,184.95
	1991	6,811.40	741.51	7,066.00	6,559.97	40.46	-	-	-	-	-	-	-	21,219.33
	1992	6,682.50	1,474.54	10,217.00	4,748.23	106.86	-	-	-	-	-	-	-	23,229.13
	1993	8,247.00	1,137.69	5,792.00	7,833.96	84.08	-	33.00	-	-	-	-	-	23,127.74
	1994	9,385.78	887.89	8,636.00	7,658.81	83.76	-	69.00	-	-	-	-	-	26,721.24
	1995	13,350.82	1,113.39	7,784.00	5,555.57	56.65	-	102.00	-	-	-	-	847.00	28,809.43
	1996	11,378.35	1,069.31	11,628.00	4,851.81	258.63	-	98.40	-	-	6.66	867.00	-	30,158.16
	1997	5,272.42	2,317.21	9,558.00	4,396.52	180.29	-	34.80	-	-	10.68	1,335.90	-	23,105.82
	1998	5,573.95	2,172.53	8,771.00	3,720.34	247.84	-	109.80	-	-	30.23	876.00	-	21,501.68
	1999	7,173.37	2,668.18	8,390.00	3,133.50	118.10	-	192.00	-	-	216.07	1,110.00	-	23,001.23
	2000	6,950.70	1,682.50	9,064.00	2,950.82	80.52	-	204.00	-	-	22.19	2,134.40	-	23,089.14
	2001	7,742.58	2,173.40	6,061.00	1,666.67	66.32	-	450.00	-	-	86.14	2,562.40	-	20,808.51
	2002	5,368.08	1,970.50	8,445.00	1,446.59	84.70	-	252.00	-	-	2,275.93	2,323.50	-	22,166.29
	2003	6,626.11	2,165.76	7,228.00	5,469.22	480.01	-	360.00	-	-	2,549.57	1,840.80	-	26,719.47
	2004	7,366.30	1,667.36	6,005.00	2,680.30	462.45	-	288.00	-	36.64	2,033.45	1,863.17	-	22,402.68
	2005	6,410.13	2,523.27	5,045.00	1,660.23	375.80	-	348.00	-	259.25	6,787.14	3,184.26	-	26,593.07
	2006	8,724.38	2,591.33	2,433.00	3,281.84	231.72	-	384.00	-	184.14	3,864.40	2,751.23	-	24,446.04
	2007	8,941.77	2,645.28	2,177.00	3,653.30	337.48	-	585.00	-	236.45	3,501.79	4,493.50	-	26,571.56
	2008	9,615.26	2,012.58	1,842.56	5,521.34	358.88	-	39.90	-	109.03	2,475.50	4,866.39	-	26,841.44
	2009	13,098.70	1,273.50	1,356.25	3,768.00	941.81	-	109.00	-	175.99	340.10	5,358.23	-	26,421.58
	2010	13,953.44	1,500.50	1,625.49	5,335.59	207.93	-	40.60	-	272.76	2,699.47	6,338.02	-	31,973.79
	2011	16,978.10	1,979.53	2,141.55	4,242.17	724.56	-	130.80	-	242.94	3,602.97	7,642.33	-	37,684.94
	2012	14,348.00	1,607.26	2,146.88	4,447.36	432.75	-	83.56	-	483.46	1,761.18	2,424.06	-	27,734.50
	2013	10,473.49	1,008.13	2,286.73	3,509.40	129.87	-	64.47	-	234.02	1,446.84	1,646.17	-	20,799.11
	2014	11,446.72	2,551.41	2,239.94	3,232.00	-	2,470.60	47.72	525.27	170.64	1,946.22	1,622.30	-	26,252.81
	2015	10,133.28	2,420.47	1,853.53	2,277.42	-	2,136.60	20.47	401.59	105.42	729.55	2,420.14	-	22,498.48
	2016	10,107.30	1,334.30	1,991.79	2,127.30	-	2,774.90	30.49	355.91	167.37	918.12	5,609.21	-	25,416.69
	2017	11,487.60	2,176.72	2,053.32	3,111.65	-	1,356.61	282.71	418.20	200.36	805.03	6,662.68	-	28,554.88
	2018	13,515.41	3,010.73	1,372.27	3,495.36	-	3,290.43	126.82	403.44	221.63	1,062.60	8,015.30	-	34,513.99
	2019	18,496.71	3,784.27	861.45	2,513.27	-	2,473.98	52.45	291.75	164.68	2,016.40	6,753.01	-	37,407.98
	2020	14,716.98	3,434.90	1,337.92	2,116.49	-	4,120.02	44.82	51.81	15.09	685.86	7,349.51	-	33,873.40
	2021	16,777.87	4,629.16	1,051.77	1,639.42	-	3,237.31	15.47	180.93	21.48	683.99	5,523.80	-	33,761.19

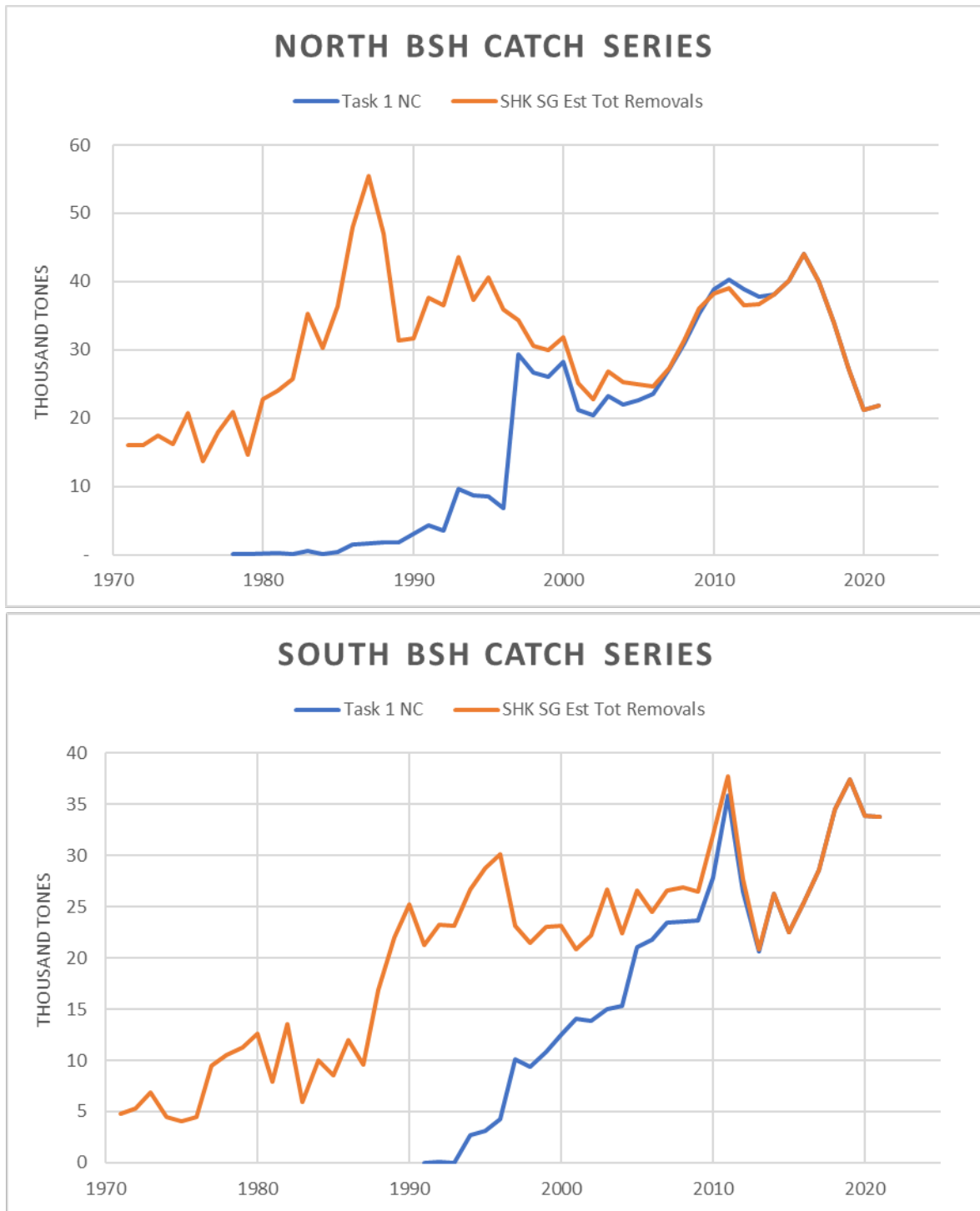


Figure 1. Yearly catch (t) of North and South Atlantic blue sharks as estimated by the Sharks Species Group and the Task 1 NC reports 1971 - 2021.

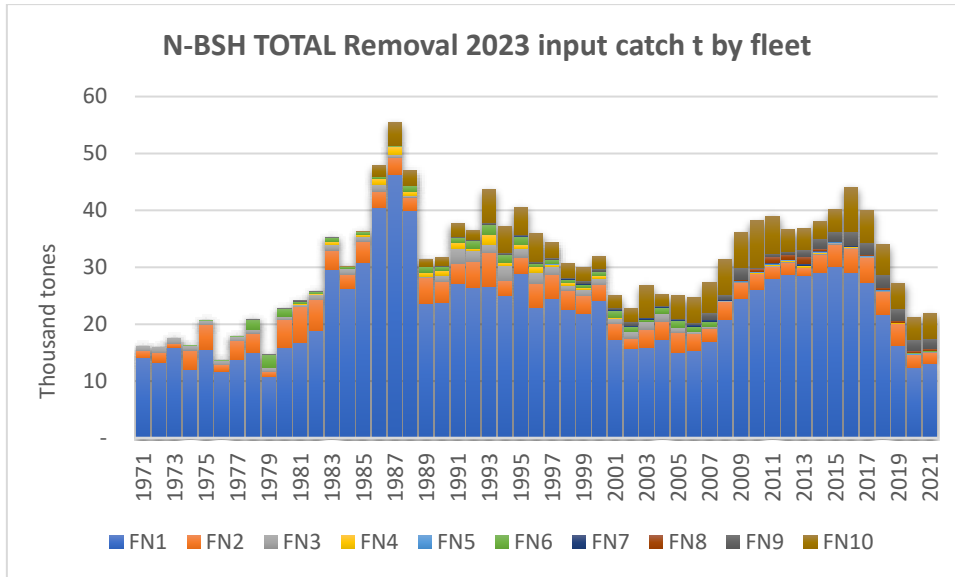


Figure 2. Yearly catch (t) by fleet North Atlantic blue shark 1971 – 2021.

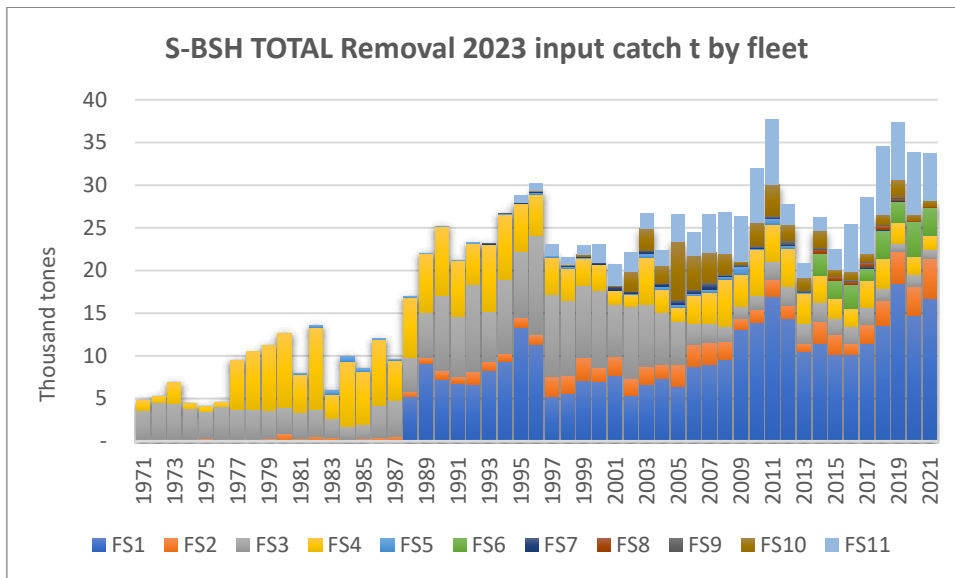


Figure 3. Yearly catch (t) by fleet South Atlantic blue shark 1971 – 2021.

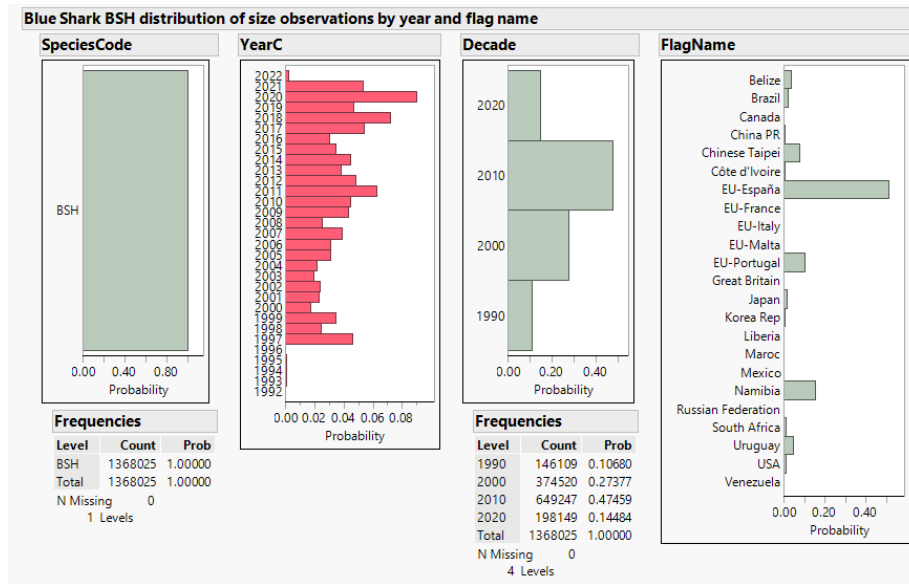


Figure 4. Summary of the blue shark size information provided to ICCAT (Task 2SZ) by CPCs.

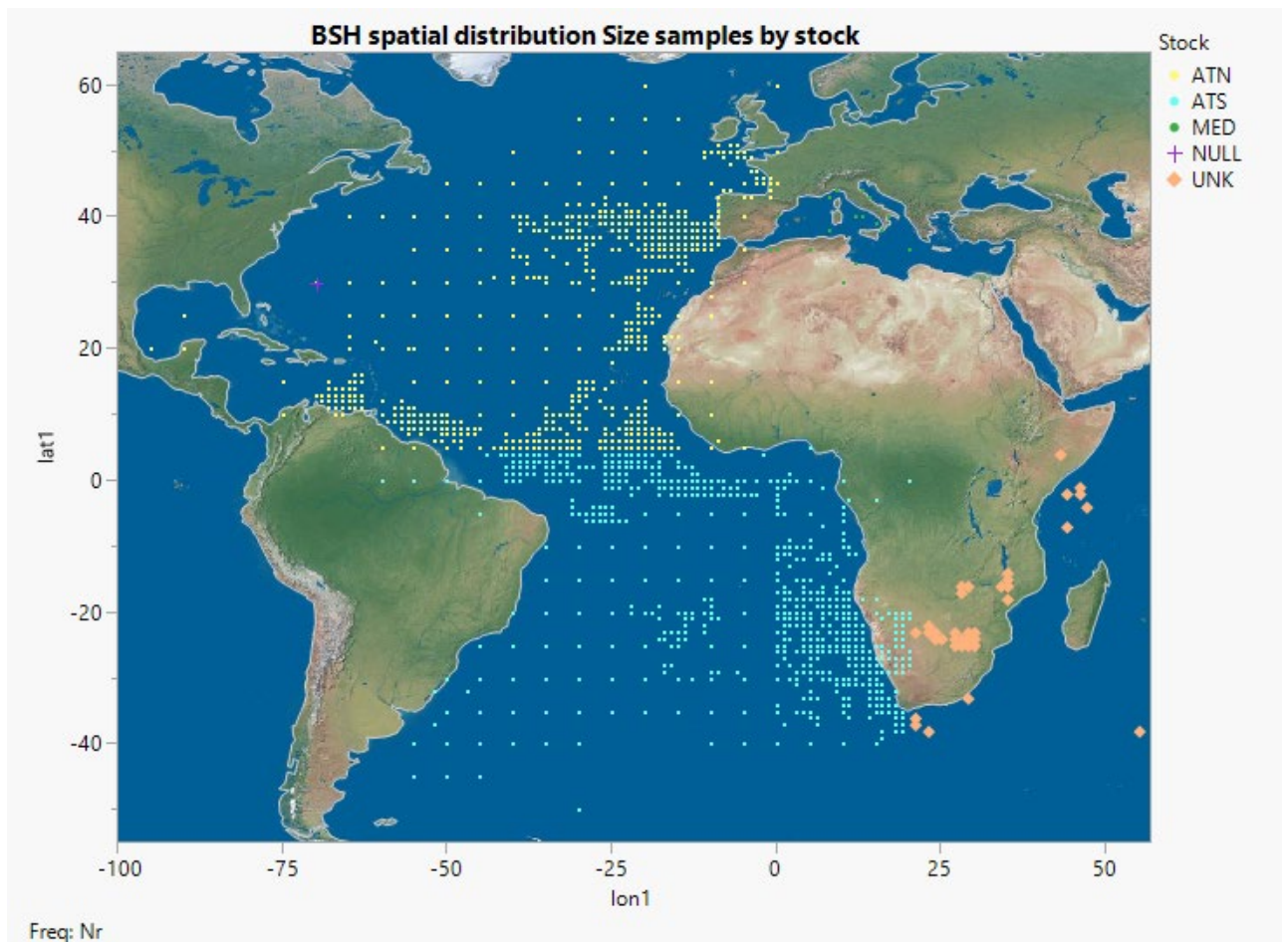


Figure 5. Blue shark size data geographic distributions by stock as submitted in the Task 2SZ data.

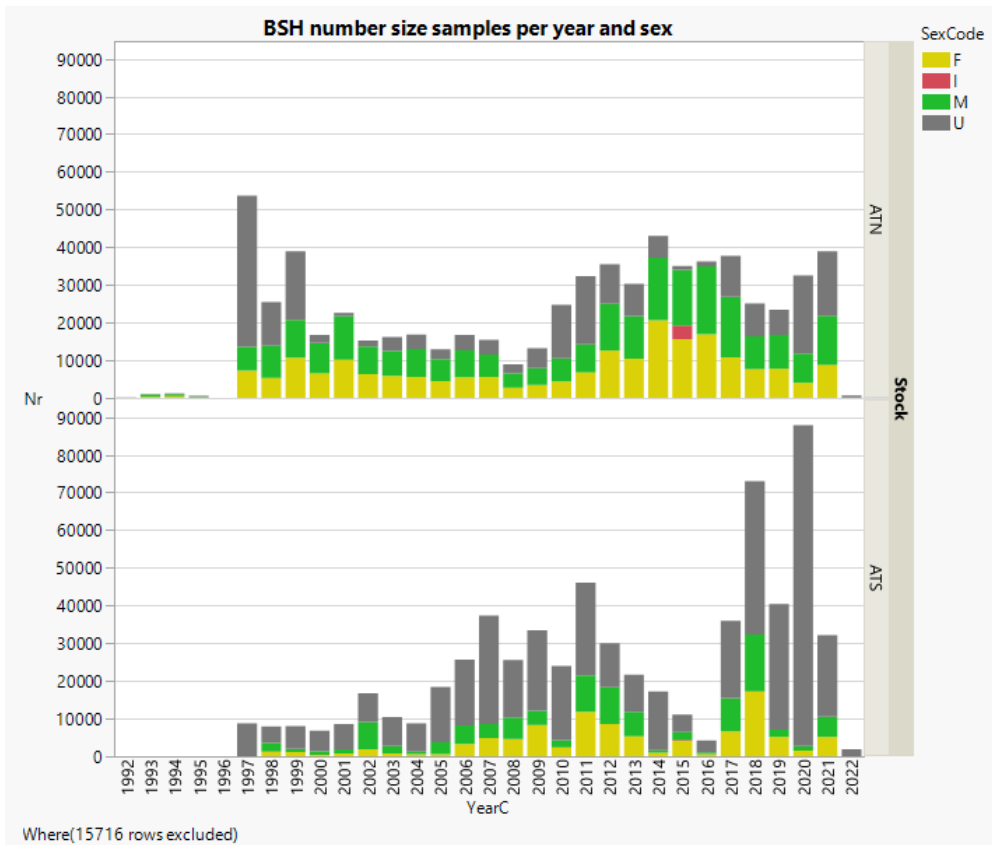


Figure 6. Annual distribution of blue shark size by stock and sex as available in the ICCAT database.

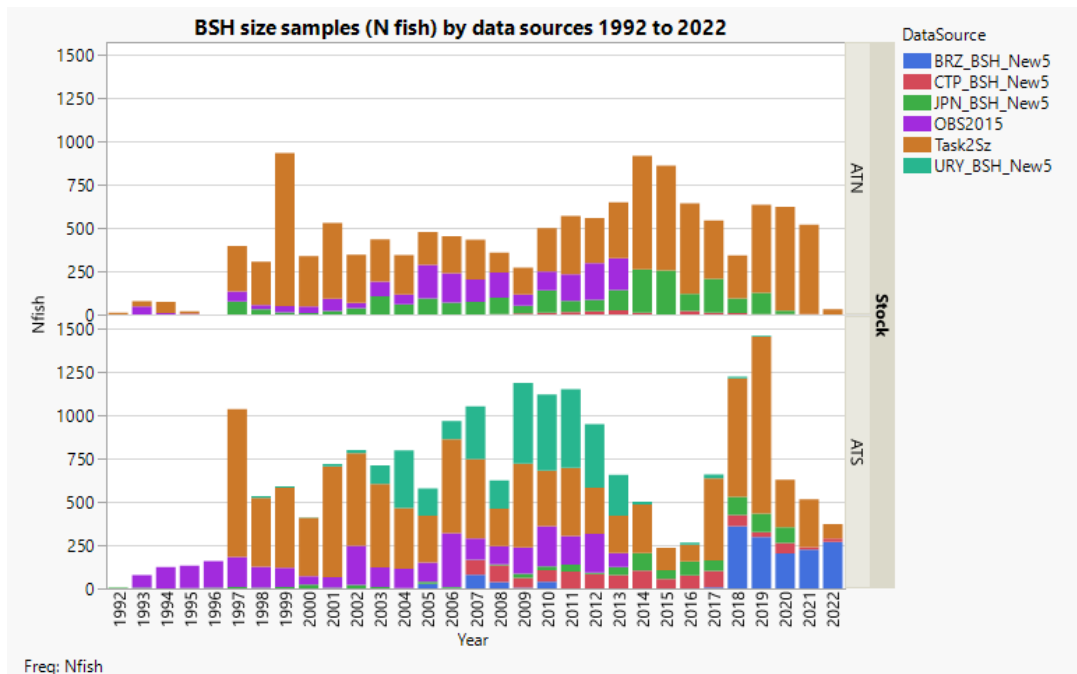


Figure 7. Number of blue shark size samples by stock from different data sources available for the stock assessment model inputs.

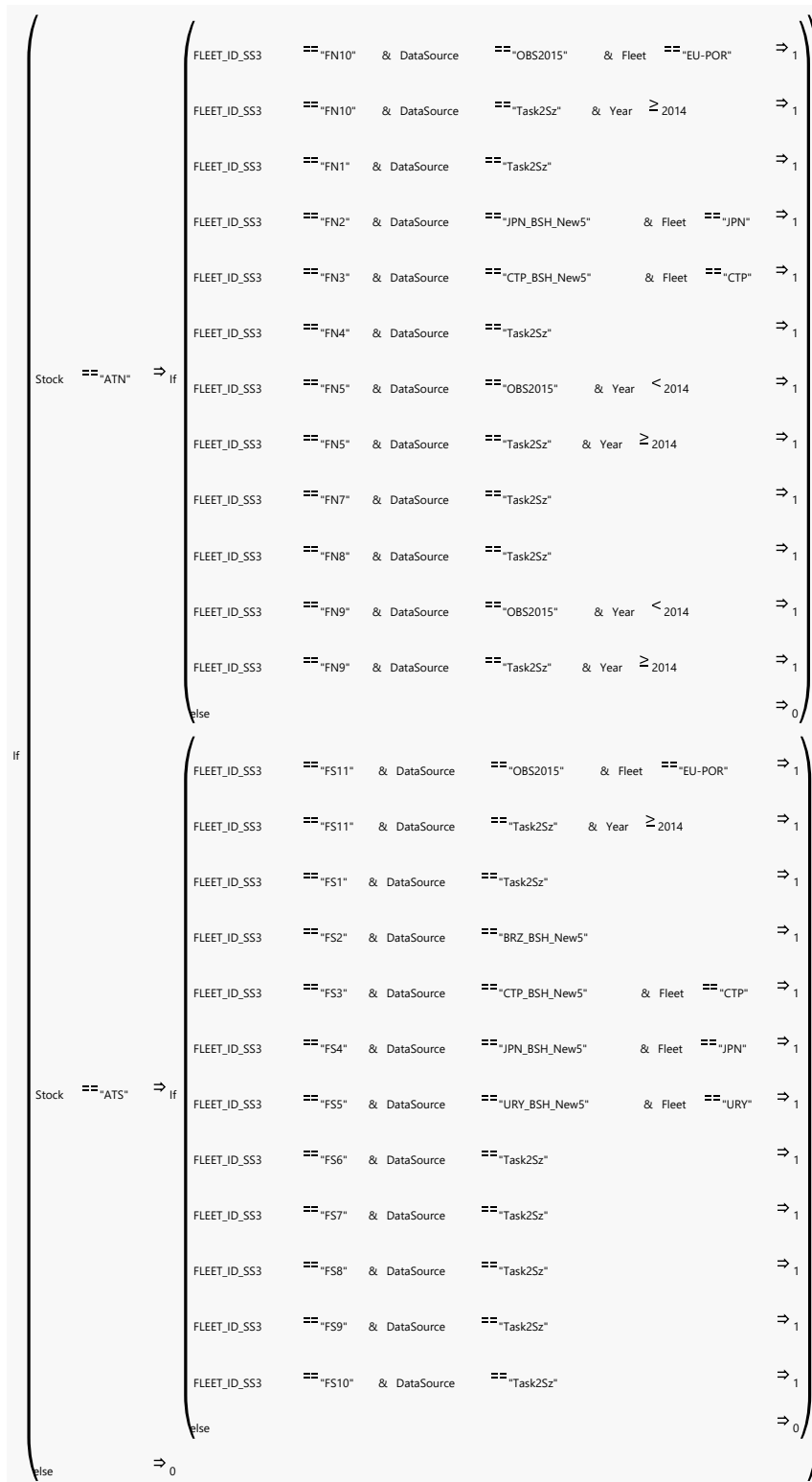


Figure 8. A decision algorithm for selecting the input BSH size data by fleet (FLEET_ID) and stock. Values of 1 indicate to use of the data, and 0 excludes the size data.

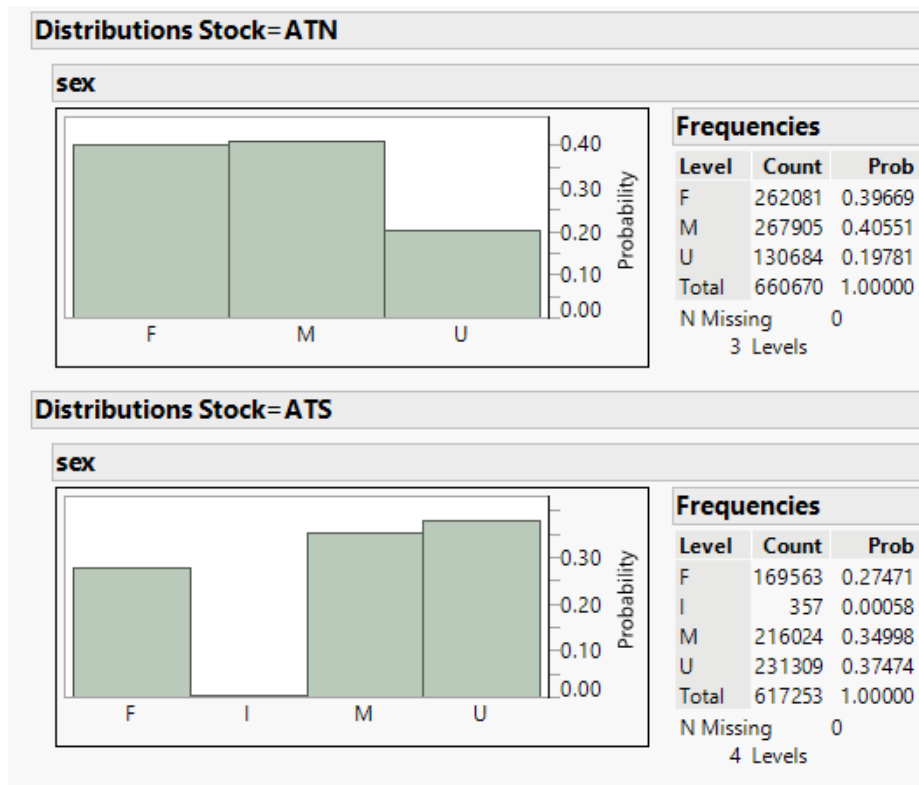


Figure 9. Blue shark sex information distribution by stock within the compiled size data for all years.

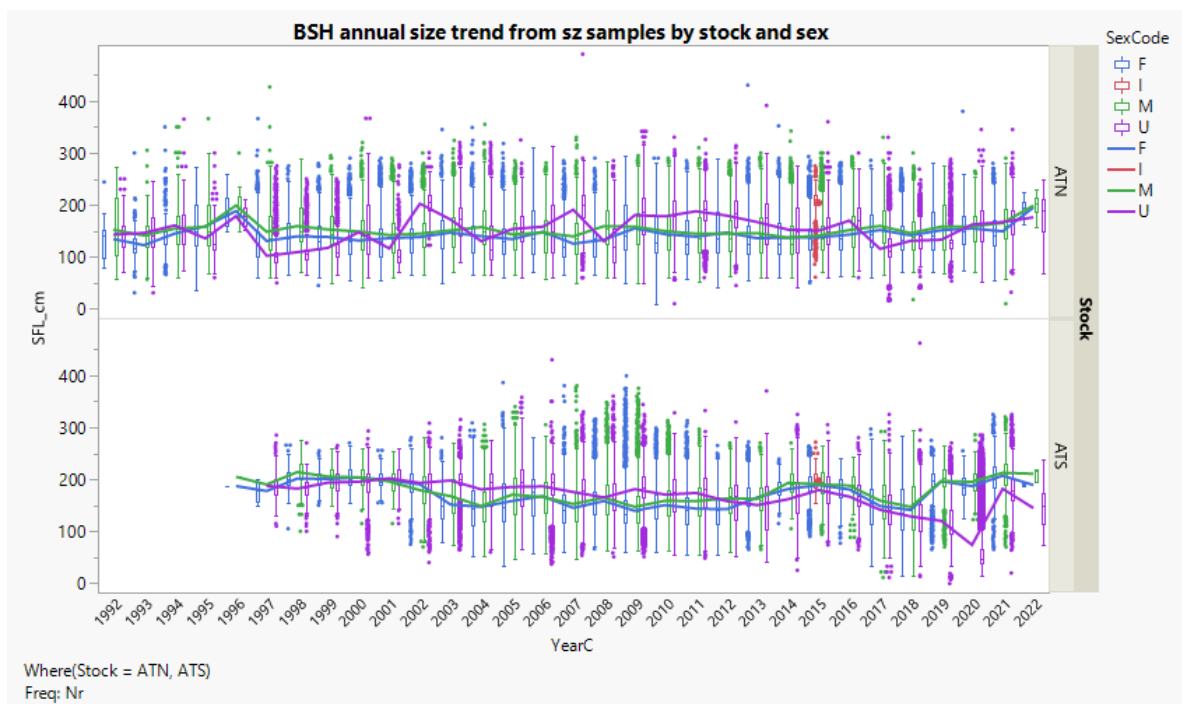


Figure 10. Blue shark annual size distributions by sex and stock unit from the ICCAT Task 2SZ dbase.

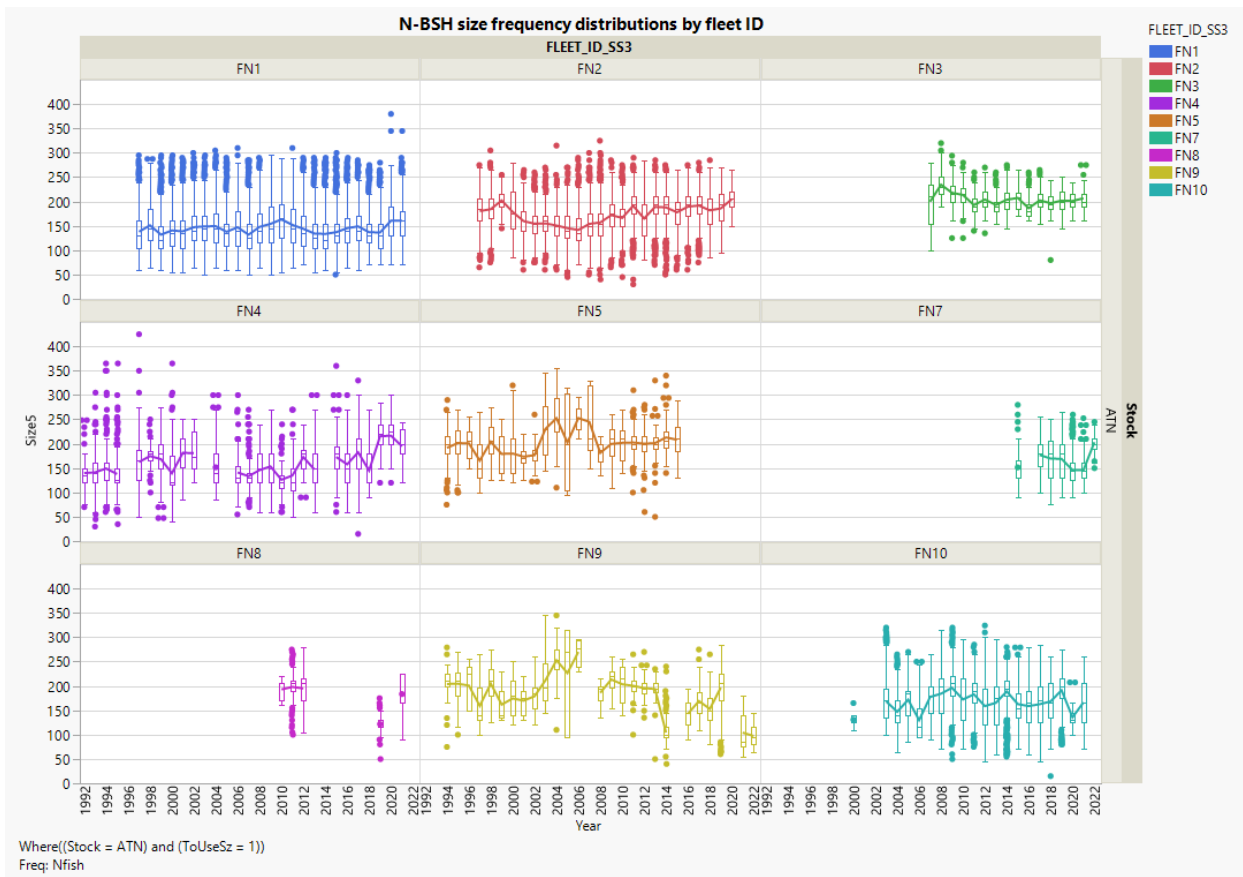


Figure 11. Annual north blue shark size (SFL, 5 cm bin size low limit) distribution by fleets. This size matrix represents the compilation of size information from different sources following the SHKSG decisions.

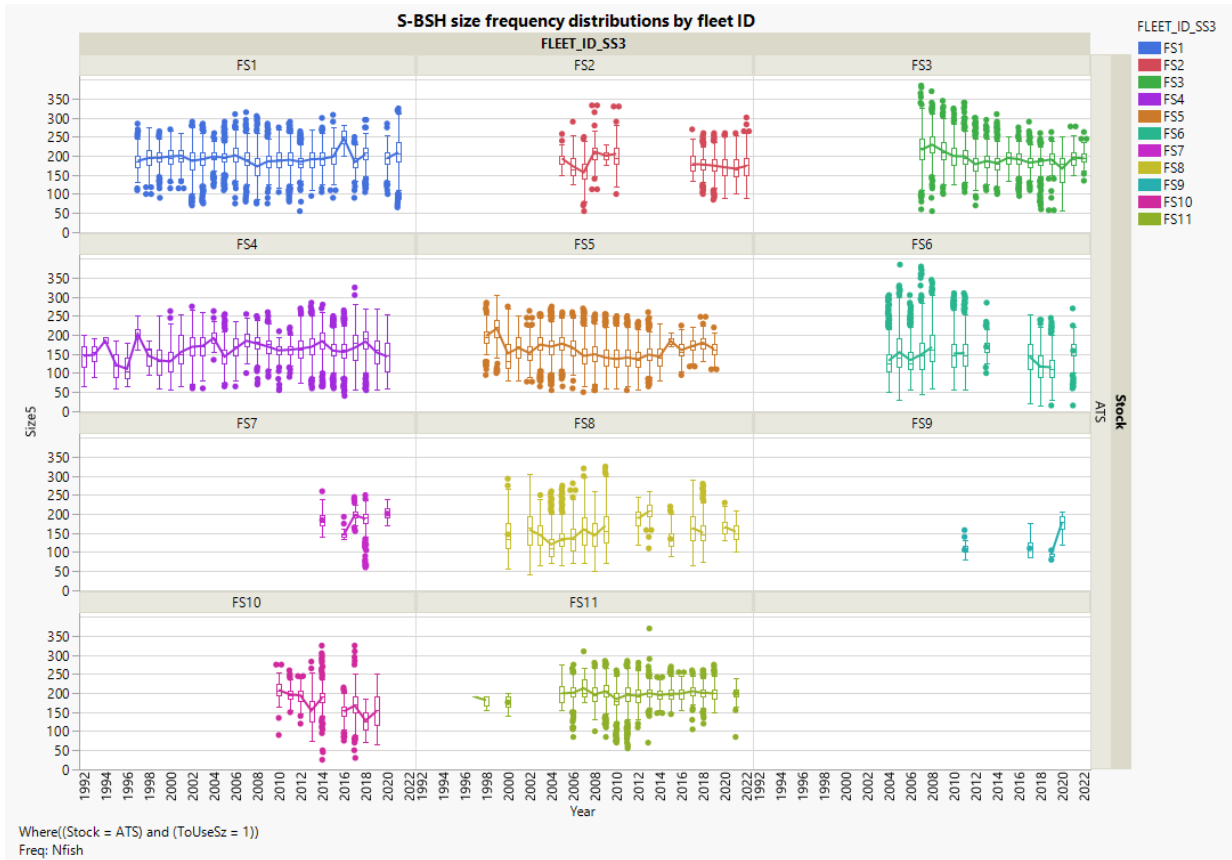


Figure 12. Annual south blue shark size (SFL, 5 cm bin size low limit) distribution by fleets. This size matrix represents the compilation of size information from different sources following the SHKSG decisions.

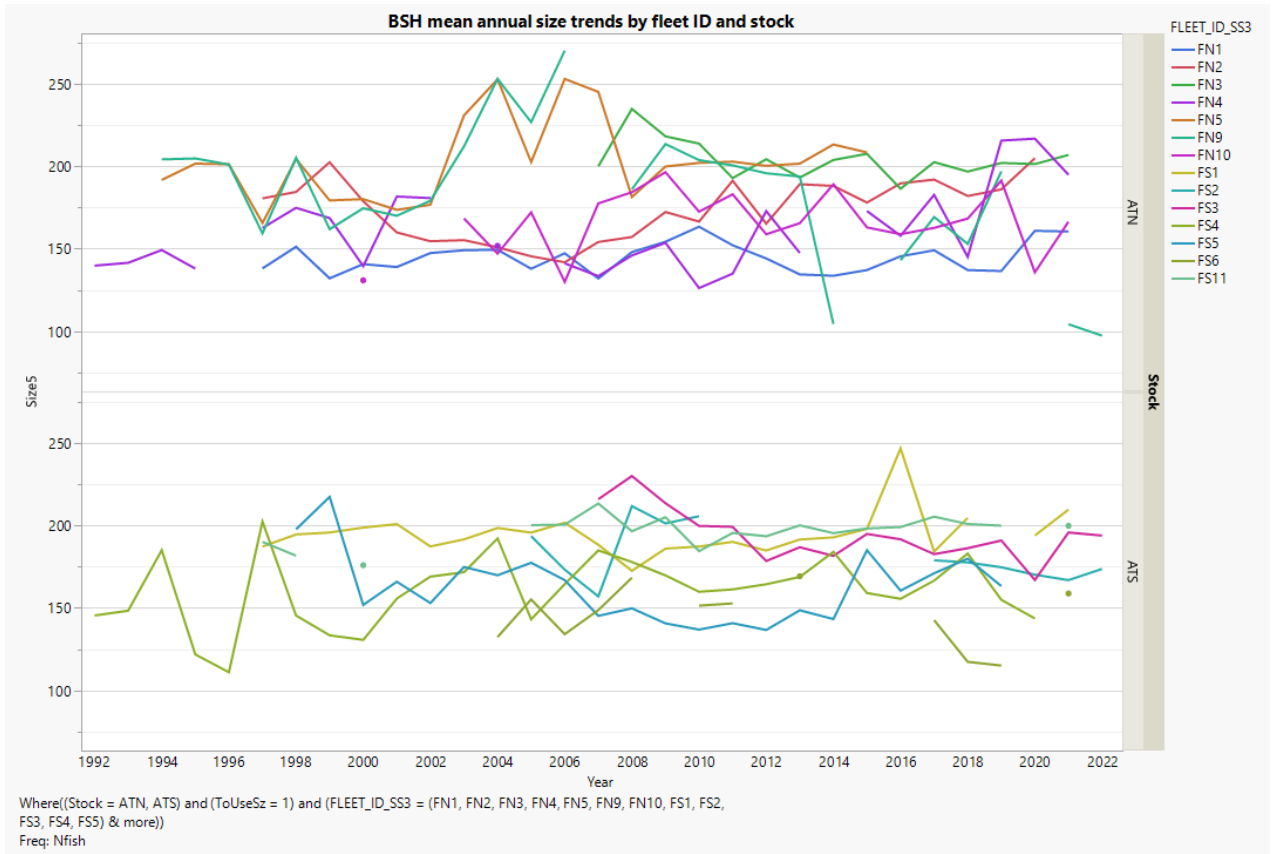


Figure 13. Mean annual blue shark size (SFL) trend by fleet ID and stock unit.

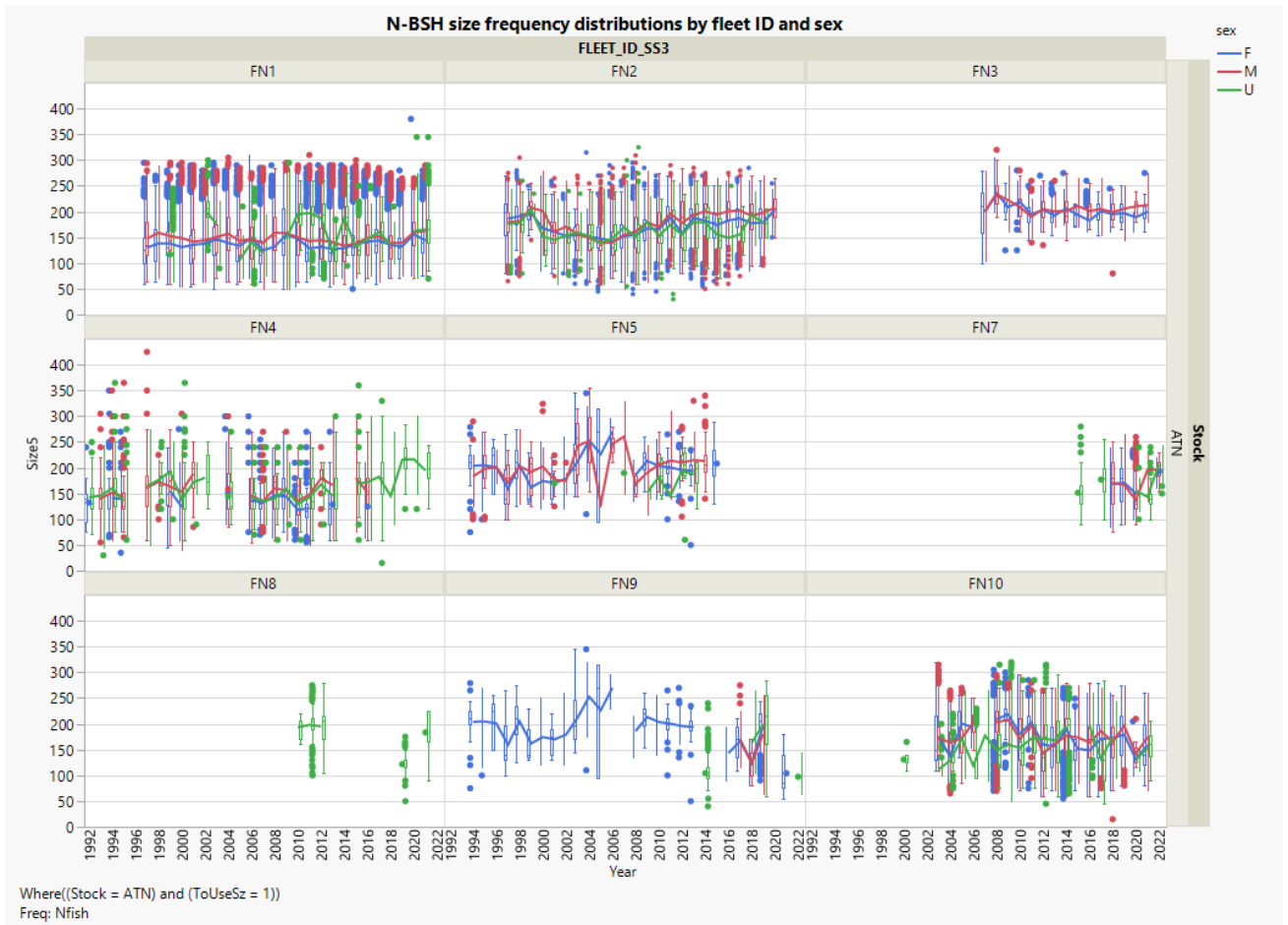


Figure 14. Annual north blue shark size (SFL, 5 cm bin size low limit) distribution by fleets. This size matrix represents the compilation of size information from different sources following the SHKSG decisions

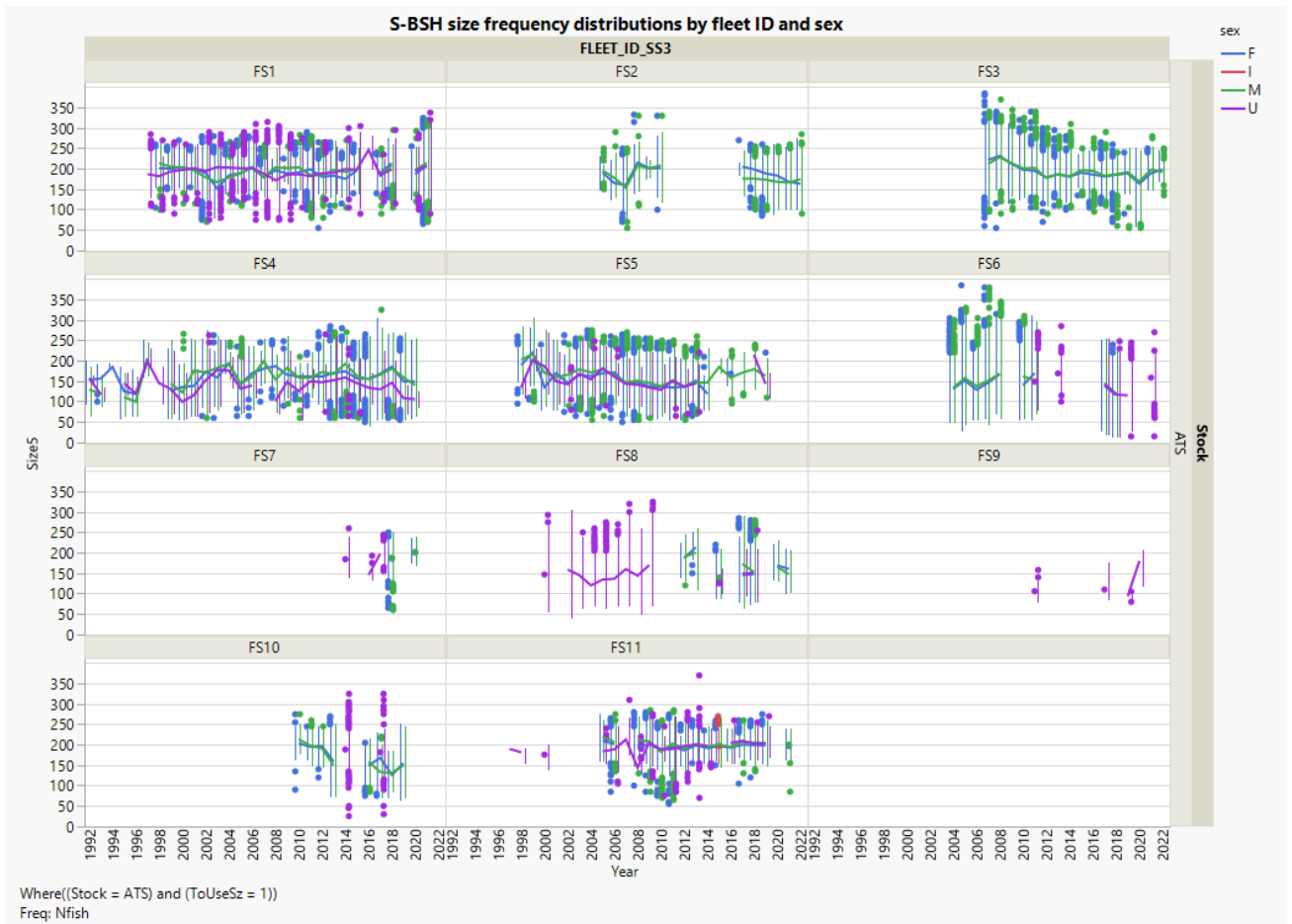


Figure 15. Annual south blue shark size (SFL, 5 cm bin size low limit) distribution by sex and fleets. This size matrix represents the compilation of size information from different sources following the SHKSG decisions.