9.3 SKJ - Skipjack

The last stock assessment for eastern and western Atlantic skipjack were conducted in 2022 through a process that included a data preparatory meeting, held online from 21-25 February 2022 (Anon., 2022a), and a stock assessment meeting, held online from 23-27 May 2022 (Anon., 2022b). Additionally, informal intersessional meetings of the Group were held in April and July (Anon., 2022c) to prepare and finalize the stock assessment results. This report covers the most recent information on the status of the eastern and western skipjack stocks. The 2022 assessment was able to provide quantitative estimates of management reference points and projections of stock status for both skipjack stocks, something that was never achieved before by the Committee.

These new assessments for the eastern and western Atlantic skipjack stocks used fishery data from 1950-2020 and 1952-2020, respectively, and indices of relative abundance used in the assessments were calculated through 2020. In both cases, Surplus Production models and Statistically Integrated models were used.

For a complete and detailed description of the assessment and the state of knowledge and status of the eastern and western Atlantic skipjack tuna stocks, readers should consult the Report of the 2022 Skipjack Tuna Data Preparatory Meeting (Anon., 2022a) and the Report of the 2022 Skipjack Stock Assessment Meeting (Anon., 2022b).

SKJ-1. Biology

Skipjack tuna is a cosmopolitan species found in schools distributed mainly in tropical and subtropical waters of the three oceans. This tropical tuna is the predominant species aggregated around FOBs (including FADs) where it is caught, commonly associated with juveniles of yellowfin tuna, bigeye tuna and with other species of epipelagic fauna. This species exploited sizes range from 30 cm to 62 cm FL for SKJ-W (**SKJ-Table 2**) and 30 cm to 80 cm FL for SKJ-W (**SKJ-Table 3**).

Skipjack tuna breed opportunistically throughout the year over broad areas of the Atlantic Ocean. Both stocks show synchronized spawning behavior when in a school. Moreover, the skipjack's reproductive potential is considered high because it reaches sexual maturity around one year of age and spawns in warm waters above 25º C which represents a large ocean area. More specifically, the eastern skipjack stock, spawns over a wide area on either side of the equator, from the Gulf of Guinea to 20º-30º W. There are two known spawning areas for the western skipjack stock, one off the Brazil margin delimited by the parallel of 20º S and the southern limit of the Brazil current, and another area in the North of the Atlantic Ocean, located in the Gulf of Mexico and Caribbean.

Movement patterns based on AOTTP tagging data demonstrated some connectivity between the Azores and Gulf of Guinea areas for the eastern stock, which had not been observed in the ICCAT historical tagging data. Although in general, the AOTTP tagging data shows minimal exchange between the eastern and western skipjack stocks, the separation between the two stocks is less clear for those tags released by the AOTTP close to the boundaries of the stock (5º S; 35º W) (**SKJ-Figure 2**). This pattern sparked concerns in the current way catches are assigned to a stock when fleets are fishing near and/or across this boundary area. More studies on the potential migration across stock boundaries are needed. These include analysis of returned AOTTP skipjack tags, or potential future releases of conventional tagged fish in places where movement details remain unknown (e.g., Venezuela to the Equator and northern migrations of the western stock). Such studies could improve our understanding of these movements and of potential levels of mixing across the current stock boundaries.

Length at 50% maturity remains estimated at 42 cm, approximately 9.5 months old, and the size of full maturity at 55 cm. Both reproduction parameters remain the same as those used in the last stock assessment.

Considerable uncertainty remains around the growth parameters for the skipjack tuna. To deal with this uncertainty, a distribution of potential growth curves was developed considering available estimated growth parameters compiled from scientific literature, and the resulting growth parameters are shown in the Report of the 2022 Skipjack Stock Assessment Meeting (Anon., 2022b). Natural mortality at age was estimated assuming the Lorenzen function and maximum age of 6 years.

All these uncertainties reported on growth, natural mortality, and stock structure could have important implications for the stock assessment of the eastern and western skipjack stocks. Research should aim to continue to reduce these uncertainties.

SKJ-2. Fishery indicators

Skipjack tuna stocks have been historically exploited by two major gears (purse seine on the eastern stock and baitboat on the western stock) and by many countries throughout their range. Longline fisheries remove a comparatively small portion of the total removals (**SKJ-Figures 1, 5 and 6**).

The numerous changes that have occurred in the skipjack fisheries, mainly since the early 1990s (e.g., the progressive use of FOBs and the geographical expansion of the fishing areas by surface fleets), have brought about an increase in skipjack catchability and the proportion of biomass exploited. The nominal catches for the eastern stock had shown a generally increasing trend since the 1960s (**SKJ-Figure 4**). The total catches increase from 1,171 metric tons in 1960 to about 283,000 metric tons in 2018. Since 2018 the total catches decreased to 206,953 t in 2021. The preliminary catch reported for 2022 have increased by 31% (271,371 t) (**SKJ-Table 1**). This recent increase is observed for most of gears, in particular eastern Atlantic purse seine.

The Group estimated the current fishing capacity of all large-scale purse seiners (defined as vessels with ≥ 335 m^3 of fish hold-volume) targeting tropical tunas in the Atlantic, using a combination of data sources including the ICCAT authorized vessel records, ISSF records on purse seiners, and AIS data. The Group estimated that at least 67 - and possibly 72 - large-scale purse seiners were operating in the Convention area as of the first half of 2022. The 2022 capacity estimate (67-72) for large-scale purse seiner was similar to the estimate of capacity made by the SCRS in 2020 (68-72 vessels) and lower than the capacity estimate in 2021 (74-80), indicating that at least some vessels moved out of the ICCAT area during the last year. The Committee was informed by national scientists of the reductions in the operations of the baitboat fleet in recent years (since 2020), in part due to the implementation of a Marine Protected Area (Decree No. 2020-1133 on the creation of the Marine Protected Areas of Kaalolaal Blouffogny and Gorée (Senegal)) limiting access to live bait for the fishery.

The western skipjack landings have shown a slight decrease since 1982, and this has intensified in the most recent period of the time series (2013-2020) (**SKJ-W Figure 6**). The maximum total catch for this stock was observed in 1985 (40,272 t), and the lowest catch since 1985 was reached in 2020 (18,903 t). This trend can be explained by the reductions in the baitboat catches, which decreased from 26,941 t on average for the period 2011 – 2015 to less than 15,400 t (on average) in the most recent period of the time series (2016-2021). On the contrary, handline catches have increased in recent years, reaching more than an annual average of 2,960 t in the period between 2016-2021, a significant increase over the 301 t average for the period 2011-2015 (**SKJ-Table 1**). Data provided in Task 1 Fleet showed a reduction in the number of vessels operating within the Brazilian baitboat fleet (from 54 baitboat vessels operating in 2015 to 30 vessels in 2020). This reductions in the number of baitboat vessels may be driving much of the decrease in catches of this stock observed in the recent period, as the Brazilian fleet catches the majority of skipjack in the West side of the Atlantic. Finally, preliminary catches reported for 2022 show an increase of 1,335 t (from 20,048 t in 2021 to 21,383 t in 2022). This increase concerns catch of the others surface gears, with the exception of PS and BB (**SKJ-Figure 6**).

Estimates of "faux poisson" catches for the purse seine fleets targeting tropical tunas in the eastern Atlantic were provided by the majority of the CPCs as indicated in **SKJ-Table 1**. For the 2022 stock assessment, the Group estimated "faux poisson" catches based on a methodology presented and adopted by the Group at the data preparatory meeting and were included under the "NEI_mixed flags" code for the stock assessment.

As indicated before, another important fishery indicator was the westward expansion of the eastern purse seine FOB fisheries with an increase in catches in the equatorial area. In the last decade surface fleet fisheries have reported catches on both sides of the skopjack stock boundary of the equatorial area (**SKJ-Figures 1 and 3**). Recent research has shown some similarities between the skipjack size ranges among the catches reported by the EU and Ghana PS-FOB when they are operating on either side of the boundary (40-50 cm SFL, **SKJ-Figure 7** and **SKJ-Figure 8**). Such fish caught by these two fleets tend to be smaller than those caught by purse seiners in the West stock area, mainly by Venezuela PS non-FOB fisheries (45-60 cm). It is possible that the stock boundary area is a mixed area including individuals of both stocks. Any increases in effort of purse seine vessels fishing on FOBs in this area could increase removals from the western skipjack stock.

Mean weight time-series by major fishery for both eastern and western skipjack stocks were estimated using the most recent information available on T1NC, T2SZ and T2CS (Task 2 catch-at-size estimated/reported by ICCAT CPCs). For the eastern and western skipjack stocks, the estimated mean weights have oscillated throughout the time series (1969-2020), **SKJ-Figure 9, SKJ-Figure 10**. The estimated mean weight of eastern skipjack is about 2.1 kg for 1969-2020. The western skipjack average weight is 3.4 kg, indicating that fish caught on eastern stock are smaller than the ones in the western stock.

Three relative indices of abundance were included in the stock assessment of the eastern skipjack, the Canary historical baitboat index (1980-2013), the EU PS FAD index (2010-2020), and the EU Echosounder buoy (2010-2020) index. The EU PS FAD index is new for this stock, derived from sets made by vessels fishing on FADs with operational buoys not owned by the vessel making the set. The Canary baitboat index showed a generally stable trend. For the recent period, the EU PS FAD index showed a slight decreasing trend over the time series, while the EU echosounder buoy index showed a sharp decline at the beginning of the series and a sharp increase at the end of the series (**SKJ-Figure 11**). For the western skipjack, five relative abundance indices were included in the stock assessment model: Brazilian baitboat historical (1981-1999) and recent (2000-2020), Brazilian handline (2010-2016), US-longline (1993-2020), and Venezuelan purse seiner (1987-2020) indices. The indices for recent years showed a slight decrease trend since the mid-2010s (**SKJ-Figure 12**).

SKJ-3. State of the stocks

The 2022 Skipjack Stock Assessment Meeting (Anon., 2022b) was conducted using similar assessment models/methods to those used in the assessments of other tropical tuna species, including yellowfin and bigeye tuna. Stock status evaluations for both stocks of Atlantic skipjack tuna used in 2022 included several modelling approaches, ranging from non-equilibrium (MPB) and Bayesian state-space (JABBA) production models to integrated statistical assessment models (Stock Synthesis). Different model formulations considering plausible representations of the dynamics of the skipjack stocks were used to characterize the stock status and the uncertainties in stock status evaluations.

Eastern skipjack stock

A full stock assessment was conducted for the eastern skipjack tuna stock in 2022, applying production models (JABBA) and one integrated statistical assessment model (Stock Synthesis) to the available catch data through 2020. The Group decided to combine the results of JABBA and Stock Synthesis, with equal weighting, to estimate stock status and develop management advice to capture all major uncertainties in the population dynamics. The uncertainty grids were comprised of combinations of CPUE selection ((i) Canary BB index + EU PS FADs index, and; (ii) Canary BB index + Echosounder buoy index), steepness *h* (0.7, 0.8, or 0.9), and growth (25, 50 or 75th regression quantiles) for both Stock Synthesis and JABBA.

SKJ-Figure 13 shows the historic trends of the relative fishing mortality (F/F_{MSY}) and relative biomass (B/B_{MSY}) from the different assessment model runs for eastern skipjack. The combined results of the assessment, based on the median of the entire uncertainty grid, show that in 2020 the East Atlantic skipjack tuna stock was not overfished (median B_{2020}/B_{MSY} = 1.60) and was not undergoing overfishing (median F_{2020}/F_{MSY} = 0.63). The median MSY was estimated as 216,617 t from the uncertainty grid of the deterministic runs. Probabilities of the stock being in each quadrant of the Kobe plot (**SKJ-Figure 14**) are 78% in the green (not overfished, not subject to overfishing), 4% in the orange (subject to overfishing but not overfished), 1% in the yellow (overfished but not subject to overfishing) and 16% in the red (overfished and subject to overfishing). In summary, the results indicated a stock status of not overfished (83% probability), with no overfishing (80% probability).

Noteworthy, the estimated stock biomass of the combined results as shown in the Kobe plot (**SKJ-Figure 14**) and summary table, there is large uncertainty in biomass estimates reflected in the long tails of the biomass distribution relative to B_{MSY} (95% confidence interval of 0.5 to 5.79 B/B_{MSY}). This large range of uncertainty in stock status estimates has implications on the estimated probabilities for each constant catch scenario in the projections that have been used to develop management advice (**SKJ-Tables 4 and 5**).

In the projection results from the Stock Synthesis and JABBA models, some iterations of high catches were predicted with exceptionally small biomass, which results in extremely high fishing mortality. Especially Stock Synthesis and JABBA runs with the Acoustic Buoy index removed projected low biomass within 3-4 years once the stock is harvested at high constant catches. **SKJ-Table 5** and **SKJ-Figure 15** show the joint stochastic projections for both quantities (B/B_{MSY} and F/F_{MSY}). The probability of biomass being less than 10% or 20% of the biomass that supports MSY was calculated for each projection year and catch scenario (**SKJ-Table 4**). Assuming a constant catch at MSY level, the probability of the stock being below 20% of the B_{MSY} at 2028 was about 17% and the probability of being below 10% of the B_{MSY} was about 14%.

Western skipjack stock

The assessment of the western skipjack stock was conducted using a Bayesian state-space production model (JABBA) and an integrated statistical assessment model (Stock Synthesis). Given that the stock status estimated from the JABBA model agreed with the estimated stock status using Stock Synthesis, the Group decided to use the results of the surplus production model as a comparative perception of the western skipjack stock status, but not for the development of management advice. Therefore, the final stock status and management advice presented in this Executive Summary are based on the combined results from the 9 distinct Stock Synthesis runs derived from the uncertainty grid proposed for the western skipjack stock. A more detailed description of the assessment can be seen in the Report of the 2022 Skipjack Stock Assessment Meeting (Anon., 2022b).

SKJ-Figure 16 shows the historical trends of the relative fishing mortality (F/F_{MSY}) and relative biomass (B/B_{MSY}) from the different assessment model platforms for the western skipjack. Based on the combined results used to the develop management advice (9 Stock Synthesis deterministic runs), the median estimate of SSB_{2020}/SSB_{MSY} is 1.60, and the median estimated for F_{2020}/F_{MSY} is 0.41. The combined results of all runs indicates that the western skipjack stock is estimated to be in healthy condition with 91% probability of being in the green quadrant, and that the stock is not overfished nor undergoing overfishing (**SKJ-Figure 17**). There was a relatively low estimated probability that the stock is either overfished (yellow quadrant; 6.2%) or both overfished and undergoing overfishing (red quadrant; 2.9%).

The catch advice is provided in the form of Kobe 2 Strategy Matrices including probabilities that overfishing is not occurring ($F <= F_{MSY}$), stock is not overfished ($SSB >= SSB_{MSY}$) and the joint probability of being in the green quadrant of the Kobe plot (i.e., $F <= F_{MSY}$ and $SSB >= SSB_{MSY}$) (**SKJ-Table 7**). Future constant catches of 20,000 t, close to the current catch (19,951 t in 2021) are expected to maintain the stock in the green quadrant. The median MSY across the 9 grid runs was 35,277 t. Future constant catches of this level are expected to maintain the stock in the green quadrant ($F \leq F_{MSY}$ and $SSB \geq SSB_{MSY}$) with about 70% probability by 2028. Probabilities of the stock biomass being below 20% and 10% of B_{MSY} are presented in **SKJ-Table 6.** The probability of the stock biomass being below 20% or 10% of B_{MSY} was less than 1% until 2028 assuming a future constant catch at the level of MSY. The projections for both quantities (F/F_{MSY} and SSB/SSB_{MSY}) are presented in **SKJ-Table 7** and **SKJ-Figure 18.**

SKJ-4. Effect of current regulations

The current regulations for tropical tunas, in Rec. 22-01, only entered into force in June 2023, and the impacts on the SKJ stock and fisheries are not yet evident in the available scientific data. However, the previous Recommendation, Rec. 21-01, included several measures that impacted fishing for the eastern stock, including the first Atlantic-wide, temporal closure on fishing for schools associated with FADs, limits to the number of FADs that can be actively managed by individual purse seiners, changes in FAD design, and others. In addition, taking into consideration the multi-species nature of tropical tuna fisheries, the TAC and catch limits adopted for other tropical tuna stocks, mainly bigeye tuna, may also explain the drop in skipjack catches in recent years. Before this closure, the Commission had adopted various FAD spatio-temporal closures (Rec. 98-01, Rec. 99-01, Rec. 14-01, and Rec. 16-01).

The effect of the temporal FAD closure was evaluated by examining catch of each tropical tuna species, by month and by fleet, in 2020 with comparison to a reference period in the 1990s, to account for years in which no closure was in place. There is preliminary evidence that tropical tuna catch was lower during the closure than during the same months in the reference period, and the annual 2020 catch was lower than in 2019. Preliminary catch estimates for skipjack in 2021 are also lower than the catches recorded in 2020. After reviewing this information, the Committee concluded that Atlantic-wide, temporal closures on fishing on FAD-associated schools may lead to reduced catch of eastern skipjack. This conclusion is further discussed in section 19 (Responses to the Commission) of this report.

Although the measures in Rec. 19-02 also applied to the western stock, no fleets were targeting western skipjack using FADs, so the impact of Rec. 19-02 on the western stock and fisheries was likely to be minimal.

SKJ-5. Management recommendations

Eastern skipjack stock

The stock status of eastern Atlantic skipjack tuna in 2020 was estimated with a high probability (78%) to be in a sustainable condition (green quadrant), with that stock not overfished or subjected to overfishing. According to the Kobe 2 Strategy Matrix (K2SM), a future constant catch using the median MSY of 216,617 t will have about 55% probability of maintaining the stock in the green quadrant of the Kobe plot through 2028. Assuming a constant catch at MSY[1], the probability of the stock biomass being below 20% of B_{MSY} in 2028 was about 17%, and the probability of stock biomass being below 10% in 2028 was about 14%. Moreover, provisional catches for 2022 are substantially higher than the MSY estimated in the last stock assessment.

The Commission should also be aware that fishing effort for skipjack also impacts other species that are caught in combination with skipjack particularly in the purse seine FOB fisheries (particularly juveniles of yellowfin and bigeye tuna).

Western skipjack stock

The status of the western Atlantic skipjack stock in 2020 was estimated with a high probability (91%) to be in healthy condition and is not overfished nor undergoing overfishing. According to the Kobe II Strategy Matrix (K2SM), a future constant catch using the median MSY of 35,277 t will have about 70% probability of maintaining the stock in the green quadrant of the Kobe plot by 2028. Assuming a constant catch at MSY, the probabilities of the stock biomass being below 20% or 10% of the B_{MSY} until 2028 are less than 1%.

The SCRS will present results of the candidate management procedures (CMPs) of the western Atlantic skipjack tuna management strategy evaluation (MSE) to the Commission for their consideration for MP adoption in line with the MSE Road Map, which is contained in item 19.36.

[1] Projections are conducted with the MSY estimated for each model of the uncertainty grid.

ATLANTIC SKIPJACK SUMMARY		
	Eastern Atlantic	***Western Atlantic***
Maximum Sustainable Yield (MSY)[1]	216,617 t (172,735 – 284,658 t)	35,277 t (28,444 – 46,340 t)
Yield for 2020 at the Stock Assessment	217,874 t	18,183 t
Current yield for 2022	271,371 t	21,383 t
Relative Biomass (B_{2020}/B_{MSY})[2]	1.60 (0.50 – 5.79)	1.60 (0.90 – 2.87)
Relative Fishing Mortality (F_{2020}/F_{MSY})[2]	0.63 (0.18 – 2.35)	0.41 (0.19 – 0.89)
Stock Status (2020)		
Overfished:	No	No
Overfishing:	No	No

[1] Median and 95% confidence interval estimated from the joint uncertainty grid.
[2] Median and 95% confidence interval based on 90,000 iterations of the multivariate lognormal (MVLN) approximation for Stock Synthesis and 90,000 Markov chain Monte Carlo (MCMC) iterations for JABBA.

SKJ-Table 1. Estimated catches (t) of skipjack tuna (*Katsuwonus pelamis*) by area; gear and flag.

			1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
TOTAL			209776	191405	174844	157152	148941	161412	182296	155487	163360	122185	154941	181467	172499	138376	145662	145104	163604	189933	219484	251498	258603	232672	242142	259762	266002	306442	275439	241133	227002	292754
	ATE		176555	161456	152984	129590	117229	132325	154940	126294	131909	100585	130192	154006	143982	111923	120223	123091	137829	164026	187096	218431	224007	205316	221076	237395	241957	283169	255318	222230	206953	271371
	ATW		33221	29949	21860	27562	31712	29087	27356	29193	31451	21600	24749	27461	28517	26453	25440	22013	25774	25907	32388	33067	34596	27356	21066	22367	24045	23273	20121	18903	20048	21383
Landings	ATE	Bait boat	31670	37767	33840	35861	36993	46506	44901	33705	56493	31167	34428	54194	48279	44700	44316	31863	35105	38607	38085	44814	30670	25682	23843	28875	25776	33437	24415	15677	16664	16194
		Longline	2	10	3	7	47	85	42	48	53	59	83	67	83	204	428	199	59	46	35	58	79	54	21	540	498	113	350	366	97	289
		Other surf.	1013	366	423	409	425	1228	301	2399	867	597	562	1324	2672	5270	3436	3803	5137	5098	5885	6769	7206	2184	2527	2623	4698	5087	5432	5784	9814	10038
		Purse seine	125997	107452	105709	89096	72015	76790	100459	79507	72492	67097	88350	90464	87660	58570	66817	81431	89059	112070	133696	159881	179759	170477	183342	190130	202265	233353	215150	189772	175056	236892
	ATW	Bait boat	19902	22855	17744	23741	27045	24727	23881	25641	25719	18737	21990	24082	26028	23766	23898	20702	23518	22803	29468	30693	32187	24817	17538	16810	14648	14926	15410	14593	15573	11687
		Longline	21	16	36	21	7	21	58	22	60	334	95	206	207	286	52	49	20	854	352	62	642	464	209	806	292	322	416	193	420	1217
		Other surf.	504	1367	2021	450	313	513	481	467	374	413	367	404	316	355	280	361	202	306	708	498	792	837	728	1534	5702	4797	2395	2432	2515	7242
		Purse seine	12794	5712	2059	3349	4347	3826	2936	3063	5297	2116	2296	2769	1967	2045	1209	901	2035	1943	1859	1814	975	1238	2524	3110	3347	3182	1881	1649	1537	1237
Landings(FP)	ATE	Bait boat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39
		Purse seine	17873	15860	13010	4217	7749	7716	9237	10634	2004	1666	6769	7956	5288	3181	5226	5796	8471	8205	9395	6909	6293	6918	10712	15227	8626	11123	9762	10610	5283	7811
	ATW	Purse seine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	67	107	55	45	19	35	0	
Discards	ATE	Bait boat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
		Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
		Purse seine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	631	0	94	56	208	22	35	106
	ATW	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Purse seine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	
Landings	ATE CP	Algerie	0	0	0	0	0	171	43	89	77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Angola	13	7	3	15	52	2	32	14	14	14	14	10	0	0	0	0	50	636	44	91	514	0	1	1	3	0	10	14	**0**	
		Belize	0	0	0	0	0	720	0	229	278	0	0	0	0	0	0	0	1373	2714	7429	15554	6218	10779	12599	7730	9958	20748	17063	19180	18044	29134
		Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1008	4948
		Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Cape Verde	1138	1176	1585	581	858	1245	1040	789	794	398	343	1097	7157	4754	5453	4682	4909	5155	7883	5535	16016	15254	17600	10925	7823	7852	5785	6068	1281	1250
		China PR	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
		Curaçao	0	0	0	7096	8444	8553	10045	11056	15450	7246	12084	10225	101	3042	1587	6436	9143	9179	11939	12779	17792	18086	19621	22180	20660	24539	17360	10841	12398	3953
		Côte d'Ivoire	0	0	0	0	0	0	0	1173	259	292	143	559	1259	1565	1817	2328	2840	2840	5968	10923	8063	2365	254	675	1534	22	3241	990	1311	2266
		EU-Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
		EU-España	63660	50538	51594	38538	38513	36008	44520	37226	30954	25466	44837	38751	28178	22292	23723	35124	36722	41235	56908	67040	66911	51628	46085	52110	57458	52912	48378	31804	37865	33569
		EU-Estonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		EU-France	33691	32798	25239	23068	17035	18323	21800	18149	16320	16180	19336	21326	14850	7033	6196	4439	7790	14900	13067	13139	16173	17674	20960	19342	16574	23112	20438	12800	16178	21217
		EU-Germany	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	**0**
		EU-Greece	0	0	0	0	0	0	0	0	0	0	102	99	99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		EU-Ireland	0	0	0	0	0	0	0	0	0	0	0	14	14	14	0	0	8	6	0	0	0	0	0	0	7	0	0	0	0	**0**
		EU-Italy	0	0	0	0	0	0	0	0	0	4	29	34	17	0	0	0	0	0	0	0	0	0	0	47	57	91	131	402	69	3483
		EU-Latvia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		EU-Lithuania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	95	0	0	6	0	0	0	0	**0**
		EU-Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	2	0	6	5
		EU-Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	9	0	0	23	0	0	0	0	0	5	1	0	0	0	0
		EU-Portugal	5651	7528	4996	8297	4399	4544	1810	1302	2167	2958	4315	8504	4735	11158	8995	6057	1084	12974	4143	2794	4049	1712	1347	708	1785	7480	2799	1033	6640	4026
		EU-Rumania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6970	16949	14577	17045	16729	14806	9374	10633
		Gabon	1	11	51	26	0	59	76	21	101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
		Gambia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	0	
		Ghana	20225	21258	18607	24205	26380	43612	54088	36517	57540	40194	34435	47746	54209	31934	35419	38648	43922	45505	44169	54032	48064	49986	61849	54723	57496	68147	62855	63223	44489	76751
		Guatemala	0	0	0	0	0	0	0	0	0	0	2120	4808	6389	4959	5546	6319	4036	2951	2829	3631	4907	5811	7078	7386	9800	8648	7626	6503	5873	6839
		Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1224	1224	1010	0	1	1	3	1	0	1	1	1	1	1
		Guinée Rep	0	0	975	6432	2408	0	0	0	0	0	0	0	0	0	0	0	0	1500	1473	7942	7363	5484	0	0	0	0	0	0	888	5133
		Japan	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	4	5	2	4	1	1	3	5	2	3	3
		Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	1	1	1
		Liberia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	61	80	49	98	21	19	29	21	6770	489	0
		Maroc	3652	3672	6886	2859	5532	4741	4176	4091	1737	1303	3403	3843	4666	4032	1592	1309	2580	2343	2151	2267	2045	1068	576	258	750	3585	1258	3171	5503	4189
		Namibia	0	2	15	0	1	0	0	0	8	0	0	0	0	0	0	0	71	2	2	15	1	0	0	1	1	0	0	1	11	19
		Nigeria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	12	4	0	0	0	6	2	0	0	0	0	**0**
		Norway	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Panama	13027	12978	14853	5855	1300	572	1308	1559	281	342	0	7126	11490	13468	18821	8253	8518	9590	12509	10927	14558	14165	8372	11510	8815	9089	10926	10626	10554	13192
		Russian Federation	540	1471	1450	381	1146	2086	1426	374	0	0	0	0	0	392	1130	313	260	0	20	0	0	2	1	1	110	178	25	6	0	**0**
		S Tomé e Príncipe	212	190	180	187	178	169	181	179	179	179	179	117	166	143	0	229	235	241	247	254	260	266	360	380	346	15	36	40	87	120
		Senegal	108	64	282	238	429	1983	1784	1357	1284	1178	639	1456	5033	3858	4552	3045	4566	2743	5441	4477	4659	3931	5943	17082	25431	28476	30633	23286	29537	42671
		South Africa	6	4	4	1	6	2	1	7	1	1	2	2	1	0	0	4	4	2	6	8	2	5	2	2	1	2	2	1	1	2
		St Vincent and Grenadines	5731	2184	1847	1501	1191	1441	2127	1422	1435	524	42	0	0	1	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	**0**
		Syria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	36	0	0	0	15	17	0	0	0	0	0	0	0	0	**0**
		UK-Sta Helena	65	55	115	86	294	298	13	64	205	63	178	317	321	88	110	45	15	25	371	29	7	26	6	127	9	7	28	1	2	1
		USA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		USSR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Venezuela	0	0	0	0	0	0	0	0	35	2407	1197	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**

				1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
		NCC	Chinese Taipei	2	10	3	5	47	73	39	41	24	23	26	16	10	9	14	19	6	11	15	2	12	9	4	2	2	3	4	4	4	3
		NCO	Benin	2	2	2	2	7	3	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Cayman Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Congo	10	7	7	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Cuba	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			NEI (ETRO)	133	744	2803	0	27	0	0	0	760	148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Vanuatu	10808	10896	8477	5992	1233	0	1192	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	ATW	CP	Barbados	6	6	6	5	5	10	3	3	0	0	0	0	0	0	0	0	0	0	1	2	0	1	1	1	2	1	1	0	0	1
			Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	164	0	0	0	0	0	**0**
			Brazil	17771	20588	16560	22528	26564	23789	23188	25164	24146	18338	20416	23037	26388	23270	24191	20846	23307	23456	30571	30863	32438	25195	18133	18231	20068	19687	17925	17432	18788	20544
			Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	94	0	88	0	**0**
			China PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42
			Curaçao	45	40	35	30	30	30	30	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	100	123	157	35	30	0	151
			EU-España	397	0	0	0	0	0	1	1	0	0	0	0	0	0	5	11	0	0	0	0	0	0	0	641	223	109	192	124	78	147
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	10	0	0	0	0	25	224	282	23	2	210	10
			EU-Portugal	0	0	0	0	0	0	0	4	1	0	3	3	5	21	11	0	6	0	8	0	0	0	0	0	0	0	0	0	0	**0**
			El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	85	35	135	27	0	70	0	37
			Ghana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	232	67	160	265	160	411	1234	700	283	0	**0**
			Grenada	25	11	12	11	15	23	23	23	15	14	16	21	22	15	26	20	0	0	0	0	0	0	22	17	17	18	30	10	13	18
			Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	86	54	44	7	91	**0**
			Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Mexico	1	1	0	2	3	6	51	13	54	71	75	9	7	10	7	8	9	7	9	8	5	5	7	10	6	6	4	4	3	3
			Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	543	410	161	185	0	0	22	40	0	31
			St Vincent and Grenadines	66	56	53	37	42	57	37	68	97	357	92	251	251	355	90	83	54	46	50	0	36	39	47	0	78	36	35	29	0	**0**
			Trinidad and Tobago	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			UK-Bermuda	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
			UK-British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			USA	367	99	82	85	84	106	152	44	70	88	79	103	30	61	66	67	119	95	107	99	326	183	94	179	199	78	46	68	65	103
			Venezuela	11172	6697	2387	3574	3834	4114	2981	2890	6870	2554	3247	3270	1093	2008	921	757	2250	2119	1473	1742	1002	1179	2019	2317	2222	1276	927	614	694	213
		NCC	Chinese Taipei	9	7	2	10	1	2	1	0	1	16	14	27	28	29	2	8	0	2	1	11	1	2	21	17	34	32	27	19	19	8
		NCO	Argentina	50	1	0	1	0	2	0	1	0	0	0	30	0	0	0	0	3	12	0	0	0	0	0	0	0	0	0	0	0	
			Colombia	2074	789	1583	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Cuba	1017	1268	886	1000	1000	651	651	651	0	0	624	545	514	536	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Dominica	24	43	33	33	33	33	85	86	45	55	51	30	20	28	32	45	25	0	13	0	4	41	16	27	21	11	10	4	0	
			Dominican Republic	143	257	146	146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Jamaica	0	0	0	62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	0	
			Saint Kitts and Nevis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
			Sta Lucia	53	86	72	38	100	263	153	216	151	106	132	137	159	120	89	168	0	153	143	109	171	139	87	138	142	122	78	44	83	73
Landings(FP)	ATE	CP	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	395	368	179	636	301	0	0	0	0	0	0	0	**0**
			Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	419	131	162	276	603	726	411	230	428	1362	1485	1046	327	512	355	410	0	**0**
			Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	88	171	116	105	917	415	441	545	520	351	0	0	0	0	0	0	447	**0**
			Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42	562	544	202	0	0	0	0	0	0	0	**0**
			EU-España	5959	4719	2899	453	1990	2562	3802	3700	0	0	1738	1907	713	437	366	1158	1994	1394	1842	983	998	1623	3028	3658	2788	1943	2396	1809	2035	2163
			EU-France	8055	7573	5568	2447	3414	3647	4316	4740	1786	1601	3484	3096	918	346	206	287	1120	743	1480	1646	463	440	1716	1920	893	2169	1616	1681	2206	3355
			El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1223
			Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	260	69	66	162	59	136	51	102	72	93	0	0	0	0	0	0	180	496
			Guinée Rep	0	0	0	0	0	0	0	0	0	0	0	0	387	0	330	118	359	614	1778	2379	1670	2146	0	0	0	0	0	0	0	**0**
			Panama	0	0	0	0	0	0	0	0	0	0	0	0	796	548	977	693	680	354	609	284	962	400	0	0	0	0	0	0	415	613
		NCO	Mixed flags (EU tropical)	3858	3568	4543	1316	2345	1508	1119	2194	218	65	1547	2953	1708	1478	3003	2998	2624	3427	2372	0	0	0	4484	8603	4618	6499	5396	6710	0	
	ATW	CP	Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	9	0	9	0	**0**
			EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	67	35	7	13	9	0	**0**
		NCO	Mixed flags (EU tropical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58	37	21	29	6	17	0	
Discards	ATE	CP	Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**0**
			EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	631	0	94	56	208	22	35	106
			EU-Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Russian Federation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	ATW	CP	EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	**0**
			Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			UK-Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**

SKJ-Table 2. CAS (catch-at-size) matrix estimated for SKJ-E (eastern stock) in thousands of fish caught, by year and 2 cm size classes.

	Year																																																		
Li (2cm)	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
20	0	0	1	0	0	0	0	66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	1	0	0	0	0	4145	0	0	1	0
22	0	1	6	0	0	0	0	2	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	3	0	1	15	3	0	5
24	0	6	34	4	0	0	0	0	0	1	0	14	0	0	0	0	0	0	1	1	1	1	2	1	2	2	1	0	1	1	1	2	0	0	1	6	1	3	1	7	10	21	1	0	0	8	6	13	24	11	5	4
26	1	13	45	4	0	0	0	0	0	3	0	7	37	1	1	1	1	0	5	5	5	6	16	13	19	17	17	4	8	8	11	11	7	2	7	10	11	6	8	41	25	55	5	5	4	20	20	30	27	57	30	28
28	2	20	98	40	1	14	1	2	0	4	3	10	207	28	8	4	4	2	29	28	31	35	92	78	109	97	81	27	61	63	60	70	33	26	41	67	35	34	48	95	67	118	22	55	29	80	60	117	134	123	89	116
30	3	18	25	4	6	40	11	59	7	49	30	69	195	82	63	30	22	13	139	145	154	186	462	379	549	471	390	145	330	311	342	366	138	142	293	523	230	183	288	382	269	324	252	383	246	349	455	811	779	719	516	515
32	3	16	28	18	10	63	15	73	67	58	211	221	315	180	175	90	53	40	436	463	492	587	1430	1189	1645	1521	1261	520	1028	920	1118	1168	483	378	1005	1791	706	584	1081	1045	1054	1046	1108	1326	843	1009	1451	2568	2318	2392	1796	1976
34	31	57	88	93	131	279	54	169	200	197	314	543	664	489	460	262	206	145	935	975	1064	1188	2765	2283	3192	3004	2456	1316	2085	1716	2414	2336	953	811	2030	3453	1973	1172	2523	2423	2818	3055	3499	4131	2045	2472	3529	5516	5277	5913	4051	4521
36	73	112	161	167	358	744	246	386	493	632	895	1950	1008	1194	1037	652	603	573	1475	1638	1634	1860	4149	3373	4643	4385	3768	2731	3422	2592	3665	3723	2160	1633	3284	4677	3304	1866	4639	3792	5386	5557	7082	7362	3363	4997	5964	7583	9332	10659	7674	7431
38	240	377	707	904	1013	2078	644	1318	1345	1514	1718	3110	2914	2512	2115	1264	1301	1183	1788	2595	2452	2874	5454	4087	5796	5489	5337	3556	4249	3244	4565	4638	3721	2716	4526	5178	4478	2954	6275	4740	6189	7031	9873	9477	4466	6209	5823	9489	14112	15679	10985	10105
40	466	834	1771	1850	2584	5500	1396	3105	2984	3467	2818	4613	5792	5083	4161	2828	3003	1923	2873	4772	3890	4250	7835	6102	8632	6798	8127	5582	5415	4409	7059	6654	6391	4148	6205	6422	6544	4683	8124	5773	6455	9679	11951	11654	6108	8236	8495	14280	19006	22065	17171	15242
42	870	1685	3268	3123	4836	8551	2181	4038	4286	5124	3817	6139	8555	7530	7647	5279	5163	3688	5155	8087	5912	6321	12267	9322	12041	10183	12771	9548	7912	6743	10726	8182	9074	5832	8788	8143	9041	6848	8711	7685	7242	10924	13469	12299	7297	9701	13151	16993	20404	25817	19362	16646
44	1555	3301	5077	4843	7418	9364	2744	4676	5359	6572	5133	6514	9817	9390	9033	6635	5633	6784	6801	11022	7190	8355	15072	11687	14621	13058	14890	11521	8926	9530	13306	8473	10222	7138	10306	9769	10159	8166	8429	8521	8344	11115	13559	12459	9324	11775	16208	16143	19485	24687	19420	15613
46	1299	3188	4128	3953	5969	8204	2764	3994	6284	7182	6053	6165	8229	11027	9690	6104	4738	8674	7537	10436	7591	9682	15780	12262	16248	14204	13457	12145	10178	11360	12818	8123	9029	7592	9235	10458	9695	7986	7391	7671	8264	10545	11421	13222	10319	12328	13482	12622	16231	20569	17256	13770
48	1070	2590	3555	3821	3685	6076	2129	3357	6648	5961	4708	5337	5538	7235	6943	5245	3954	7097	5951	7628	5988	8055	12395	8430	11789	11042	9206	8467	7895	9350	8939	6779	7583	6667	7057	9988	7959	6498	5397	6207	6472	9279	8567	10897	9866	10236	9728	10546	11076	13409	12417	9867
50	981	1776	3289	3385	2159	4020	1977	2823	5797	4095	3339	3774	3842	4527	3898	4579	3110	4439	4213	4525	4220	5286	8042	4824	5781	5622	4329	3815	4210	5722	6353	4950	5544	4486	4954	6982	6023	4470	3551	4249	4631	6480	5888	7511	7909	6708	6814	7857	6535	7502	7507	5843
52	1150	1783	3229	3129	1952	2564	1798	1836	3838	2692	2055	2821	2725	3131	2459	3467	2431	2847	3113	2746	2605	3173	4461	2687	2954	3549	2251	2247	2642	3894	3452	2971	3504	2709	2865	4050	3681	2958	2531	3143	3226	4293	4268	5302	6903	5023	5597	5315	3923	4229	4857	4062
54	1138	1627	2775	2693	1915	1760	1470	1529	2528	2046	1420	1875	1767	2110	1420	2119	1756	1617	1648	1592	1396	1965	2516	1507	1815	1647	1053	1365	1129	1829	2042	2243	2052	1574	1675	2209	2202	2008	1774	2117	2476	2347	2925	3574	6114	3868	3969	3880	2328	2500	3042	2598
56	797	1122	1681	1702	1343	1086	1168	1073	1697	1616	967	1110	1005	1648	771	1056	1145	898	943	976	777	1081	1388	887	1132	1009	681	948	691	1014	1060	1304	1104	938	1091	1433	1552	1408	1148	1388	1750	1525	1942	2645	4544	2919	2828	2601	1664	1534	2528	1996
58	498	606	927	853	770	651	579	635	1130	1169	632	639	595	942	445	469	740	468	521	600	411	569	868	595	700	626	583	645	489	701	652	900	797	609	776	826	955	800	779	908	1393	918	1373	1866	3474	2147	2038	1943	1070	1154	1785	1547
60	275	317	458	354	294	611	535	385	760	613	565	532	375	516	319	232	494	219	394	401	271	404	469	472	501	441	474	468	345	441	403	563	552	398	576	580	642	435	637	696	924	556	780	1583	2560	1681	1398	1291	866	926	1559	1253
62	115	135	198	194	165	303	236	177	393	445	491	370	315	217	192	199	347	137	248	269	205	288	308	388	336	267	359	305	246	239	220	335	346	227	364	405	460	267	418	412	644	373	504	1144	1969	1233	956	826	621	565	946	811
64	29	63	111	89	80	105	205	93	238	203	343	223	144	114	135	160	203	74	149	144	117	223	189	330	157	194	220	176	129	150	171	152	216	116	224	280	297	137	187	335	472	181	262	637	1322	875	571	584	400	275	614	542
66	8	24	37	42	52	127	222	45	122	149	201	153	111	91	61	122	104	37	91	51	41	142	137	251	96	129	133	111	47	75	107	79	112	54	184	134	155	79	103	126	145	68	134	300	706	584	474	348	169	96	334	362
68	8	8	24	19	36	41	106	21	93	107	177	121	66	35	32	75	56	10	30	16	19	78	81	166	95	98	78	75	38	24	40	38	77	31	91	68	99	61	33	46	75	47	53	139	239	329	378	220	99	48	158	154
70	1	0	0	6	8	27	71	22	37	75	61	69	35	21	7	35	22	2	8	4	32	25	35	99	38	39	37	30	12	20	19	52	20	16	46	28	24	28	17	17	35	9	29	18	85	170	337	104	39	22	44	38
72	1	0	0	1	1	3	34	6	5	34	29	34	28	9	12	8	7	1	3	4	27	10	13	26	9	25	23	5	5	8	11	20	7	12	27	14	15	11	18	11	37	9	9	19	31	50	161	84	33	2	11	7
74	4	7	10	12	8	3	23	3	2	9	12	4	8	5	1	6	3	0	1	6	10	1	1	13	7	8	7	1	0	2	1	3	2	10	12	7	7	5	20	16	11	0	4	4	10	5	88	33	13	1	4	1
76	0	0	0	0	0	2	7	0	6	2	1	2	2	1	0	1	0	0	1	7	1	0	0	4	3	1	1	0	3	2	3	3	2	4	2	3	5	9	12	8	1	1	3	1	2	1	4	8	4	0	0	0
78	0	0	0	0	0	5	2	1	11	5	0	0	1	1	1	1	0	0	1	9	1	0	0	3	0	0	0	0	0	0	0	1	3	3	4	1	3	4	3	1	1	1	3	0	0	1	1	0	2	0	1	0
80	0	0	0	0	0	0	7	1	5	0	0	1	0	1	0	1	0	0	1	3	0	0	0	0	0	0	0	0	0	1	1	0	0	1	2	0	1	3	2	2	0	1	1	0	0	0	0	1	1	0	1	0
82	0	0	0	0	0	0	0	0	9	0	0	0	0	2	0	0	0	0	1	1	0	0	0	0	0	0	0	0	3	1	0	0	0	1	1	18	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
84	0	0	0	0	0	0	0	0	3	4	13	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
86	0	0	0	0	0	0	0	0	6	9	26	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
88	0	1	0	0	0	0	0	0	9	9	26	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
90	0	1	0	0	0	232	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	4	2	0	0	1	0	1	1	2	5	0	0	0	1	2	1	0	2	0	1	0	0	0	0
TOTAL	10619	19687	31734	31305	34796	52451	20627	29895	44370	44045	36061	46425	54290	58121	51087	40924	35098	40871	44495	59151	46536	56644	96228	71456	92910	83925	81992	65756	61508	64371	79561	64138	64134	48273	65674	77527	70263	53671	64151	61860	68417	85562	98989	108017	89778	93021	103985	125952	135986	160957	134165	115056

SKJ-Table 3. CAS (catch-at-size) matrix estimated for SKJ-W (western stock) in thousands of fish caught, by year and 2 cm size classes.

	Year																							
Li (2cm)	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0
24	0	1	1	1	1	1	0	0	0	1	0	2	0	0	0	0	0	0	0	0	1	1	0	0
26	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	0	0	0	1	0	1	0	1	0
28	1	2	2	2	2	2	1	1	1	1	0	1	0	0	1	0	0	0	2	1	2	1	3	0
30	2	3	2	2	2	3	2	2	1	4	1	8	1	2	1	1	12	15	3	1	2	1	4	0
32	5	7	6	6	6	7	7	8	7	10	5	14	1	1	1	2	15	33	4	4	4	2	13	1
34	5	7	6	6	6	7	26	30	27	16	11	18	2	1	3	10	14	24	5	5	6	3	30	22
36	7	10	9	8	9	13	39	45	40	23	22	23	4	3	17	29	74	62	16	15	35	33	49	77
38	23	34	30	30	30	46	66	70	64	44	49	44	8	6	27	57	59	121	75	36	76	48	129	68
40	25	38	34	36	35	78	107	117	106	83	84	91	30	34	56	166	694	305	105	63	86	67	202	121
42	33	50	45	49	47	116	110	110	104	113	95	186	119	342	385	706	1047	383	93	108	121	101	393	221
44	50	75	67	75	73	161	161	147	140	160	127	273	211	556	600	1016	1100	407	311	229	235	147	518	357
46	59	87	78	81	89	175	159	149	140	210	153	266	231	253	373	547	945	551	385	389	419	357	764	530
48	55	82	72	72	89	166	152	154	148	219	154	274	300	289	380	475	1041	710	648	647	583	756	1070	707
50	54	79	69	68	93	129	127	130	123	198	188	241	461	436	588	582	1637	922	729	919	958	1258	1204	741
52	43	56	48	52	63	84	107	120	95	165	131	192	792	847	877	986	1448	1111	701	929	1183	1473	1291	821
54	30	39	32	34	43	61	83	87	69	139	106	197	710	1025	933	1122	1437	1288	795	778	1129	1437	1214	863
56	29	36	27	27	31	41	64	72	58	116	119	215	684	932	811	824	1300	1323	854	743	952	1067	1093	851
58	31	34	22	25	27	30	41	56	49	98	123	278	467	676	643	638	1054	1003	792	682	830	565	855	790
60	37	41	27	31	37	33	43	62	52	76	113	289	496	550	529	527	681	691	528	509	424	287	588	595
62	21	25	16	16	27	19	19	26	25	55	85	241	400	580	491	592	390	369	251	326	265	187	373	399
64	21	24	17	18	25	21	16	23	20	51	73	187	313	461	359	422	184	168	155	189	121	68	182	282
66	11	10	6	9	10	7	12	22	18	49	46	136	253	420	354	419	95	86	103	97	83	49	119	159
68	8	11	7	7	10	9	5	6	7	38	34	89	121	280	269	255	54	42	90	40	51	19	49	127
70	16	23	21	19	24	27	8	5	5	26	21	64	83	211	229	238	33	34	51	19	56	9	19	81
72	10	15	14	12	17	17	5	3	3	13	12	25	50	79	102	79	30	21	53	16	14	5	31	85
74	2	4	4	3	6	6	4	2	2	7	7	16	36	26	48	22	11	10	29	19	14	13	15	39
76	0	1	1	1	2	1	1	0	0	4	4	12	24	18	41	12	2	4	10	7	5	5	15	34
78	0	0	0	0	1	1	0	0	0	6	7	3	10	6	16	7	2	2	3	15	11	11	13	38
80	0	0	0	0	1	0	0	0	0	4	8	0	0	1	4	5	1	1	1	1	0	0	5	3
82	0	0	0	0	0	0	0	0	0	9	4	0	0	1	2	11	0	1	1	0	11	7	16	11
84	0	0	0	0	1	0	0	0	0	6	4	0	0	0	0	2	1	0	0	0	0	0	1	6
86	0	0	0	0	0	0	0	0	0	1	4	0	0	0	0	1	0	0	1	1	0	0	0	0
88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	28
TOTAL	578	796	665	693	808	1263	1369	1449	1303	1944	1792	3385	5808	8036	8141	9750	13363	9691	6797	6786	7677	7979	10258	8057

Li (2cm)	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	18	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0
24	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7	0	0	0	0	0	1	0	0	0	0
26	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	6	0	0	0	0	0	1	0	3	0	0
28	1	5	1	0	0	0	0	0	0	0	0	1	3	0	1	0	1	0	0	0	14	33	0	4	2	2	1	2
30	17	10	2	1	2	0	2	0	4	0	2	10	6	3	2	1	2	1	1	1	36	0	1	16	10	8	4	4
32	56	31	4	2	3	1	3	8	11	2	4	16	9	0	9	1	10	5	2	0	12	1	4	39	24	59	30	11
34	127	35	11	8	11	5	11	29	52	8	10	34	16	0	23	3	23	13	6	0	15	33	29	109	87	62	48	48
36	305	58	32	27	34	10	27	32	86	16	12	24	34	2	39	12	40	28	21	11	8	1	14	300	271	242	214	207
38	512	148	79	65	75	48	75	92	144	29	30	47	45	9	78	13	69	47	30	12	10	136	74	453	435	398	378	350
40	586	281	114	152	174	119	147	144	294	45	84	67	102	30	94	25	76	70	35	26	187	75	141	244	335	248	160	149
42	687	326	146	173	167	140	125	150	350	74	175	128	247	105	133	190	160	278	242	309	93	150	185	265	571	295	226	165
44	894	512	204	208	187	177	132	201	425	103	319	382	458	338	223	362	288	479	475	596	295	61	512	396	843	439	350	277
46	855	716	283	320	302	296	185	187	413	188	473	901	634	477	316	442	615	634	735	742	524	994	571	636	988	769	592	489
48	793	837	434	510	466	400	344	312	577	329	567	1228	909	899	411	908	847	850	1035	996	507	1622	842	894	1096	1097	894	694
50	833	981	531	579	732	522	517	519	801	526	614	1316	1337	1207	696	979	963	900	1163	995	2050	2410	486	1004	1061	1140	975	816
52	885	1020	621	690	1000	826	697	735	935	689	675	904	1486	1306	775	704	1053	807	1154	981	3063	1783	494	972	980	1025	918	783
54	1213	914	607	739	1180	963	821	895	1013	725	740	809	1426	1327	587	501	898	686	1026	919	1536	807	439	616	632	834	711	486
56	991	899	566	775	1206	935	898	959	952	714	745	726	1091	955	478	391	758	570	841	784	667	420	429	758	689	599	616	562
58	898	798	626	850	1063	1004	985	1066	817	620	684	568	543	723	418	388	611	484	692	701	843	341	550	663	661	603	601	562
60	553	647	538	743	782	880	861	916	551	407	457	471	334	356	404	302	493	396	547	584	526	107	389	218	205	200	184	256
62	362	420	436	584	509	569	556	602	449	321	371	372	175	188	368	217	322	277	375	416	287	203	446	116	100	79	70	108
64	271	219	256	340	292	297	291	321	327	230	256	265	107	102	405	113	147	123	170	190	20	68	215	64	46	67	37	48
66	97	86	114	157	193	194	190	208	268	196	214	109	39	49	322	123	113	129	145	168	2	69	156	35	11	9	5	35
68	41	43	64	85	99	103	104	104	197	136	149	37	19	11	270	136	78	150	151	186	1	38	96	19	9	9	3	12
70	66	35	57	73	41	47	46	41	57	48	47	17	21	0	146	117	47	128	121	157	0	2	22	14	5	5	1	27
72	18	28	49	54	13	10	12	10	50	40	41	14	19	0	75	56	27	72	61	76	1	0	22	12	3	3	3	24
74	21	27	26	26	11	9	9	7	31	25	26	7	8	6	50	70	10	76	65	91	19	5	24	4	3	3	1	0
76	30	13	12	8	4	5	2	3	25	16	16	8	4	9	31	41	10	46	38	52	1	1	3	4	2	5	1	22
78	8	10	16	13	8	5	5	5	2	2	2	6	5	7	5	27	1	29	24	34	20	0	12	1	1	54	28	0
80	4	1	3	5	0	0	0	0	4	3	6	5	3	6	6	22	5	24	19	26	0	0	0	0	1	10	13	21
82	2	1	1	2	0	1	0	0	2	2	2	0	0	0	3	7	1	7	6	9	2	0	6	0	1	6	5	21
84	2	7	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	0	6	0	0	1	1	0	0
86	0	2	3	4	0	0	0	0	0	0	0	0	0	0	0	7	1	7	6	9	0	6	3	0	4	0	0	21
88	1	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	7	1	0	0	0
90	1	1	1	0	0	1	0	0	0	8	1	3	0	0	1	0	0	1	0	0	24	11	0	14	6	0	1	0
TOTAL	11131	9116	5838	7193	8555	7567	7046	7548	8837	5500	6722	8478	9085	8116	6369	6161	7670	7332	9187	9072	10781	9382	6165	7881	9085	8272	7072	6201

SKJ-Table 4. SKJ-E. The probability of stock biomass being below 10% or 20% of B_{MSY} during the projection period for a given catch level and is based on 180,000 iterations of the MVLN and MCMC statistical analyses developed from the Stock Synthesis and JABBA model runs (2 model platforms x 3 steepness options x 3 growth/M options x 2 index combinations).

Probability of B<10%*B_{MSY}

TAC (kt)	2023	2024	2025	2026	2027	2028
100	5%	6%	6%	6%	6%	6%
110	5%	6%	6%	6%	6%	7%
120	5%	6%	6%	7%	7%	7%
130	5%	6%	7%	7%	7%	7%
140	5%	6%	7%	7%	7%	7%
150	5%	6%	7%	7%	8%	8%
160	5%	7%	7%	8%	8%	8%
170	5%	7%	7%	8%	8%	9%
180	5%	7%	8%	8%	9%	9%
190	5%	7%	8%	9%	9%	10%
200	5%	7%	8%	9%	10%	10%
210	5%	7%	9%	10%	11%	12%
220	5%	7%	9%	10%	12%	14%
230	5%	7%	9%	11%	14%	15%
240	5%	8%	10%	13%	15%	17%
250	5%	8%	10%	14%	17%	20%
260	5%	8%	11%	15%	19%	23%
270	5%	8%	13%	17%	21%	31%
280	5%	9%	14%	18%	27%	48%
290	5%	9%	15%	21%	41%	51%
300	5%	10%	16%	27%	49%	54%

Probability of B<20%*B_{MSY}

TAC (kt)	2023	2024	2025	2026	2027	2028
100	6%	6%	6%	6%	6%	6%
110	6%	6%	6%	7%	7%	7%
120	6%	6%	7%	7%	7%	7%
130	6%	7%	7%	7%	7%	7%
140	6%	7%	7%	7%	7%	7%
150	6%	7%	7%	8%	8%	8%
160	6%	7%	7%	8%	8%	8%
170	6%	7%	8%	8%	8%	9%
180	6%	7%	8%	9%	9%	9%
190	6%	7%	8%	9%	10%	10%
200	6%	7%	9%	9%	10%	11%
210	6%	8%	9%	10%	11%	14%
220	6%	8%	9%	11%	14%	17%
230	6%	8%	10%	13%	17%	20%
240	6%	8%	11%	16%	19%	22%
250	6%	9%	13%	18%	22%	26%
260	6%	9%	15%	20%	25%	32%
270	6%	10%	17%	22%	29%	43%
280	6%	11%	18%	25%	38%	61%
290	6%	12%	20%	30%	54%	64%
300	6%	13%	22%	38%	61%	67%

SKJ-Table 5. SKJ-E. Joint probabilities of the eastern Atlantic skipjack stock being below F_{MSY} (overfishing not occurring), above B_{MSY} (not overfished) and above B_{MSY} and below F_{MSY} (green zone) in a given year for a given catch level (thousand t), based on 90,000 iterations of the MVLN approximation for Stock Synthesis and 90,000 MCMC iterations for JABBA.

Probaility $F<=F_{MSY}$

TAC (kt)	2023	2024	2025	2026	2027	2028
100	91%	92%	93%	93%	93%	94%
110	90%	92%	92%	93%	93%	93%
120	89%	91%	92%	92%	93%	93%
130	88%	90%	91%	92%	92%	92%
140	87%	89%	90%	91%	91%	92%
150	85%	87%	88%	89%	90%	90%
160	84%	85%	86%	87%	88%	88%
170	82%	84%	84%	85%	85%	86%
180	81%	81%	82%	82%	82%	82%
190	79%	79%	79%	78%	77%	76%
200	77%	76%	75%	73%	71%	70%
210	75%	73%	71%	68%	65%	63%
220	73%	70%	67%	63%	59%	57%
230	71%	67%	62%	57%	53%	50%
240	69%	63%	57%	51%	46%	42%
250	67%	60%	52%	45%	39%	35%
260	65%	56%	47%	38%	32%	27%
270	63%	52%	42%	33%	26%	20%
280	60%	48%	36%	27%	20%	14%
290	58%	44%	31%	21%	14%	10%
300	56%	40%	26%	16%	10%	7%

Probability $SSB>=SSB_{MSY}$ or $B>=B_{MSY}$

TAC (kt)	2023	2024	2025	2026	2027	2028
100	82%	88%	91%	92%	93%	93%
110	82%	88%	90%	92%	92%	93%
120	82%	87%	90%	91%	92%	92%
130	82%	87%	89%	91%	92%	92%
140	81%	86%	88%	90%	91%	91%
150	81%	85%	87%	89%	90%	90%
160	81%	84%	86%	87%	88%	89%
170	80%	83%	84%	85%	86%	87%
180	80%	81%	82%	82%	82%	83%
190	79%	80%	80%	79%	78%	77%
200	79%	78%	77%	74%	72%	70%
210	78%	76%	73%	70%	66%	63%
220	77%	74%	69%	64%	60%	58%
230	77%	72%	65%	59%	55%	52%
240	76%	69%	61%	54%	49%	45%
250	75%	66%	57%	49%	43%	37%
260	74%	63%	53%	44%	36%	29%
270	73%	61%	48%	38%	29%	19%
280	72%	57%	44%	32%	20%	12%
290	71%	54%	39%	24%	12%	9%
300	70%	51%	34%	17%	9%	7%

Probability $F<=F_{MSY}$ and $SSB>=SSB_{MSY}$ or $B>=B_{MSY}$

TAC (kt)	2023	2024	2025	2026	2027	2028
100	82%	88%	91%	92%	93%	93%
110	82%	88%	90%	92%	92%	93%
120	81%	87%	90%	91%	92%	92%
130	81%	86%	89%	90%	91%	92%
140	81%	85%	88%	89%	90%	91%
150	80%	84%	86%	88%	89%	90%
160	79%	83%	84%	86%	87%	88%
170	79%	81%	83%	84%	84%	85%
180	78%	79%	80%	80%	81%	81%
190	77%	77%	77%	77%	76%	75%
200	76%	75%	74%	72%	70%	68%
210	75%	72%	70%	67%	63%	61%
220	73%	70%	65%	61%	57%	55%
230	71%	66%	60%	55%	51%	48%
240	69%	63%	55%	49%	45%	41%
250	67%	59%	50%	43%	38%	33%
260	65%	54%	45%	37%	31%	25%
270	62%	50%	40%	32%	24%	17%
280	60%	46%	34%	26%	17%	10%
290	58%	41%	30%	19%	10%	8%
300	55%	38%	25%	13%	7%	6%

SKJ-Table 6. SKJ-W. The probability of stock biomass being below 10% or 20% of B_{MSY} during the projection period for a given catch level and is based on 200,000 iterations of the MVLN approximation for the Stock Synthesis.

Probability of B<10%*B_{MSY}

TAC (1000s mt)	2023	2024	2025	2026	2027	2028
16	0%	0%	0%	0%	0%	0%
18	0%	0%	0%	0%	0%	0%
20	0%	0%	0%	0%	0%	0%
22	0%	0%	0%	0%	0%	0%
24	0%	0%	0%	0%	0%	0%
26	0%	0%	0%	0%	0%	0%
28	0%	0%	0%	0%	0%	0%
30	0%	0%	0%	0%	0%	0%
32	0%	0%	0%	0%	0%	0%
33	0%	0%	0%	0%	0%	0%
34	0%	0%	0%	0%	0%	0%
35	0%	0%	0%	0%	0%	0%
36	0%	0%	0%	0%	0%	0%
38	0%	0%	0%	0%	0%	0%
40	0%	0%	0%	0%	0%	0%

Probability of B<20%*B_{MSY}

TAC (1000s mt)	2023	2024	2025	2026	2027	2028
16	0%	0%	0%	0%	0%	0%
18	0%	0%	0%	0%	0%	0%
20	0%	0%	0%	0%	0%	0%
22	0%	0%	0%	0%	0%	0%
24	0%	0%	0%	0%	0%	0%
26	0%	0%	0%	0%	0%	0%
28	0%	0%	0%	0%	0%	0%
30	0%	0%	0%	0%	0%	0%
32	0%	0%	0%	0%	0%	0%
33	0%	0%	0%	0%	0%	0%
34	0%	0%	0%	0%	0%	0%
35	0%	0%	0%	0%	0%	0%
36	0%	0%	0%	0%	0%	0%
38	0%	0%	0%	0%	0%	1%
40	0%	0%	0%	0%	1%	3%

SKJ-Table 7. SKJ-W. Estimated probabilities of the western Atlantic skipjack stock being below F_{MSY} (overfishing not occurring), above B_{MSY} (not overfished) and above B_{MSY} and below F_{MSY} (green zone) in a given year for a given catch level (thousand t), based on 200,000 iterations of the MVLN approximation.

Probaility $F<=F_{MSY}$

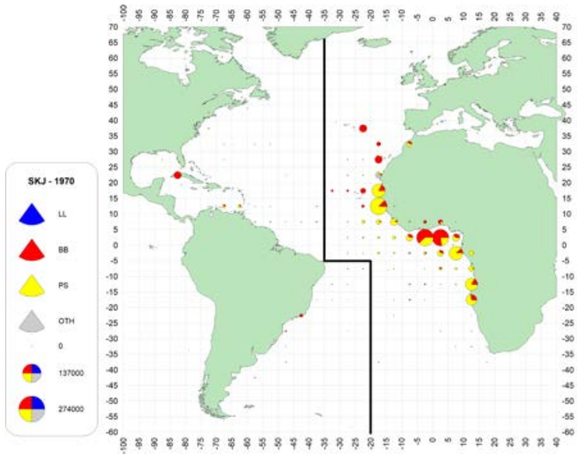
TAC (1000s mt)	2023	2024	2025	2026	2027	2028
16	100%	100%	100%	100%	100%	100%
18	100%	100%	100%	100%	100%	100%
20	100%	100%	100%	100%	100%	100%
22	99%	100%	100%	100%	100%	100%
24	99%	99%	99%	100%	100%	100%
26	98%	98%	98%	99%	99%	99%
28	97%	97%	97%	97%	97%	97%
30	96%	95%	94%	93%	93%	92%
32	94%	92%	91%	89%	87%	85%
33	93%	91%	88%	86%	83%	80%
34	92%	89%	86%	82%	79%	75%
35	91%	87%	83%	78%	74%	70%
36	90%	85%	80%	75%	70%	65%
38	88%	81%	74%	67%	61%	56%
40	85%	76%	67%	59%	53%	48%

Probability $SSB>=SSB_{MSY}$

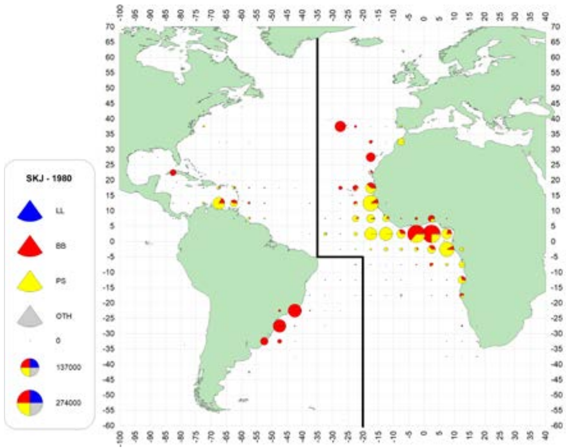
TAC (1000s mt)	2023	2024	2025	2026	2027	2028
16	99%	100%	100%	100%	100%	100%
18	99%	100%	100%	100%	100%	100%
20	99%	100%	100%	100%	100%	100%
22	99%	99%	100%	100%	100%	100%
24	99%	99%	99%	100%	100%	100%
26	98%	99%	99%	99%	99%	99%
28	98%	98%	98%	98%	98%	98%
30	98%	97%	96%	96%	95%	94%
32	97%	96%	94%	92%	90%	88%
33	97%	95%	93%	90%	87%	84%
34	96%	94%	91%	87%	83%	79%
35	96%	93%	89%	84%	79%	74%
36	96%	92%	87%	81%	75%	69%
38	95%	89%	82%	73%	66%	60%
40	94%	86%	76%	66%	59%	53%

Probability $F<=F_{MSY}$ and $SSB>=SSB_{MSY}$

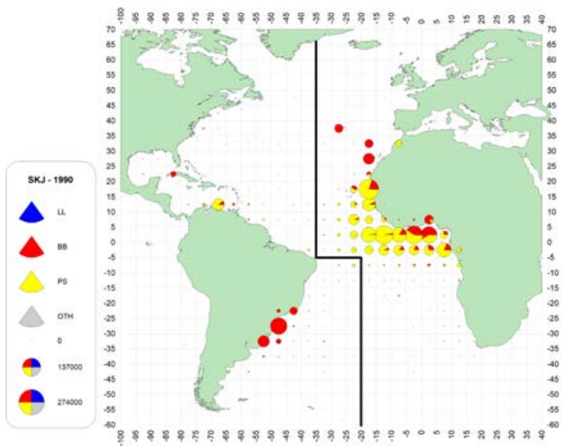
TAC (1000s mt)	2023	2024	2025	2026	2027	2028
16	99%	100%	100%	100%	100%	100%
18	99%	100%	100%	100%	100%	100%
20	99%	100%	100%	100%	100%	100%
22	99%	99%	100%	100%	100%	100%
24	99%	99%	99%	99%	100%	100%
26	98%	98%	98%	99%	99%	99%
28	97%	97%	97%	97%	97%	97%
30	96%	95%	94%	93%	93%	92%
32	94%	92%	91%	89%	87%	85%
33	93%	91%	88%	86%	83%	80%
34	92%	89%	86%	82%	79%	75%
35	91%	87%	83%	78%	74%	70%
36	90%	85%	80%	75%	70%	65%
38	88%	81%	74%	67%	61%	56%
40	85%	76%	67%	59%	53%	48%



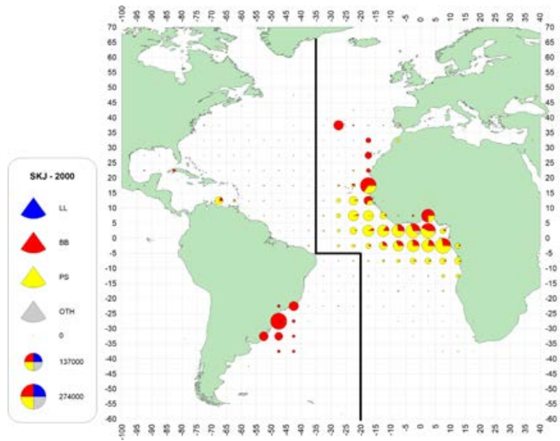
a. SKJ (1970-79)



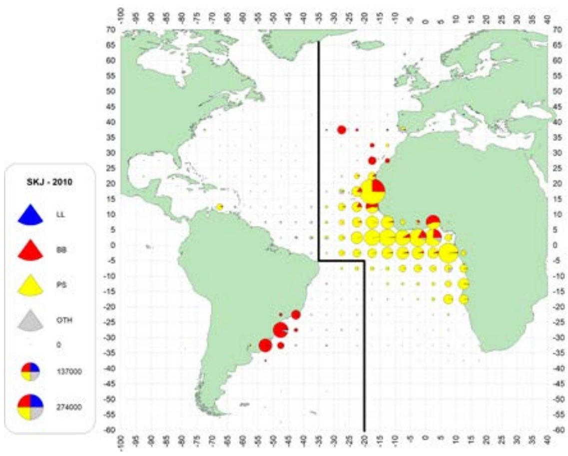
b. SKJ (1980-89)



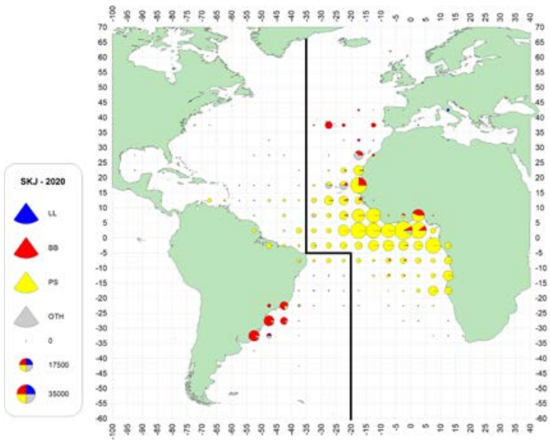
c. SKJ (1990-99)



d. SKJ (2000-09)

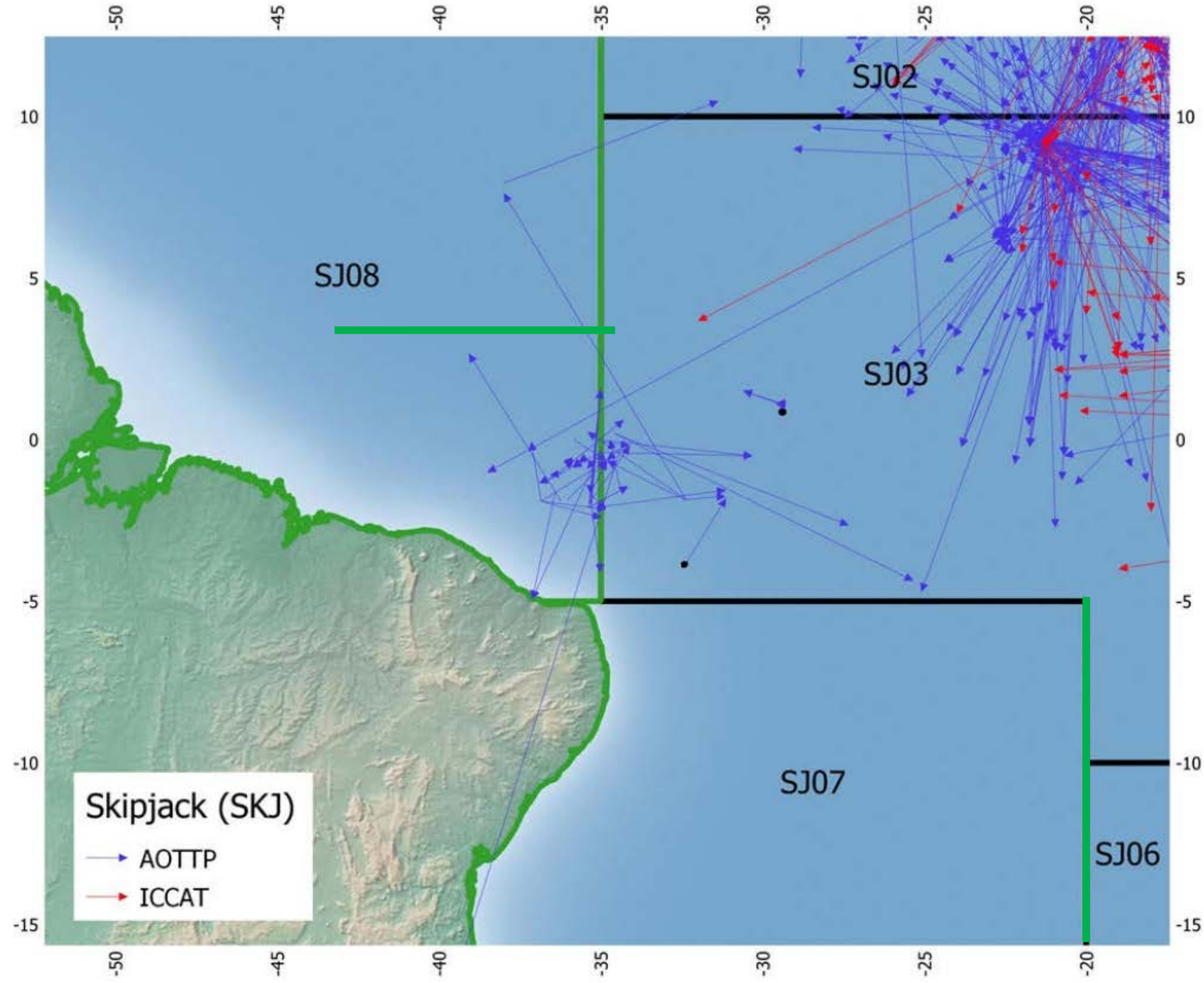


e. SKJ (2010-19)

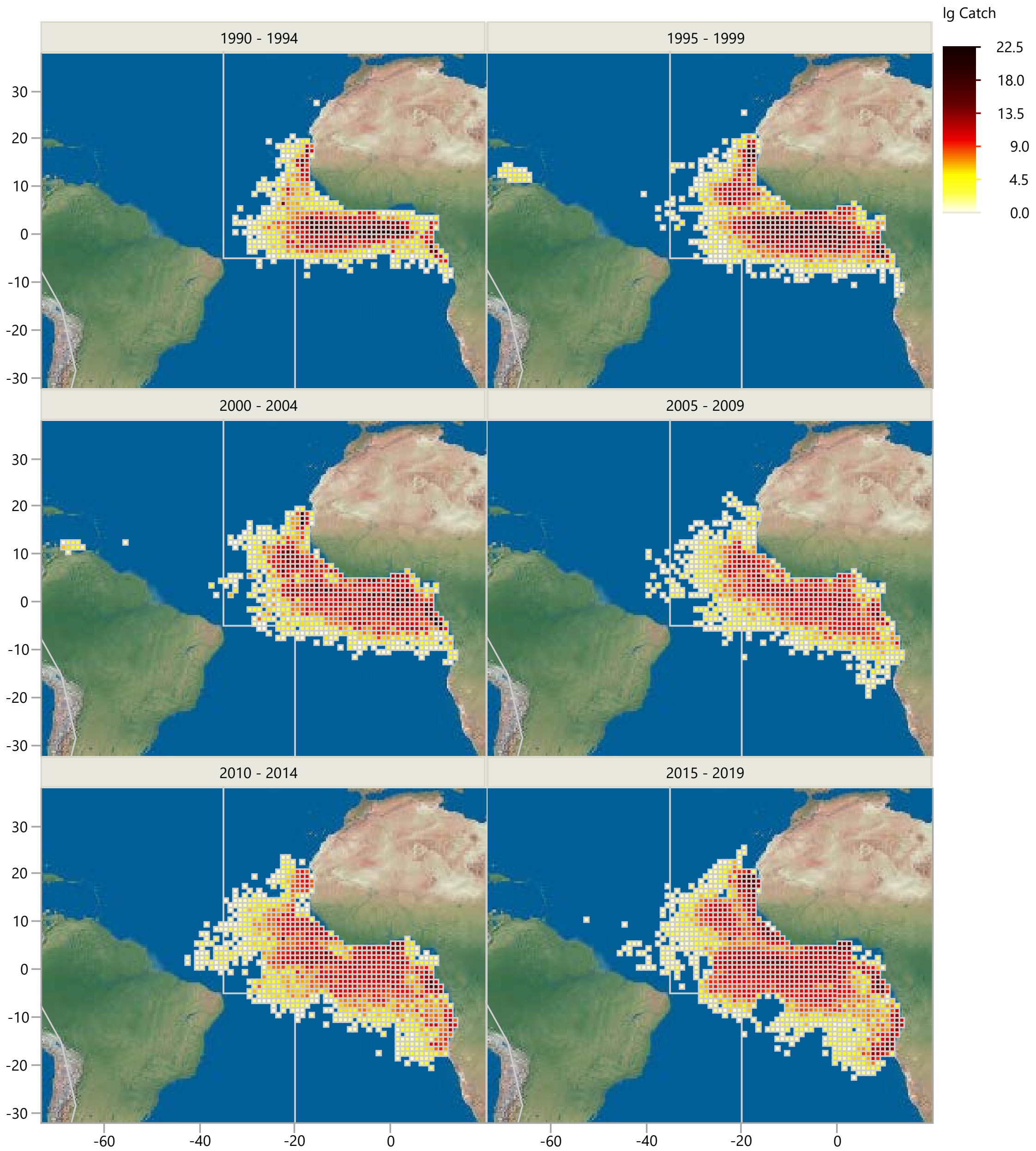


f. SKJ (2020-21)

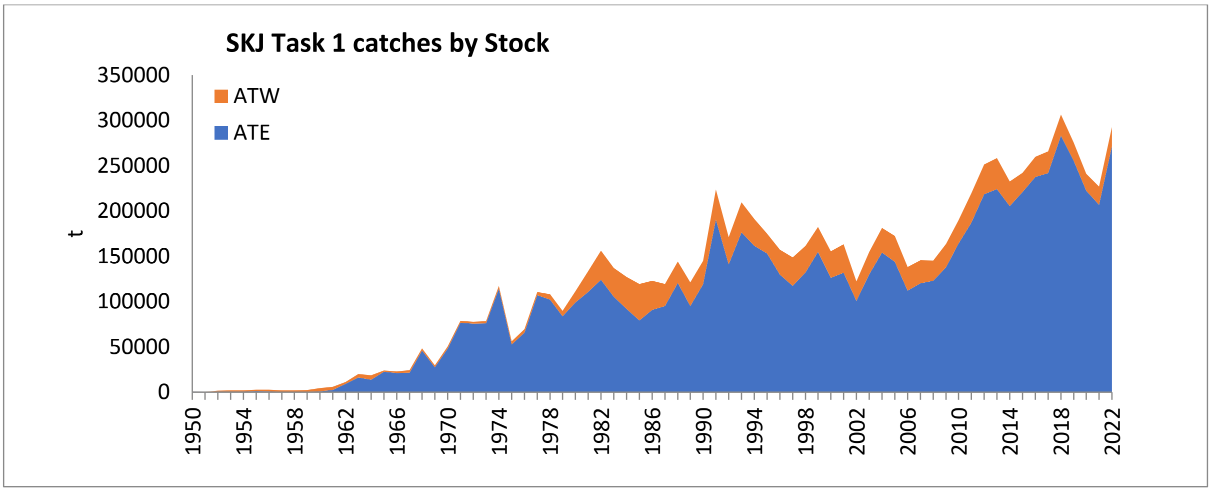
SKJ-Figure 1. [a-f]. Geographical distribution of the skipjack catch by major gears and decade. The maps are scaled to the maximum catch observed during 1970-2021 (last decade only covers 2 years).



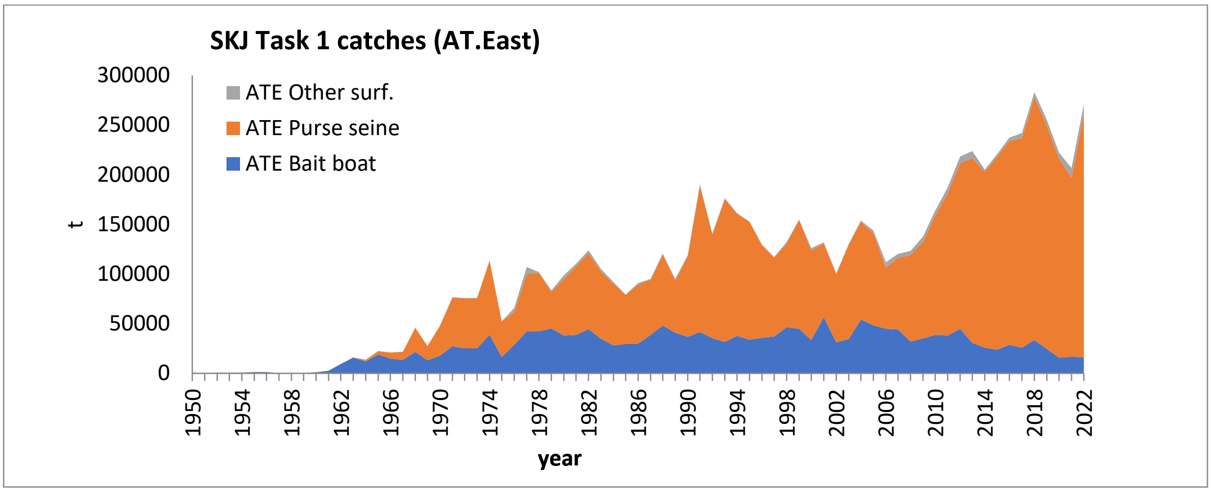
SKJ-Figure 2. A map of the AOTTP (blue lines) and ICCAT (red lines) tagged returns demonstrating the movement of fish in proximity to the eastern-western stock boundary. Area codes correspond to SKJ sample areas. Green line represents the East-West stock boundary.



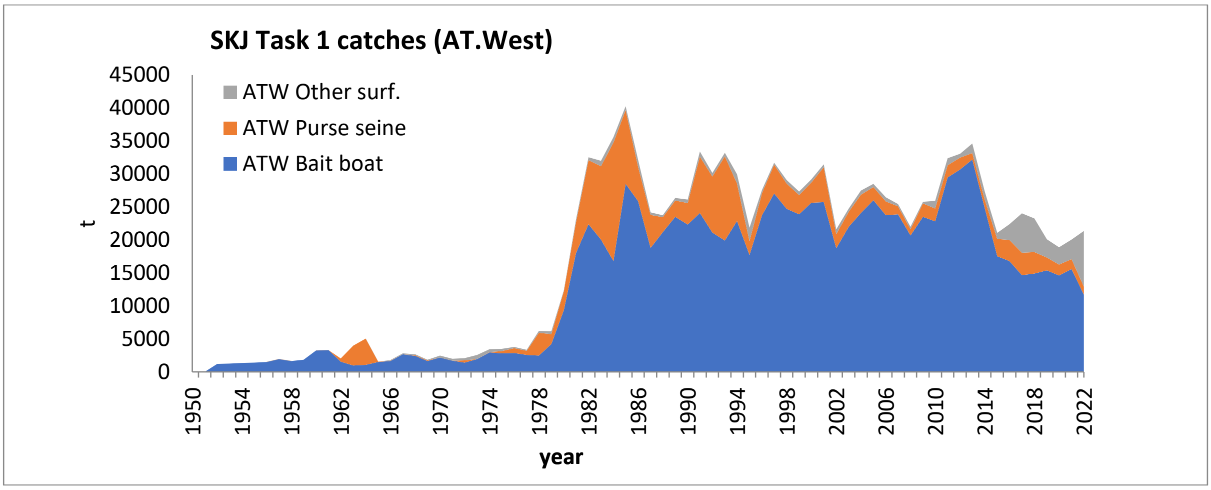
SKJ-Figure 3. Spatial distribution of the total SKJ catch (lg scale) from all PS-FAD fisheries by 1º x 1º of latitude - longitude and by lustrum (each box) 1990 – 2019. Line denotes the SKJ stocks boundary.



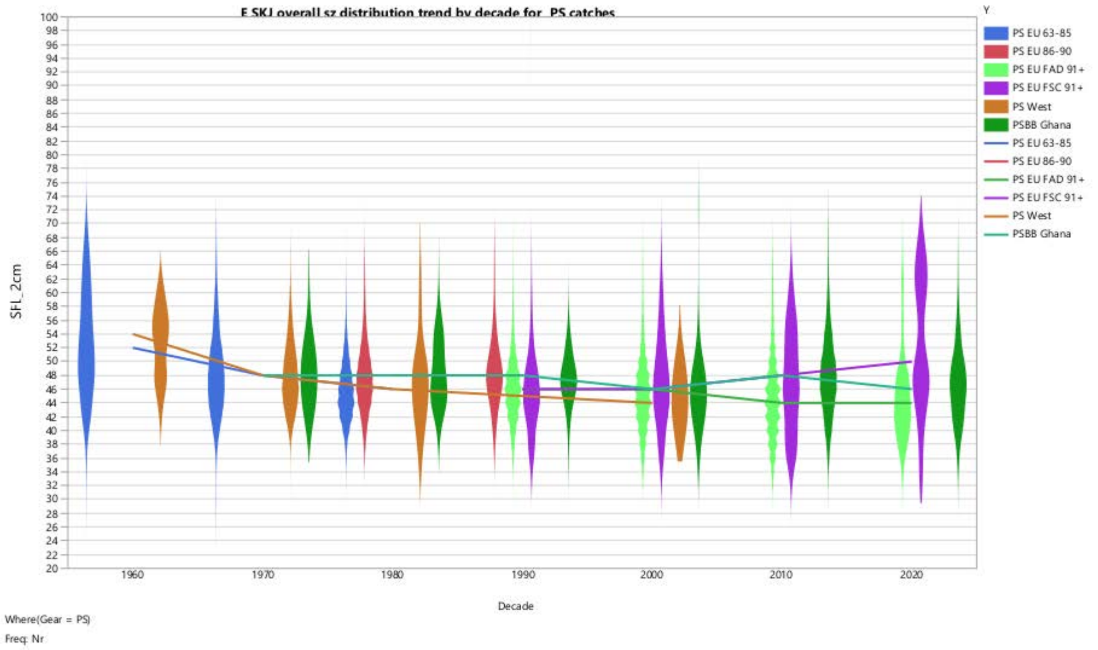
SKJ-Figure 4. Total skipjack catches (t) in the Atlantic and by stock (East and West) between 1950 and 2022. The 2022 figure is still preliminary.



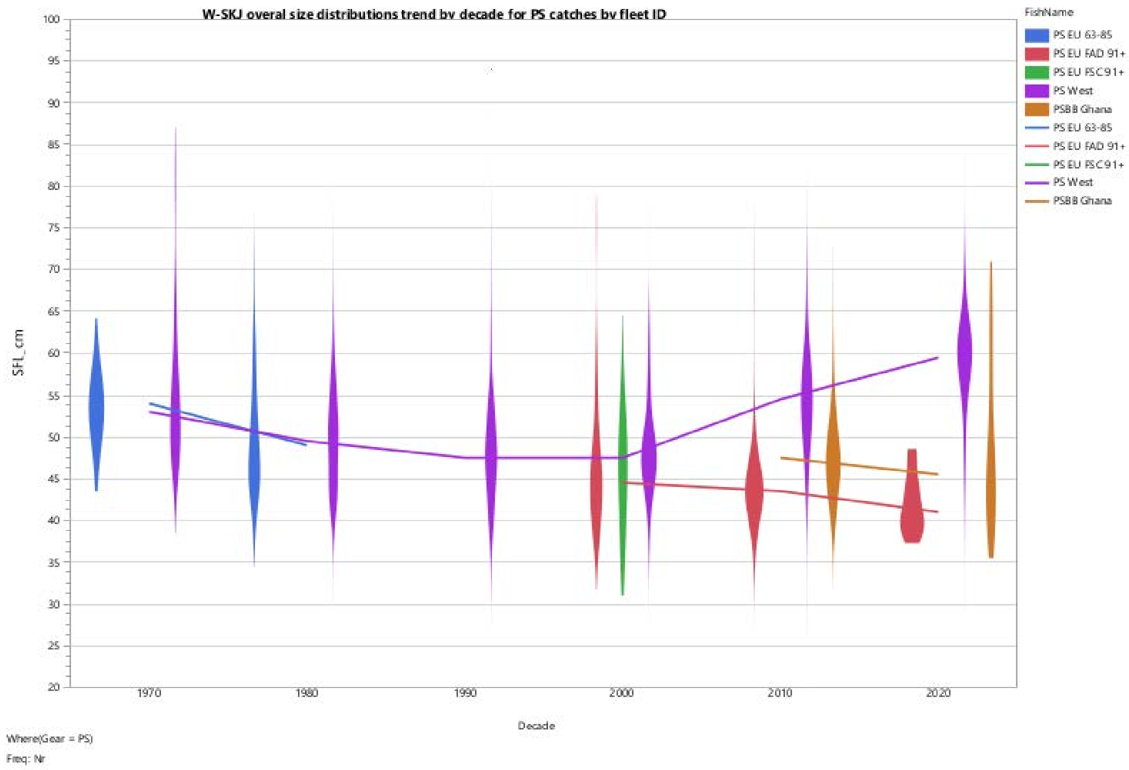
SKJ-Figure 5. Skipjack catches in the eastern Atlantic, by gear (1950-2022). The values for 2022 are preliminary.



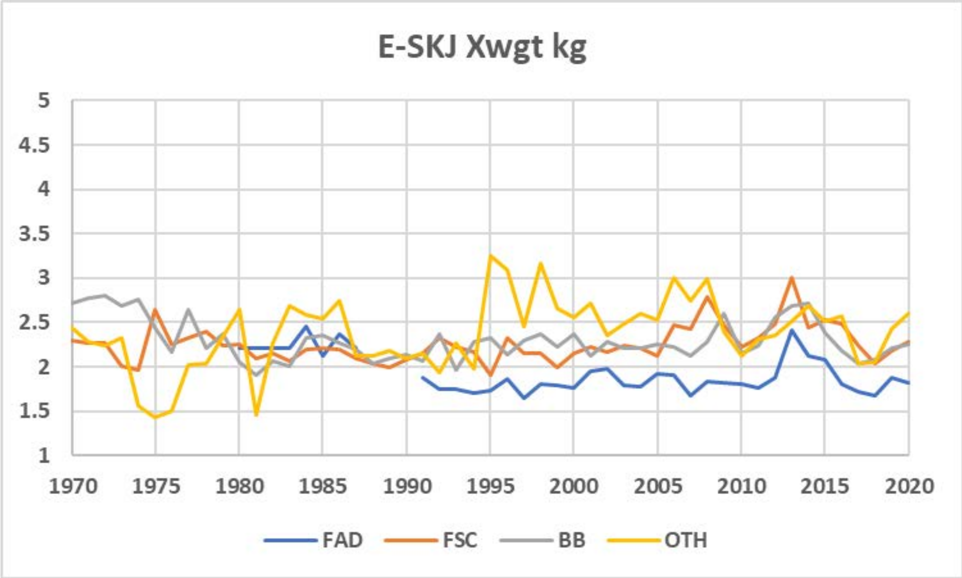
SKJ-Figure 6. Skipjack catches in the western Atlantic, by gear (1950-2022). The values for 2022 are preliminary.



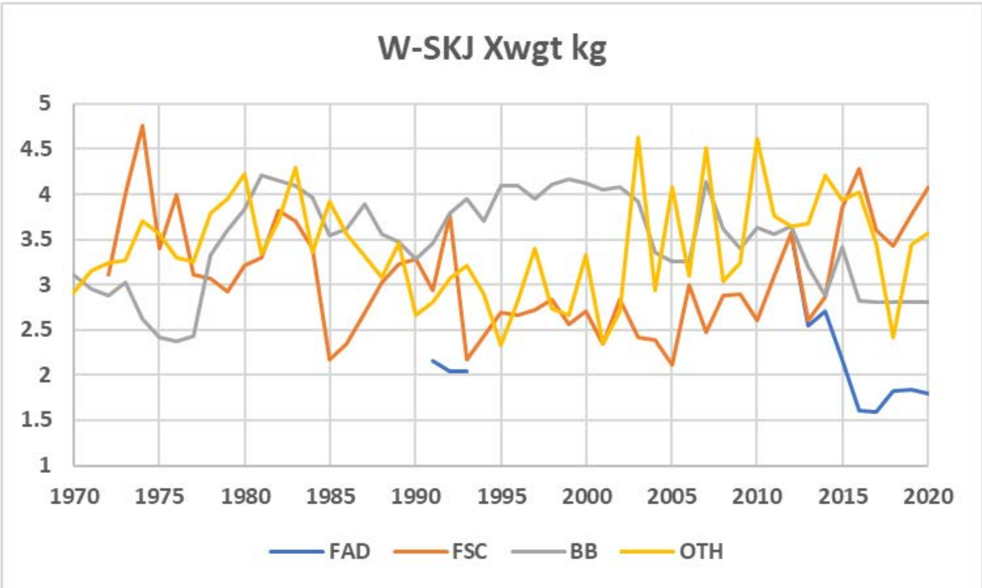
SKJ-Figure 7. SKJ-E. Overall size distribution of catch by decade for the PS fisheries by fleet ID, lines indicate the median of the distribution.



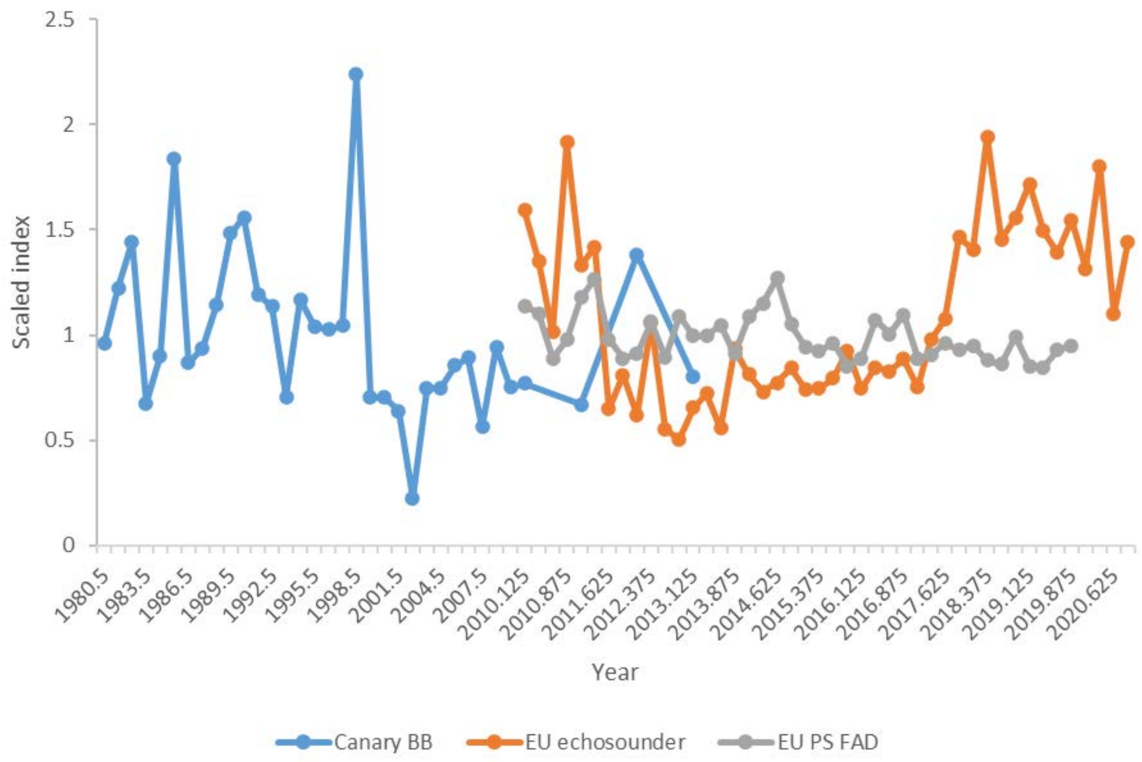
SKJ-Figure 8. SKJ-W. Size distributions by fleet ID from the PS fisheries, lines indicate the median of the distributions.



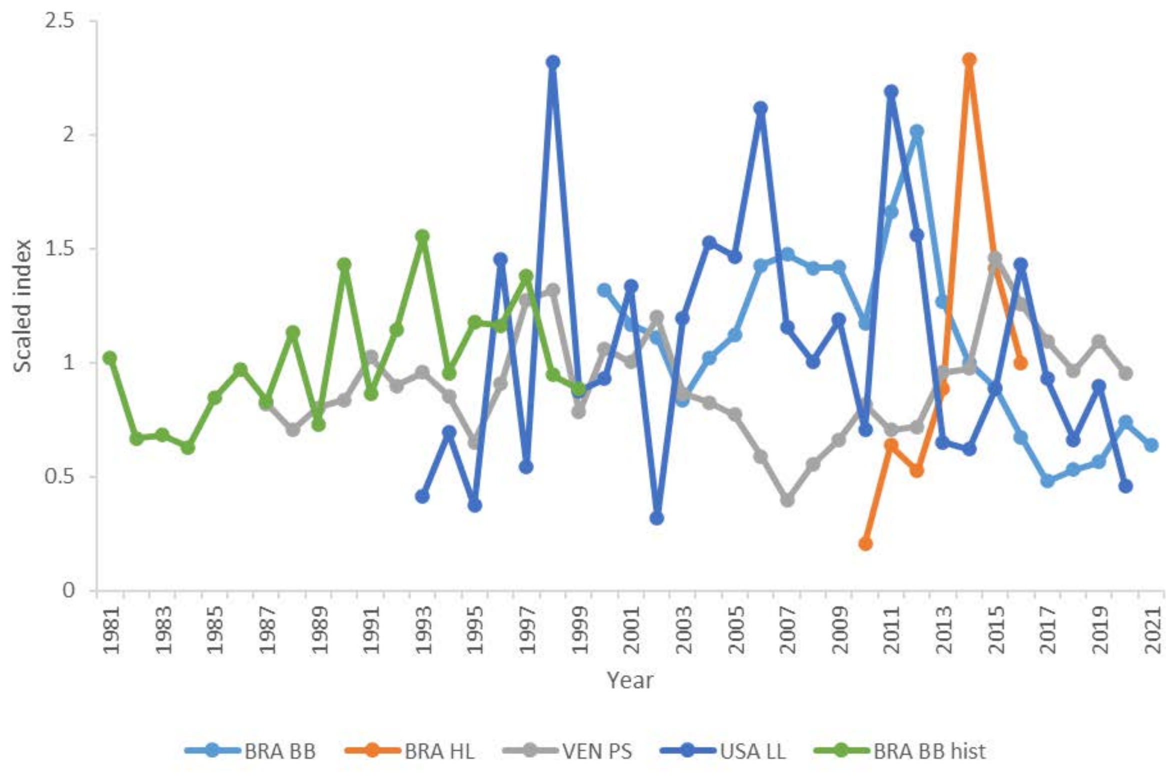
SKJ-Figure 9. SKJ-E. Mean weights (kg) estimated from the overall CAS estimations updated by Secretariat including Fishing mode free-schools (FSC), FOB (FAD), baitboat (BB), and other gears (OTH).



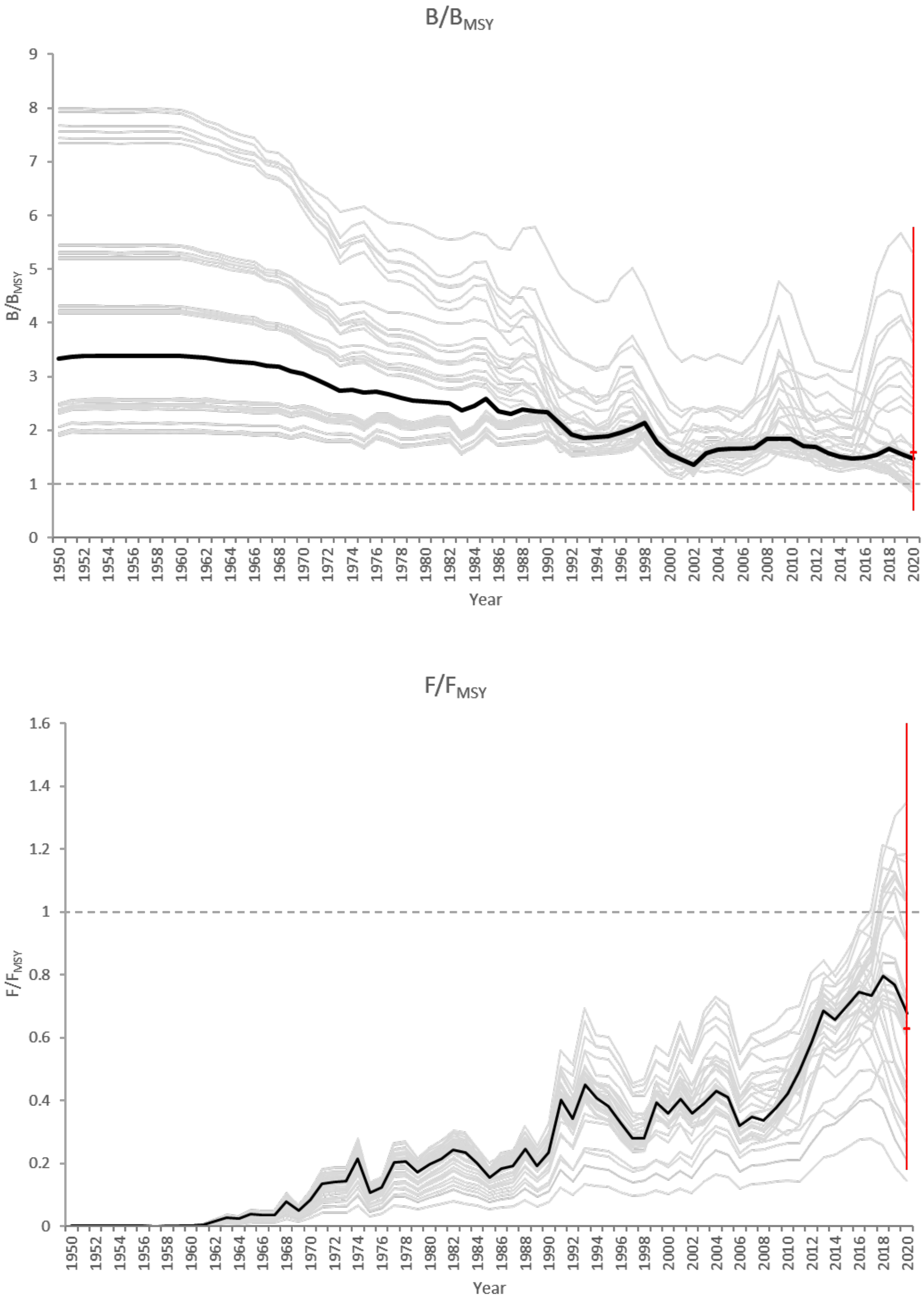
SKJ-Figure 10. SKJ-W. Mean weights (kg) estimated from the overall CAS estimations updated by Secretariat including Fishing mode free-schools (FSC), FOB (FAD), baitboat (BB), and other gears (OTH).



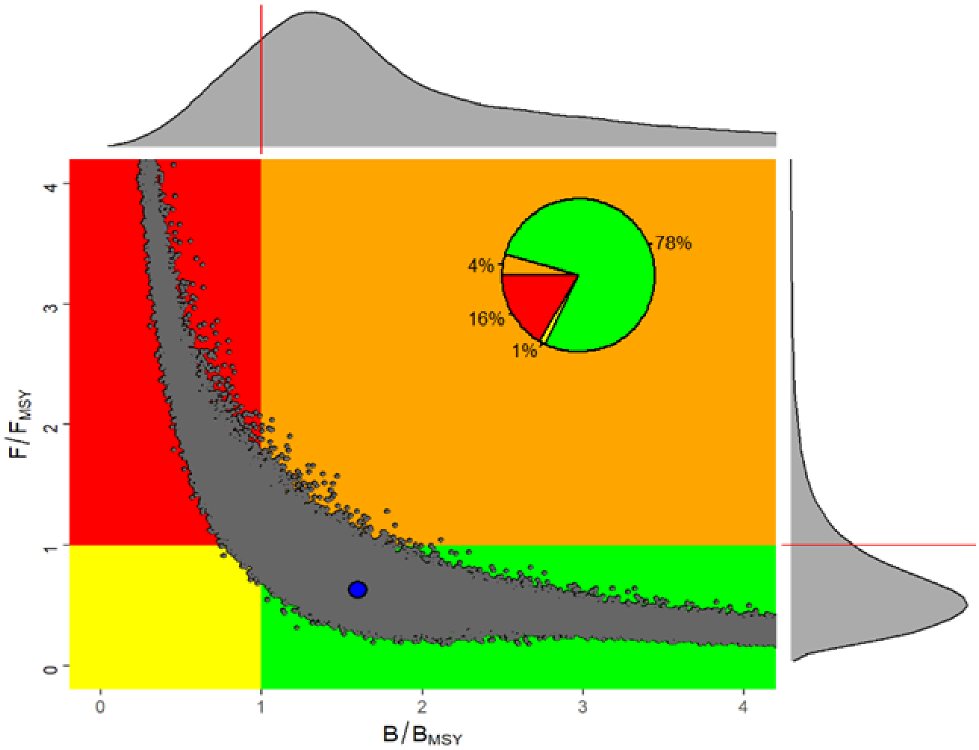
SKJ-Figure 11. SKJ-E. Relative abundance indices included in the final stock assessment models, Stock Synthesis and JABBA, for the eastern skipjack stock. Years in the x axis are non-integers because the model runs at quarterly time steps.



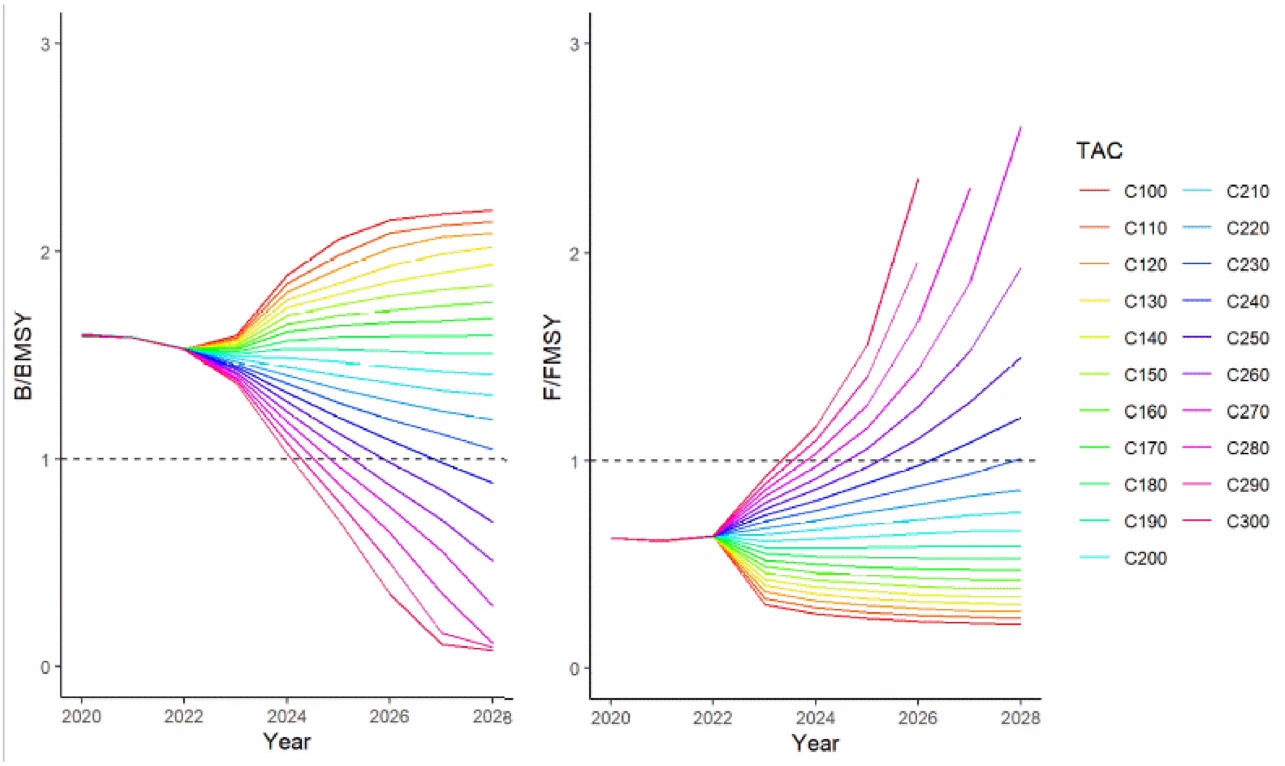
SKJ-Figure 12. SKJ-W. Relative abundance indices included in the final stock assessment model, Stock Synthesis, for the western skipjack stock.



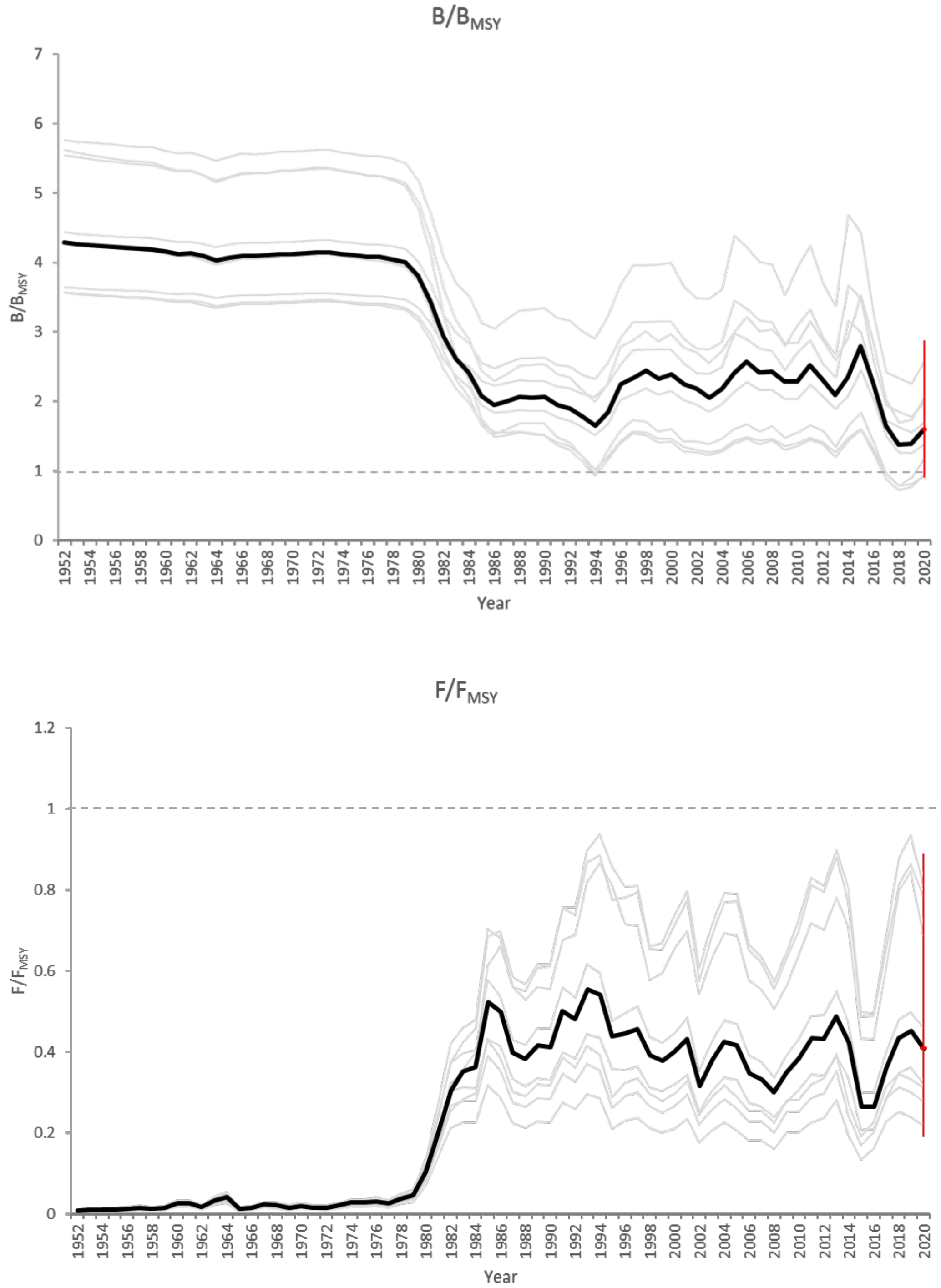
SKJ-Figure 13. SKJ-E. Relative abundance (B/B_{MSY}) (top) and fishing mortality (F/F_{MSY}) (bottom) historic median trends for the eastern skipjack stock estimated by each model from the uncertainty grid, solid line represent the median of the trends plotted, and the vertical red line in 2020, the 95% confidence bound of the stochastic combined results.



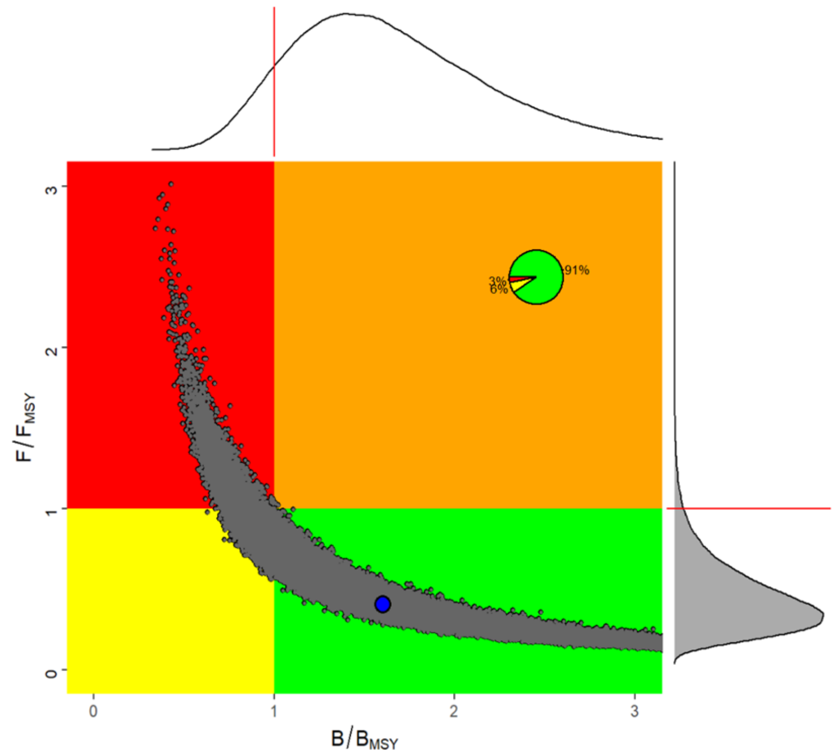
SKJ-Figure 14. SKJ-E. Joint Kobe phase plot for the 18 Stock Synthesis uncertainty grid runs and 18 JABBA uncertainty grid runs for the eastern Atlantic skipjack stock. For each run the benchmarks are calculated from the year-specific selectivity and fleet allocations, and based on 90,000 MVLN iterations for Stock Synthesis and 90,000 MCMC iterations for JABBA. The blue point shows the median of 180,000 iterations for SSB_{2020}/SSB_{MSY} or B_{2020}/B_{MSY} and F_{2020}/F_{MSY} for the entire set of runs in the grid. Grey points represent the 2020 estimates of relative fishing mortality and relative spawning stock biomass for 2020 for each of the 180,000 iterations. The upper graph represents the smoothed frequency distribution of SSB_{2020}/SSB_{MSY} or B_{2020}/B_{MSY} estimates for 2020. The right graph represents the smoothed frequency distribution of F_{2020}/F_{MSY} estimates for 2020. The inserted pie graph represents the percentage of each 2020 estimate that fall in each quadrant of the Kobe plot. All SSB for Stock Synthesis showed the values at the end of years.



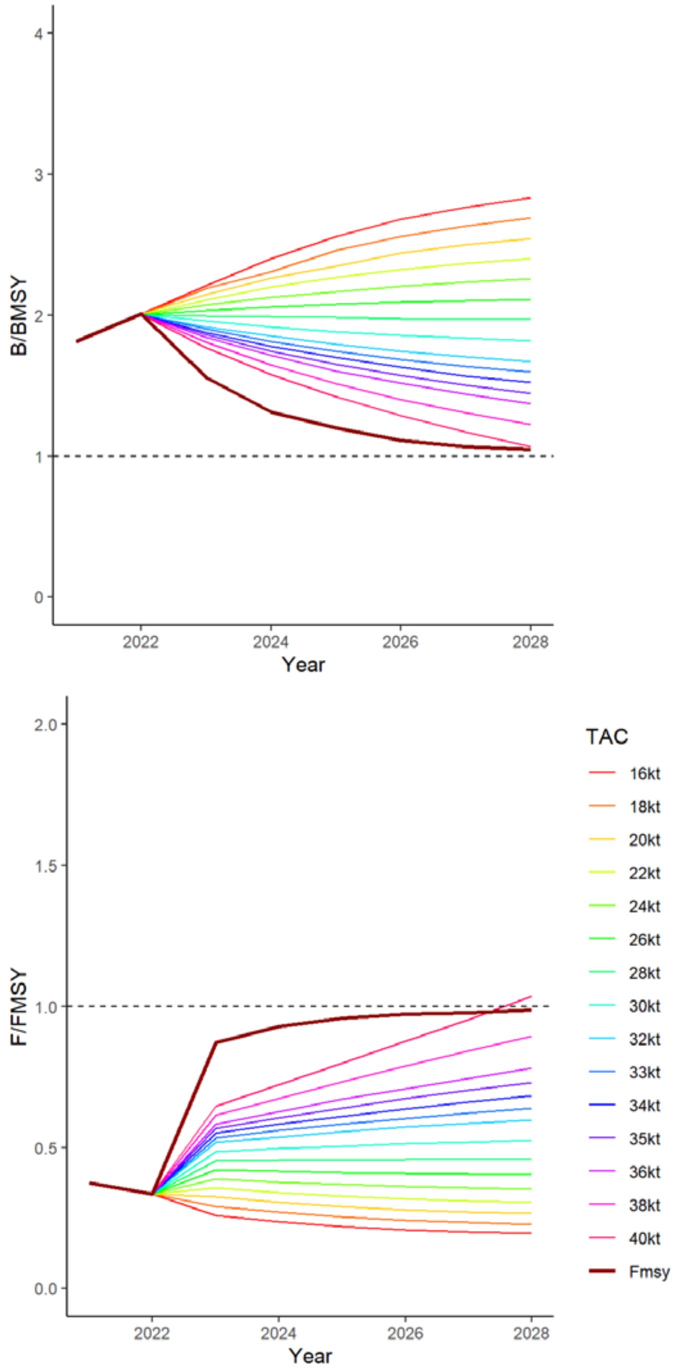
SKJ-Figure 15. SKJ-E. Joint stochastic projections of B/B$_{MSY}$ and F/F$_{MSY}$ for the 18 Stock Synthesis and the 18 JABBA uncertainty grid runs at 100-300 thousand t constant TACs for the eastern Atlantic skipjack stocks. The lines are the median of 180,000 iterations.



SKJ-Figure 16. SKJ-W. Relative abundance (B/B_{MSY}) (top) and fishing mortality (F/F_{MSY}) (bottom) historical median trends for the western skipjack stock estimated by each model from the uncertainty grid, solid line represents the median of the trends plotted, and the vertical red line in 2020, the 95% confidence bound of the stochastic combined results.



SKJ-Figure 17. SKJ-W. Kobe phase plot for the 9 Stock Synthesis uncertainty grid runs for the western Atlantic skipjack stock. For each run the benchmarks are calculated from the year-specific selectivity and fleet allocations and based on 200,000 MVLN iterations. The blue point shows the median of 200,000 iterations for SSB_{2020}/SSB_{MSY} and F_{2020}/F_{MSY} for the entire set of runs in the grid. Black line with black symbols represents the historical evolution of the median of all runs. Grey points represent the 2020 estimates of relative fishing mortality and relative spawning stock biomass for 2020 for each of the 200,000 iterations. The upper graph represents the smoothed frequency distribution of SSB/SSB_{MSY} estimates for 2020. The right graph represents the smoothed frequency distribution of F/F_{MSY} estimates for 2020. The inserted pie graph represents the percentage of each 2020 estimate that fall in each quadrant of the Kobe plot. All SSB showed the values at the end of years.



SKJ-Figure 18. SKJ-W. Stochastic MVLN projections of SSB/SSB_{MSY} and F/F_{MSY} for the 9 Stock Synthesis uncertainty grid runs at 16-40 thousand t constant TACs and constant F_{MSY} for the western Atlantic skipjack stocks. The lines are the median of 200,000 iterations.