

REVIEW AND UPDATE OF THE CATCH AT AGE (CAA) FOR THE SPAIN BAY OF BISCAY BLUEFIN TUNA FISHERIES FOR 1950-2000

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SUMMARY

Following an update of the bluefin tuna catches made by the Spanish baitboat fleet in the Bay of Biscay, a review of the catch at age distribution was presented in 2016. This document makes specific recommendations to improve the current CAA for the Spain and France baitboat fisheries in the Bay of Biscay. It is concluded that in the estimation of Catch at Age after 1965 as there are appropriate size samples and C/E sampling in the ICCAT database for the Baitboat EU_Spain and EU_France fisheries. However, for Catch at Age estimation prior to and including 1965 the whole series for EU_Spain CAA are to be replaced by annual CAA proportions provided in SCRS/2016/179 (1950 – 1965). Furthermore, it is recommended using the average monthly proportions of Catch-at-age from the period (1976-1985) to estimate EU_Spain BB CAA by month for the 1950 – 1965 years. And, consider the EU_Spain CAA as best “substitution fleet” for the Bait boat EU_France fishery 1950 – 1984.

RÉSUMÉ

Suite à une mise à jour des captures de thon rouge réalisées par la flottille de canneurs espagnols dans le golfe de Gascogne, un examen de la distribution de la capture par âge a été présenté en 2016. Le présent document fait des recommandations précises pour améliorer la CAA actuelle pour les pêcheries de canneurs de UE-Espagne et UE-France dans le golfe de Gascogne. Il est observé que dans l'estimation de la prise par âge après 1965, il y a des échantillons de tailles et un échantillonnage de prise/effort appropriés dans la base de données de l'ICCAT pour les pêcheries de canneurs de UE-Espagne et de UE-France. Cependant, pour les estimations de prise par âge avant et incluant 1965, toutes les séries de CAA pour UE-Espagne doivent être remplacées par les proportions annuelles de CAA fournies dans le SCRS/2016/179 (1950-1965). En outre, il est recommandé d'utiliser les proportions moyennes mensuelles de prise par âge de la période (1976-1985) pour estimer la CAA des canneurs de UE-Espagne par mois pour les années 1950-1965. La CAA de UE-Espagne a été considérée comme la meilleure « flottille de substitution » pour la pêcherie de canneurs de UE-France pour la période 1950-1984.

RESUMEN

Tras una actualización de las capturas de atún rojo realizadas por la flota de cebo vivo española en el golfo de Vizcaya, en 2016 se presentó una actualización de la distribución de la captura por edad. En este documento se formulan recomendaciones específicas para mejorar la CAA actual para las flotas española y francesa en el golfo de Vizcaya. Se observa que en la estimación de la captura por edad posterior a 1965 existen muestras de talla apropiadas y un muestreo de captura/esfuerzo apropiado la base de datos de ICCAT para las pesquerías de cebo vivo de UE-España y de UE-Francia. Sin embargo, para la estimación de la captura por edad anterior a 1965 inclusive, toda la serie de CAA de UE-España debe ser reemplazada por las proporciones de CAA anuales facilitadas en el SCRS/2016/179 (1950-1965). Además, se recomienda que se utilicen las proporciones mensuales medias de la captura por edad del periodo (1976-1985) para estimar la CAA española de cebo vivo por mes para los años 1950-1965. Asimismo, se considera la CAA de UE-España como la mejor "flota de sustitución" para la pesquería de cebo vivo de UE-Francia para 1950-1984.

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KEYWORDS

Bluefin tuna, Baitboat, Catch-at-age

1. Introduction

In 2014 (Cort *et al.* 2015) a review of the bluefin tuna catches made by the Spanish baitboat fleet in the Bay of Biscay were presented and approved by the SCRS to update this component in the historical Task I Nominal Catches for EU_Spain. Following this research, the catch at age for the Spanish and French Baitboat fleets in the Bay of Biscay used in the last assessment was reviewed (SCRS/2016/179) and alternative biometric and fishery historic data was used to better characterized the CAA composition for these fleets, particularly in the early years (1950-1965) when it appears that catches of juveniles were substantially underestimated (Table 3, SCRS/2016/179).

This document review and compared the current information available at the Secretariat and used in the last assessment of bluefin tuna (2014) to contrast and proposed possible modifications in the current CAA for the Spain and France baitboat fisheries in particular.

2. Data

The information used in this document is the bluefin tuna latest assessment Task I nominal catch, catch-at-age (**Table 1**) (Anon. 2015) and the summarized data of CAA presented in Cort (SCRS/2016/179, Tables 2 and 3).

3. Results

Initially total catches for the Spanish and French baitboat fleets of Bay of Biscay were compared (**Figure 1**). The plot shows identical catch series from 1950 to 1983. From 1984 onwards, the values presented in Table 2 SCRS/2016/179 are higher than the corresponding ICCAT Task I. These differences were due to the inclusion in the SCRS/2016/179 of catches from other gears (besides baitboat), mainly trawl from Spanish vessels targeting albacore. It was decided to use the ICCAT Task I NC of Baitboat Spanish + French catches to adjust the CAA matrix.

Comparison Catch-at-Age 1950 – 2000

SCRS/2016/179 provided annual CAA for ages 1 to 8+. It was assumed that age 1 include also potential age 0 fish. **Figure 2** shows the total number of fish between the Table 3 SCRS/2016/179 and the CAA/ICCAT 2016, for the correspondent fleets [EU.Spain: EU.ESP, EU.ESP_CANT_CDZ_ALB, EU.ESP_ES_CANT_BFT; EU.France: EU.FRA] Gear BB (baitboat exclusively).

Overall the total number of fish caught by these fleets in the 1950 -2000 period is much greater (300%) than the numbers at age in latest BFT CAA. Particularly in the early years 1950's where numbers are double or higher. Also from 1983 forward, the estimated numbers of fish are on average 50% – 100% higher. While the landings remain similar (**Figure 1**), the large differences in numbers of fish caught, implies a substantial difference in the age distribution of the catch by year, with increased catches of smaller fish. This is clearly depicted in **Figure 3**. The main difference between the CAA presented in SCRS/179 and the CAA ICCAT/2016 is the contribution of ages 1 and 2 to total catch. In the CAA SCRS/179 from 1950 through 1990's ages 1 and 2 account for on average 80% to 90%. While in the ICCAT-CAA, from 1955 through 1974 ages 1 and 2 represent about 50% of the total catch in numbers, from 1978 forward the percentage of catch from age 1 and 2 increased to about 80%. It is also noticeable, that in ICCAT CAA, from 1950 to 1954 there is not age 1 catch, and the ages 5 and 6 accounted for 80% of the catch in those early years. It is certainly very different catch-at-age distribution for the same fleet prior to 1956. This may be due to biased sampling in the early 1950's, where all size samples came from a fishing port (Ondarroa) that landed exclusively large fish, while there were not samples from the main baitboat fishing port in the Bay of Biscay (Hondarribia) where most of the juveniles would had been landed (Cort 1990, Santiago *et al.* 2016). However, the changes in the age distribution of the catches are not only for ages 1 and 2. In an attempt to graphically summarize these differences, **Figure 4** shows a plot for each decade (1950's to 1990's), where each plot shows the difference in the cumulative age distribution (cdf) of the CAA/179 minus CAA/ICCAT. Briefly, if the CAA for a given year were similar, the differences will be near or 0, showing as a flat line in the plot. When for a given age the CAA/179 proportion is higher than the ICCAT-CAA, then a positive value will show. For example, taking the 1950's plot (top left), clearly most of the lines are positive for ages 1 to 5, indicating that the proportions of these ages in the CAA/179 are much higher than CAA-ICCAT. Similarly for the 1960's, although

in few years 1968 the CAA-ICCAT assigned higher proportion of fish age 1 and 2 in comparison. In Summary, for 1950's, 1960's, and 1970's most of the CAA/179 allocated higher proportions of fish ages 1, 2, 3, 4, and 5. Instead by the 1980's, 1990's the differences in catch at age proportions are smaller, mostly of age 1 with some decrease in ages 2, 3. Note that the range of the y-axis between plots varied.

Differences of CAA respond to the source of sampling, methodology and assumptions between the two models. Document SCRS/2016/179 described in detailed the sources of information and data used to create the CAA/179, broken down in four-periods; 1950-1965, 1966-1970, 1971-1974, and 1975-2000. The ICCAT-CAA protocols and methodology has been described previously (Anon. 2015). They are major differences in both methodologies: i) CAA-ICCAT is derived primarily from the Catch-at-size (CAS) of the whole fisheries, and then converted to age ("sliced") following basically the expected size-at-age by month predicted by the von Bertalanffy growth model (Cort *et al.*, 2014, Anon. 2015), taking into account some variance of size at age, and a fixed month of birth (June). ii) Instead, SCRS/179 ageing relies primarily on conversion tables of size/weight commercial categories to age by month, and in later years in Age Length Keys (Cort 1990). For the early years (1950 – 1965), the CAA was estimated base on size samples of Le Gall (1950, 1951) indicating the seasonality between small and large fish. For years without size catch information prior to 1965, the average proportion for each age of the period 1966-1986 (see Table 1 in Cort, 2016) was applied, considering that the average annual weight for that period was 12.3 kg (Cort and Abaunza 2015, 2016), a value that has been applied to estimate the total number of fishes caught each year.

For 1966 -1970 the catch-at-size (individual weight) of the bluefin caught by the Spanish fleet was obtained from the sale-sheets of the Port of Ondarroa. The number of bluefin size sampled between 1966 and 1970 was 54,982 fish. Most of these size samples have been included in the ICCAT SZ dbase. Size was converted to age using the conversion weight-at-age key by month (see Table 35 in Cort 1990).

Since 1971 it began the systematic collection of sale-sheets from auctions at the port of Hondarribia. These sheets indicated the distribution of the catch by commercial weight categories. Similarly, scientific size sampling started at the port of St. Jean de Luz in 1972 (Bard *et al.*, 1973), and in 1974 at the port of Hondarribia (Cort and Cendrero, 1975). Commercial categories and size samples were converted to age using the conversion key tables (Cort 1990). From 1985 forwards, ageing is based in actual Age-Length key (ALK) generated from fin-spine readings, and applied to the size at catch distribution of the landed fish (Cort 1990).

The SCR/S2016/179 Table 3 presents annual catch at age distributions, in contrast the ICCAT-CAA is estimated monthly based on the reported catch and effort (Task II/CE) distribution and the size (Task II/SZ/CAS) provided by CPCs. Although the current VPA assessment model uses the annual aggregated ICCAT-CAA, differences in age distributions can be also due to seasonality distribution of the fisheries. In the case of Bay of Biscay there is ample evidence of seasonal size and age availability of bluefin to the fleets with in some cases interannual variations (Cort 1990, Santiago *et al.* 2016). Unfortunately, consistent fisheries sampling and monitoring including both, fishing effort and age/size sampling is only available since the 1980's for most of the fleets in the Bay of Biscay. Prior to that, information is mostly aggregated, scatter or not available. When size information is unavailable for a given year/gear/ fleet, then the CAS is estimated using a "substitution" size data source. This is a process where missing size data is substituted by fleets/fisheries alike, operating hopefully in the same general area. The Secretariat has routinely presented the "Substitutions Table" where the decisions for the whole CAS generation are specified.

Figure 5 shows the distribution of the landings by year-month for the Bait boat Spanish. The plot indicates that after 1976 there is C/E and SZ information to estimate monthly distribution of CAS and CAA, with most of the bluefin catch taking place in July-August in the Bay of Biscay. There are some minor catches in June, but the landings continued into September through November. However, prior to 1976 there is clearly missing information, and three periods of "substitutions" are indicated. From 1967 to 1975, all bluefin catch was allocated to August only, while from 1957 to 1966 all catch was allocated in July, and in the early period (1950-1956), catch was distributed between May-September with most of the catch in August.

There are indications that in the Biscay of Bay the arrival of the bluefin has a size/age component, e.g. smaller/younger fish arrive first to the feeding grounds of Bay of Biscay, in May, June while larger / older fish follow them in July, August (Le Gall 1950, 1951, Bard *et al.* 1973, Cort 1976, Cort 1990, Cort and Rodríguez-Marin, 2009). Albeit, availability of the fish to the fishing fleets is also determined by oceanographic and other biotic conditions and it shows interannual variability. This feature was explored with the size sampling for the Baitboat fleet (EU_Spain) using data from 1976 through 1992, years with relative good sampling and prior to major management regulations; **Figure 6** shows the size distributions of bluefin by month. Although there is large variance, there is some indication that ages (2-4), larger size fish are present as early as May in the area, and the mean size of the fish decrease as the season progress until November when the mean size increases again, indicating the leaving of the younger fish from the area. Similar trends are observed when including the size

sampling from trawling fisheries that also operate in the area. (**Figure 7**). If it is considered that the period 1976 - 1985 is a good representation on average of the seasonality and size composition of the catch for the BB fleet fishery in the early years (1950 – 1975), the proportions of ages by month (**Figure 8**), can be used in conjunction with the annual SCRS/179 CAA to estimate the seasonal component of the CAA.

4. Discussion and recommendations

The review of the ICCAT-CAA for the EU_Spain, EU_France for the Baitboat fishery Bay of Biscay indicated that prior to 1966 there is limited information in ICCAT databases (Task II) to properly estimate the CAS/CAA for these fleets from 1950 to 1965. SCRS/2016/179 document provides annual CAA estimates, more consistent with biological and commercial information collected from the fisheries at least from 1950 through 1965. For the period 1950 – 1964 a constant CAA distribution was assumed for this period (Fig 3); however, the 85 t (caught in 1953) and 299 t (caught in 1956) of fish > 140 cm landed in the port of Ondarroa have been taken into account when making the total demographic distribution for those years.

Review of monthly landings and size distributions by month; corroborate information regarding size/age differential availability of bluefin in the Bay of Biscay for the baitboat and troll fleets. Thus, is plausible that the fisheries did operated in a season extending likely from May through November, and likely smaller size fish are available early in the season compare to the larger fish. Hence will be important to use monthly/ size distribution to properly allocate the annual CAA into month for the 1950 – 1965 years. If the fisheries in those years operated in a similar fashion as during 1976 -1985 then the proportions by month of the latest period can be used for this estimation.

In summary and after the revision of landings, catch at size and catch at age information available for the baitboat fisheries of the Bay of Biscay it is recommended the following:

- a. Task I NC not to be modified, indicating that ICCAT Task I NC 2016, reflects the best estimates of total removals 1950 -2000.
- b. For Catch at Age estimation, after 1965 there are appropriate size samples and C/E sampling in the ICCAT database for the Baitboat EU_Spain and EU_France fisheries thus no modifications is recommended.
- c. For Catch at Age estimation prior to and including 1965 the whole series for EU_Spain CAA are to be modified, and it recommended applying the annual CAA proportions provided in SCRS/2016/179 (1950–1965) to estimate EU_Spain BB CAA.
- d. Furthermore, it is recommended using the average monthly proportions of Catch-at-age from the period (1976-1985) to estimate EU_Spain BB CAA by month for the 1950 – 1965 years. And,
- e. In the case for Bait boat EU_France, no modification of Task I are required, and for the estimation of the EU_France BB CAA it is recommended to use the use the updated BB EU_Spain CAA as substitution for this fleet 1950 – 1984.

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Table 1. Summary of the ICCAT Task I Nominal catches (NC) Sep 2016 of bait boat fleets from the Bay of Biscay.

Year	EU.España		EU.España Total	EU.France		EU.France Total	Total Task I NC 2016
	CANT_ALB	CANT_BFT		EU.FRA	EU.FRA-FR		
1950	0	1106	1106	1869		1869	2975
1951	0	979	979	2893		2893	3872
1952	0	2323	2323	2362		2362	4685
1953	0	1771	1771	2364		2364	4135
1954	0	2049	2049	3451		3451	5500
1955	0	3528	3528	3031		3031	6559
1956	0	1956	1956	1453		1453	3409
1957	0	2467	2467	1550		1550	4017
1958	0	2938	2938	1303		1303	4241
1959	0	1769	1769	2031		2031	3800
1960	271	550	821	553		553	1374
1961	176	514	690	907		907	1597
1962	432	305	737	965		965	1702
1963	318	520	838	543		543	1381
1964	378	482	860	400		400	1260
1965	584	582	1166	621		621	1787
1966	642	1069	1711	1624		1624	3335
1967	368	543	911	860		860	1771
1968	340	584	924	390		390	1314
1969	325	901	1226	534		534	1760
1970	327	1308	1635	732		732	2367
1971	125	1450	1575	680		680	2255
1972	153	1209	1362	740		740	2102
1973	399	1471	1870	540		540	2410
1974	117	1009	1126	522		522	1648
1975	275	945	1220	692		692	1912
1976	158	587	745	267		267	1012
1977	164	1035	1199	592		592	1791
1978	533	1266	1799	723		723	2522
1979	173	1000	1173	275		275	1448
1980	208	818	1026	260		260	1286
1981	357	428	785	153		153	938
1982	156	608	764	150		150	914
1983	1245	1114	2359	400		400	2759
1984	687	1678	2365	566		566	2931
1985	360	1488	1848	380		380	2228
1986	839	1036	1875	272		272	2147
1987	311	1202	1513	533		533	2046
1988	746	1336	2082	479		479	2561
1989	714	1399	2113	306		306	2419
1990	300	1193	1493	367		367	1860
1991	203	938	1141	448		448	1589
1992	277	740	1017	372		372	1389
1993	321	3219	3540	164		164	3704
1994	260	1034	1294	66		66	1360
1995	375	2397	2772	181		181	2953
1996	624	4099	4723	310		310	5033
1997	921	5139	6060	134		134	6194
1998	507	2005	2512	282		282	2794
1999	82	1112	1194	270		270	1464
2000	278	941	1219		91	91	1310
2001		1806	1806		105	105	1911
2002		1918	1918		150	150	2068
2003		413	413		130	130	543

2004	1357	1357	47	47	1404
2005	1884	1884			1884
2006	750	750	50	50	800
2007	1572	1572	128	128	1700
2008	1434	1434	67	67	1501
2009	931	931	62	62	993
2010	470	470	83	83	553
2011	470	470	74	74	543
2012	134	134	85	85	219
2013	0	0	74	74	74
2014	25	25	2	2	28

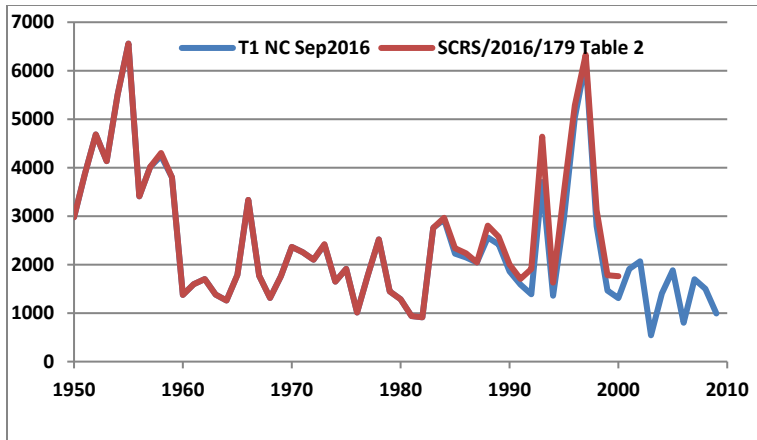


Figure 1. Comparison of total catch (Task I NC) of bluefin tuna from the Baitboat fisheries in the Bay of Biscay 1950-2010. Blue line represents the ICCAT Task I NC 2016, red line shows the values presented in SCRS/2016/179 Table 2 document.

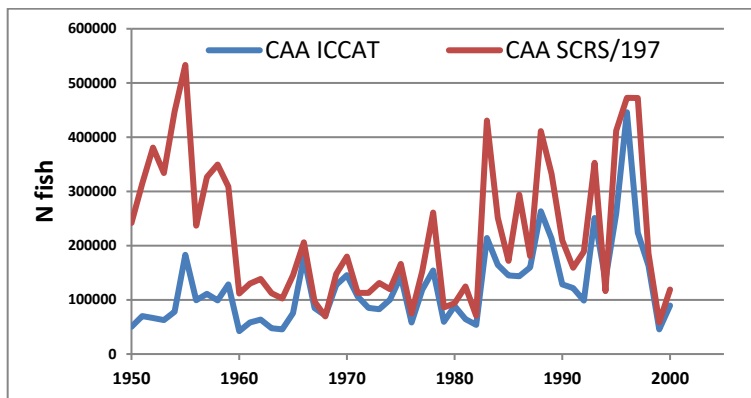


Figure 2. Estimates of total number of fish (BFT) caught in the Bay of Biscay (EU_FRA + EU_SPA) 1950 – 2000 from the CAA latest version (Sep 2016) (blue line) and the proposed CAA SCRS/2016/179 Table 3 document.

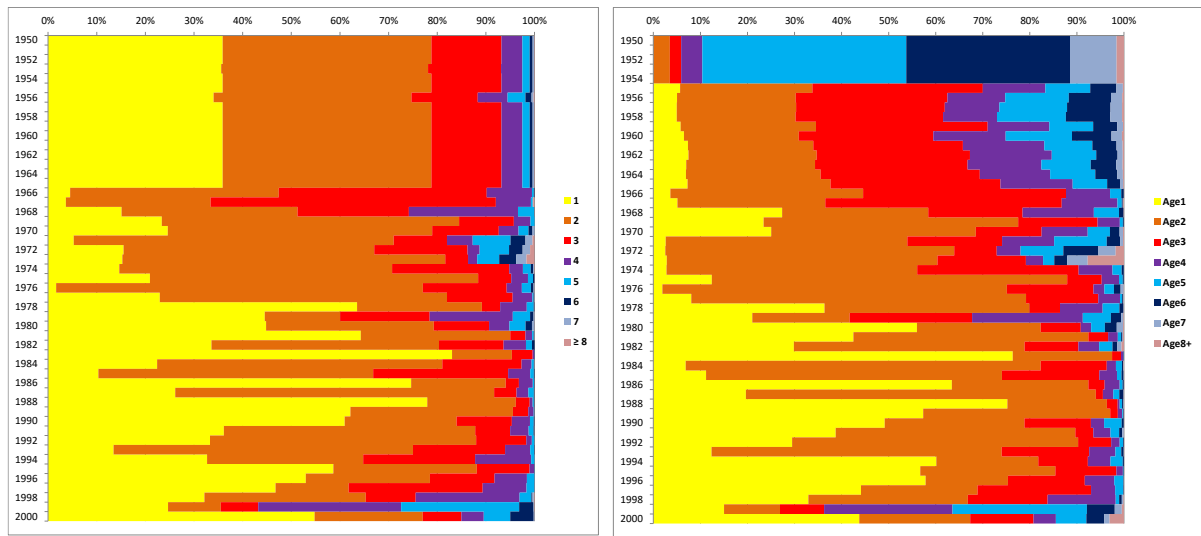


Figure 3. Proportions of catch-at-age (CAA 1 – 8+) for bluefin tuna caught by BB fleets (EU_Spain + EU_France) in Biscay Bay 1950 -2000. Left plot shows the CAA proposed in SCRS/2016/179, right plot shows the CAA ICCAT Sep 2016.

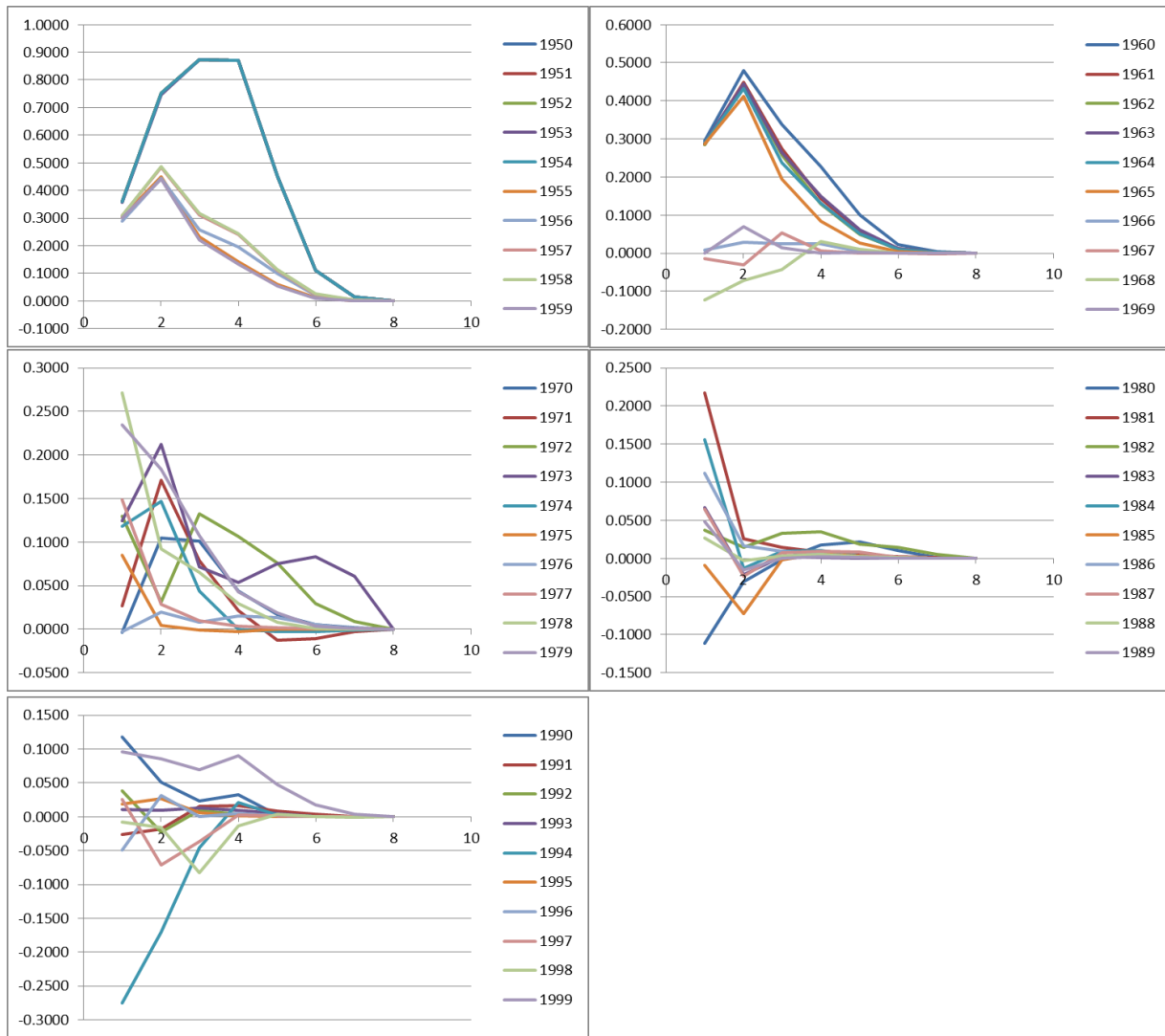


Figure 4. Differences between CAA SCRS/2016/179 and CAA-ICCAT 2016. Lines represent the differences of the cumulative proportions by age (cdf) by year for each decade 1950 – 1999. Positive values indicate a higher proportion of the age (1-8+) in the CAA/179. Note the y-axis range varies between decades.

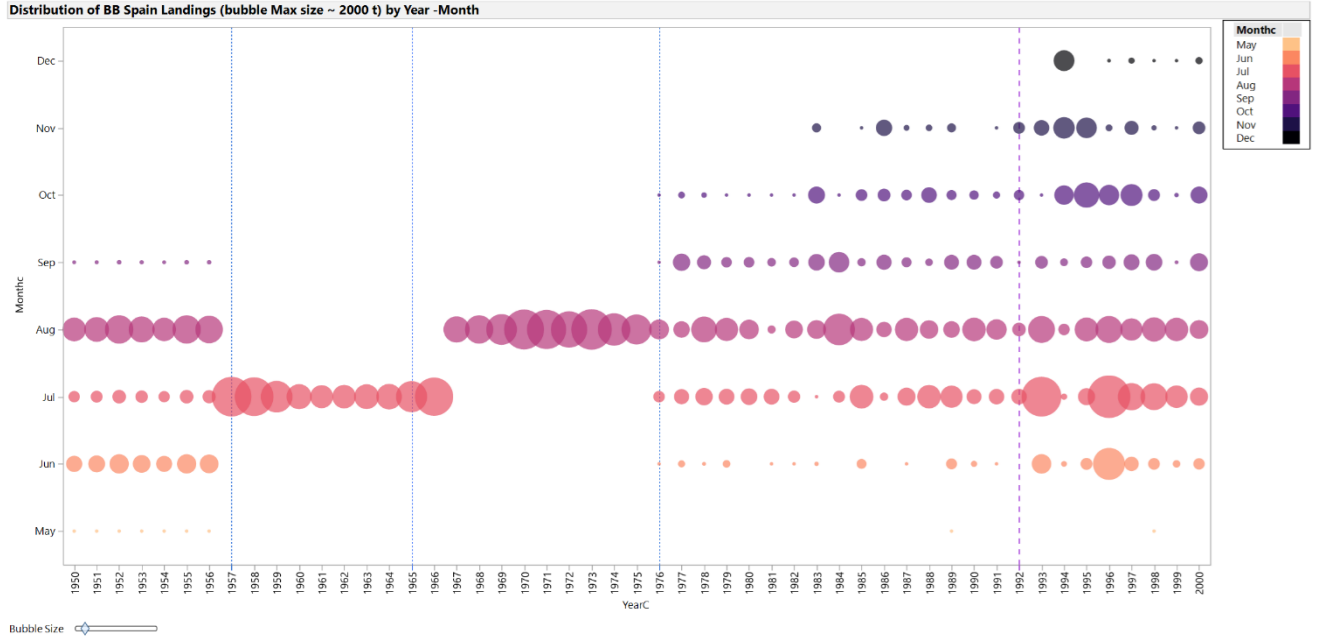


Figure 5. Landings (t) of bluefin tuna by Year Month estimated from the ICCAT-CAA 2016. Maximum circle represents approximately 2000 t.

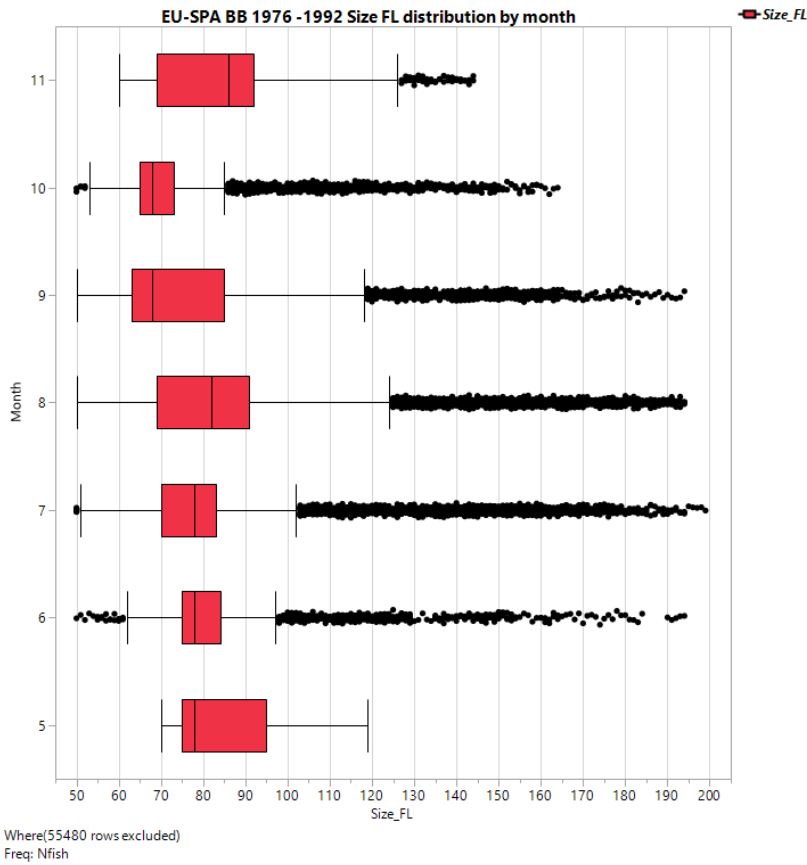


Figure 6. BFT size distribution by month for EU_SPA Baitboat samples 1976-1992.

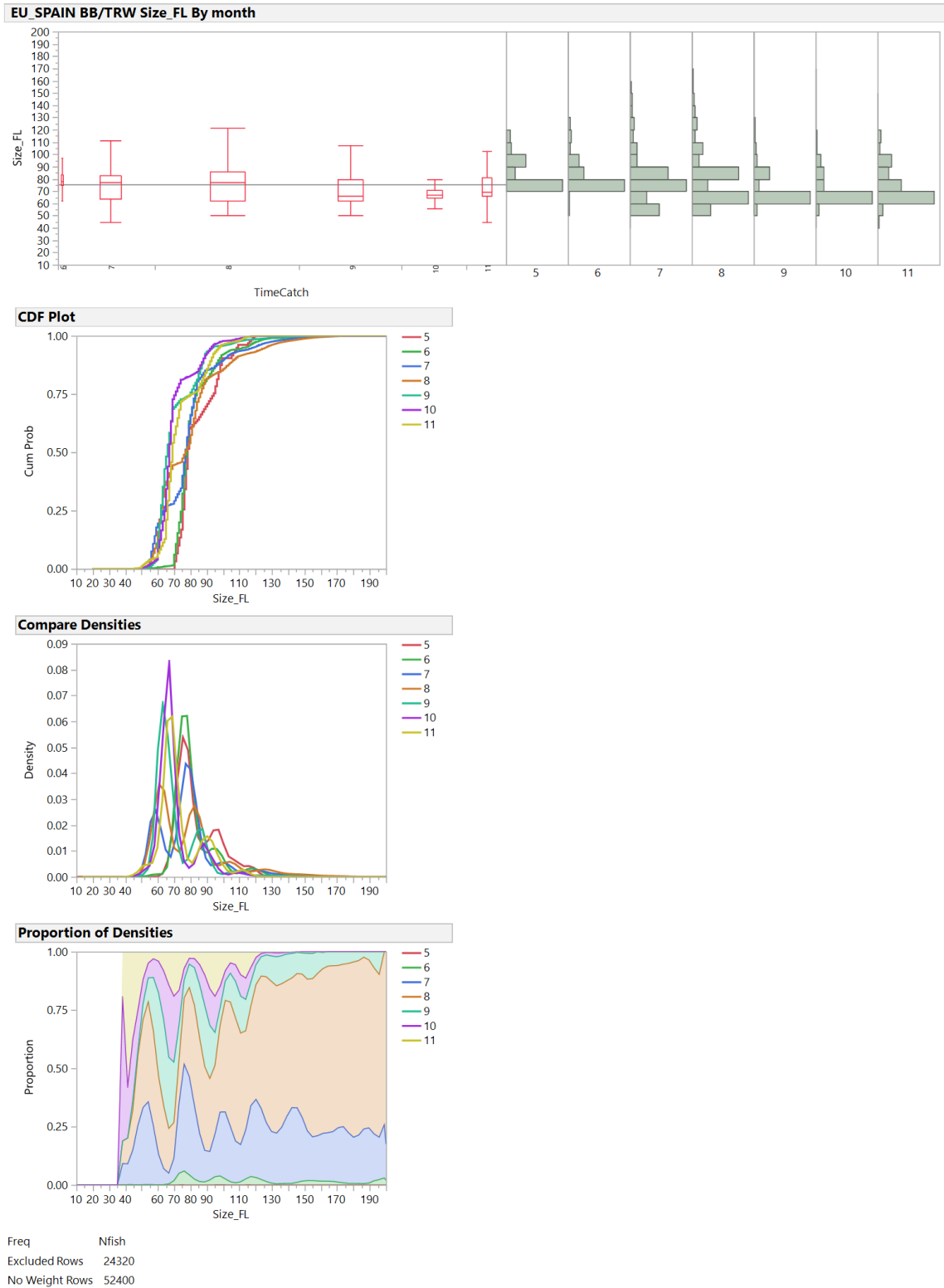
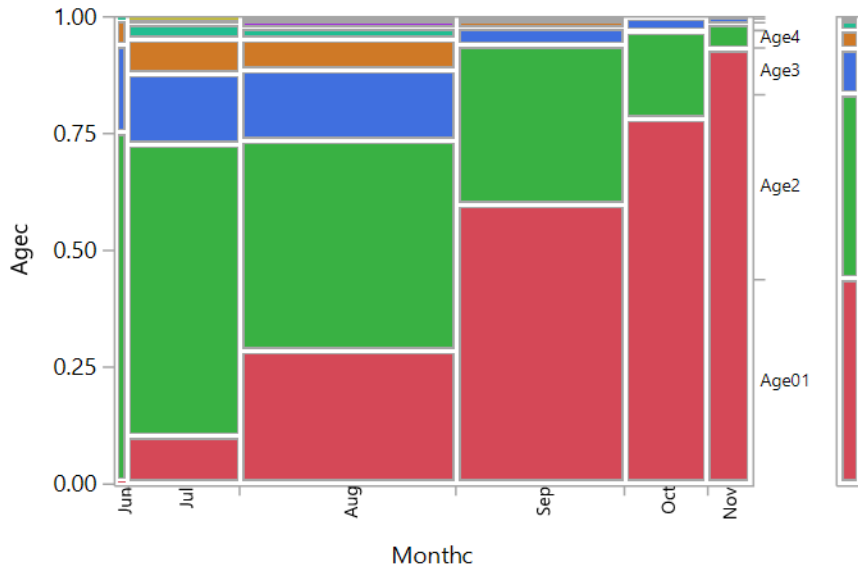


Figure 7. Size composition and density distribution of bluefin size samples by month (May – November) from the Baitboat and trawl fisheries in the Biscay Bay 1976- 1992.

Contingency Analysis of Agec By Monthc 1976 - 1985

Mosaic Plot



Freq: NFish

Contingency Table

		Agec								
		Age01	Age2	Age3	Age4	Age5	Age6	Age7	Age8+	Total
Monthc	Jun	0.02	1.60	0.41	0.12	0.00	0.01	0.00	0.00	2.15
	Jul	1.81	11.05	2.65	1.31	0.58	0.19	0.08	0.02	17.68
	Aug	9.76	15.26	5.18	2.14	0.94	0.47	0.23	0.06	34.02
	Sep	15.90	9.03	1.00	0.35	0.18	0.07	0.00	0.00	26.54
	Oct	10.19	2.40	0.41	0.02	0.00	0.00	0.00	0.00	13.02
	Nov	6.12	0.38	0.08	0.01	0.00	0.00	0.00	0.00	6.59
Total		43.79	39.72	9.73	3.94	1.70	0.74	0.31	0.08	

Figure 8. Estimated proportions of catch-at-age bluefin tuna y month for the EU_Spain BB /TR fleets 1976-1992.