THE SKIPJACK FISHERY IN THE CANARY ISLANDS FOR THE PERIOD 1926 TO 2020

P.J Pascual-Alayón[1], Déniz S[1] y F. J. Abascal[1]

SUMMARY

*This document presents a detailed study of the skipjack (*Katsuwonus pelamis*) fishery in the Canary Islands during the period from 1926 to 2020. There is clear evidence of the existence of this fishery since the beginning of the 19th century on the island of La Gomera. The fishing effort for the different fleet segments and all period is analyzed. Total catches of skipjack have oscillated in saw tooth pattern, with good years and bad years. The skipjack catches is directly related to bigeye catches, representing in many years more than 40% of the total catches in the islands. The seasonality of catches of the species has not changed in the last 25 years, with the second and third quarters being the most important in terms of catch volume. Catch sizes are smaller in the second and third quarters. And the largest sizes are captured in the free school mode and mainly in the winter months such as December, January and February. Skipjack catches are made mainly in coastal areas and inter-island channels by vessels of less than 50 GRT.*

RÉSUMÉ

*Le présent document fournit une étude détaillée de la pêcherie de listao (*Katsuwonus pelamis*) dans les îles Canaries pendant la période allant de 1926 à 2020. Il existe des preuves évidentes de l'existence de cette pêcherie depuis le début du XIXe siècle sur l'île de La Gomera. L'effort de pêche pour les différents segments de la flottille et pour toutes les périodes est analysé. Les captures totales de listao ont oscillé en dents de scie, avec de bonnes et de mauvaises années. Les captures de listao sont directement liées aux captures de thon obèse, représentant de nombreuses années plus de 40% des captures totales dans les îles. La saisonnalité des captures de cette espèce n'a pas changé au cours des 25 dernières années, les deuxième et troisième trimestres étant les plus importants en termes de volume de captures. La taille des captures est plus faible au cours des deuxième et troisième trimestres. Et les plus grandes tailles sont capturées en bancs libres et principalement dans les mois d'hiver tels que décembre, janvier et février. Les captures de listao sont effectuées principalement dans les zones côtières et les canaux inter-îles par des navires de moins de 50 TJB.*

RESUMEN

*Este documento presenta un estudio detallado de la pesquería de listado (*Katsuwonus pelamis*) en las islas Canarias durante el período comprendido entre 1926 y 2020. Hay evidencias claras de la existencia de esta pesquería desde principios del siglo XIX en la isla de La Gomera. Se analiza el esfuerzo pesquero de los distintos segmentos de la flota y de todo el periodo. Las capturas totales de listado han oscilado en forma de diente de sierra, con años buenos y años malos. Las capturas de listado están directamente relacionadas con las de patudo, representando en muchos años más del 40 % de las capturas totales en las islas. La estacionalidad de las capturas de la especie no ha cambiado en los últimos 25 años, siendo el segundo y el tercer trimestre los más importantes en cuanto a volumen de capturas. Las tallas de las capturas son menores en el segundo y tercer trimestre. Y las mayores tallas se capturan en la modalidad de banco libre y principalmente en los meses de invierno como diciembre, enero y febrero. Las capturas de listado se realizan principalmente en zonas costeras y canales interinsulares por parte de buques de menos de 50 TRB.*

KEYWORDS

Atlantic Ocean, Canary Islands, bigeye, tropical tuna, artisanal fishing, live bait, catches, effort, sizes

[1] Instituto Español de Oceanografía. Centro Oceanográfico de Canarias. Apdo. de Correos 1373. 38080. Santa Cruz de Tenerife. Islas Canarias (España).

1. Introduction

The Canary Islands have a great tradition in tuna fishing. The presence, throughout history, of numerous tuna canning factories shows that tuna has been one of the main fishery resources exploited on these islands. Numerous initiatives and fishing companies were planned or installed in all the islands, mainly to provide business cover for the large quantities of fish caught in the Canary Islands and on the nearby African coast (Anuario 1929). Already in 1835, on the island of La Gomera, under royal privilege, an average of 105 tons of fresh tuna was produced, using 22 boats and 182 crew members (AMAB, Legajos 8717, 2130). The island of La Gomera was a pioneer and the most important in this sector. There is evidence that in 1831, the first canned tuna salting factory was installed (AMAB, Files 8717, 2130). Subsequently, between 1860 and 1875, new factories were opened in other areas of the island of La Gomera, also dedicated to canning tuna in oil and "Caviar Gomero", which they made with Atlantic chub mackerel (*Scomber colias*) in oil. The tuna canning factories, in addition to La Gomera, around the year 1850, the number of canning factories reached the figure of 19, located in the leeward areas of the western islands of the archipelago. There were 8 La Gomera, 5 La Palma and 6 Tenerife, estimating an average production of around 1,995 tons of fresh fish and 1,027.6 tons of salted fish per year (SCRS/2014/050, COLLECT. Vol. Sci. Pap. ICCAT, 71(3):1152-1173 (2015)). These canning factories exported their preserves to Europe, mainly to Italy. Subsequently, in the years 1904, 1920 and 1925, other more modern canning factories were opened on the island of La Gomera, which operated until the end of the 70s and early 80s (Figure 1). In relation to the latter, some of older data on skipjack tuna landings in the Canary Islands are presented in this paper, corresponding to those that occurred on the island of La Gomera during the period from 1926 to 1984 from a group of factories called ("La Rajita", "Playa Santiago", "Trujillo", "Casanova" and "La Cantera") and which have been canning tuna since the beginning of the 19th century (**Figure 1**).

The tuna fleet in these years was very numerous and was made up of small sailing and rowing boats, with an average tonnage of about 4 GRT and an average length of about 6 meters. The modernization and motorization of this first tuna fleet was very basic, the presence of motors on the boats appeared in the mid-twenties, but above all of larger boats used to collect and transport the tuna to the factories. During the period, years 30-50, an average of about 50 tons per year was captured only on the island of La Gomera. The possible causes of this reduction, compared to the 1920s, could be found in the fact that these years were years of national and international wars and post-war times, with numerous shortcomings and where the drop in international maritime trade was very high. Another possible reason, although less important, would be the emergence of other canning factories on the islands of La Palma or Tenerife, which competed with the island of La Gomera. In the 1960s, the first great modernization and improvement of the fishing boats on the islands took place. The first reliable engines arrive, bringing a technological breakthrough, which would quickly translate into bigger catches for years to come. Despite the progressive disappearance of the canning factories on the islands, especially at the end of the 1970s, during this decade, tuna fishing definitely took off in the Canary archipelago, resulting in a constant increase in GRT and which produced an increase in catches of these great oceanic migrants. It is precisely in these early 1970s, when the Spanish Institute of Oceanography created a network to obtain fishing information to know more accurately the volume of tuna unloaded in the Canary Islands. The years 1971 and 1972 are considered the beginning years of this network for collecting tuna statistics from the Canary Islands, and therefore, these years present data on catches and efforts that are not complete for the entire archipelago in the official statistics present in ICCAT (SCRS/1975/086). Until 1970, tuna fishing was done in the Canary Islands in a very traditional way, with boats that did not exceed 10 GRT and were unloading was carried out in many ports, beaches and inlets, which made it very difficult to monitor. Between the years 1970 and 1973, some 40 boats with an average of 10 GRT and 12 with more than 50 GRT were built in the province of Santa Cruz de Tenerife alone. There were also then 3 boats of more than 80 GRT fishing in the Canary Islands (SCRS /1975/086). Until 1970, tuna fishing was done in the Canary Islands in a very traditional way, with boats that did not exceed 10 GRT and where unloading was carried out in many ports, beaches and inlets, which made it very difficult to monitor. Between the years 1970 and 1973, some 40 boats with an average of 10 GRT and 12 with more than 50 GRT were built in the province of Santa Cruz de Tenerife alone. There were also then 3 boats of more than 80 GRT fishing in the Canary Islands (SCRS /1975/086; SCRS/1998/108). In the 1980s, fishing effort stabilized, in terms of the number of boats fishing for tuna, with an annual average of about 200 active boats and reaching a maximum of 280 boats in this decade. This maximum number of active vessels does not translate into larger quantities of catches; these are reduced below 3000 t in many years. The 1990s were years of great change in the fishery, the implementation of new fishing strategies to capture Tuna species "fishing a Mancha", especially from the year 1992, was implemented by all the larger ships in the Canary Islands (SCRS/1994/164). This new fishing strategy translates into a progressive increase in bigeye tuna catches, reaching its historical maximum in 1994, with more than 9,000 t and another effect, with a decrease in skipjack catches in this fleet segment. At the end of the 1990s, the fishing agreement with the Kingdom of Morocco was not renewed and the tuna vessels were moored in the canary ports, which implied a sharp drop in the catches of all tuna species in the

Canary Islands. In the 2000s, the new fishing strategy "a Mancha" began to be more effective and extended to the entire fleet, especially in vessels of more than 50 GRT, which translated into a great stability of the catches. The last decade has been characterized by instability in the fishing activity itself. Catch limit quotas are established for bigeye tuna, albacore (*Thunnus alalunga*) and bluefin tuna (*Thunnus thynnus*), slowing catches of these species and by inertia also of skipjack. Catches of this species continue to decline in recent years.

2. Data and methods

Records of skipjack or bonito, SKJ (*Katsuwonus pelamis*), captured in the Canary Islands during the entire documented historical record are analyzed. A historical and detailed study of the record book of tuna landings in existing factories on the island of La Gomera for the period from 1926 to 1984 is carried out (**Figure 2**). The existing data in this historical book have already been compiled by ICCAT during the "ICCAT/GBYP PHASE 6-2016 data recovery plan" historical rescue of old data existing in various countries with tuna tradition. The historical data of the catches of the Canary Islands, present in the ICCAT historical database, from the year 1965 to 2020, are studied. The landing and sampling data from the RIM (information and sampling network) IEO established on the islands since the 1970s. Size data collection for the period prior to 2011 did not distinguish whether the catches came from fishing on “free school” or fishing on “a Mancha” modality. The temporal size distributions by fishing modality for the period 2011 to 2019 are analyzed. The conditioning factors of this fishery to obtain a standardized CPUE index in its catch series are discussed.

3. Results and Discussion

3.1 Fishing effort

Table 1 presents the data by GRT categories of the Canary Islands tuna fishing fleet for the period from 1973 to 2020. The data for years prior to 1974 must be considered as incomplete (Santos, A. 1976). In the 1970s, the fishing fleet began its modernization and the lengths of the boats began to increase. It can be seen how the number of small vessels of <10 GRT decreases and the number of medium and large GRT vessels increases. In the 1980s, the number of tuna fishing vessels stabilized at around 200 vessels, although throughout this decade, the active fleet suffered significant fluctuations as a result of variations in the availability and the sale price of these ocean resources. Despite this, the average number of vessels remained around 230 units and an average annual GRT of around 5,980 tons. In the 1990s, the first significant decrease in fishing effort took place in the Canary Islands, especially in the fleet of more than 100 tons GRT, from an annual average of 35.5 vessels to an average during this decade of only 23.3 fishing units. This decrease in ships is reflected in the loss of more than 1,200 GRT between these two decades, although the average GRT remained somewhat higher than 4,700 tons. The beginning of the new century was preceded by the non-renewal of the fishing agreement with the Kingdom of Morocco in 1999 and by the scrapping of numerous ships. This event, the loss of one of the traditional tuna fishing grounds for the islands' tuna fleet, resulted in a decline in all types of boats on the islands. The total number of ships fell to an annual average of 192.3 per year during this decade. The average GRT fell to a value slightly above 3600 tons. And finally, in the last decade, and unlike in previous years, after its lowest level in 2007, there was a continued increase in the number of ships in subsequent years, reaching an annual average of 231.8 units fisheries. This increase was not enough to prevent the average GRT from continuing to decline slightly, currently reaching just over 3,100 GRT in 2020 (**Table 1**). The fishing effort aimed at skipjack fishing is concentrated fundamentally in the inter-island channels and coastal areas of all the islands, mainly in the south-southwest areas where there are greater concentrations of small pelagic fish, their favorite prey. Smaller vessels with less than 10 GRT catch tuna near the coast in the free-school fishing modality. On the other hand, the fishing effort in the most remote areas of the islands is carried out by large vessels with more than 50 GRT and catch tuna usually in the "a Mancha" fishing modality.

3.2 Fishery production

The catch data of the main tuna caught in the waters of the Canary Islands are presented for the period from 1965 to 2020 (**Table 2 and Figure 3**). During the 60s and 70s, the reported catches of skipjack tuna did not exceed 1000 tons in many years. It must be considered and kept in mind that the fishery statistics in these years were incomplete and these figures should be considered untrue. The catches in the decade of the 70s, higher for the period 1971-1974, exceed 2500 t in period with a maximum of 5357 t in the year 1974 and reaching 24% and 48.2% of the total catches of those years. Skipjack catches in these first two decades, the 70s and 80s, represented 23% and 39% of the total catches in the Canary Islands respectively (**Figure 3A and 3B**). In the

1990s, there was a progressive increase in the catches of this species, reaching its historical maximum in 1992 to 7,128 tons. Skipjack catches, in that historic year represented 50.1% of the total catches and during this decade the catches of the species represented 39% of the total catches (**Figure 3C**). In the 2000s, skipjack catches show a declining pattern and stabilize around 1,800 tons per year on average. The annual maximums caught during the decade reached 3544 t and the minimum was 366 t. skipjack catches in this decade ranged from a minimum of 10.6% to a maximum of 55.4%, with 35 % of the total caught of this period (**Table 2 and Figure 3D**). In this last decade, from 2010 to 2019, catches increased slightly and stabilized around 3,200 t, with a maximum caught in 2012 with 7,321 t and a minimum in 2011 with 1,257 t. Skipjack catches, in this decade, ranged from a minimum of 19.9% to a maximum of 64.9% and with 39% of the total caught of this period (**Table 2 and Figure 3E**). In 2020, with COVI-19 pandemic situation, the total catches were affected with a decrease generally in all species but the total catch of SKJ represented 35% of the total catch (**Table 2 and Figure 3F**). The catch percentages of skipjack and bigeye show a significant negative correlation (corr. Person:-0.744, p-value=5e-11<p=0.005). There is a relationship between years with high abundance of bigeye tuna and low catch of skipjack and a vice versa between years with little catch of bigeye and a lot of skipjack.

3.3 Fishery production by fishing strategy ("a Mancha" and "Free school")

The skipjack catches by fishing modality for the two fleet segments in the Canary Islands is presented. The landing of skipjack caught in the "free school" fishing modality is always higher than those made in the "a Mancha" fishing modality. With maximum catches of 6,769 t at "free school" in 2012 and 1,266 t "a Mancha" in 2018; and minimum catches of 949 t at "free school" in 2011 and 48.9 t "a Mancha" in 2020, respectively, characterize skipjack catches. Free school skipjack catches came to represent a maximum of 98 % of the total landing in 2020 and a minimum of 70.2 % of total catches in 2018 and with an annual average of 87.3 % for the all data set analyzed. On the contrary, catches of skipjack "a Mancha" reached a maximum of 29.8% in 2018 and a minimum of 2% in 2020 of the total catches, with an annual average of 12.6% of the total for this period of study (**Table 3**).

3.4 Seasonality of skipjack catches

Fishing tuna species is characterized by a marked seasonal behavior that is related to the more or less rhythmic movements that these species make throughout the year. The migratory pattern of the skipjack is relatively well known and could consist of traveling long distances from North (the Azores, Madeiran or Canary islands) to South (the Equatorial latitude) and from West (Cape Verde) to East (Senegalese EEZ) (Kamarel and Fambaye, 2021), as a consequence of this behavior, the fishing fleets of subtropical latitudes adapt and prepare for the arrival of this species in their fishing zone. Analyzing the volume of landings per month over 4 decades in the Canary Islands, it is confirmed that skipjack is caught mainly during the second and third quarters of each year and there are no significant changes in the annual seasonality of catches in the four decades analyzed. Despite this, some years significant catches occur in the fourth or the first quarter of a particular year (**Figure 4**).

3.5 Analysis of catch sizes for the period 1995 to 2019

The minimum, maximum and average annual sizes of skipjack are presented for the period from 1995 to 2019. The minimum annual sizes obtained ranged from 25 cm in 2009 to 37 cm in 2011, the average sizes ranged from 50.3 cm in 2009 to 55.8 cm in 1995 and with size maximum between 70 cm in 2000 and 95 cm in 2019 (**Table 4**). On the other hand, the density distributions of the skipjack sizes captured for the period 1995 to 2019 are presented. In the years 2008, 2009 and 2010, a high frequency of sizes less than 40 cm was observed. In 2002, the largest sizes of skipjack were observed, reaching more than 80 cm (**Figure 5A**). Also, the density distributions of sizes captured by months for the period 1995-2019 are presented. It is clearly observed how the catch sizes change throughout the year. In the months of March, April, May and June the smallest specimens are captured. And during the winter months, in November, December, February and March, the largest skipjack specimens are caught in the Canary Islands (**Figure 5B**).

3.5.1 Analysis of catch sizes for fishing mode "a Mancha" and "Free school"

The minimum, maximum and average annual sizes of skipjack are presented for the period from 1995 to 2019 according to the two fishing strategies practiced in the Canary Islands. In "a Mancha" fishing mode, the minimum annual sizes ranged from 32 cm in 2017 to 37 cm in 2011 and 2012, the average sizes ranged from 46.9 cm in 2019 to 55.9 cm in 2013 and with maximum between 70 cm in 2017 and 85 cm in 2013 (**Table 5**). In the "free school" fishing mode, the minimum annual sizes ranged from 31 cm in 2013 to 40 cm in 2011, the average sizes ranged from 51.4 cm in 2019 to 57.9 cm in 2011 and with maximum between 73 cm in 2011 to 95

cm in 2019 (**Table 5**). The density distributions of sizes caught for each type of fishing strategy are presented. Slightly lower catch sizes are observed in the "a Mancha" fishing strategy (**Figure 6 right**) with respect to the "free school" (**Figure 6 left**) sizes, with homogeneity of variance (Levene's Test for homogeneity of variances p=0.49>p=0.005) and according to the Two simple t-test, the p-value=0.002<p=0.005, it is concluded that the mean catch sizes of skipjack for these two fishing strategies are statistically different.

3.6 Analysis of the seasonality of the sizes according to quarters

The density distributions of sizes caught according to quarters and years are presented for the Bait Boat fleet of the Canary Islands for the period from 1995 to 2019. In the comparative analysis, joint arrivals of different sizes of "School" are observed for the quarter "Feb- Apr" of the years 1997, 1998, 2003, 2008, 2016 and 2018. In this quarter, very different sizes are caught and correspond to a recruitment of skipjack to the fishery in pulses and with different sizes. For the central quarters of the year; "May-Jul" and "Ago-Oct" the catch sizes are the smallest of the year in general, as occurred in the years 1999, 2002, 2005, 2008, 2010, 2013, 2015 or 2018. In the winter quarters, observed the largest catch sizes, especially in the years 1995, 1996, 1997, 2000, 2001, 2003, 2012, 2013, 2015, 2016, 2017 or 2018. In 1999, 2012 and 2017, there is also evidence of the growth phenomen of some schools arrived to the islands. They are feeding and growing while stay in Canary and translates into a higher size school in the following quarters of the year (**Figure 7**).

4. Discussions

Catches of skipjack (*K.pelamis*) in the Canary Islands date back to very distant dates, as shown by the records of existing factories on the island of La Gomera. For the period analyzed in this document from 1965-2020, the behavior of the landed catches was very oscillating in the form of saw teeth, with larger peaks corresponding to good years and bad years. These strong oscillations are explained by the very seasonal nature of these ocean resources. This species comes every year from equatorial zones, where they reproduce. The skipjack recruitment episodes to the Canary Islands tuna fishery vary from year to year and are usually conditioned by environmental factors and possibly also by the alterations that other fleets cause to the annual recruitment volume of the species. Skipjack catches in the Canary Islands have always been important for artisanal fishing communities, reaching landing percentages of more than 40% in many years. There is an interesting relationship between the catches of skipjack and bigeye (*T. obesus*). The presence of this species in the waters of the archipelago significantly alters the behavior of fishermen and affects the catch of skipjack, since bigeye has a higher commercial value and boats prioritize catches of bigeye over skipjack. The percentages of catches of these two species show a very high negative correlation, which shows that when bigeye (*T. obesus*) is abundant less skipjack (*K. pelamis*) is caught and when there is a shortage of bigeye (*T. obesus*) it is caught a greater quantity of skipjack (*K. pelamis*). Due to its low price in the market, skipjack is often a complementary fishing resource for many boats, especially those of larger GRT. In general, skipjack catches are more abundant and important for the fleet segment of <10 GRT, which is currently about 160 fishing units throughout the Canary Islands. Regarding the seasonality of the catches, the skipjack has always been more abundant in the summer months (2nd and 3rd quarter). In the historical records of the last century, coming from data from canning factories, summer seasonality is also evident. In spite of this, some years, in December and January, important captures of skipjack take place.

Regarding the catch sizes of skipjack in the last twenty-five years (period 1995-2019), no significant changes are observed. The most frequent minimum catch size is around 35 cm, an average size of 53.83 cm and a maximum size of 95 cm for the entire series analyzed. The different sizes of skipjack catch show seasonality; the largest number of small skipjack is fished in the months of May, June, July and August. And the largest sizes of skipjack are fished during the winter months, December, January and February. The catch sizes for the two fishing strategies are slightly different, with somewhat smaller sizes in the "a Mancha" catches and larger sizes in the free school catches. This could be explained by several reasons. The small-sized skipjack has a great affinity for the boat that has formed "the spot or Mancha", and they stay under the boat for a long time as it is the best refuge from predators in the pelagic environment. And this increased time under the ship increases the chances of being caught. Regarding the sizes of free school captures, a part of these large skipjack are caught in mixed schools with albacore. The large specimens are the only ones with swimming capacity to be able to accompany the tuna albacore. Also, the large specimens are the most voracious and are the ones that are caught first in live bait fisheries, leaving the smaller ones for last, which are often not caught.

In a generic pattern, the sizes of skipjack increase over time in the Canary Islands. The smallest skipjack schools join the fishery mainly in May, June and July, and remain for at least another six months, feeding and growing to become larger specimens that are caught during the winter months.

Referencias

Anuario Estadístico de España de 1929 y contabilidad de la empresa conservera de la Gomera, Estadística de Pesca año 1933 y 1934. Universidad de La Laguna.

An unknown Bluefin tuna fishery and industry in Tenerife (Canary Islands, Spain) in the Early XX Century: The Florio Enterprise, SCRS/2014/050, Collect. Vol. Sci. Pap. ICCAT, 71(3):1152-1173 (2015)).

Ariz, J., J.C. Santana, A. Delgado de Molina y R. Delgado de Molina. Estudio de la modalidad de pesca sobre "Manchas" de túnidos en las islas Canarias. SCRS/1994/164, Col. Vol. Sci. Pap. ICCAT, 44 (2): 262-271 (1995).

Ariz, J., Delgado de Molina, R, Santana, JC. y Delgado de Molina, A, Datos estadísticos de las pesquerías de túnidos de las Islas Canarias durante el período 1975 a 1977, SCRS/1998/108, Col. Vol. Sci. Pap. ICCAT, 49 (3): 318-322 (1999).

Delgado de Molina, A, Delgado de Molina, R, Santana, J.C. y Ariz, J. Datos estadísticos de las pesquerías de túnidos de las Islas Canarias durante el período 1975 a 2013, SCRS/2014/079, Col. Vol. Sci. Pap. ICCAT, 71(1): 264.274 (2015)

Estadística de Pesca 933 y 1934; Anuario Estadístico de España 1930 a 1932; Memoria comercial de la COCIN de Las Palmas años 1931 a 1934 y Estadística de importación y exportación de mercancías, frutos y movimiento marítimo del Puerto de Santa Cruz de Tenerife 1924 a 1932.

Kamarel Ba, Fambaye Ngom Sow. SCRS/P/2021/XXX. Studying displacements and size structure of tropical tuna species (bigeye, skipjack and yellowfin) between the Senegalese EEZ and adjacent waters. Symposium AOTTP, January 12-14 2021.

Pesquerías de Túnidos en las Islas Canarias del Laboratorio Oceanográfico de Canarias, SCRS/1973/048, Col. Vol. Sci. Pap. ICCAT, 2:314-319 (1974).

Privilegio de salazón de atún en La Gomera Sr. Francisco Grasso año 1831. Archivo Museo Álvaro de Bazán (AMAB) Fondo Documental de Cádiz (FDC), Legajo 8717 (38B) y Investigación realizada por el Comandante de Marina de la provincia de Tenerife 1835. AMAB, Pesca, Leg. 2130.

Santos Guerra A, Las pesquerías de túnidos en Canarias durante 1974. SRCS/1975/086. Col. Vol. Sci. Pap. ICCAT, (1): 5-10 (1976).

Table 1. List of the number of vessels by fleet segment, according GRT level of the vessels for the period from 1973 to 2020.

Year	**< 10 GRT**	**10-19.9 GRT**	**20-49.9 GRT**	**50-99.9 GRT**	**>100 GRT**	**Total Barcos**	**GRT _anual**
1973	262	125	53	29		469	5325
1974	250	19	10	9	15	303	3745
1975	250	19	13	8	15	305	3895
1976	---	---	---	---	---	---	---
1977	---	---	---	---	---	---	---
1978	---	---	---	---	---	---	---
1979	---	---	---	---	---	---	---
1980	55	33	15	15	39	157	6213,6
1981	102	44	16	15	52	229	7532,2
1982	110	46	12	13	24	205	4979,7
1983	91	46	10	14	24	185	4607,8
1984	90	36	12	11	42	191	6532
1985	104	45	13	14	43	219	7160,7
1986	142	48	10	13	42	255	6355,1
1987	161	53	11	14	26	265	5170,6
1988	145	46	12	11	44	258	6897,1
1989	148	44	13	12	19	236	4358,8
1990	130	44	9	9	17	209	3736,9
1991	145	42	12	9	22	230	4719,2
1992	178	41	8	11	30	268	5193,7
1993	136	39	7	8	18	208	3783
1994	152	44	11	7	19	233	4274,1
1995	151	41	12	13	20	237	4453,7
1996	167	42	10	13	38	270	6618,6
1997	174	50	10	15	18	267	4139
1998	122	42	12	12	24	212	5072,36
1999	153	38	10	16	27	244	5436,4
2000	121	38	3	12	10	184	2766,68
2001	152	42	13	12	20	239	4515,36
2002	125	37	12	13	17	204	4118,1
2003	112	41	7	11	16	187	3977,82
2004	103	32	7	11	13	166	3511,88
2005	130	45	8	14	13	210	3771,74
2006	127	32	6	10	14	189	3573,78
2007	90	26	7	7	14	144	3380,92
2008	139	36	6	11	13	205	3540,36
2009	141	28	5	10	11	195	3033,93
2010	151	33	6	10	11	211	3269,34
2011	144	34	6	9	12	205	3274,78
2012	164	40	4	9	10	227	3005,91
2013	181	39	6	10	14	250	3734,08
2014	176	40	5	10	11	242	3367,46
2015	134	40	5	9	12	200	3318,53
2016	179	43	6	11	11	250	3516,68
2017	194	42	5	9	11	261	3353,55
2018	176	39	5	6	11	237	3177,39
2019	175	37	5	8	10	235	3090,48
2020	166	35	5	8	11	225	3164,37

Table 2. Catches (in tons) and percentage of catches for the tuna species landed in the Canary Islands for the period from 1965 to 2020.

Year	BET	**SKJ**	ALB	YFT	BFT	Total	%_BET	**%_SKJ**	%_ALB	%_BFT	%_YFT
1965	1017	**552**	253	179	197	2198	46,3	**25,1**	11,5	9,0	8,1
1966	1145	**621**	287	202	222	2477	46,2	**25,1**	11,6	9,0	8,2
1967	1272	**690**	316	224	247	2749	46,3	**25,1**	11,5	9,0	8,1
1968	1399	**759**	348	247	271	3024	46,3	**25,1**	11,5	9,0	8,2
1969	1526	**828**	379	269	296	3298	46,3	**25,1**	11,5	9,0	8,2
1970	3600	**1844**	250	701	650	7045	51,1	**26,2**	3,5	9,2	10,0
1971	6991	**2715**	400	420	800	11326	61,7	**24,0**	3,5	7,1	3,7
1972	3080	**4083**	725	731	930	9549	32,3	**42,8**	7,6	9,7	7,7
1973	4422	**2636**	0	786	906	8750	50,5	**30,1**	0,0	10,4	9,0
1974	3170	**5357**	0	2032	546	11105	28,5	**48,2**	0,0	4,9	18,3
1975	5719	**776**	1332	1028	978	9833	58,2	**7,9**	13,5	9,9	10,5
1976	4225	**604**	656	228	832	6545	64,6	**9,2**	10,0	12,7	3,5
1977	3561	**728**	975	273	1250	6787	52,5	**10,7**	14,4	18,4	4,0
1978	3850	**558**	1160	243	1548	7359	52,3	**7,6**	15,8	21,0	3,3
1979	2975	**1330**	604	145	758	5812	51,2	**22,9**	10,4	13,0	2,5
1980	4034	**2162**	518	77	397	7188	56,1	**30,1**	7,2	5,5	1,1
1981	2313	**3876**	1009	96	524	7818	29,6	**49,6**	12,9	6,7	1,2
1982	1449	**3366**	519	385	43	5762	25,1	**58,4**	9,0	0,7	6,7
1983	2352	**1255**	768	690	305	5370	43,8	**23,4**	14,3	5,7	12,8
1984	2817	**2013**	985	2449	2	8266	34,1	**24,4**	11,9	0,0	29,6
1985	4920	**5652**	1470	2824	133	14999	32,8	**37,7**	9,8	0,9	18,8
1986	2779	**2499**	443	1644	78	7443	37,3	**33,6**	6,0	1,0	22,1
1987	3615	**3369**	181	2731	25	9921	36,4	**34,0**	1,8	0,3	27,5
1988	2276	**3103**	280	2010	92	7761	29,3	**40,0**	3,6	1,2	25,9
1989	2382	**5161**	141	964	265	8913	26,7	**57,9**	1,6	3,0	10,8
1990	3515	**4322**	138	2213	121	10309	34,1	**41,9**	1,3	1,2	21,5
1991	5129	**5764**	93	2451	59	13496	38,0	**42,7**	0,7	0,4	18,2
1992	5267	**7128**	299	1493	29	14216	37,0	**50,1**	2,1	0,2	10,5
1993	4376	**2839**	603	1128	31	8977	48,7	**31,6**	6,7	0,3	12,6
1994	9325	**4772**	160	1330	56	15643	59,6	**30,5**	1,0	0,4	8,5
1995	7271	**5143**	657	801	4	13876	52,4	**37,1**	4,7	0,0	5,8
1996	5253	**4472**	743	2621	157	13246	39,7	**33,8**	5,6	1,2	19,8
1997	5559	**5884**	1045	411	360	13259	41,9	**44,4**	7,9	2,7	3,1
1998	1034	**5441**	313	3259	39	10086	10,3	**53,9**	3,1	0,4	32,3
1999	6191	**4119**	1972	524	32	12838	48,2	**32,1**	15,4	0,2	4,1
2000	2167	**1120**	240		26	3553	58,6	**30,3**	6,5	0,7	0,0
2001	2543	**1538**	1509	15	55	5660	44,9	**27,2**	26,7	1,0	0,3
2002	1863	**366**	1114	88	5	3435	54,2	**10,6**	32,4	0,1	2,6
2003	3191	**1417**	1312	172	2	6094	52,4	**23,3**	21,5	0,0	2,8
2004	2463	**2093**	680	213	5	5452	45,2	**38,4**	12,5	0,1	3,9
2005	2960	**2882**	731	106	35	6713	44,1	**42,9**	10,9	0,5	1,6
2006	2739	**3006**	325	292	73	6436	42,6	**46,7**	5,1	1,1	4,5
2007	1984	**958**	256	199	113	3509	56,5	**27,3**	7,3	3,2	5,7
2008	1768	**3544**	730	341	9	6393	27,7	**55,4**	11,4	0,1	5,3
2009	3030	**1592**	49	272	2	4945	61,3	**32,2**	1,0	0,0	5,5
2010	1754	**1482**	408	825	14	4484	39,1	**33,0**	9,1	0,3	18,4
2011	3305	**1257**	330	1280	53	6224	53,1	**20,2**	5,3	0,8	20,6
2012	2260	**7321**	1571	88	38	11277	20,0	**64,9**	13,9	0,3	0,8
2013	2097	**3187**	1048	222	139	6693	31,3	**47,6**	15,7	2,1	3,3
2014	2800	**4350**	2126	57	67	9400	29,8	**46,3**	22,6	0,7	0,6
2015	2971	**1470**	2757	75	120	7394	40,2	**19,9**	37,3	1,6	1,0
2016	2747	**2846**	5014	222	140	10969	25,0	**25,9**	45,7	1,3	2,0
2017*	3171	**3356**	2329	275	177	9308	34,1	**36,1**	25,0	1,9	3,0
2018*	2407	**4245**	710	95	307	7764	31,0	**54,7**	9,1	4,0	1,2
2019	3044	**2497**	1179	100	371	7191	42,3	**34,7**	16,4	5,2	1,4
2020**	2659	**2409**	1115	251	505	6939	38,3	**34,7**	16,1	7,3	3,6

*Years with catch limit (TAC for BFT) or stop fishing activity for exceeding the TAC in the bigeye or albacore specie.
**Year of the COVI-19 Pandemic.

Table 3. Number of boats and skipjack catches according fishing strategies “in free school=FS” and “a Mancha fishing=FM” for the period from 2011 to 2020. % SKJ_FS= % catches by free school and % SKJ_FM= % catches by “a Mancha” fishing mode.

year	Ntotal_vessels	N_vessels_FSchool	N_vessels_FMancha	Landing SKJ_FS(t)	Landing SKJ_FM(t)	Total Catches	SKJ_FS(%)	SKJ_FM(%)
2011	204	203	21	949,8	307,0	1256,8	75,6	24,4
2012	227	227	17	6769,2	551,5	7320,8	92,5	7,5
2013	249	249	18	2833,0	354,1	3187,1	88,9	11,1
2014	242	242	16	3539,0	811,4	4350,4	81,3	18,7
2015	200	199	25	1315,2	154,8	1470,0	89,5	10,5
2016	249	248	22	2566,2	232,5	2798,7	91,7	8,3
2017	260	260	28	3080,9	274,6	3355,5	91,8	8,2
2018	236	236	31	2978,7	1266,5	4245,1	70,2	29,8
2019	234	234	28	2344,0	153,0	2497,0	93,9	6,1
2020	225	225	6	2359,6	48,9	2408,6	98,0	2,0

Table 4. Minimum, mean and maximum sizes (FL cm) of skipjack (*K. pelamis*) caught in the Canary Islands for the period from 2011 to 2019.

Year	**N samples**	**Min size (FL cm)**	**Mean size (FL cm)**	**Max size (FL cm)**
1995	6797	37	55,87	89
1996	5053	36	54,38	73
1997	4880	36	52,48	79
1998	4920	36	51,38	73
1999	6306	38	55,13	76
2000	1399	39	57,15	70
2001	2906	36	53,59	85
2002	1677	36	59,03	88
2003	3573	36	52,81	83
2004	4726	36	55,15	77
2005	4131	36	52,39	81
2006	4365	36	53,43	77
2007	6075	34	52,25	87
2008	20804	31	54,07	89
2009	8064	25	50,32	80
2010	9859	25	51,55	82
2011	6669	37	55,83	84
2012	11809	35	54,83	80
2013	22389	31	55,49	85
2014	24364	33	55,36	94
2015	8058	34	54,33	78
2016	8221	33	54,54	89
2017	8939	32	53,29	93
2018	13283	32	51,22	76
2019	5107	33	50,18	95
Total	204374	25	53,83	95

Table 5. Minimum, mean and maximum sizes (FL cm) of skipjack (*K. pelamis*) caught in "a Mancha" and "free school" in the Canary Islands for the period from 2011 to 2019.

Fishing a Mancha	N samples	Min size (FL cm)	Mean size (FL cm)	Max size (FL cm)
2011	5618	37	55,0	84
2012	6957	37	55,7	80
2013	8469	36	55,9	85
2014	15942	33	55,2	80
2015	4977	34	50,4	76
2016	4967	33	51,0	77
2017	6020	32	49,5	70
2018	7135	32	47,3	76
2019	1885	33	46,9	79
Total	61970	32	52,3	85
Free School	**N samples**	**Min size (FL cm)**	**Mean size (FL cm)**	**Max size (FL cm)**
2011	1051	40	57,9	73
2012	4852	35	54,1	76
2013	13920	31	54,2	79
2014	8422	34	56,0	94
2015	3081	34	57,0	78
2016	3254	36	55,9	89
2017	2919	33	56,0	93
2018	6148	33	52,6	74
2019	3222	35	51,4	95
Total	46869	31	55,0	95
Total	108839	31	53,8	95

Figure 1. Location of tuna canning factories for canning and salting on the island of La Gomera during the period from 1831 to 1926.

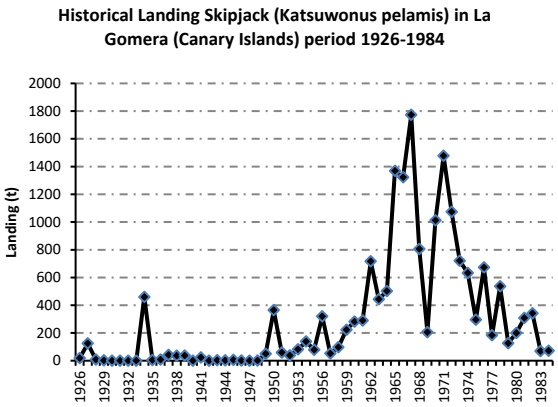


Figure 2. Historical landing of skipjack (*Katsuwonus pelamis*) in canning factories on the island of La Gomera in the period from 1926 to 1984.

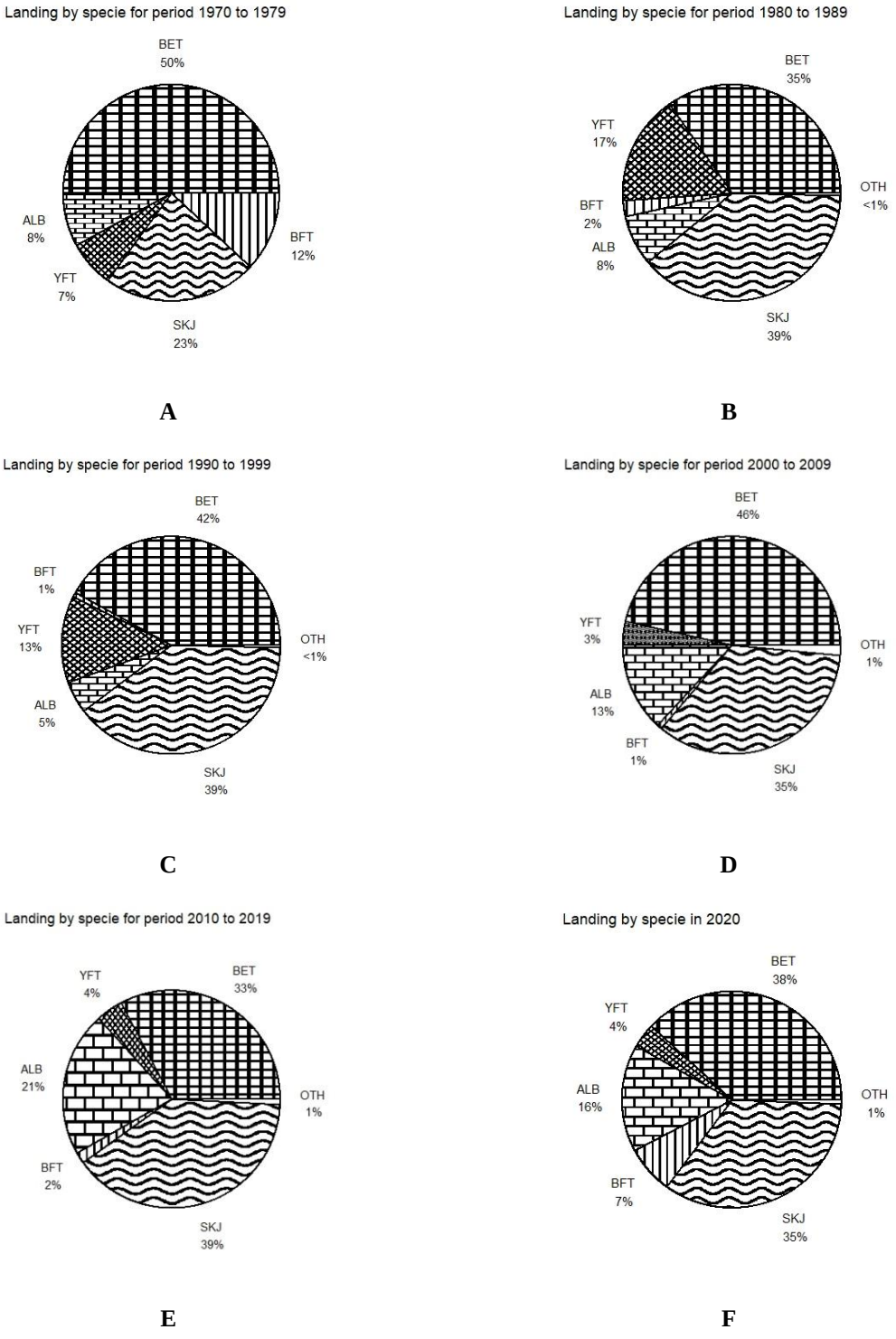


Figure 3. Percentage (%) of catches landed by tuna species in the Canary Islands for the periods: A: 1970-1979; B: 1980-1989; C: 1990-1999; D: 2000-2009; E: 2010-2019; F: 2020.

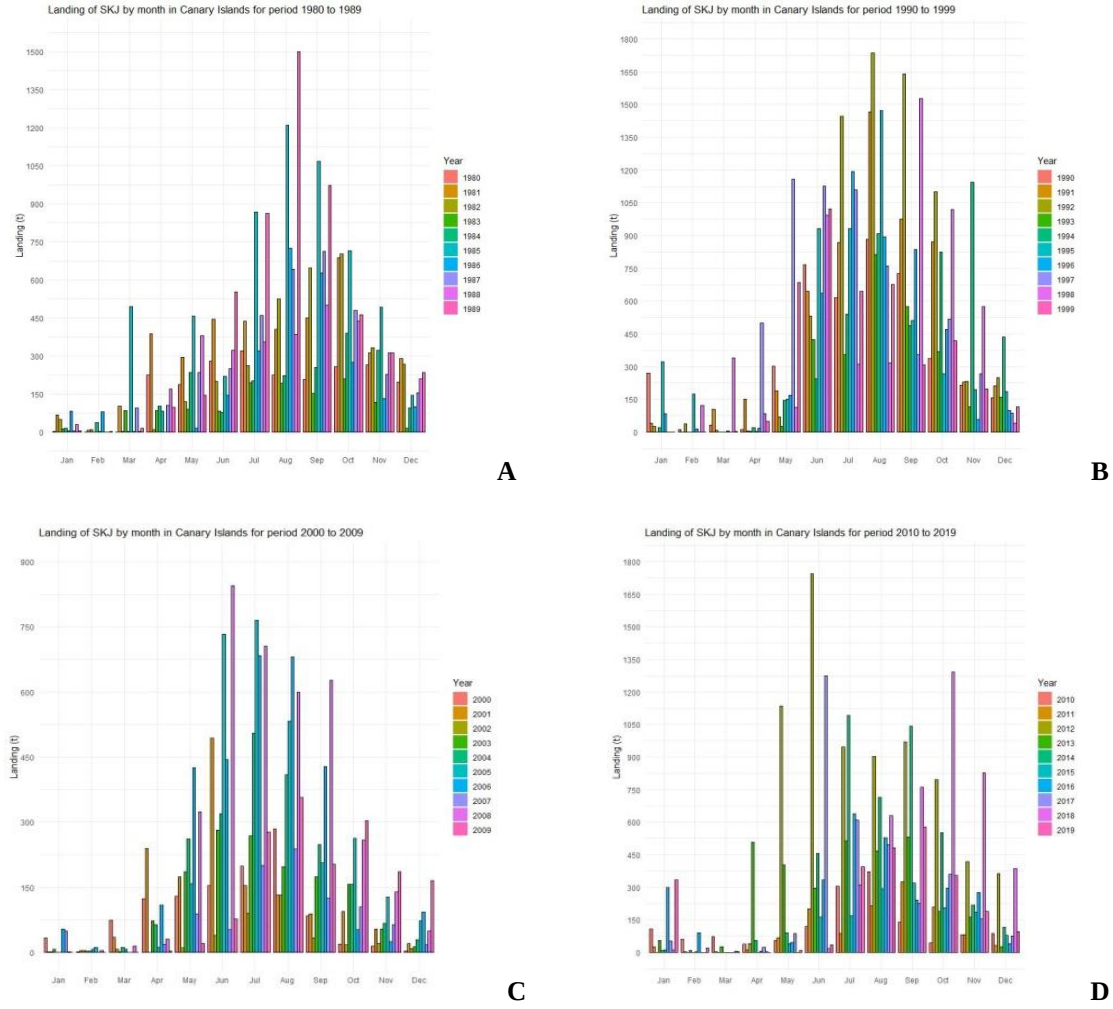
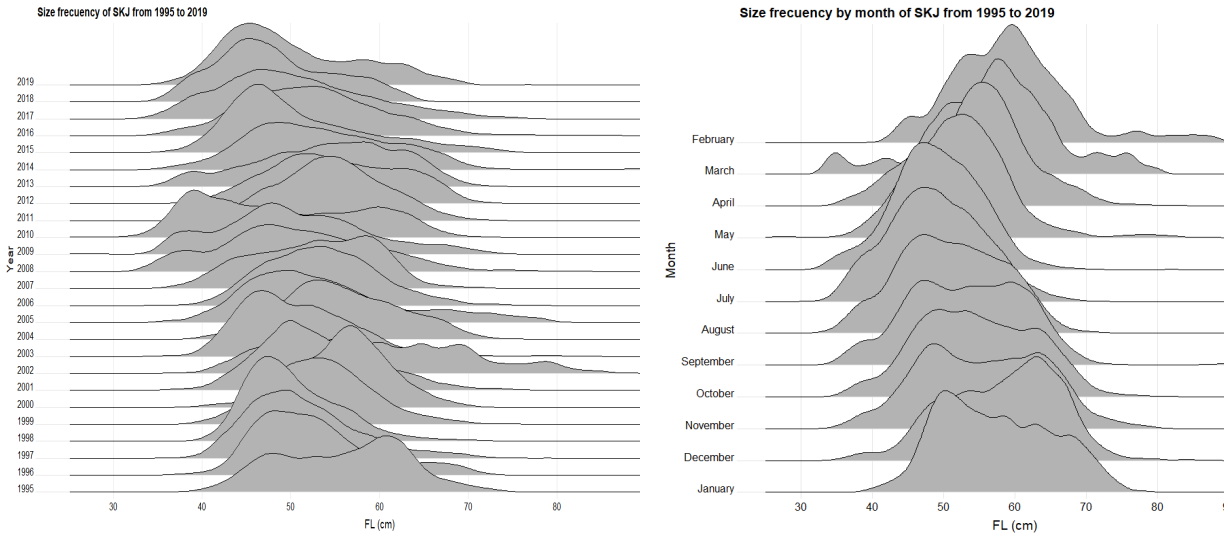


Figure 4. Monthly landings of skipjack (*K.pelamis*) in the Canary Islands for periods of 10 years; A: 1980-1989; B: 1990-1999; C: 2000-2009; D: 2010-2019.



A **B**

Figure 5. Size density graphs of skipjack (*K.pelamis*) for the BB catches in the Canary Islands for the period 1995-2019 (A). Size density graphs of skipjack (*K.pelamis*) fished by month for the period 1995-2019 (B).

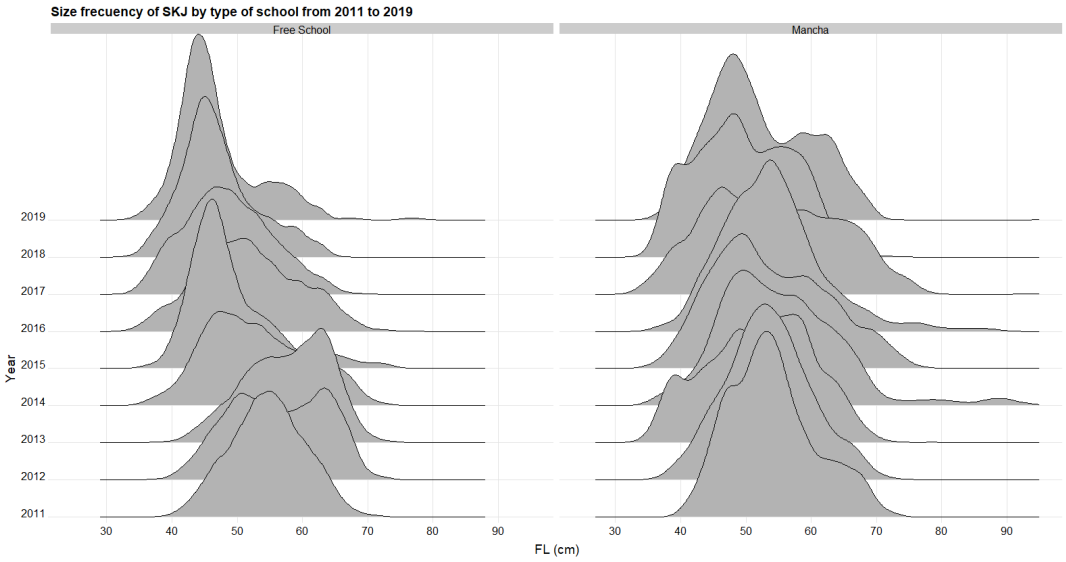


Figure 6. Size density graphs of skipjack (*K.pelamis*) BB catches in the Canary Islands for the "free school" fishing strategy (left) and for the "a Mancha" fishing modality (right) for the period 2011-2019 (Levene's Test p=0.49>p=0.005 and t-test p-value=0.002<p=0.005).

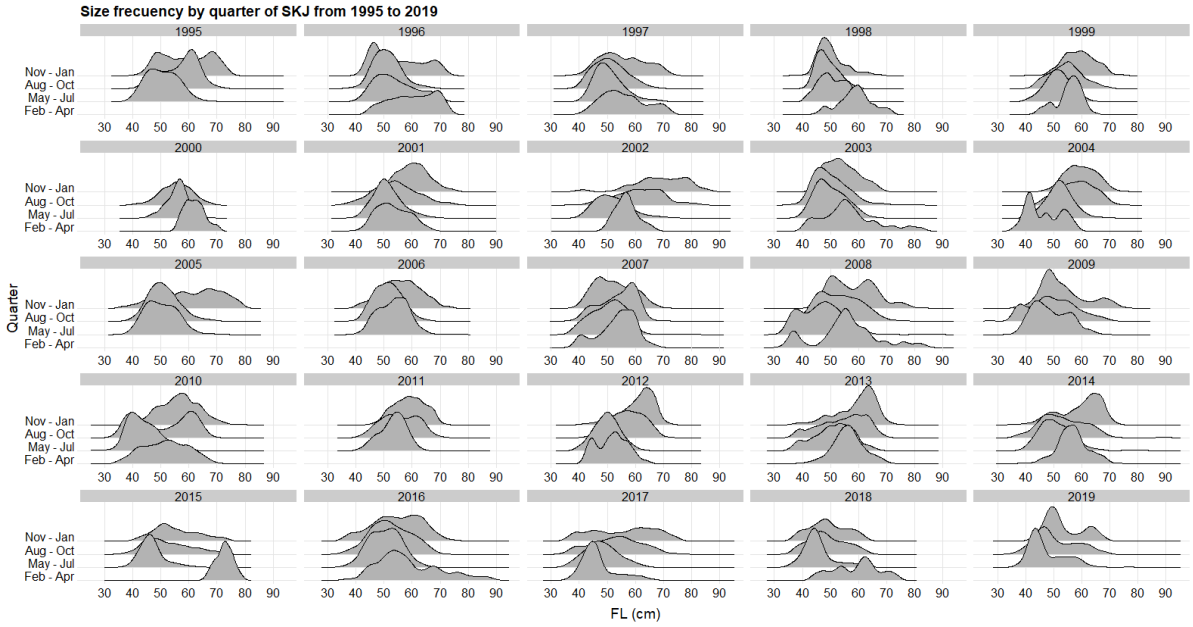


Figure 7. Size density graphs of skipjack (*K.pelamis*) BB catches in the Canary Islands by quarters for the period 1995-2019.