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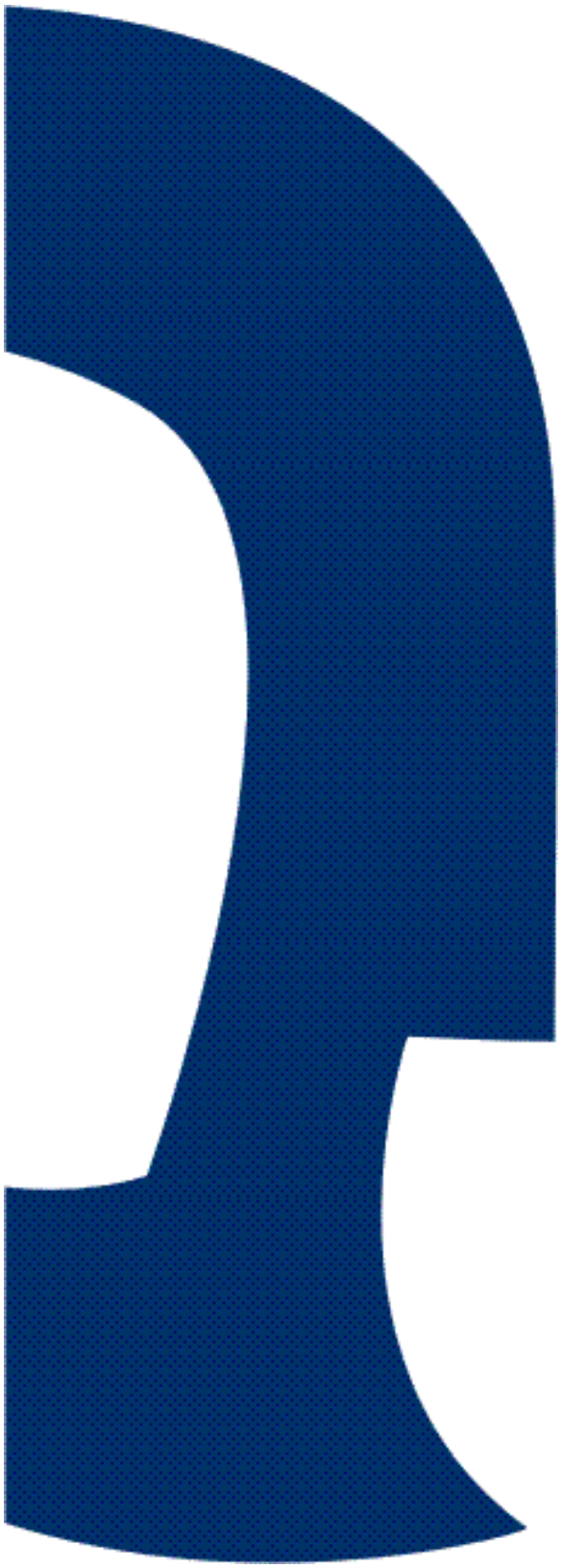

# THE SMALL-SCALE FISHERY OF THE EAST COAST OF LANZAROTE (CANARY ISLANDS)

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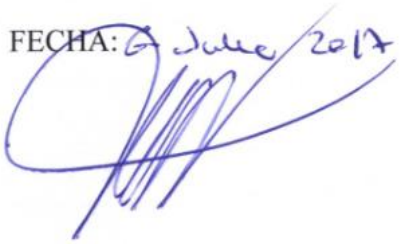

# INDEX

# 1. ABSTRACT

The artisanal fishing in Lanzarote as in the resto of Canary Islands is multiespecific and multi-gear, but the evaluation of its impact on the fishery resources is hampered by the lack of historical series of capture and effort, thus because of the inaccuracy of the few existing data. With this study, we try to characterize the artisanal fishery that develops from Puerto del Carmen (east of Lanzarote) through the information provided from 2012, for it is first sale point. In analyzing the data available and from information obtained from surveys, it is possible to infer that catches of the different commercial species have undergone significant oscillations in recent years, due mainly to the action that fishing exerts on the populations, but also to the influence of biological and climatic factors. These oscillations observe more strikingly in the tuna catches, with declining tendencies, which has forced to exert greater pressure on the species bento-demersal, scarcer and more vulnerable to the overexploitation.

# 2. INTRODUCTION

## Artisanal fishing in the Canary Islands

Fishing pressure on marine resources has increased in recent decades (Watson et al., 2013), which has led to the overexploitation of most of the world's stocks and fishing grounds (Mitcheson et al., 2013; Chiappone et al., 2004; Pauly, 2008; FAO 2012, 2016), resulting from inadequate management of artisanal, industrial and recreational fisheries (Castro, 2013). In the specific case of the Canary Islands, more than 100 species are exploited by small-scale fishing, using various fishing systems (García-Cabrera, 1970; Pascual, 1991; Bas et al., 1995; Pajuelo & Lorenzo, 1995; Mancera-Rodríguez & Castro, 2004, 2015; Martín-Sosa, 2012).

The assessment of the state of the populations affected by fishing in the Canary Islands is difficult, mainly because much of the existing knowledge focuses on punctual aspects of a few species of high commercial value, at the same time there is a great lack of fishing, biological and ecosystem-type information (González & Lozano, 1992; Bas et al., 1995; Pajuelo & Lorenzo, 1995, 1996, 1999; García-Díaz et al., 1997,2006; Méndez-Villamil et al., 1997; Pajuelo et al., 2006; González et al., 2012). It is especially noteworthy the lack of historical catches and fishing effort (Hernández-García et al.,

1998), which prevents an adequate assessment of stocks and to know the trends of the fishery over the decades (Barrera-Lujan, 2016).

This sector has long been relegated to a second economic level due to its low productivity of the artisanal fishery, in relation to other industrial activities of the primary and secondary sector, as well as to its low contribution to the gross domestic product of the islands (in 2008 it represented only, together with aquaculture, 0.08 of PIB, according to INE , in a clearly decreasing trend, however, fishing as a primary sector has an important strategic value for a system like insular, and we must not forget its contribution to the fight against poverty and nutritional and food security (FAO 2015), in addition to setting up a significant social core element that contributes cultural and heritage value (Pascual, 1991).

Professional fishing in the Canary Islands is of a distinctive craftsmanship, based on a multipurpose fleet and a multispecific fishery (Bas et al., 1995). Most of the boats are of small size (less than or equal to 15 meters of total length), usually old and mainly of wood (Bas et al., 1995; González & Lozano, 1996; Pajuelo, 1997). The catch is unload in a wide variety of beaches, shelters and harbours, this makes it difficult to establish effective control of the level of exploitation carried out by the fishing fleet, and particularly of the enormous number of recreational vessels, which makes it easier for the contribution of illegal or furtive fishing to be very significant (Castro et al., 2016).

Since the year 1970, the fleet of artisanal fishing has experienced an intense development as far as the extractive capacity, even though it is made up of generally small vessels. This capacity has focused on the incorporation of mechanical technology (pullers, traction razors, etc.) and electronics (GPS, echo sounder, etc.) (Sistiaga-Mintegui, 2011), as well as the ground support infrastructure (Morales-Malla, 2011; Castro & Hernández-Garcia, 2012). To this, we must add that a significant part of the fleet has been renewed in recent years, because of programs of economic support to it, giving rise to a series of units of greater length and autonomy (Castro & Hernández-Garcia, 2012). As well as improved materials for the construction of the arts, increasing its size, resistance, durability and maneuverability (Bas et al., 1995). The effort of this fleet is limited, almost in general, to the Neríticas waters and edge of the slope contiguous to each one of the islands. Being able to ultimately generate depletion of stocks (González, 2008; Couce-Montero et al., 2015 Castro et al., 2016).

Nowadays, we want to achieve a balance between the economic activity associated with fishing and the protection and conservation of the marine ecosystem through rules for its sustainable exploitation and keeping in mind the rights of future

generations. In this need, the Government of the Canary Islands launched in 2006 a system of fishing information collection, mainly catches by species, based on commercial transactions made from the first sale (Royal Decree 1998/1995, of 7 December). This system used by fishermen's guilds as points of collection of information, obligatory for professional fishing as a step prior to the commercialization of the catches obtained (Royal Decree 418/2015, of 29 May). Prior to that date, minimally reliable information is lacking to apply the methods of fishing assessment to use (Barrera-Luján, 2016).

This form of control called Point of First sale (PPV), it is defined according to the State Regulation (Royal Decree 1822/2009), as the one that is carried out for the first time within the Community territory and in which the price of the fishery product is credited documentally, on the occasion of its landing or unload in the national territory. Unfortunately, these databases present a great deal of inaccuracies, although they can allow to establish a reference situation from which future trends in the coastal artisanal fisheries of the archipelago can be assessed (Couce-Montero, 2015). Besides that, they only correspond to the catches obtained by professional fishermen, there are no records on the catches obtained by the recreational fishing, which generates an intense pressure, being able to surpass even the artisan (Jiménez et al., 2012).

These PPV are in the guilds of fishermen of the different islands, to a number of 31 entities authorized as PPV of fresh fish products and 17 for frozen products. The first of these PPV was installed in the island of Tenerife, in 2006, and the last in Lanzarote, in the town of Puerto del Carmen, in 2012. Unfortunately, this relative youth of the fisheries information collection system still does not allow the establishment of a trend or to draw conclusive elements from the fishery, at least as far as the state of the target stocks of fishing is concerned, even less in action of the fleet based in Puerto del Carmen because it has only 5 years of data.

In Lanzarote, the tradition is as old as the conquest of the island, and during these centuries there have been many events of a fishing nature that have taken place on the island and the nearby African fishing grounds (García-Cabrera, 1970). From an oceanographic point of view, the selfish and fish riches of the Seas of Lanzarote, along with those of Fuerteventura and those of the so-called Archipiélago Chinijo, are the most important of the Canary Islands (Pérez-Saavedra, 1993). The fishermen of inshore of Lanzarote have been able to live of the fishing, despite the competition of the recreational fishermen and the lack of means to modernize their techniques and to regulate their catches (Pérez-Saavedra, 1993).

The main objective of this work is based on the study of the characteristics of the artisanal fishery carried out by the artisanal fishing fleet based in Puerto del Carmen (Lanzarote). This, like the one carried out in the rest of the archipelago is of marked seasonal character, according to the rhythm of the different species of tunas throughout the year (Bas et al., 1995). The versatility of most boats allows these boats to be dedicated to the bottom traps, trammel net and other arts from October to May, and leave this fishing to catch tuna, mainly listed, during the summer months (from May to October, depending on the years), through live bait.

# 2. DATA AND METHODS

## Geographic situation

The Canary Islands make up the archipelago located north-west of the African continent, between 27 ° 37 'N - 29 ° 25 'N and 13 ° 20 ' W - 18 ° 10 ' W (Fig. 1). It is independent to this continent and separated from it by depths, close to 2000 m (Carracedo, 1984). The entire archipelago is characterized by its volcanic nature and mountainous orography, the latter being more pronounced in the more western islands, geologically more recent and in its youthful state, that the eastern islands, older and affected by erosion (Carracedo, 2002). This also affects the geomorphology of the coasts and the dimension and slope of the insular platform, which, together with local oceanographic and climatic characteristics, influences the distribution of marine species and the development of fisheries (Brito, 1984, 1991; Falcón et al., 1996; Landaeta et al., 2012).

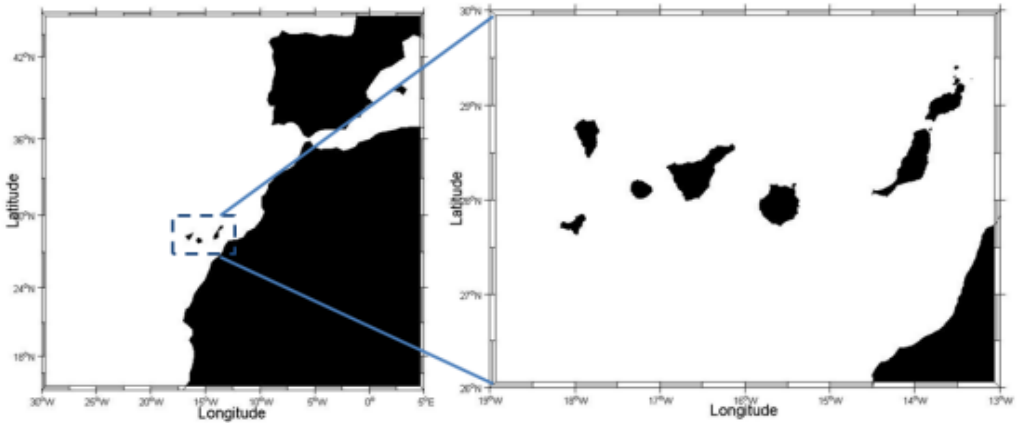


Figure 1. Geography situation in Canary Island (Matlab).

Lanzarote, with an area of 845.93 km², is the northernmost and easternmost island of the Canary Islands archipelago. It is popularly known as "The Island of volcanoes", identifying itself with the volcanic mantle that extends along much of its surface and causing the great volcanic activity of the early eighteenth century. Lanzarote is located at 140 kms from the north-west African coast and 1000 kms from the nearest point of the European continent, the south of the Iberian Peninsula. Its northernmost point is El Cabo or Punta Fariones, and the southernmost tip of the Papagayo. Its climate is subtropical with scarce precipitations. To the north of this is the Chinijo archipelago, formed by the small islets and islands of Alegranza, La Graciosa, Montaña Clara, Roque del Este and Roque del Oeste.

## Study of the area

This study focuses on the artisanal-type fishery developed by the Professional fleet based in Puerto del Carmen, in the municipality of Tías, on the south-east coast of the island (8 º 55,15 'N 13th 40.30 ' W). The construction of fishing lodge of Puerto del Carmen was started in 1988 and finished in 1994. The dike reaches an outer draught of 20 m depth, while in the sheltered area it is reduced to 13 m. The length of the main dike is approximately 180 m, with a triangular explanade of 50 m. It is built on a rocky background, and gives protection to a small artificial beach.

The fleet is made up of 21 artisanal fishing boats, although only 16 are active, and more than a hundred recreational boats with very heterogeneous characteristics. (Fig. 2).

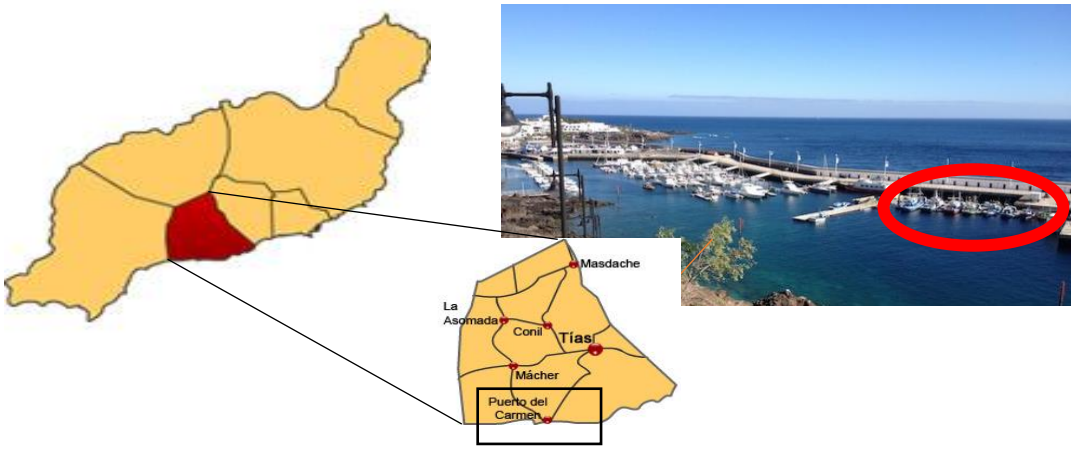


Figure 2. The location of Lanzarote's port, like as the photo of the port and its studio of boats.

This port is equipped with various facilities that facilitate the maneuverability and the accommodation of the fleet, both through pontoons, and ramps of beach and repair, and has a gantry crane or travel-lift that allows the handling of boats of up to 70 tonnes. In addition, and for the exclusive use of the artisanal fishing fleet, it has a building for the Fishermen's Guild, endowed with ice factory of 6 t of capacity, chambers of cold and freezing, and another one with offices, where there is a point of first sale of the government of the Canary Islands, and 17 rooms of ammunition for the shipowners. It also has a 2.5 t crane/boom, fuel tank of 10,000 litres capacity and two forklift trucks.

Figure 3. Different facilities that have the study port.

## Capturing data capture

The catch data obtained by the Artisan fleet based in the port of Puerto del Carmen were supplied by the Fishermen's Guild of La Tiñosa and compiled from PPV located in its facilities. However, this PPV only has capture data from January 2012, when it started to be fully operational. On this PPV are recorded the daily catches obtained, both for the fraction of the fleet dedicated to the fishing of demersal species, such as those of purse seine, dedicated to medium pelagics, and of live bait oriented to the catch of tunas in a seasonal way.

Although these catch data are daily referred to the Government of the Canary Islands, to form the statistics of catches of the sub-department of fishing, by the way in

which the Brotherhood records the data in its own files it was only possible to have the catches by species with a monthly periodicity. On the other hand, the fishing effort carried out by the different fractions of the professional fleet was estimated from the number of first sale notes that the guild made monthly, without being able to differentiate by boat or fishing mode. However, depending on the target species, it was partially possible to rebuild the effort by fraction of fleets, assuming that each fraction has a series of target species and that there is no overlap between them.

As part of the work of the collection of information of type fishing, beyond that available in the information services of the Government of the Canary Islands or of the Brotherhood itself, we conducted surveys of different fishermen (active and retired) aimed at characterize the fishery, both in terms of fishing modalities and systems, yields, fisheries, and in aspects related to fishing effort deployed in numbers of rigs used , duration of the fishing days, seasonality of the fishery, objective species and, also, in order to obtain information of socio-economic type diverse. The importance of the surveys is that it provides information on aspects that could not be obtained as mere field studies of fisheries Biology (Mackinson, 2001).

The survey has been structured on the basis of 4 thematic blocks. Thus, the initial block, with 15 issues, is aimed at obtaining information of a personal nature (name, age, place, sex, level of studies, marital status, other activities complementary to fishing, months of dedication and motivation) and its technical training (qualifications it possesses, how long and where it was trained, considerations on these). In the second block, with 4 issues, it was oriented to obtain information on the fishing systems used and yields of the fisheries (types of used arts, areas of fishing by species and stations and catch average bottom traps and daily longlines). On the other hand, the third block, with 19 issues, was dedicated to establishing a characterization of the fleet and systems of fishing aids (port, name of boat, registration, previous name, type of vessel, material, length, power, tonnage, system of conservation, instrumentation of the boat, year of construction, year of acquisition, condition acquisition, price, life, boat status and residual sale price). Finally, the last block is dedicated to collecting economic information, through 5 issues in 3 sections, related to maintenance and repair of the hull, engine, gear, equipment, navigation and other maintenance (its frequency and cost), a second section on operating expenses in terms of food, fuel, ice, expenses for loss during slaughter and other (expenses in euros), as well as data on the marketing system (sales mode, type of buyers, income, profit and distribution by parts).

Between February and April of 2017 a total of 12 surveys were carried out to different shipowners/owners of boats dedicated to the artisanal fishing (11 in active and one retiree) of a total active population made up of 16 shipowners.

The analysis of the catch data and the information obtained from the surveys has been carried out with the statistical package Excel (Microsoft) and IBM SPSS statistics 22.

# 4. RESULTS

## Characteristics of the fleet

The professional or artisanal fishing fleet based in the town of Puerto del Carmen is made up of 16 units or boats. This fleet can be divided into three groups: the one dedicated to the fishing bento-demersal and coastal pelagic and the oriented to the catch of tuna (pelagic migratory). However, the whole of the fleet is highly versatile, and it is often difficult to separate fishing units according to the mode or fishing system, as some boats can combine fishing with lesser gears, such as bottom traps and trammel net, with purse seine fishing or live bait depending on the circumstances.

The ships that make up the fleet have an average length of 9.5 meters (SD = 3.93 m). The average power of these units was 44.15 horsepower (SD = 47.52 CV), with a tonnage of 6.3 meters (SD = 8.24 m), as well as an age greater than 40 years of average, similar ages if compared with the average of the artisan fleet of the whole of the archipelago (37-49 years). Most of these boats are made of fiberglass-reinforced wood.

## Fishing areas

The fishing activity carried out by the fleet of Puerto del Carmen took place on the eastern vertical side of the island of Lanzarote, focusing on three distinct areas: San Antonio, Arrecife and Papagayo. The frequency and choice of a zone or other is governed by various aspects, depending on the target species, proximity to the base port, climatic parameters or relative abundance of the target species. However, 40% of the time the fleet fishing near the base port, while 35% of it moves towards fishing grounds near Playa Blanca, to the south. In certain periods (25%), fishing is made close to Arrecife, although this area seems to be less profitable due to the high pressure

exerted by the large number of boats that have as base the port of the capital of the island (Fig. 4)

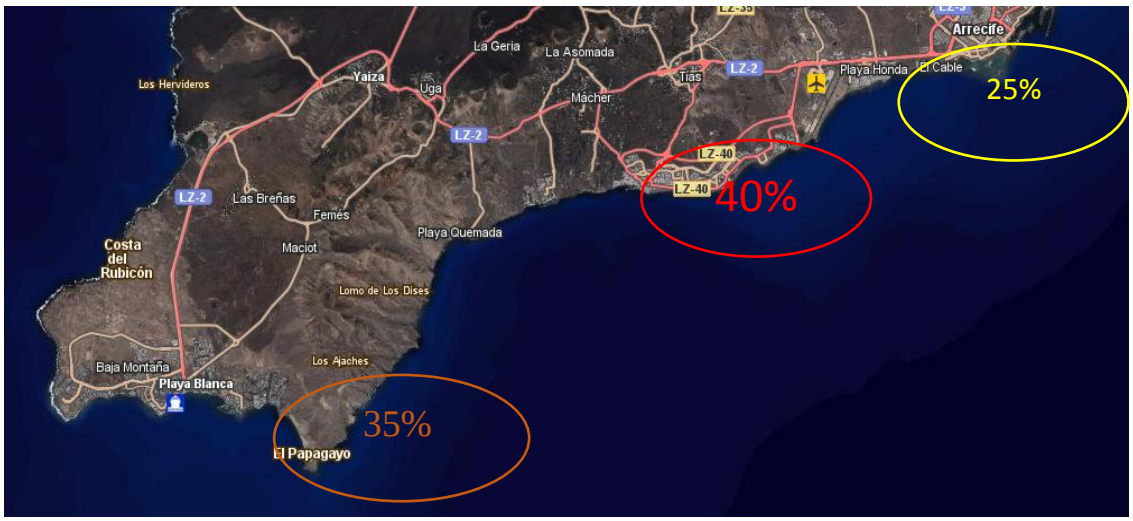


Figure 4. Percentage of fishing areas frequented by the sailors in the study area.

## Catch and effort fishing

Catches landed by the fleet of Puerto del Carmen show a decreasing trend over the 4 years of which data are available, with reference to deep-sea fishing (Fig. 5). With a marked seasonality related to the presence of tuna, mainly skipjack (*Katsuwonus Pelamis*), in the area of action of the fleet. It happens on the contrary with the non-migratory species, that is to say the bento-demersal and coastal-pelagic, with reference to the fishing of inshore, which have progressively increased its catches during the five years of study (Fig. 6).

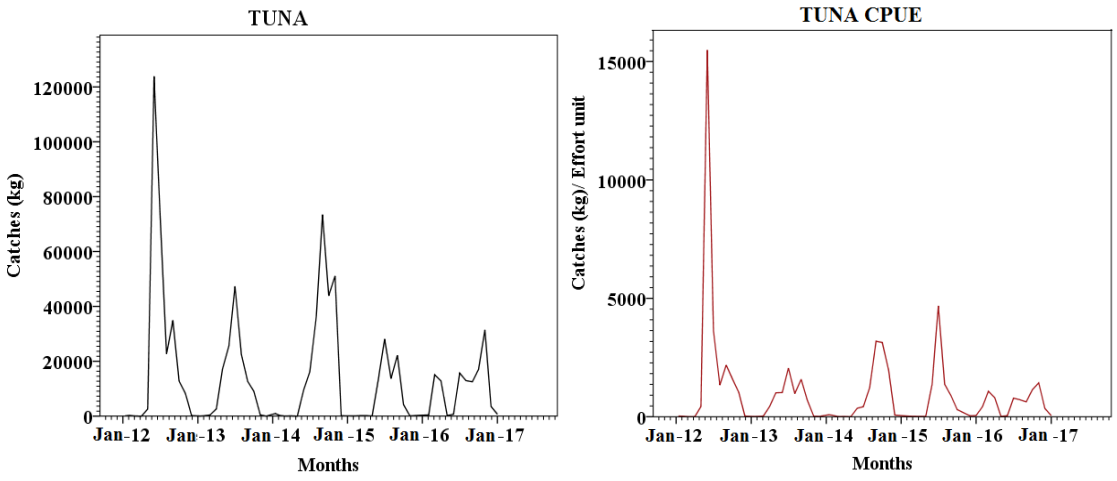


Figure 5. Catches (kg) and CPUE of Tuna (migratory species pelagic).

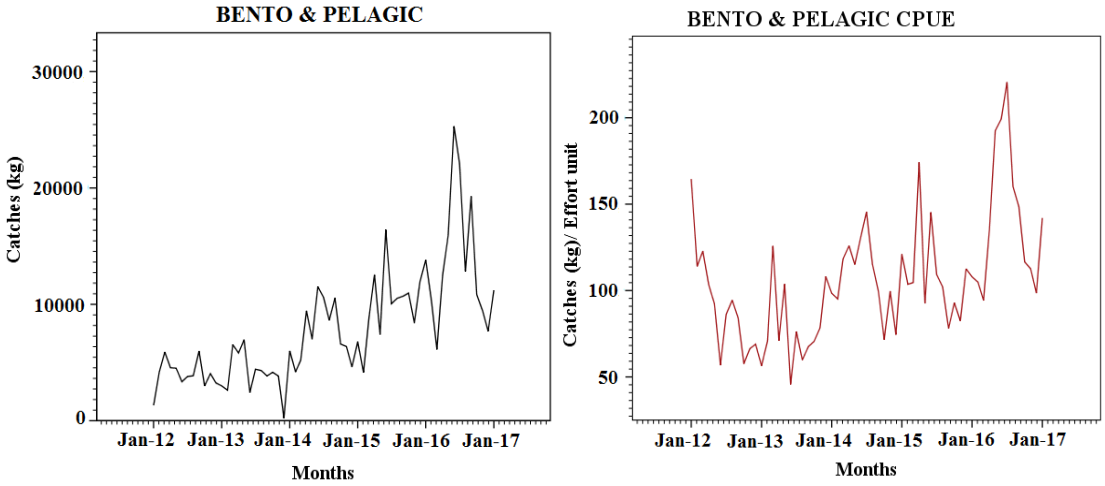


Figure 6. Catches (kg) and CPUE of non-migratory species (bento-demersal and coastal-pelagic).

With these results, it is seen in a clearer way that the tunas are having a less relevance in the catches of Puerto del Carmen, while fishing on bento-demersal species is catching more and more relevance in the total capture.

The fishermen of the area dedicate the months of February to October to the tuna fishing, a period in which the fishing of inshore decreases considerably (Fig. 5), however in the remaining months there is a clear change in the fishing strategy and target species, with no fishing for tuna. However, in 2015 and 2016 a somewhat anomalous fishery behavior was observed, with a clear decrease in tuna contribution to total catches.

The average annual catch was 284799.5 (SD = 50365.5), corresponding to 90 species of fish and cephalopods, being 65.6% of average to tuna and species related fish with live bait, while the contribution of the bento-demersal and pelagic coastal species oscillated between 7.4% and 27%, respectively (Table 1).

Table 1. Catches (kg) and percentages (%) of coastal species (pelagic and bento-demersal), as well as tuna (migratory, pelagic).

| Species / Year | Pelagic-Coastal | | Bento-demersal | | Tuna | |
|---|---|---|---|---|---|---|
| | Kg | % | Kg | % | Kg | % |
| **2012** | 28521 | 7.2% | 19136 | 17.8% | 278367 | 28.9% |
| **2013** | 52644 | 13.2% | 30044 | 27.9% | 248738 | 25.8% |
| **2014** | 75790 | 19.1% | 14805 | 13.7% | 231709 | 24% |
| **2015** | 101480 | 25.5% | 16914 | 15.71% | 82824 | 8.58% |
| **2016** | 139112 | 35% | 26887 | 24.9% | 122758 | 12.7% |
| **Mean** | 795148 | | 215574 | | 192879 | |
| **Standard. Dev** | 42925.9 | | 6585.1 | | 85095.8 | |
| **Total** | 397547 | 27% | 107787 | 7.4% | 964397 | 65.6% |

When the catch is analyzed by mode of fishing highlights the live bait as a more efficient system, motivated by the large volumes of tunas caught in relatively short periods of time, during the harvests, which generally correspond to the summer months (Fig. 7). This method of fishing preferentially acts on 5 species of target and by-catch fish, mainly tuna and whose fishing days require a time of operation of 6 hours of average. However, the fishing system that affects a greater number of species is the line-string, capturing 43 species and, therefore, is the most used in the different areas of the island, with an average time per day of fishing of 2 hours. The bottom traps, on the other hand is the second fishing system most used by the fleet and is the passive system that higher volume of catches obtains, between 42 bottom traps of average daily in the sea, something higher than the 40 allowed by the Fishing Law (Order AAA/ 2536/2015, November 30), the average time of draught is of 7 days and are installed at a depth that oscillates between 20 and 70 m. The fence affects 7 species and its use generates large volumes of capture, its operating time is approximately 6 hours per day of fishing. Finally, the longline is used in fishing days of 3 hours of average per operation, usually consisting of 300 hooks of maximum per longline. The string, longline and trammel net are geared primarily to the fishing of bento-demersal species and affect almost the same species as the bottom traps. These last two fishing systems (longlines and trammel net) are in progressive disuse in fleet.

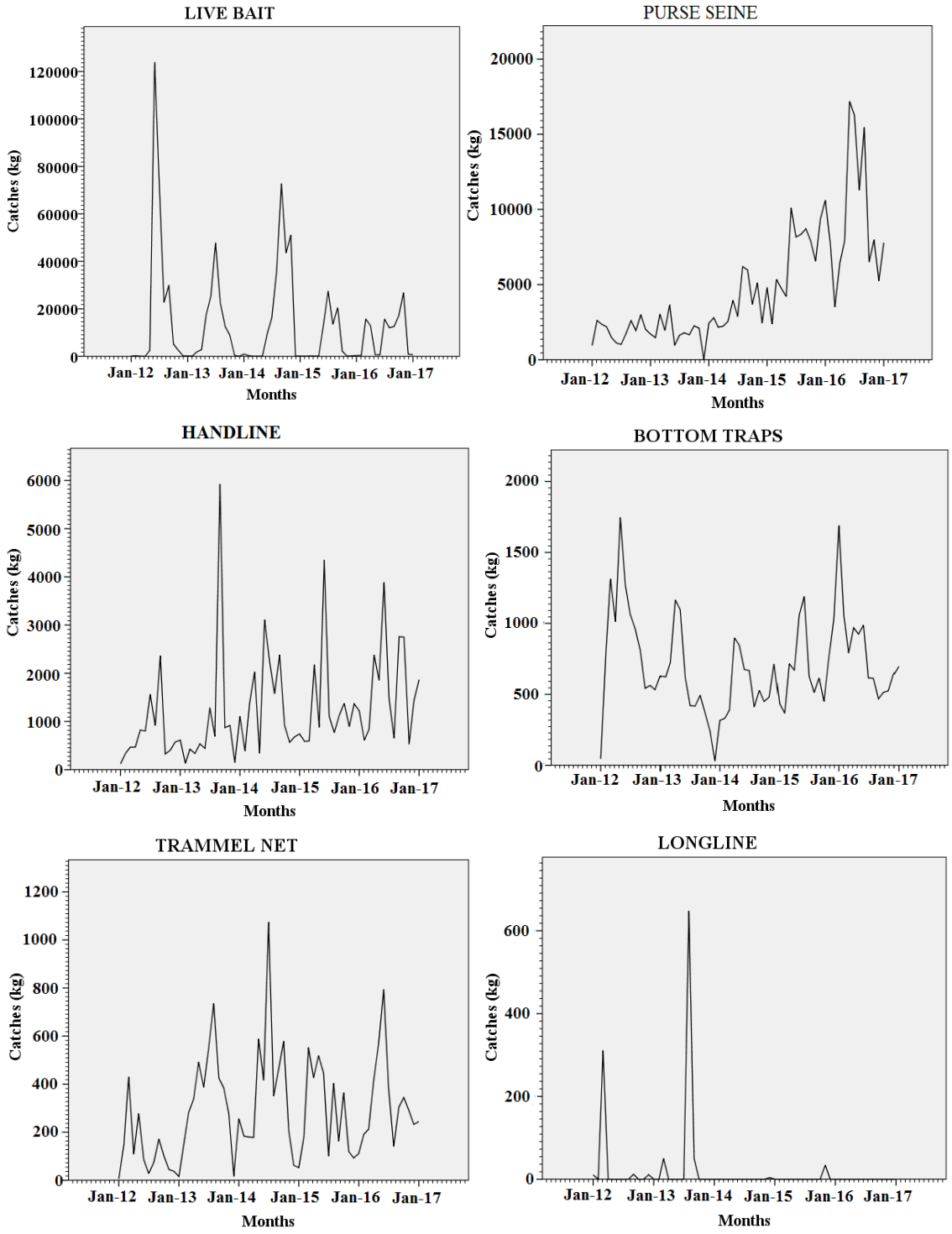


Figure 7. Catches according to arts and species in the study area.

Nowadays, the most common fishing system among fishermen in Puerto del Carmen is the fishhook (58% of total operations), although this system includes the modalities of live bait (33%), handline (17%) and longline (8%), according to surveys. The purse seine have required 25% of the fleet's total fishing operations, while the

dedication to bottom traps has only covered 17% of them (the use of the other fishing modalities is practically anecdotic). The fishing of bento-demersal species takes place over 9 months and involves 75% of the fleet, while the remaining 25%, conformed by the boats of greater length, are dedicated to the tuna fishing and related most of the year.

## Socio-economic characterization of fishermen.

The fishermen of Puerto del Carmen have an average age of 48 years, oscillating the majority between 40 and 50 years, having the most family responsibilities (75%). 25% have secondary and baccalaureate studies, another 25% in addition, it has medium training studies (professional formation), while 42% have only received primary education. 8% lacks studies (Fig. 8).

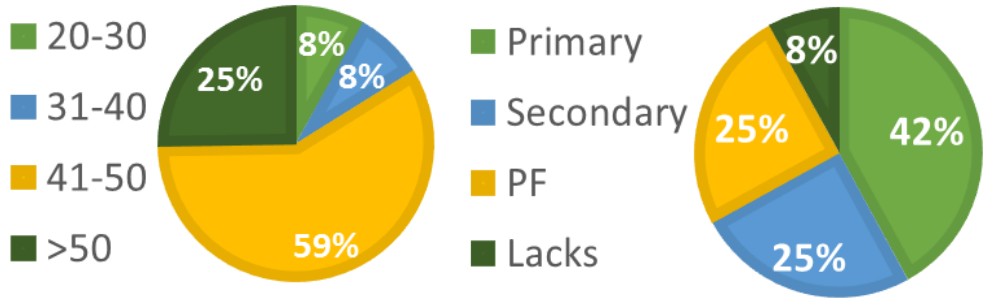


Figure 8. Age range and level of studies in the surveyed population.

All fishermen have specific qualifications necessary to carry out work related to fishing or navigation in fishing vessels. Thus, 50% of them have the title of local pattern, while only 25% have a degree of height or coastal pattern polyvalent require higher formative level (fig. 9 left). However, the profession of fisherman requires some continuous training in different subjects that affect both the navigation and handling of the boat, as well as the safety on board or the handling of the technical instrument of the boat. Therefore, all fishermen have compulsory training in initial health, survival, food handler, motorist and fire, given by the Polytechnic Institute F.P. Maritime fishing of the Canary Islands in Arrecife (Lanzarote), dependent on the Government of the Canary Islands or the Institute of Vocational Training Maritime Fisheries of Las Palmas (Gran Canaria), dependent on the Ministry of employment and Social Security. With these courses, most declares that these courses have helped to improve their expertise and vision in fishing (41%), a minority difference, believes that it helps to improve income (8%), others (17% each) believes that it improves the maintenance of the boat or

equipment and, finally, 17% think that they do not serve to improve any of the above (Fig. 9 right).

Most fishermen declare that they are fishing as a profession because they like it or by family tradition, but there are also cases where fishing is the only work alternative and they exercise it by necessity (Fig. 10 left).

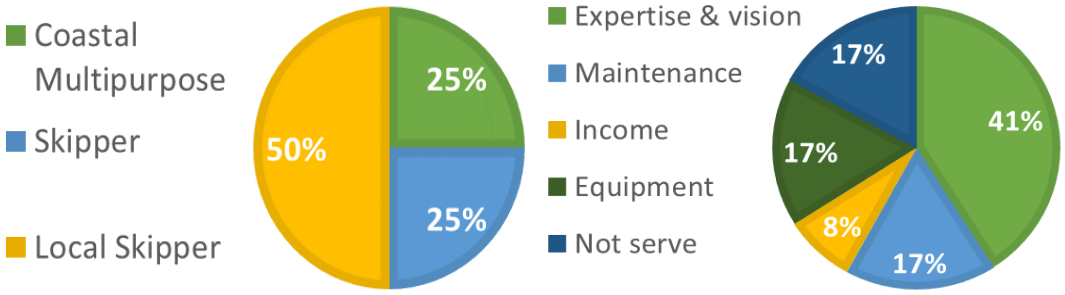


Figure 9. Titles of the sailors as well as an opinion on compulsory courses when it comes to being a fisherman.

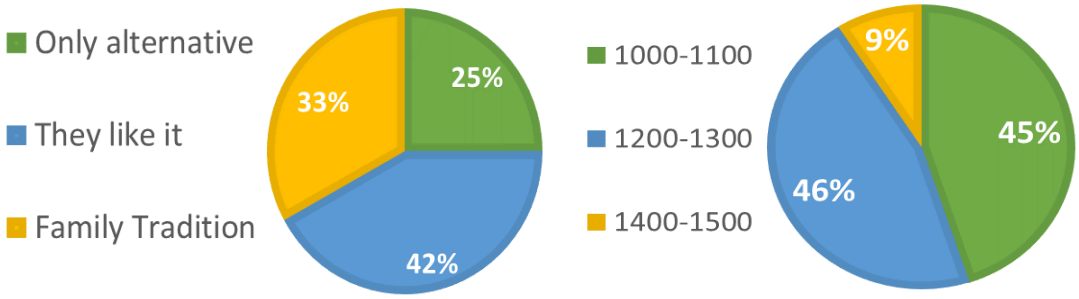


Figure 10. Motivation for the profession of fisherman and income level (€) Produced by the population surveyed monthly.

The net income of the fishermen in Puerto del Carmen does not exceed €1500 per month, according to the respondents, oscillating between €1000 and €1500 (Fig. 10 right). This variability in the income level depends heavily on the fishing modality, so fishermen engaged in tuna fishing and related species have higher incomes. Total incomes generated by the fishing operations are distributed equally between the different components of the boat, after discounting the boat's own expenses (repairs, diesel, insurance, etc.).

## Target species

In the catches, the pelagic fish species are in volume, mainly those obtained with purse seine nets, such as mackerel (*Scomber colias*), and to a lesser extent the sardines (*Sardina pilchardus* and *Sardinella aurita*), horse mackerel (*Trachurus picturatus*) and bogue (*Boops boops*), in a fishery of practically annual character. Most of these species, especially in juvenile phase, are also used as bait, dead or alive, for other fisheries but without such catches being recorded on PPV. These pelagic-coastal species compete in catch levels with the tuna species, obtained during the corresponding season, highlighting all the skipjack (*Katsuwonus pelamis*) captured with live bait. Other important species, due to their high volume of capture, on a timely basis, and their relatively high selling prices are the atlantic bonito (*Sarda sarda*) bluefin tuna (*Thunnus thynnus*), yellowfin tuna (*T. albacares*) and bigeye (*T. obesus*).

On the other hand, there is a wide variety of bento-demersal species whose volumes of catches are much lower than the previous ones, but they are really the center of the fisheries, because they have relatively high market values, even more than 10 times that reached by tuna and pelagic coastal per unit of weight. In this group, we can find the octopus (*Octopus vulgaris*), red mullet (*Mullus surmuletus*), common seabream (*Pagrus pagrus*), pandora (*Pagellus erythrinus*), parrot fish (*Sparisoma cretense*), roostersfish (*Stephanolepis hispidus*), bream (*Diplodus* spp.) and moray (*Muraena helena*), and soo on, and thus up to a hundred-species obtained mainly with handline and bottom traps. In deeper waters, surpassing 200 m, are common catches of conger (*Conger conger*), forkbeard (*Phycis phycis*) and hake (*Merluccius merluccius*), as well as more oceanic species such as amberjack (*Seriola* spp.), jack mackerel (*Pseudocaranx dentex*) and dorado (*Coryphaena* spp.) groups caught with handline, longlines and/or trolling.

## Maintenance costs

All port boats require annual maintenance. The larger boats generate a higher spending than the €4500 average, while that those of shortest length require an average of €500 in costs of stranding, cleaning, painting and antifouling. Also, the repair of the fishing systems generates UNS annual expenditure of €350 of average. The expenses

associated with repairs or adjustments of the engines or other mechanical and technical equipment reach €6000 annual average per boat dedicated to tuna fishing, and around €1000 for the smaller boats dedicated to the fishing of inshore.

Costs of feeding, fuel, ice, etc., which depend on the duration of the tides or fishing days and the number of crew members, around €20/in boats that work near the base port, while those fishing in more remote fisheries reach expenses of €1000 per tide (7 days of average duration).

## Marketing

Once passed the catch by PPV, and depending on the species, the marketing line varies. Thus, Tunas are bought almost exclusively by the organization of producers of fresh fishing Optuna, based in Arrecife, while the bento-demersal fish are acquired by various buyers from the area, such as Pescadería Chano, La Quemadita, Pescados y Maricos La Graciosa and Pescadería CTV La Tara. However, part of the capture is also sold directly to restaurants. And another significant part of the capture does not go through PPV and is sold directly to individuals, restaurants and small businesses thickening what are called IUU (illegal catches, not declared and not regulated).

# 5. DISCUSSION

The artisanal fishing fleet based in Puerto del Carmen is relatively small compared to the existing one in other areas of the island of Lanzarote or the Canary Islands (Castro & Hernández-García, 2012). They are usually small boats (9.5 m of medium length), constructed of wood reinforced with fiberglass and with ages exceeding 40 years of average. This fleet has been reduced by 24% over 2012.

The artisanal fleet of the southeast of Lanzarote, despite being of the type polyvalent (Bas et al., 1995), according to the target species it is structured in three major categories: fish traps boats geared to catching bento-demersal species, purse seine mediums boats dedicated to catching mackerels and sardines, and larger-sized boats that perform tuna fishing with live bait, similar to what is described in other parts of the archipelago (Bas et al., 1995). However, a large part of the fleet It combines fishing with minor arts, such as bottom traps, trammel net and handline or purse seine (Rico et

al., 1999), with the fishing of tuna in certain periods of the year known as season (González-Ramos, 1992).

The main problem we find in studying the state of the resources that is the object of exploitation and profitability of the fishing activity that develops in waters of the southeast coast of the island of Lanzarote, is the absence of historical series of data of capture and effort. The only available data are those provided by the point of first sale located in the Guild of fishermen of the La Tiñosa, by which it must pass by law all the catches made before its sale. Unfortunately, this information-gathering system presents a number of problems that make it a limited utility. The first is that it only has data from 2012, which prevents the establishment of a medium or long-term trend both in the abundance of resources and in the profitability of the fishery (Guerra-Sierra & Sánchez-Lizaso, 2008). On the other hand, the information collection system only records the catches, but does not provide data on the size of the species captured, the fishing effort carried out by the fleet, fishing systems used or in which fishing areas are being obtained. In addition, as seen in available lassies, mainly in the number of first-sale notes, not all catches are passed through this checkpoint, which detracts from reliability to recorded data. That is to say, this fishery can be considered as poor in data (Gómez-Muñoz, 1990).

The fleet of Puerto del Carmen fishing mainly in waters near the base port and in southwestern areas of the island (75% of the time). The fishery affects a wide variety of species and is seasonal, mainly according to the skipjack (*Katsuwonus Pelamis*), although the tunas are having a diminishing relevance in catches. As in the rest of the archipelago (González-Ramos, 1992; Trujillo-Santana, 2010), between the months of February to October the fleet is mainly dedicated to the tuna fishing, in contrast in the remaining months the bento-demersal and pelagic coastal species become the main objective of the same one (Bas et al., 1995). In this sense, according to information published by the Government of the Canary Islands, in Lanzarote the unload of pelagic species predominates (Boza-Vindel, 2015).

This multispecific and multi-gear fishery affects over a hundred species, although the target species change depending on the art of fishing, bottom traps is one of the being the least efficient system, in volume of catches, but also one of the most used. In relation to the use of traps, it is interesting to note that the number of bottom traps per boat round 42, somewhat higher than those allowed by the law of fishing in force (Order AAA/2536/2015, of 30 November). These low yields of bottom traps, as well as the use of a higher number than the legally established one, is a constant in other parts of the archipelago (Hernández-García et al.,1998; Couce-Montero, 2009). It is also

noteworthy that most of these bento-demersal species are overexploited (González, 2008).

The volume of these catches of the different commercial species has undergone fluctuations in recent years. These fluctuations are mainly due to the action that fishing exerts on the populations, but also to the influence of biological and climatic factors. (Couce-Montero, 2009). These oscillations are observed mainly in tuna catches, with declining tendency, which has forced to exert greater pressure on the species bento-demersal, scarcer and more vulnerable to the overexploitation (Couce-Montero et al., 2015). This greater pressure is more noticeable in the years when the tuna fishery does not allow to absorb much of the fishing effort exerted on the system bento-demersal (Miguel A. Rodríguez, brotherhood of fishermen of Mogán, Comm. Pers).

# 6. CONCLUSION

1. The artisanal fishing fleet of Puerto del Carmen is made up of 16 boats. The average length is 9.5 meters (SD = 3.93 m), the average power is 44.15 horsespower (SD = 47.52 CV), tonnage of 2.73 meters (SD = 8.24 m), and surpasses the 40 years of average.

2. The fleet of Puerto del Carmen fishing mainly in waters near the base port and in areas southeast of the island (75% of the time). With average annual catch of 293946 kg (SD = 39083.4).

3. Analyzed according to fishing modality highlights the live bait as a more efficient system. However, the one that affects the largest number of species is the line-string.

4. Fishermen have an average age of 48 years and most have only primary studies. Being thus the majority local skippers and generating a profit of average of €1200, exerting this profession to a great extent by taste.

5. In the catches the pelagic fish species prevail in volume. With a variety of bento-demersal.

6. The average costs generated are €40000 for those with the highest length and €5000 for those with the least length per year.

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# OPINIÓN PERSONAL

1. **Descripción detallada de las actividades desarrolladas durante la realización del TFT**

En mi caso particular, al tratarse de un trabajo que no se había realizado antes y que además hay poca bibliografía sobre Lanzarote y sobre el puerto en cuestión aumento la dificultad a la hora de realizar la introducción y la discusión ya que no había estudios de referencia sobre la zona en cuestión. Por lo que, mi cometido ha sido regenerar la pesca en esos 5 años de estudio con la información recogida en el punto de primera venta e intentar compararlo con otros puertos sí estudiados de las Islas Canarias, como son puerto de las islas de Gran Canaria y Tenerife.

2. **Formación recibida (cursos, programas informáticos, etc.)**

No he necesitado ningún curso para la realización del TFT. En todo caso, se ha utilizado, de forma preferente, programas y páginas web aprendidas durante mi formación universitaria de las cuales se quieren destacar: Glossary FAO, Marinemet, Matlab, Excel e IBM SPSS statistics 22. Los recursos para la búsqueda de información han sido Scopus, Faro y Acceda de la ULPGC y Google Académico. Además de la bibliografía proporcionada por el tutor.

3. **Nivel de integración e implicación dentro del departamento y relaciones con el personal**

El nivel de integración ha sido muy bueno, sobre todo con mi tutor José Juan Castro Hernández. Respecto a los compañeros de despacho no ha habido ningún problema. Y siempre me ayudaron en todo lo que pudieron.

4. **Aspectos positivos y negativos más significativos relacionados con el desarrollo del TFT**

Como aspecto positivo me ha encantado realizar este trabajo, el cual al ser un tema perteneciente al pueblo del cual provengo me ha sido más gratificante su realización. Y como aspectos negativos, he tenido la dificultad de la falta del título de inglés y he tenido que estar pendiente a obtenerlo, impidiéndome estar a la

dedicación completa del TFT por momentos. Y, además, el nivel que he adquirido no consigue que sea fácil la realización de un trabajo que se realiza en dicho idioma.

## 5. Valoración personal del aprendizaje conseguido a lo largo del TFT.

En mi opinión, realizar este TFT me ha acercado mucho más al tema de las pesquerías, no sólo del área de estudio, también el resto de islas. Así como proceder a la realización de estos estudios. Gracias al Dr. Castro, el cual me ha ayudado a comprender y conocer en más profundidad el avance de estos y a su vez, a consolidar los estudios que había realizado a lo largo de la carrera.