

REPORT ON REVISED TRAP DATA RECOVERED BY ICCAT GBYP FROM PHASE 1 TO PHASE 6

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SUMMARY

The Atlantic-wide research programme on bluefin tuna (GBYP), among other objectives, has the duty to improve the data records, through mining any possible source of data not already included in the ICCAT bluefin tuna data base. In the first GBYP phases, it was possible to recover a significant quantity of historical tuna trap data sets, even if some gaps are still existing. This data constitutes a very long historical series, from the year 1512 to 2009, constituting the largest time series for a single marine species. The report includes also the essential details for each trap and maps by country. The data were cross-checked against the ICCAT BFT data base, and then checked individually, also entering into the details of each record, according to the methodology approved in 2015 by the SCRS Bluefin Tuna Species Group and the Subcomstat. This report includes an overview of the revised data sets (catches, traps location and size frequency) and summary graphs, while detailed data were provided to the ICCAT Statistical Department for the SCRS uses.

RÉSUMÉ

Le Programme de recherche sur le thon rouge englobant tout l'Atlantique (ICCAT-GBYP) a pour tâche, parmi d'autres objectifs, d'améliorer les registres de données, en explorant toutes les sources éventuelles de données qui ne sont pas encore incluses dans la base de données sur le thon rouge de l'ICCAT. Dans les premières phases de l'ICCAT-GBYP, il a été possible de récupérer une quantité importante de jeux de données historiques sur les madragues thonières, même si certaines lacunes existent encore. Ces données constituent une très longue série historique, de l'année 1512 à 2009, constituant la plus grande série temporelle pour une seule espèce marine. Le rapport comprend également les détails essentiels pour chaque madrague et des cartes par pays. Les données ont été vérifiées par croisement par rapport à la base de données de l'ICCAT, puis vérifiées individuellement, en saisissant également les détails de chaque registre, selon la méthodologie approuvée en 2015 par le Groupe d'espèces sur le thon rouge du SCRS et le Sous-comité des statistiques. Ce rapport comprend un aperçu des jeux de données révisés (prises, emplacement des madragues et fréquence des tailles) et des graphiques de synthèse, tandis que des données détaillées ont été fournies au Département statistique de l'ICCAT à des fins d'utilisation par le SCRS.

RESUMEN

El Programa de investigación sobre atún rojo para todo el Atlántico (GBYP), entre varios objetivos, tiene la tarea de mejorar los registros de datos, utilizando la minería de datos en cualquier posible fuente de datos que no esté ya incluida en la base de datos de atún rojo de ICCAT. En las primeras fases del GBYP fue posible recuperar una cantidad importante de conjuntos de datos históricos de almadrabas de túnidos, aunque siguen existiendo algunas lagunas. Estos datos constituyen una serie histórica muy larga, desde el año 1512 hasta 2009, lo que supone la serie temporal más larga de una sola especie marina. El informe incluye también los detalles esenciales de cada almadraba y los mapas por país. Los datos se verificaron con los incluidos en la base de datos de atún rojo de ICCAT y posteriormente se verificaron individualmente, introduciendo también los detalles de cada registro de acuerdo con la metodología aprobada en 2015 por el Grupo de especies de atún rojo y el Subcomité de estadísticas del SCRS. Este informe incluye también una visión general de los conjuntos de datos revisados (capturas, localización de las almadrabas y frecuencias de tallas) y gráficos resumen, además, los datos detallados se facilitaron al Departamento de estadísticas de ICCAT para que los utilice el SCRS.

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KEYWORDS

Bluefin tuna, large pelagic species, ICCAT, data collection, trap data recovery, data analyses

1. Introduction

The objective of ICCAT GBYP data recovery and data mining activities is to fill the many gaps existing in several data series currently present in the ICCAT data base, concerning both recent and historical data, which causes a large amount of substitutions in the assessment process, increasing biases uncertainties.

At the same time, data mining activities should provide reliable data series, longer than those previously available, recovering data from many sources, including archives having difficulties for the access. This activity will allow for a better understanding of the long-time catch series by gear, improving the data available for the assessment and possibly for replacing substitutions used for data gaps; old data will allow also for improving our knowledge about the fishery of Atlantic bluefin tuna.

In the last part of the Phase 4 it was possible to recover a huge data base on historical tuna trap that was used for a Ph.D. Thesis by Christelle Ravier-Mailly (2003) and also for several scientific papers (Fromentin *et al.*, 2000; Ravier and Fromentin, 2001, 2002, 2003, 2004; Fromentin, 2002a, 2002; Fromentin and Farrugio, 2011). These data were provided on an Excel file, having 10 spreadsheets and 6384 records (Pagá Garcia *et al.*, 2016). The data cover the period 1525-1997, including about hundreds of traps from five countries. This huge data base was provided to GBYP, as a donation in kind by Ph.D. Jean-Marc Fromentin in 2014. It was initially examined by GBYP and the ICCAT Statistical Department and it was clear that several data and traps were already existing in the ICCAT GBYP data base. Therefore, it was necessary to plan a long and huge work in Phase 5 for checking all these data and removing possible duplicates or mistakes.

In GBYP Phase 5 it was clear that the system used for obtaining the total catch when the weight was not available was based on a mean size by area, which was constant over the many years. This method is able to always provide a catch by year, but of course it is not able to catch any variability of the mean size by year, particularly in some cases where catches were originally reported by weight or size categories. The method was not fitting the methodology used by the ICCAT Secretariat and therefore it was necessary to examine again the files and reconvert the number of fish to kg using the weight of the various size categories, when this information was available.

The tuna trap files include also catches concerning other tuna and tuna-like species that were recovered along with the bluefin tuna ones. These data can be extracted when necessary, but they need a quality check.

2. Revision of the tuna trap data

In 2015, at first the SCRS BFT Species Group and the SCRS Sub-group of Statistics and then the SCRS approved the methodological approach proposed by both the GBYP and the ICCAT Statistical Department (Pagá Garcia *et al.*, 2016) for converting the various commercial size categories into weight. According to this recommendation, the ICCAT GBYP made all conversions and proceeded in cross-checking the last data from the files above mentioned against the data already existing in the ICCAT GBYP historical trap data base (Di Natale *et al.*, 2013, 2014; Anon., 2014), examining and solving any possible data conflict according to the best available knowledge and any possible documented source, for eliminating duplicated data and for finally incorporating any missing data into the ICCAT GBYP data base, according to the format used by the Statistical Department at the Secretariat.

On February 2015 some old conversion factors by category used for the Spanish traps by the old “Consortio Almadrabeto” have been made finally available (Robles *et al.*, 2015). Therefore, following what was decided as agreed methodology for improving the data quality, it was necessary to further revise all the old trap data for the Spanish traps. These revisions, concerning a very high amount of trap data, required a long time to be carried out, with various cross checks, examining many old documents, in some case going back also to some GBYP contractors for further checking the sources and the original data.

In Phase 6, few additional trap data have been recovered, filling some holes and gaps for in some data series in few traps already included in the previous file.

In total, trap data of various types exists for 206 tuna traps, including 75 in Italy, 51 in Spain, 34 in Portugal, 19 in Morocco, 18 in Libya, 8 in Tunisia and 1 in Turkey. In the case of Turkey, the data are related to the cumulative trap catches sold on the market in Istanbul (the only local bluefin tuna market at that time) and not to individual traps. The detailed trap list, including the various names used for the same trap and the coordinates of each trap², is provided on **Table 1**. The position of all the traps for which data exist in the ICCAT GBYP files³ is shown in **Figure 1**, **Figure 2**, **Figure 3** and **Figure 4**, while **Figure 5** shows the position of Turkish tuna traps which possibly provided the cumulative data for the market in Istanbul. These maps are very important, because, so far, the only comprehensive maps about the position of tuna traps in the Mediterranean Sea and adjacent areas were those provided by Pavese (1889) and Parona (1919), both listing more traps than those available on the current list.

The entire GBYP trap data cover a period from 1512 to 2009, with various intensities and type of data. The various types of data included in the ICCAT GBYP files, which will be available on the ICCAT BFT data base, are the followings:

- Aggregated data for groups of traps by year (these data were not used for the graphs, because it was impossible to disentangle them by individual trap); mostly they are related to some groups of Spanish traps in some years, but there were also few Portuguese traps.
- Aggregated trap data for bluefin tuna sold on the market, by year and month, in weight (these data are related only to the Turkish traps).
- Total catch by trap, by year, in weight and/or number of fish and/or categories
- Total catch by trap, by month, in weight and/or number of fish and/or categories
- Total catch by trap, by fishing operation (“mattanza”, “levantada” or “matanza”), in weight and/or number of fish and/or categories.

The coverage in time is not homogeneous, depending on the availability of the ancient records and the proposals received from ICCAT GBYP after each specific Call for tenders. Some traps have data just for very few years, while others have a long data coverage. Some traps, which can be discovered by looking at old maps or lists, have no records in ICCAT GBYP files.

After eliminating duplications and errors, the total catch of the tuna trap data recovered by GBYP represents 20,129,866 bluefin tuna and 2,978,609 tons. The total catch data, in number of bluefin tuna and weight, are showed in summary by decade on **Figure 6**, while data by country/area are showed on **Figure 7** to **Figure 14**.

Figure 15 shows the annual distribution of catches, both in number and tons, for three traps in different countries having long historical series: Medo das Cascas, Portugal (1797-1971), Zahara de los Atunes, Spain (1512-2009) and Favignana, Italy (1599-2000).

Cumulative size frequencies by area (Atlantic-Mediterranean) are shown on **Figure 16**, while **Figure 17** shows cumulative size frequencies for the four most represented decades (1910, 1920, 1990 and 2000) for the Mediterranean tuna traps.

3. Conclusions

The tuna trap data represents, at the moment, the longest data series for one single marine species and one single fishing gear available in the World, being the series extended from 1512 to current years.

The present structure of the tuna trap file clearly shows the huge efforts that have been necessary for collecting all the various data, examining an incredible and diverse number of documents and folders, quite often sitting in libraries (public or private), old archives and even church archives. At the same time, the data shows gaps in time and space which are mirroring either unavailable records or entire missing archives for some traps.

The difference in “coverage” for the various traps and the full missing data for several traps and even countries (i.e.: France, Croatia, Malta) are clear limits, which might affect a full understanding of the history and evolution of this important historical fishery. Unfortunately, these gaps seem quite difficult to be filled in a short time and all efforts carried out so far were not able to find these data; possibly most of these data are not existing any more, due to many events over the centuries, but maybe some could be still found if dedicated researchers would like to spend some time and effort for recovering them. ICCAT GBYP should continue to explore all opportunities.

² Some traps had different locations over the years or they have been positioned in different ways in differ years.

³ In these cases, we used the best possible average position estimate. The trap is a complex system, with nets set sometimes for long distances; when available, we used the central position of the last chamber, otherwise the best average mean position estimate.

Initially, various GBYP tuna trap data sets and files have been validated over the last years by both the SCRS BFT Species Group and the SCRS Sub-group of Statistics, but after adding the last data sets in 2014 it was necessary to revise again all data. The methodology was duly presented, discussed and approved by the SCRS Sub-group of Statistics and the SCRS BFT Species Group, and then endorsed by the SCRS in 2015.

The huge amount of work that was necessary for revising and cross-checking the high amount of bluefin tuna trap data collected by GBYP from various sources over the first five Phases, eliminating duplicates and mistakes, but also revising the conversion factors used in some files for converting weight into number of tunas or vice versa, but also for attributing the weight to various bluefin tuna commercial categories reported in number of fish, finally resulted in a comprehensive ICCAT GBYP file that from now on can be used by the SCRS.

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Table 1. List of the 206 tuna traps for which data are included in the ICCAT GBYP files that will be incorporated in the ICCAT BFT data base. The names are those reported in the original documents, while the positions are those finally detected. The table continues in the following pages.

Country	TrapName	TrapName2	TrapName3	TrapName4	Latitude	Longitude
EU.España	Agua Amarga				36,9369	-1,9335
EU.España	Aguas de Ceuta				35,9139	-5,3334
EU.España	Ancon de Cabo de Gata				36,7427	-2,2199
EU.España	Arroyo Hondo				36,6400	-6,4300
EU.España	Barbate				36,1660	-5,9200
EU.España	Benidorm				38,5259	-0,1100
EU.España	Cabo Termino				40,7261	1,0291
EU.España	Cala del Charco				38,4876	-0,2787
EU.España	Cala Punta				38,2619	-0,5060
EU.España	Calabardina de Cope				37,4291	-1,5066
EU.España	Calpe				38,6352	0,0513
EU.España	Conilejo				36,2538	-6,0805
EU.España	Crusta				38,8327	0,1565
EU.España	Cuevas de Lobos				37,3720	-1,6330
EU.España	El Portil				37,1425	-7,1628
EU.España	El Terron	La Tuta	Nueva Umbría	Punta Umbría	37,1038	-7,1467
EU.España	Enderrocat				39,4732	2,6865
EU.España	Escombreras				37,5728	-0,9878
EU.España	Estepona				36,4517	-5,0170
EU.España	Formentera				38,7308	1,3796
EU.España	Granadella				38,8736	0,0222
EU.España	Isla de Tabarca				38,1535	-0,4792
EU.España	La Atunara	La Linea			36,1675	-5,3254
EU.España	La Azohia				37,5537	-1,1743
EU.España	La Barrosa				36,3715	-6,1858
EU.España	La Caleta				38,5761	-0,0462
EU.España	La Espada	Punta Espada			37,1808	-7,3054
EU.España	La Higuera				36,9652	-6,6586
EU.España	La Mojarrá				37,1170	-7,3932
EU.España	Lances de Tarifa				36,0088	-5,6320
EU.España	Las Cabezas				37,1026	-7,2616
EU.España	Las Huertas				38,3580	-0,4401
EU.España	Las Torres				37,0078	-6,7564
EU.España	Lentiscar				36,0718	-5,7750
EU.España	Moraira				38,6553	0,1355
EU.España	Nuestra Señora de la Cinta				37,0543	-6,9430
EU.España	Nuestra Señora del Carmen				37,1853	-7,2772
EU.España	Olla de Benicasim				40,0499	0,0796
EU.España	Punta de la Isla	Sancti Petri	Hercules		36,3900	-6,2400
EU.España	Reina Regente				37,0772	-7,3704
EU.España	Rio Torres				38,5064	-0,1948
EU.España	Rota				36,5930	-6,3580
EU.España	San Miguel				36,8254	-2,3547
EU.España	San Sebastian				36,5114	-6,3316
EU.España	Terreros	San Juan de los Terreros			37,3556	-1,6601
EU.España	Torre Atalaya	Conil de la Frontera	Conil		36,2567	-6,1609
EU.España	Torre Carboneros				36,8950	-6,4960
EU.España	Torre del Agua				38,4036	-0,3901
EU.España	Torre del Puerco				36,3310	-6,1670
EU.España	Torre Gorda				36,4580	-6,2630
EU.España	Zahara	Zahara de los Atunes			36,1360	-5,8700

EU.Italy	Angitola	from 1924 Mezzapraia			38,7667	16,2667
EU.Italy	Arenella				38,1520	13,3760
EU.Italy	Asinelli				38,0638	12,5696
EU.Italy	Avola				36,9150	15,1540
EU.Italy	Bafuto	Vindicari			36,8023	15,0993
EU.Italy	Bagno di Marciana	Capo d'Enfola	Enfola		42,8300	10,2600
EU.Italy	Bivona				38,7116	16,1018
EU.Italy	Bonagia				38,0674	12,5948
EU.Italy	Brucoli				37,2840	15,1883
EU.Italy	Cala Pozzillo				38,1850	13,1350
EU.Italy	Calavinagra				39,1685	8,2525
EU.Italy	Camogli				44,3500	9,1500
EU.Italy	Capo Feto				37,6610	12,5400
EU.Italy	Capo Passero grande				36,6800	15,1300
EU.Italy	Capo Passero piccolo				36,6800	15,1300
EU.Italy	Castellammare del Golfo				38,0300	12,8820
EU.Italy	Cefalù				38,0410	14,0200
EU.Italy	Columbargia				40,0533	8,4550
EU.Italy	Curto				38,1117	12,6805
EU.Italy	del Pepe	Capo Bianco			37,3888	13,2744
EU.Italy	del Tono				38,2390	15,2410
EU.Italy	Torre della Tonnara Dell'Orsa	Dell'Orsa			38,1833	13,1167
EU.Italy	Detta				38,1746	13,0821
EU.Italy	Favignana	Tonnara fissa di Favignana			37,9333	12,3333
EU.Italy	Fiume di Noto				36,8600	15,1220
EU.Italy	Flumentorgiu				39,6842	8,4383
EU.Italy	Fontane Bianche				36,9640	15,2100
EU.Italy	Formica				37,9880	12,4250
EU.Italy	Gallipoli				40,0500	17,9667
EU.Italy	Isola delle Femmine				38,2030	13,2410
EU.Italy	Isola Piana	Tonnara Isola Piana			39,1833	8,3167
EU.Italy	La Punta				38,1659	14,7485
EU.Italy	Langhione				38,7202	16,0742
EU.Italy	Magazzinazzi				38,0167	12,9333
EU.Italy	Marzamemi				36,7400	15,1160
EU.Italy	Mondello				38,1907	13,3362
EU.Italy	Oliveri				38,1458	15,1584
EU.Italy	Palma di Montechiaro				37,1711	13,7187
EU.Italy	Peloso				40,1367	8,4025
EU.Italy	Pizzo	Torre Pizzo	Torre di Pizzo		38,7333	16,1500
EU.Italy	Porto Paglia				39,2500	8,4167
EU.Italy	Porto Scuso				39,1833	8,3667
EU.Italy	Portopalo				36,6803	15,1365
EU.Italy	Pozzallo				36,7272	14,8487
EU.Italy	Puntanera				38,0383	12,8708
EU.Italy	S. Antonino				38,2390	15,2410
EU.Italy	S. Caterina				40,1333	17,9833
EU.Italy	S. Elia				38,0960	13,5400
EU.Italy	S. Giorgio				38,1667	14,9000
EU.Italy	San Cusumano				38,0547	12,5470
EU.Italy	San Giuliano Palazzo	S. Giuliano	Tonnara di S. Giuliano		38,0274	12,5266
EU.Italy	S. Giuseppe				36,7404	15,1271
EU.Italy	S. Nicolò	S. Nicola			38,0160	13,6160
EU.Italy	S. Panagia				37,1114	15,2520
EU.Italy	S. Vito lo Capo	Capo S. Vito			38,1890	12,7340
EU.Italy	Salicà				38,1200	15,1200
EU.Italy	Saline				41,0333	8,2667
EU.Italy	Santa Lucia				38,2183	15,2733
EU.Italy	Sciacca - Lo Tono				37,5050	13,0727
EU.Italy	Scopello				38,0768	12,8190
EU.Italy	Secco	Monte S. Giuliano			38,1670	12,7700
EU.Italy	Sibilliana				37,7204	12,4687
EU.Italy	Siculiana				37,3373	13,3868
EU.Italy	Solanto				38,0740	13,5430
EU.Italy	Terrauzza				37,0148	15,3040
EU.Italy	Tonnara Capo Altano				39,1833	8,3167
EU.Italy	Tono di Milazzo				38,2238	15,2211
EU.Italy	Torre Caldura				38,0360	14,0390
EU.Italy	Torre Cofano				38,1287	12,7155
EU.Italy	Torre Sant'Isidoro				40,2174	17,9222
EU.Italy	Torre Squillace				40,2325	17,9172
EU.Italy	Trabia				37,9970	13,6550
EU.Italy	Trabucato				41,0333	8,2667
EU.Italy	Vaccarella				38,2217	15,2408
EU.Italy	Vergine Maria				38,1650	13,3700

Libya	Bu Fatma			32,4350	14,9050
Libya	Dzeira			32,4175	15,0035
Libya	Gebbana Sidi Mahfud	Sidi Bilal		32,8030	12,8847
Libya	Marsa al Hamra	Marsa Beltan		32,7412	13,9860
Libya	Marsa Dila			32,7897	12,7415
Libya	Marsa Marrecan			32,8550	12,2333
Libya	Marsa Sabratha			32,7960	12,4870
Libya	Marsa Soman			32,7908	12,5585
Libya	Marsa Zwaga			32,9180	12,0930
Libya	Mellaha Ras Tagiura	Sidi Azus		32,9042	13,2923
Libya	Mongar el Chebir			32,1742	20,1033
Libya	Punta Lebdi			32,6375	14,3007
Libya	Ras el Msel	Ras el Mouen		32,6872	14,2365
Libya	Ras Lahmar	Gargaresch		32,8757	13,1363
Libya	Ras Urih			32,4383	14,8000
Libya	Sidi Abdul Gelil	Zanzur		32,8348	13,0003
Libya	Sidi Ryeia			32,4930	14,5702
Libya	Sidi Sbeh Lahman			32,7912	13,7237
Maroc	Bouknadel			34,1667	-6,8000
Maroc	Briech			35,6083	-6,0486
Maroc	Cab spartel			35,7603	-5,9500
Maroc	Capo Negro			35,8200	-5,2900
Maroc	Es Sahel			35,3028	-6,1944
Maroc	Garifa			35,5475	-6,0853
Maroc	Gharb			34,3958	-6,6750
Maroc	Jolot			35,0936	-6,2372
Maroc	Kenitra1			34,9736	-6,3083
Maroc	Kenitra2			34,8500	-6,3500
Maroc	Kenitra3			34,7625	-6,3953
Maroc	Las Cuevas			35,4567	-6,1150
Maroc	Los Cenizosos			35,3847	-6,1625
Maroc	Mabrouka			34,6667	-6,4833
Maroc	Mansouria			34,4833	-6,5333
Maroc	Mansouria2			34,5758	-6,5167
Maroc	Principe			35,0569	-6,2636
Maroc	Punta Negra			35,1517	-6,2311
Maroc	Tahad Art			35,6756	-6,0150
EU.Portugal	Abobora			37,1780	-7,4500
EU.Portugal	Abóbora II			37,0600	-7,4900
EU.Portugal	Almadana			36,9800	-8,8000
EU.Portugal	Armação Nova			37,0900	-7,4000
EU.Portugal	Arrifana			37,2900	-8,9500
EU.Portugal	Barril	Barril ou Tres Irmaos		37,0100	-7,6100
EU.Portugal	Beliche			36,9300	-9,0100
EU.Portugal	Bias			36,9300	-7,7500
EU.Portugal	Cabeço			37,0900	-7,4400
EU.Portugal	Cabo de Santa Maria			36,8700	-7,9500
EU.Portugal	Cabo dos Corais			36,9300	-8,9800
EU.Portugal	Sul do Cabo Carvoeiro			37,0850	-8,4520
EU.Portugal	Farol			36,8600	-7,8500
EU.Portugal	Farroilhas			36,9500	-8,0900
EU.Portugal	Forte Novo			37,0610	-8,0890
EU.Portugal	Fuzeta			36,9400	-7,7300
EU.Portugal	Pedra da Galé	Galé		37,0790	-8,3140
EU.Portugal	Livramento	Senhora do Livramento		36,9800	-7,6400
EU.Portugal	Medo Branco	Ramalhete		36,9300	-8,0400
EU.Portugal	Medo das Cascas			37,0500	-7,6200
EU.Portugal	Olhos de Agua	Valongo		36,9900	-8,2100
EU.Portugal	Oura			36,9800	-8,2500
EU.Portugal	Pedras Negras			36,9300	-8,9300
EU.Portugal	Penedo do Sono			33,1100	-16,3500
EU.Portugal	Ponta do Burgau	Burgau		37,0630	-8,7890
EU.Portugal	Senhora Da Rocha			36,9900	-8,3700
EU.Portugal	Sol de Ponta de Zavial	Zavial		36,9700	-8,8600
EU.Portugal	Sul da Ponta da Baleeira			36,9500	-8,8800
EU.Portugal	Torre Alta			37,0954	-8,6577
EU.Portugal	Torre Alinha			37,0300	-8,6500
EU.Portugal	Torre da Barra			37,0852	-8,5146
EU.Portugal	Torre d'Ares			36,9300	-7,7800
EU.Portugal	Torre d'Aspa			37,1158	-8,9497
EU.Portugal	Vau			37,0100	-8,6000
Tunisia	Bordj Kadidja			35,2180	11,1620
Tunisia	Cap Zebib			37,2680	10,0660
Tunisia	Conigliera			35,7551	11,0132
Tunisia	El Aouaria			37,0500	11,0100
Tunisia	Kuriat			35,8000	11,0300
Tunisia	Monastir			35,7700	10,8300
Tunisia	Ras el Ahmar			37,0500	10,9000
Tunisia	Sidi Daoud			37,0200	10,9000
Turkey	Istanbul port			40,9871	28,9820

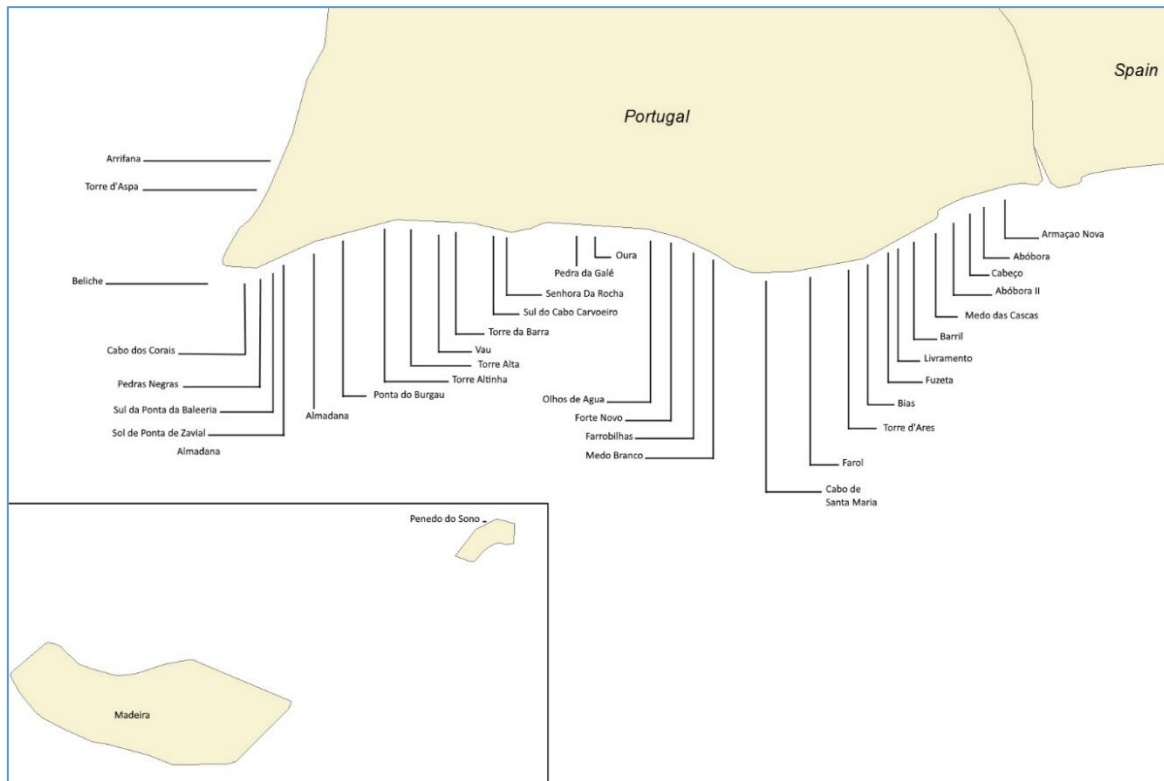


Figure 1. Distribution of the tuna traps for which data exist in the GBYP files, in Portugal (top) and in Morocco (bottom).

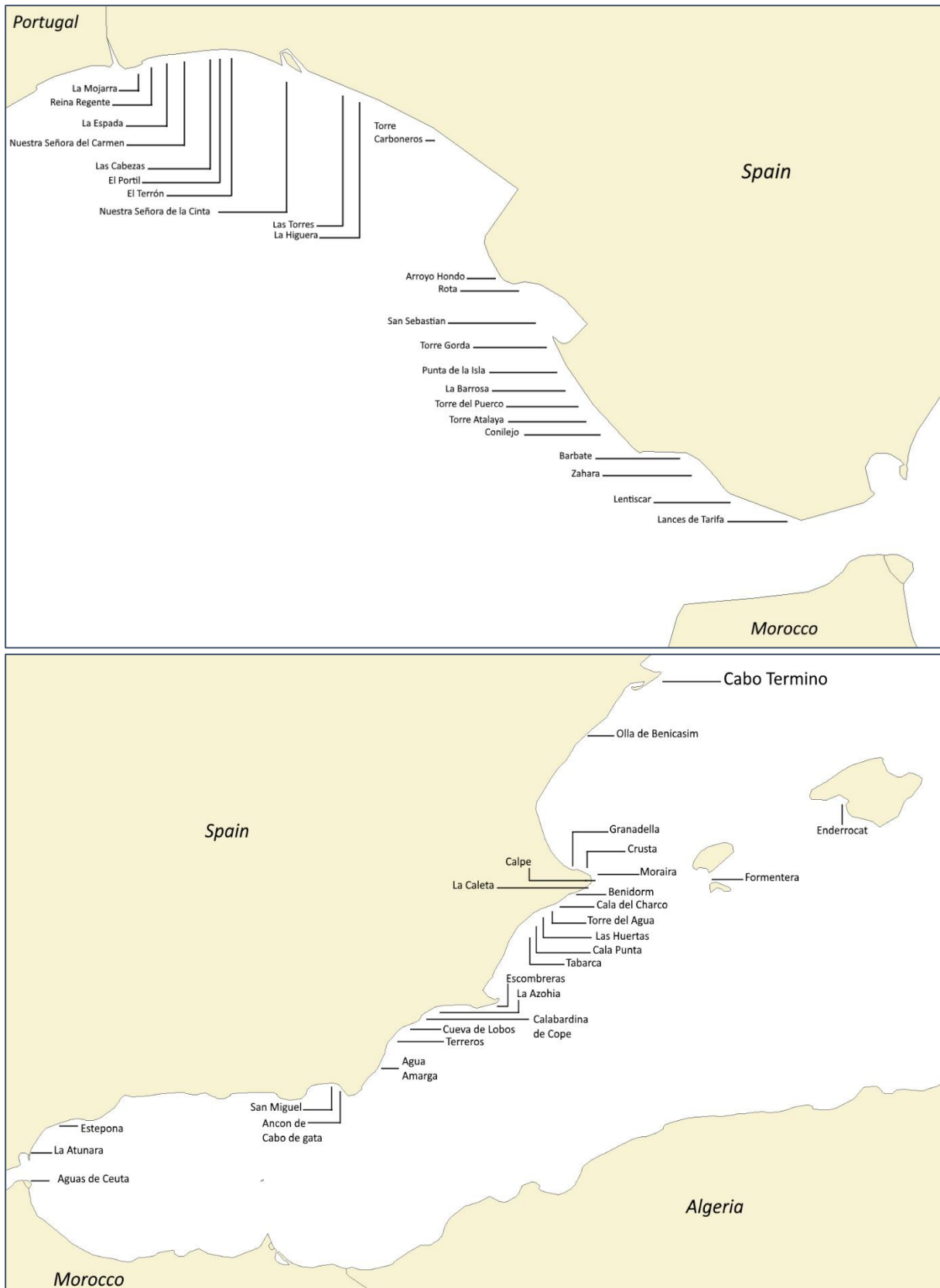


Figure 2. Distribution of the Spanish tuna traps in the Atlantic Ocean (top) and in the Mediterranean Sea (bottom).

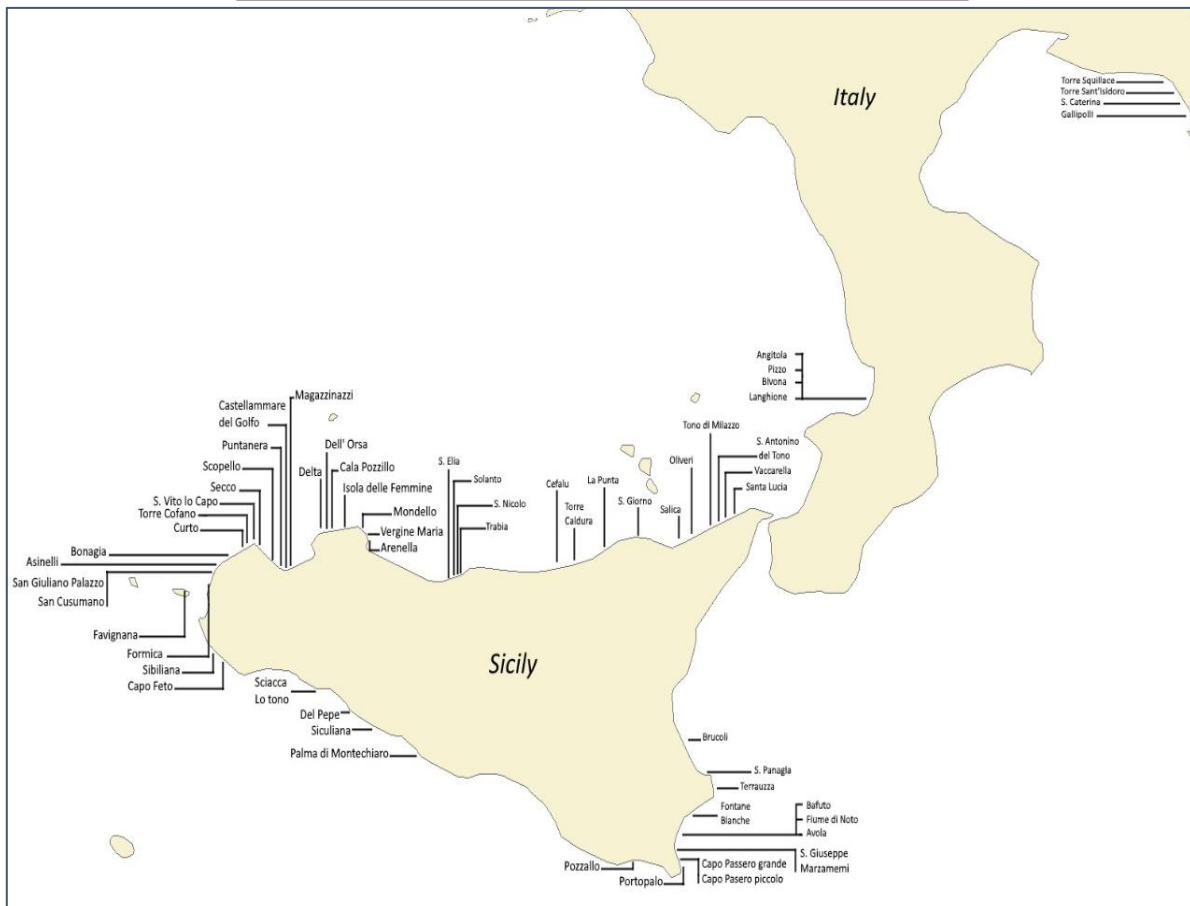
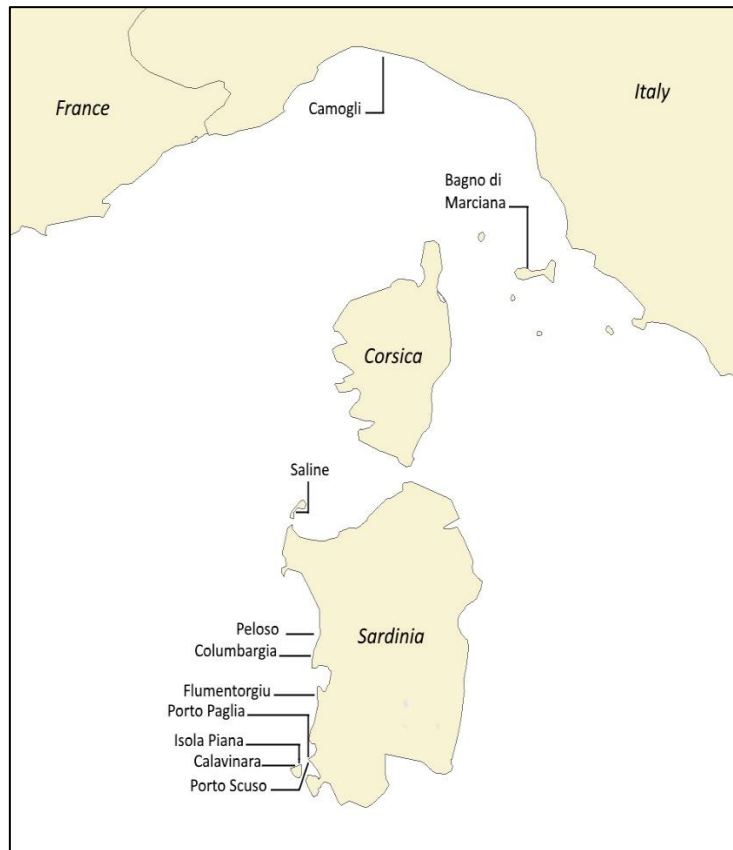


Figure 3. Distribution of Italian traps in Sardinia, Ligurian Sea and northern Tyrrhenian Sea (top) and in southern Italy and Sicily (bottom).

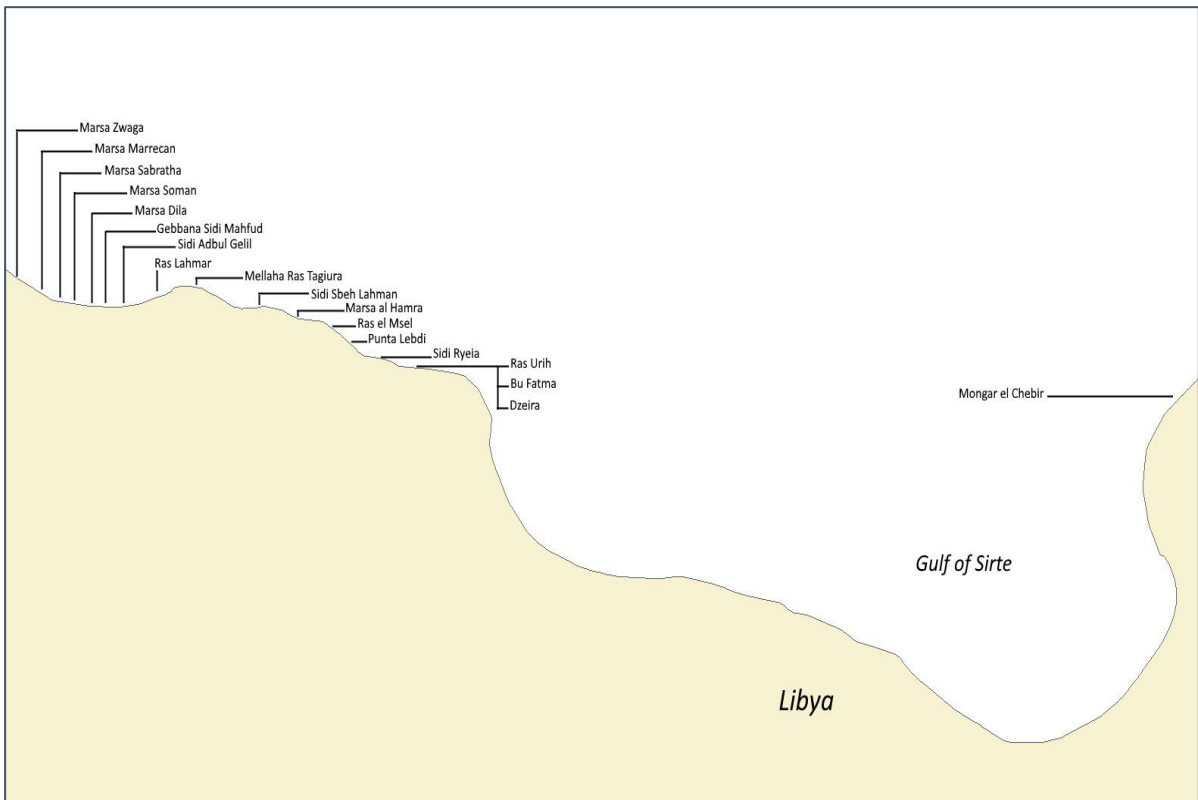
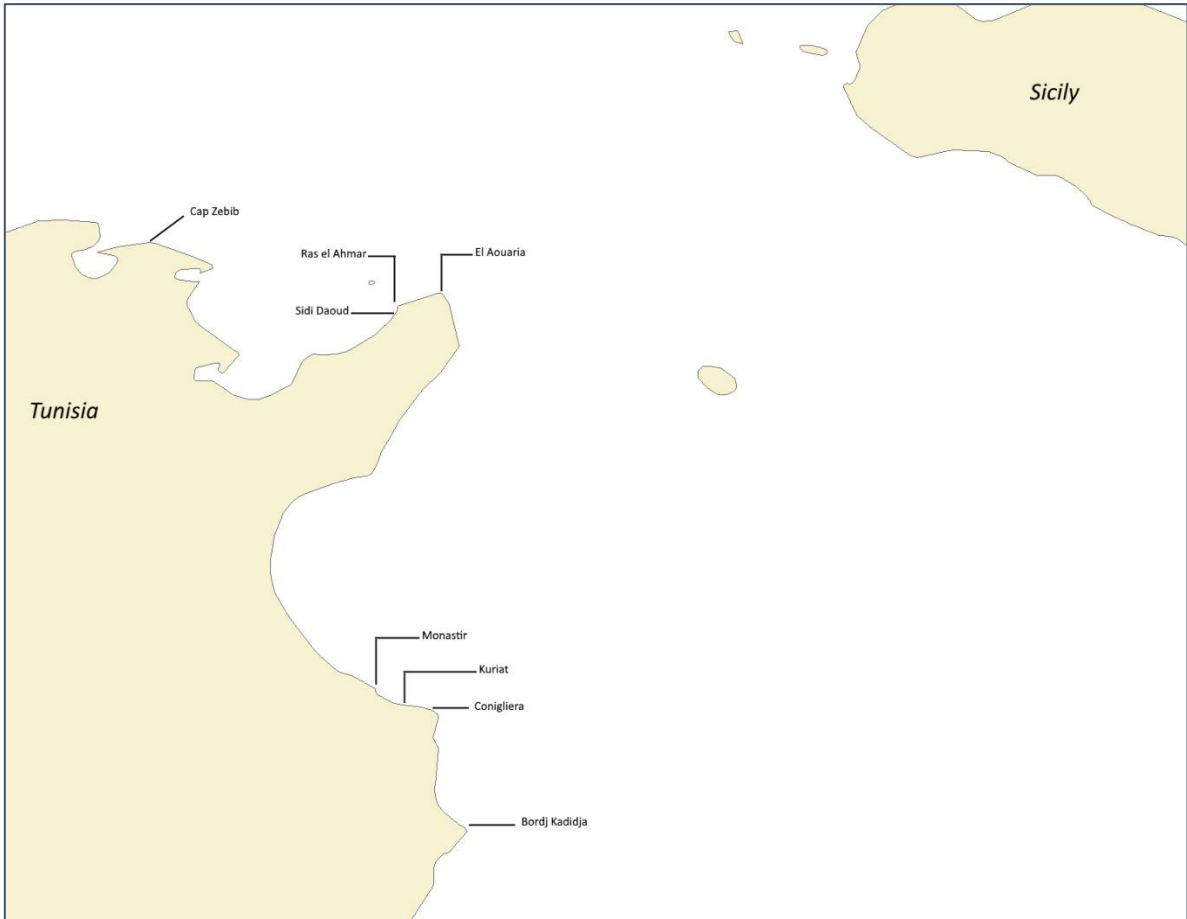


Figure 4. Distribution of the tuna traps in Tunisia (top) and Libya (bottom).

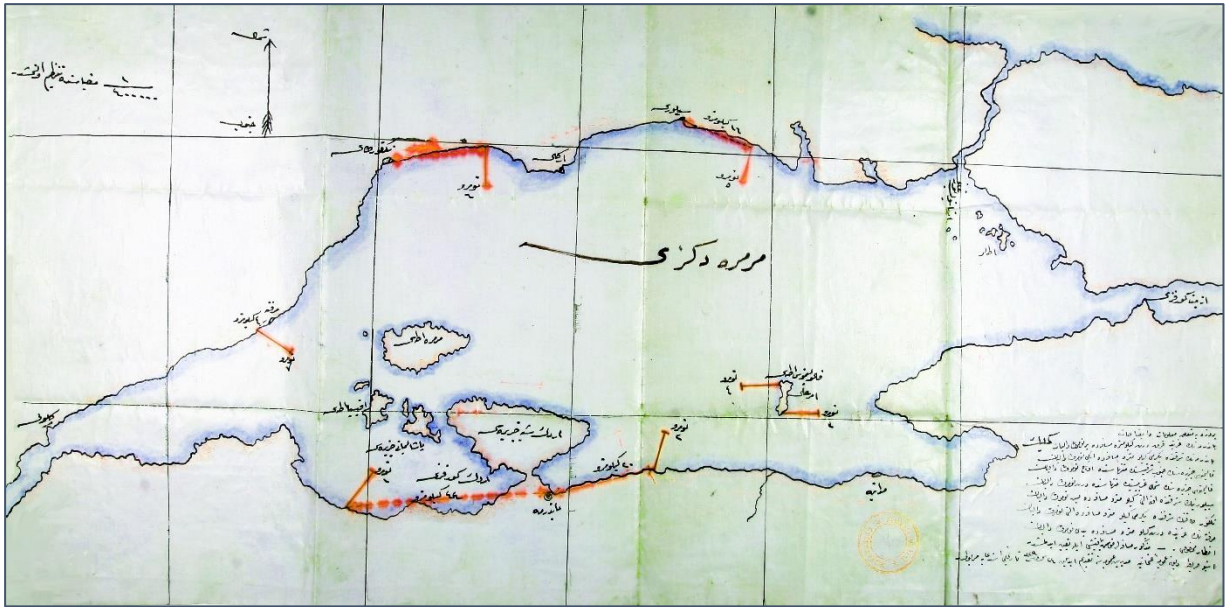


Figure 5. Distribution of the Turkish tuna traps which provided the bluefin tuna for the market in Istanbul at the beginning of the XX century. Top: Ottoman map of the traps in 1913 (from Örenc *et al.*, 2014); bottom: map of the traps in 1918 (from: Parona, 1919).

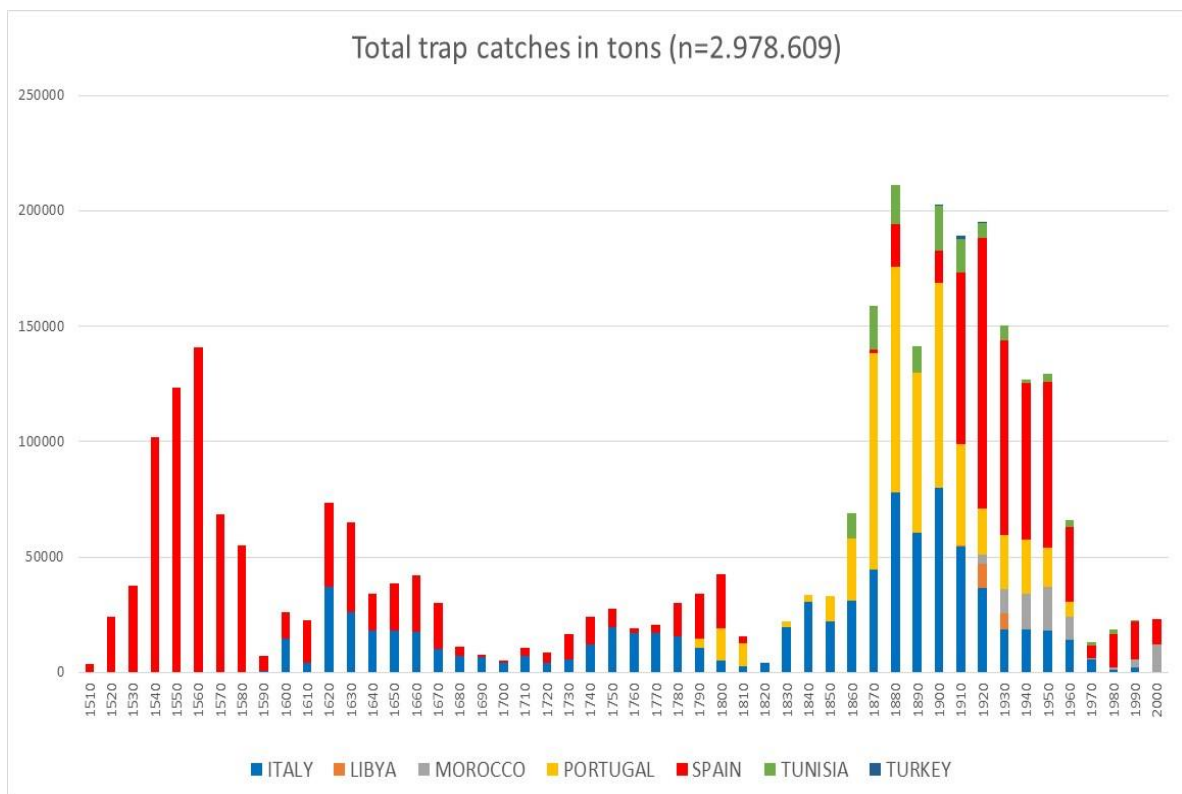
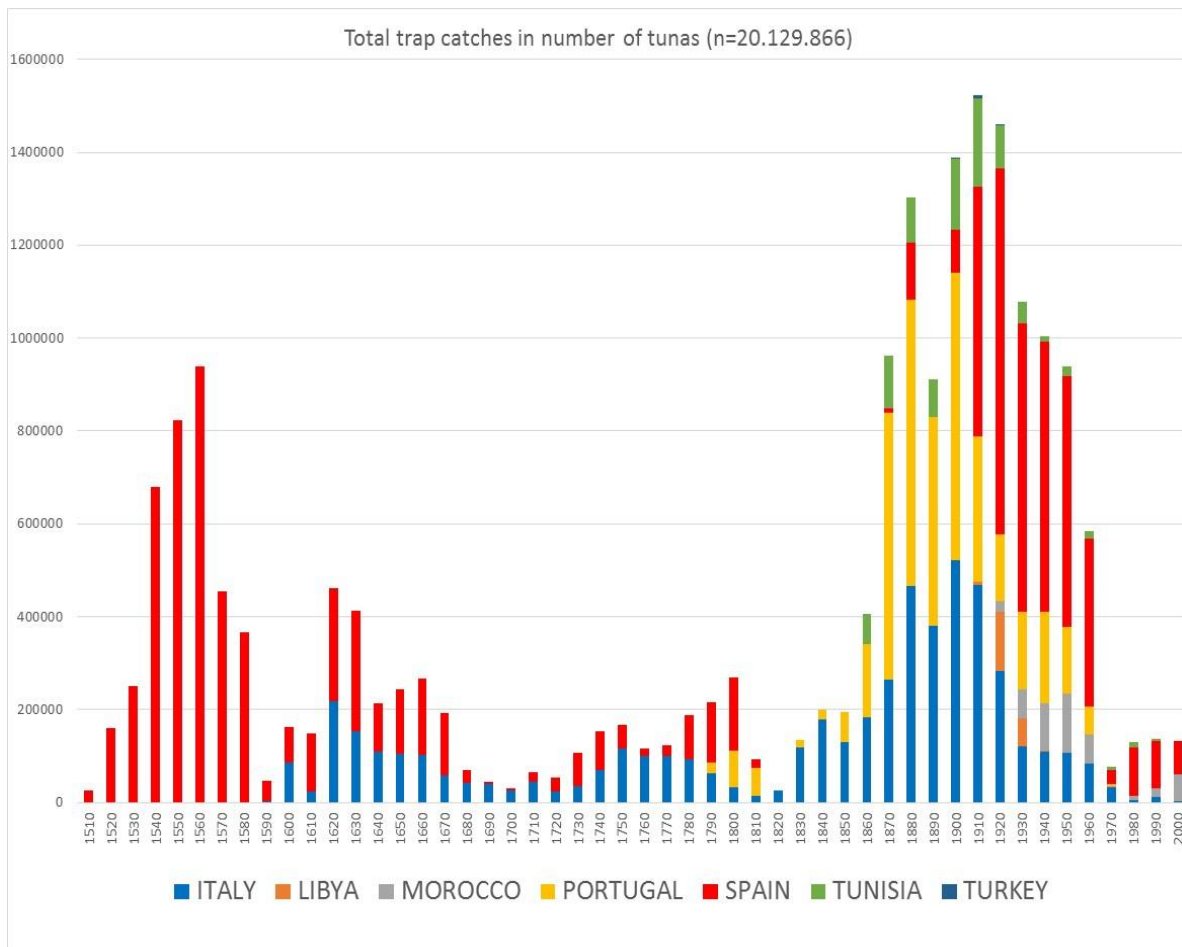


Figure 6. Cumulative bluefin tuna catch data by decade, in number of fish (top) and in weight (tons) (bottom) for the all traps included in the ICCAT GBYP files.

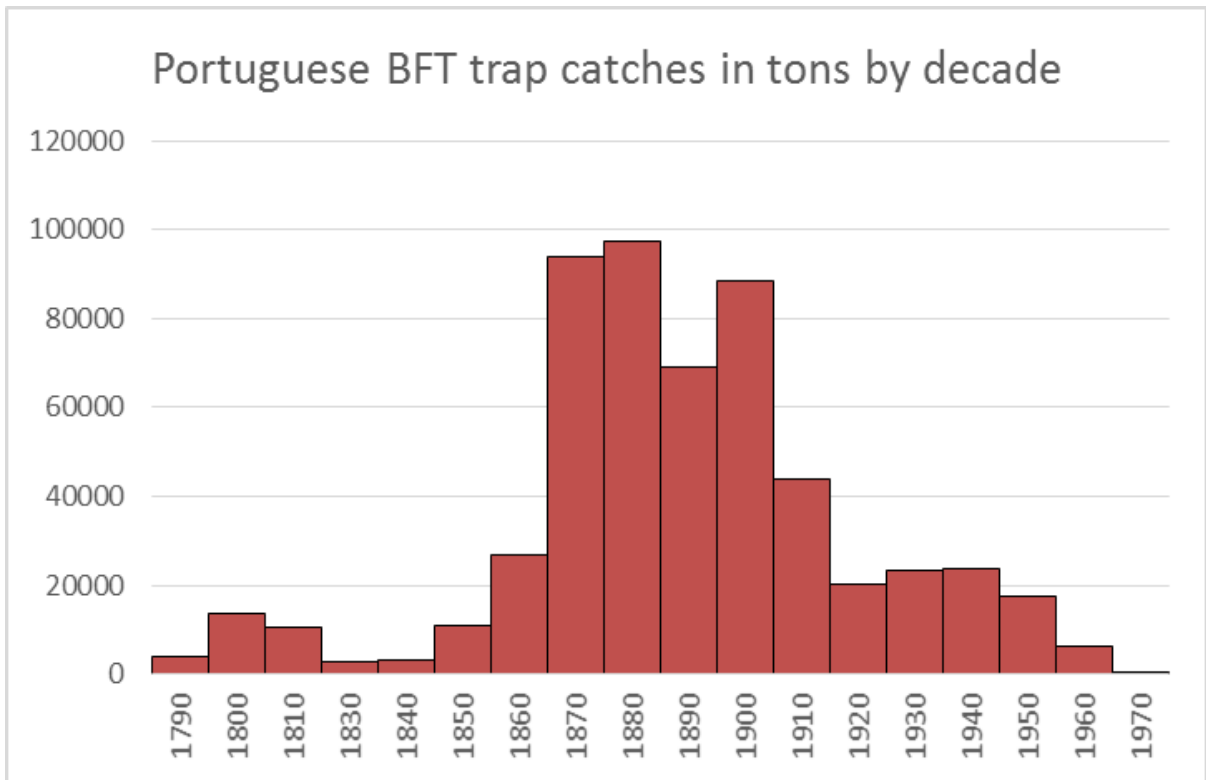
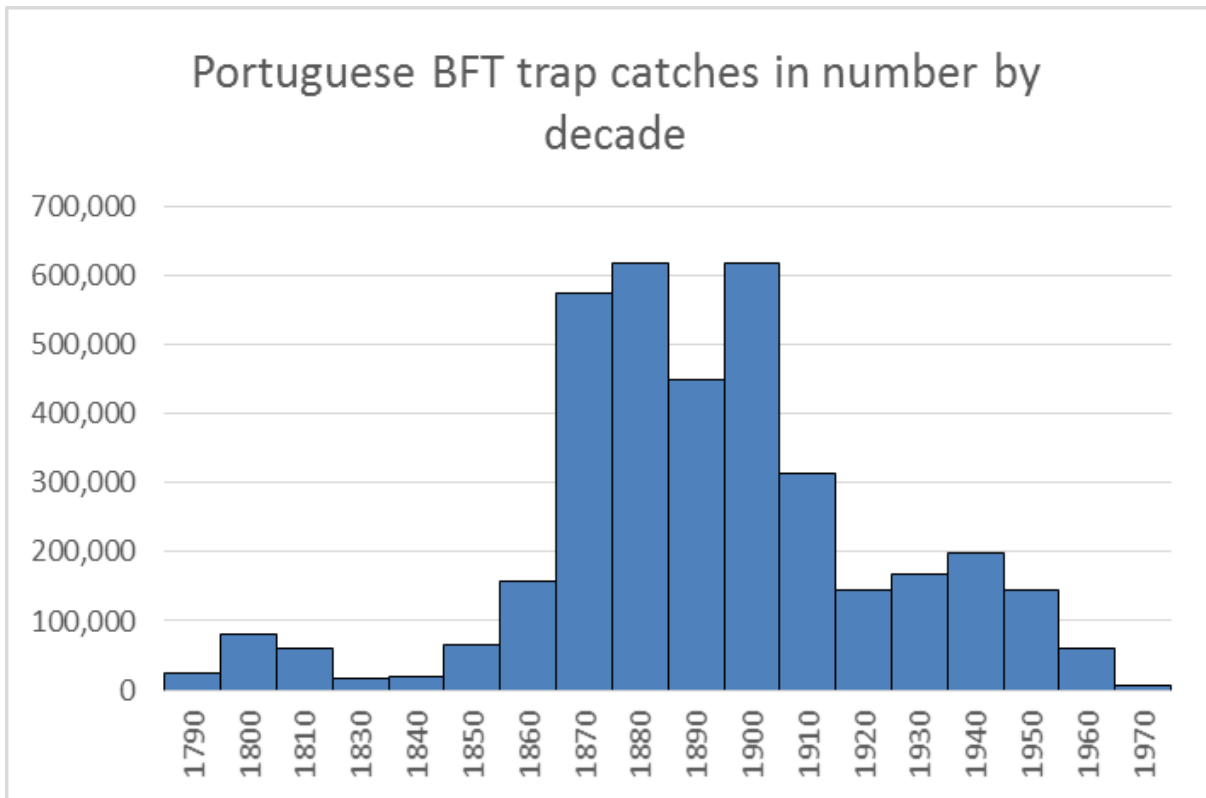


Figure 7. Bluefin tuna catch data by decade, in number of fish (top) and in weight (tons) (bottom) for the Portuguese traps.

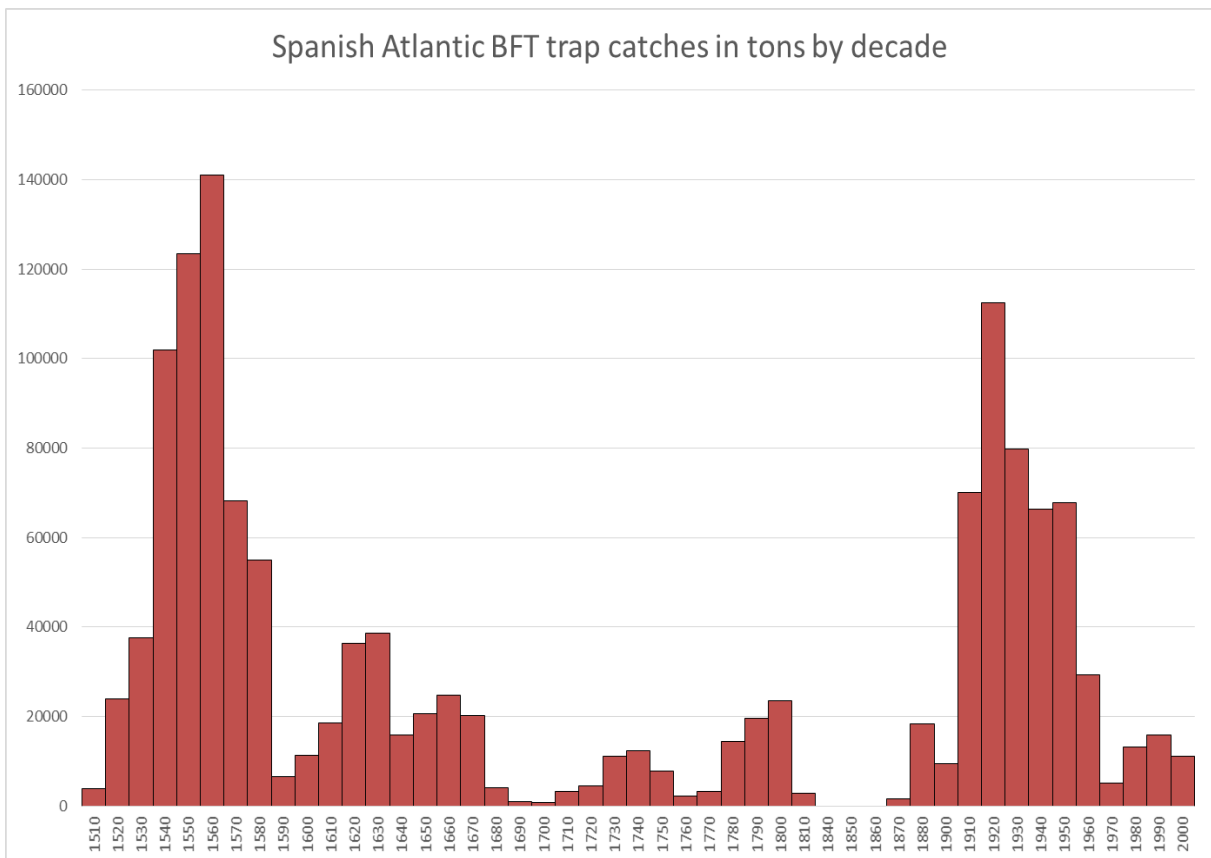
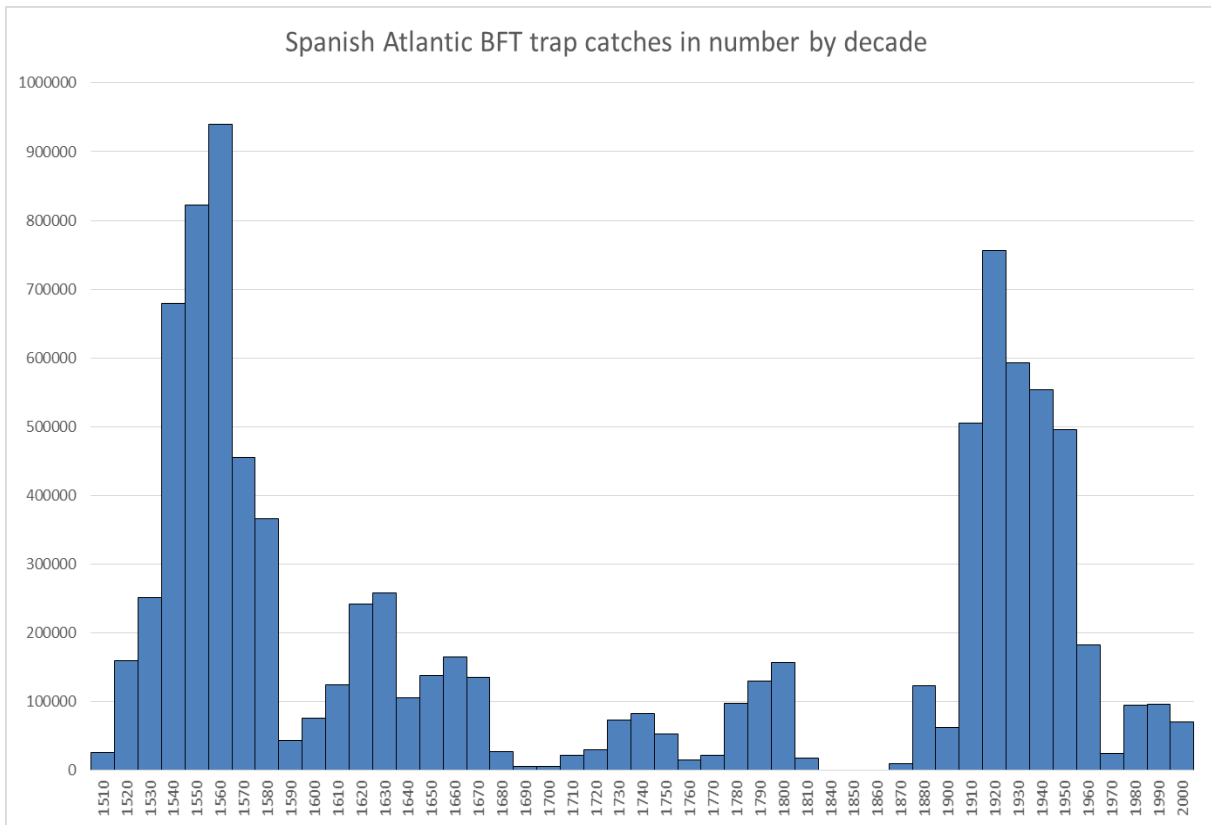


Figure 8. Bluefin tuna catch data by decade, in number of fish (top) and in weight (tons) (bottom) for the Spanish Atlantic traps.

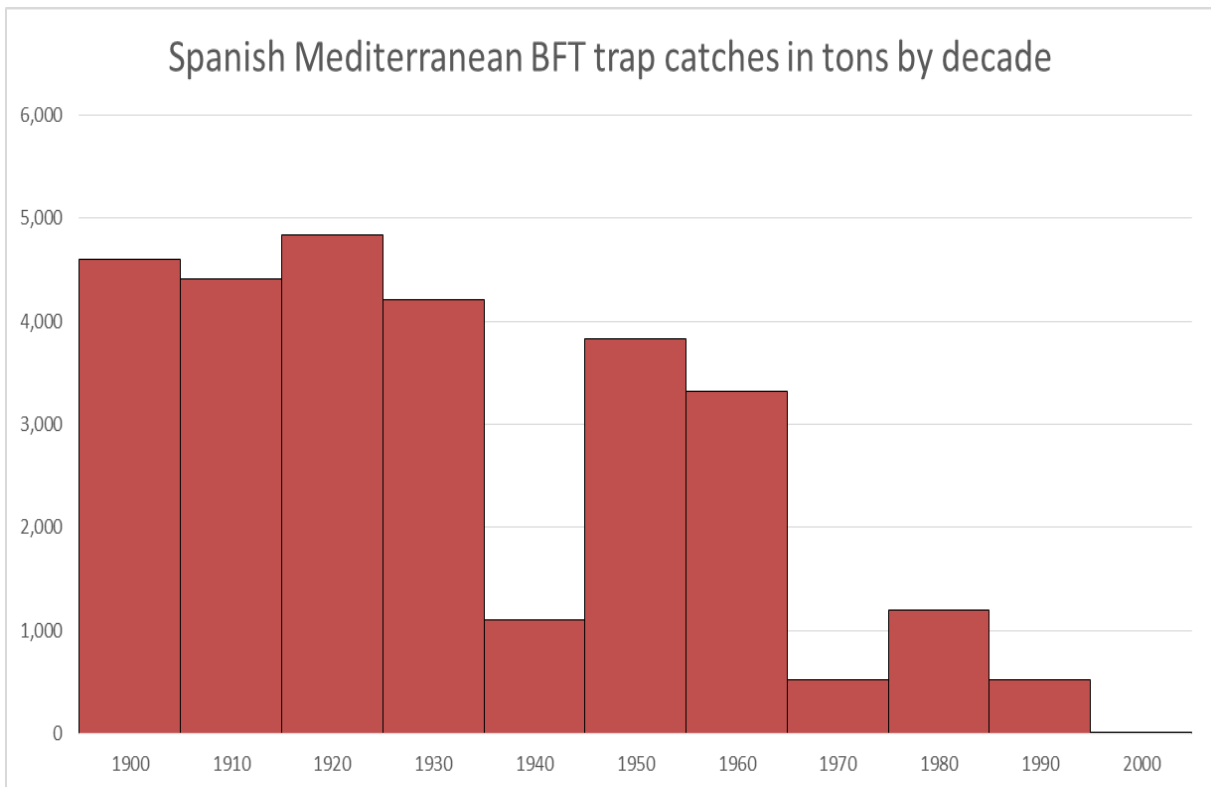
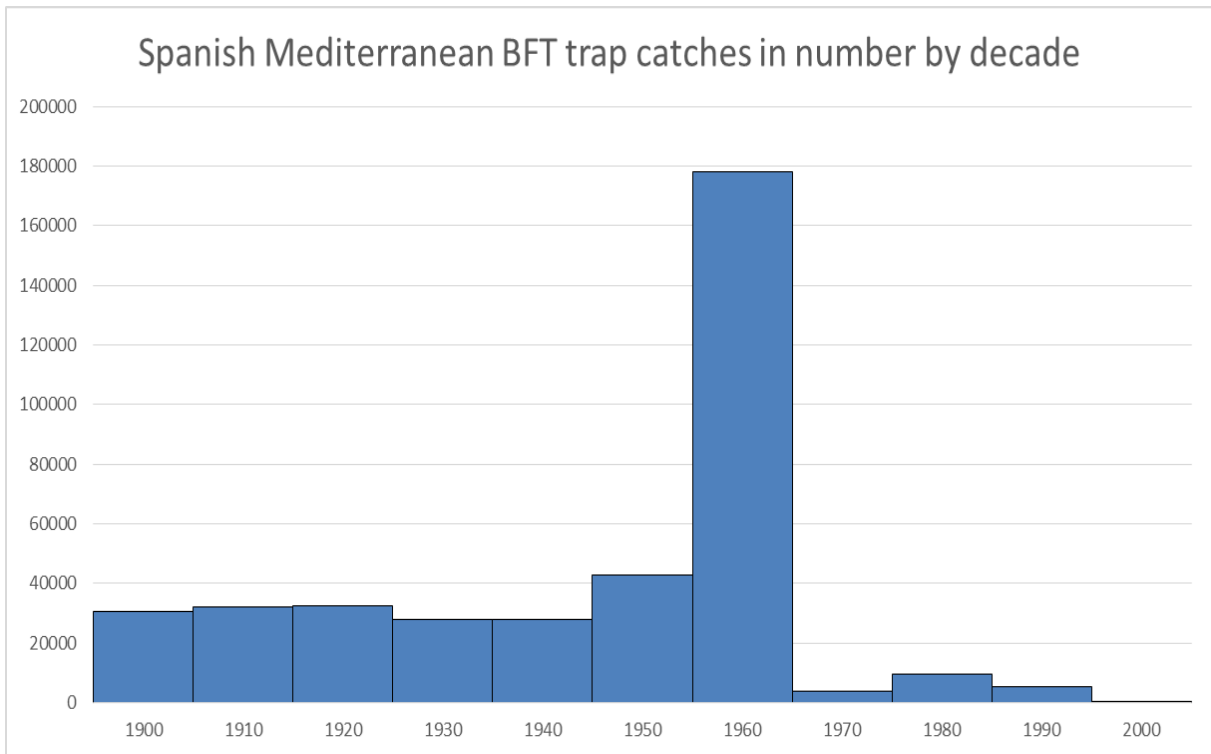


Figure 9. Bluefin tuna catch data by decade, in number of fish (top) and in weight (tons) (bottom) for the Spanish Mediterranean traps.

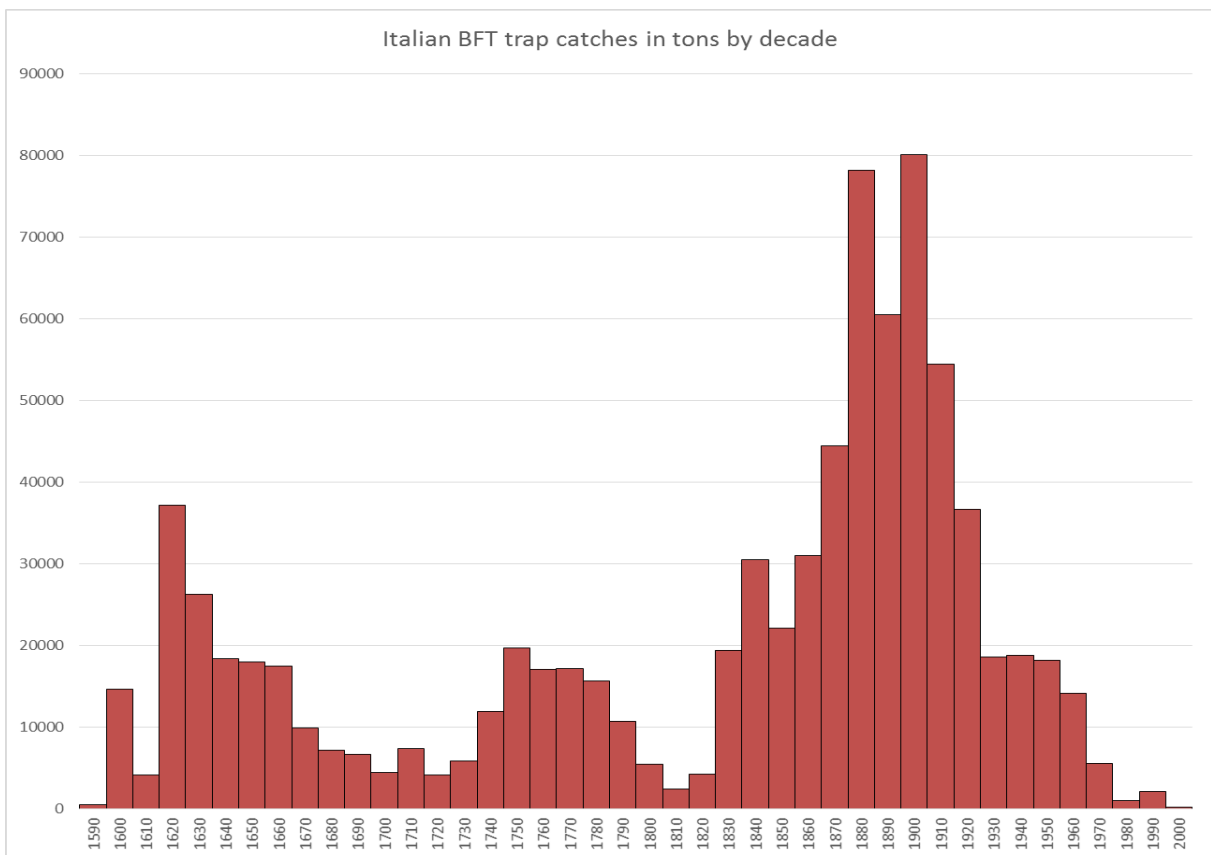
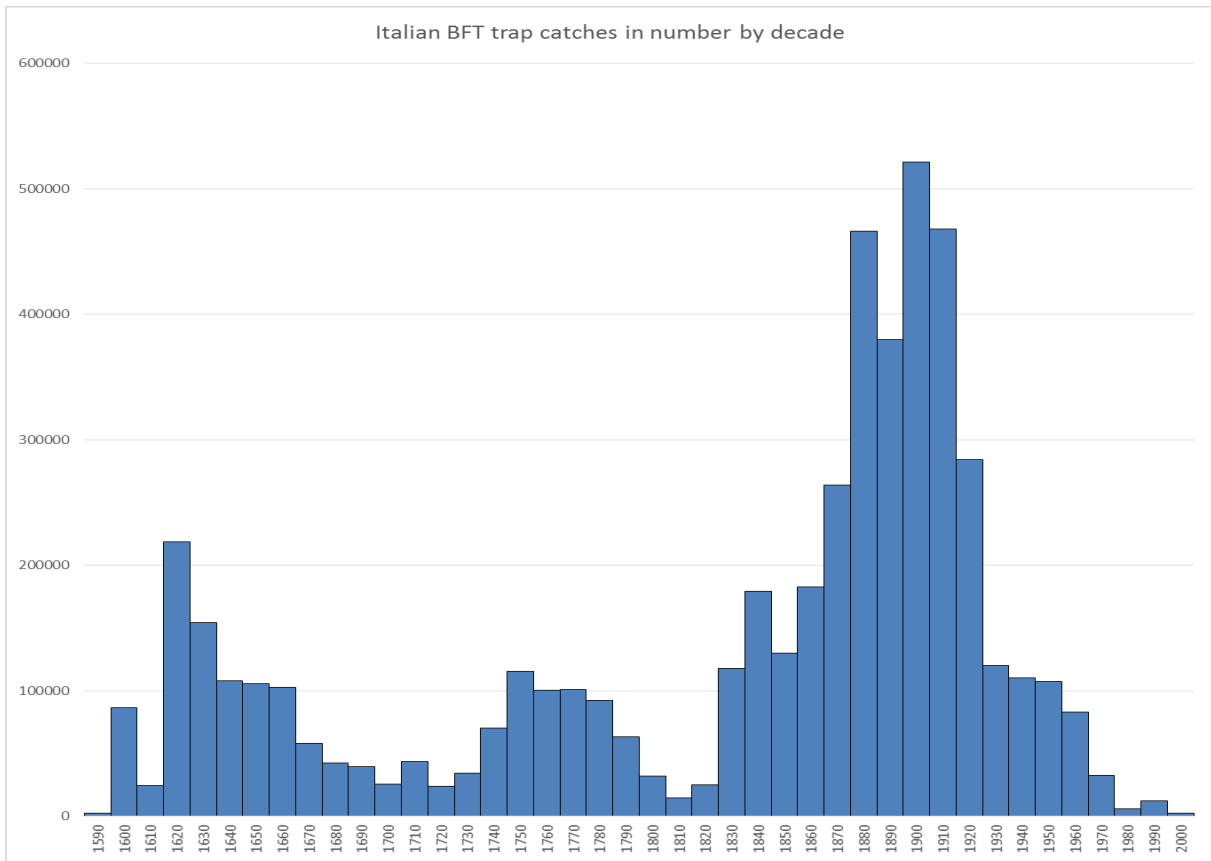


Figure 10. Bluefin tuna catch data by decade, in number of fish (top) and in weight (tons) (bottom) for the Italian traps.

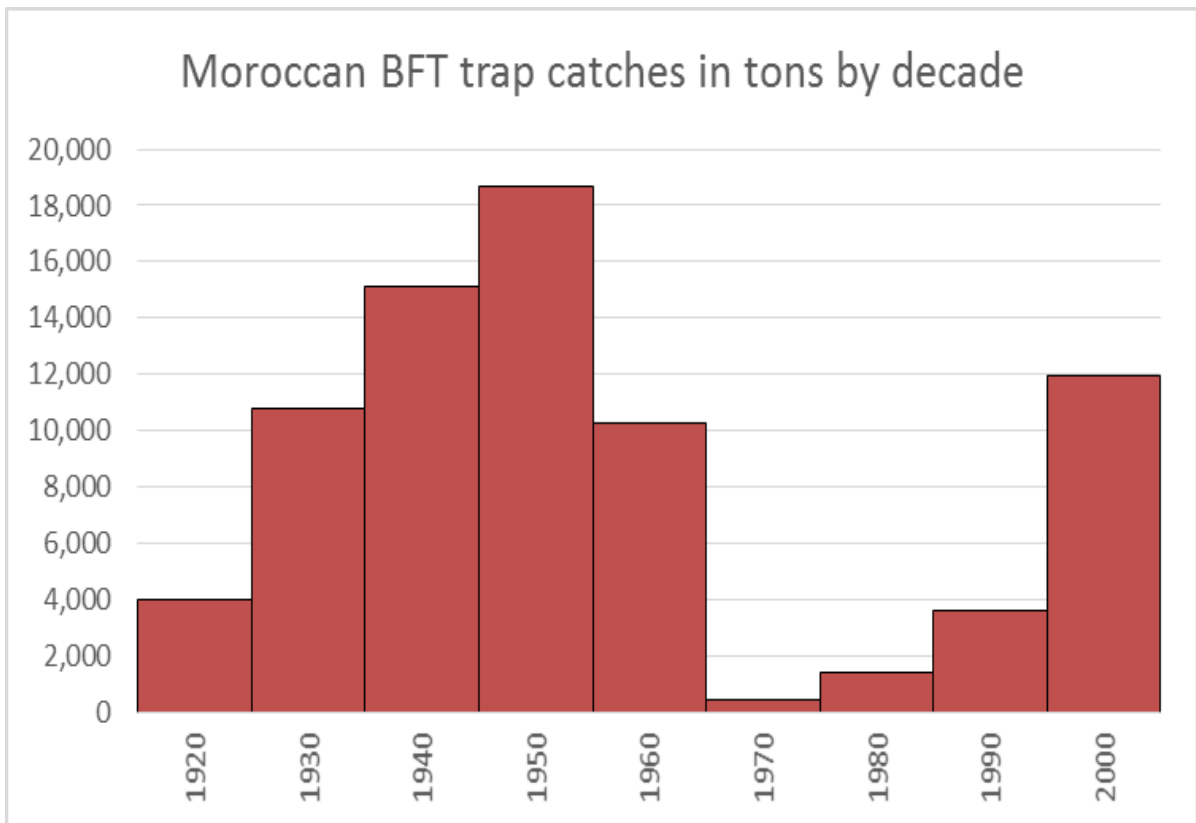
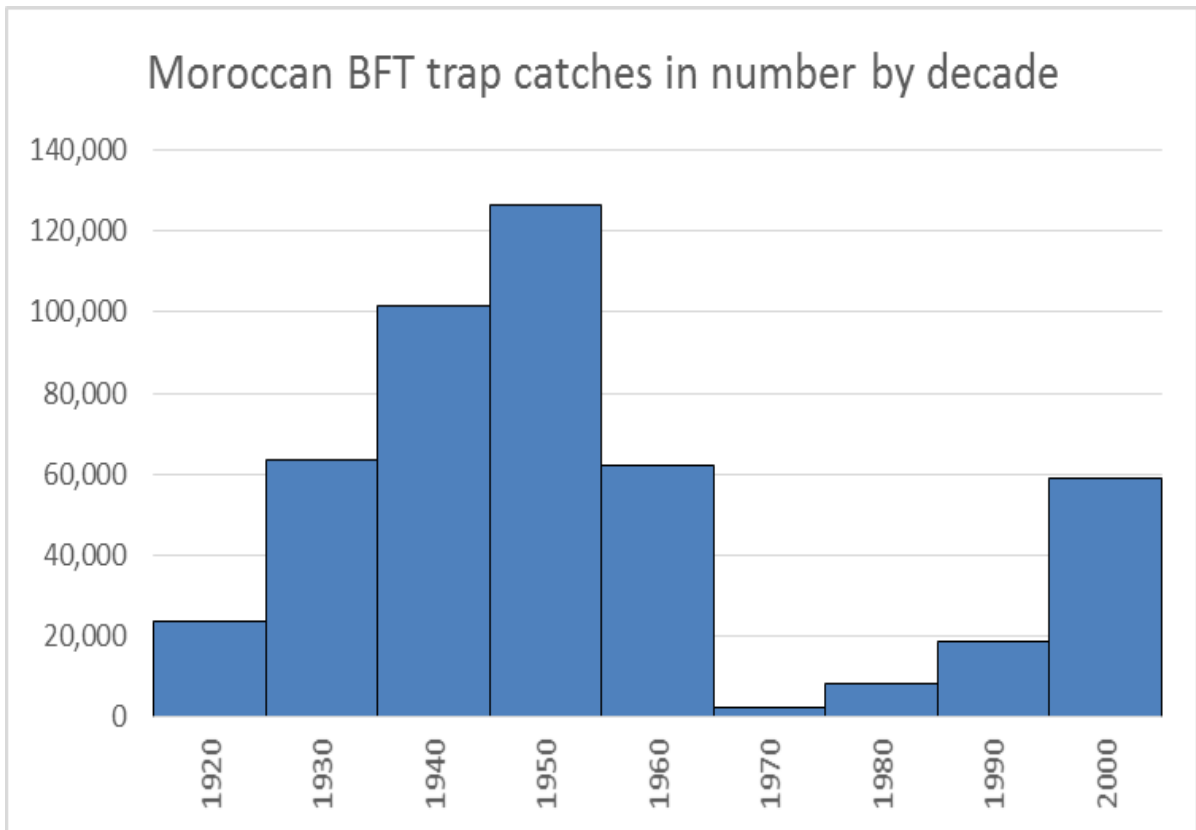


Figure 11. Bluefin tuna catch data by decade, in number of fish (top) and in weight (tons) (bottom) for the Moroccan traps.

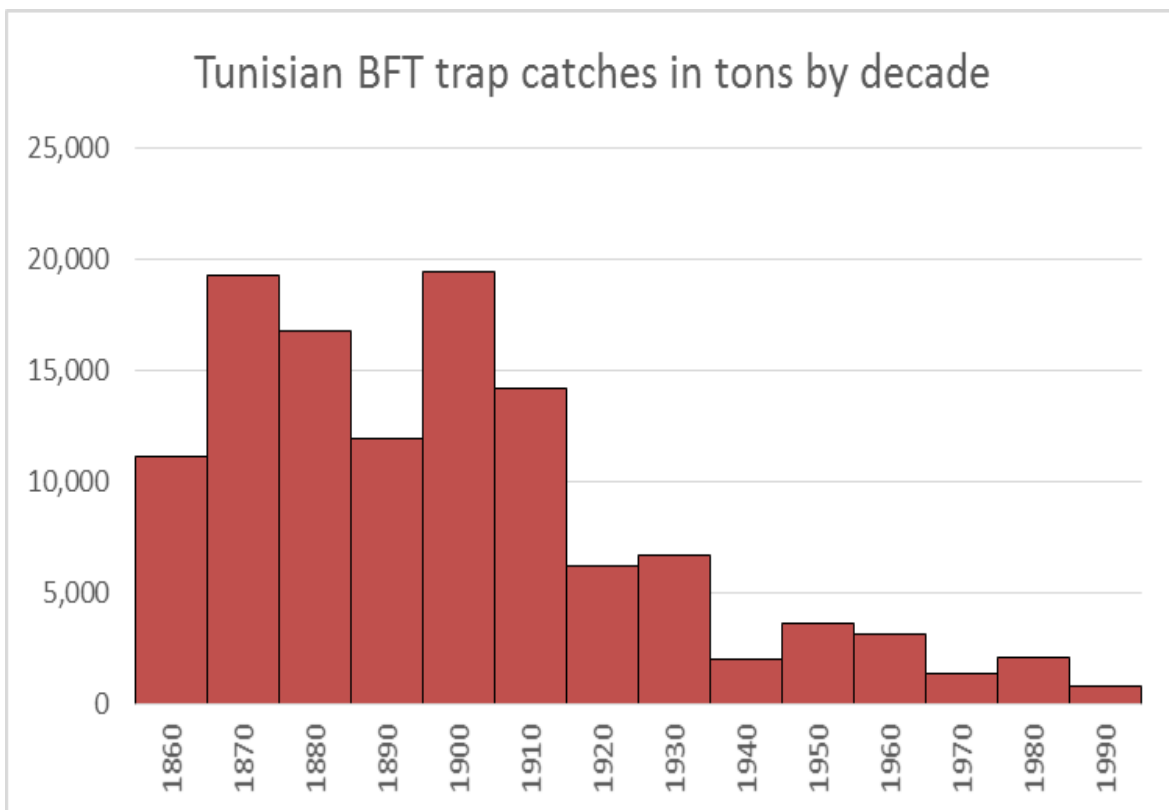
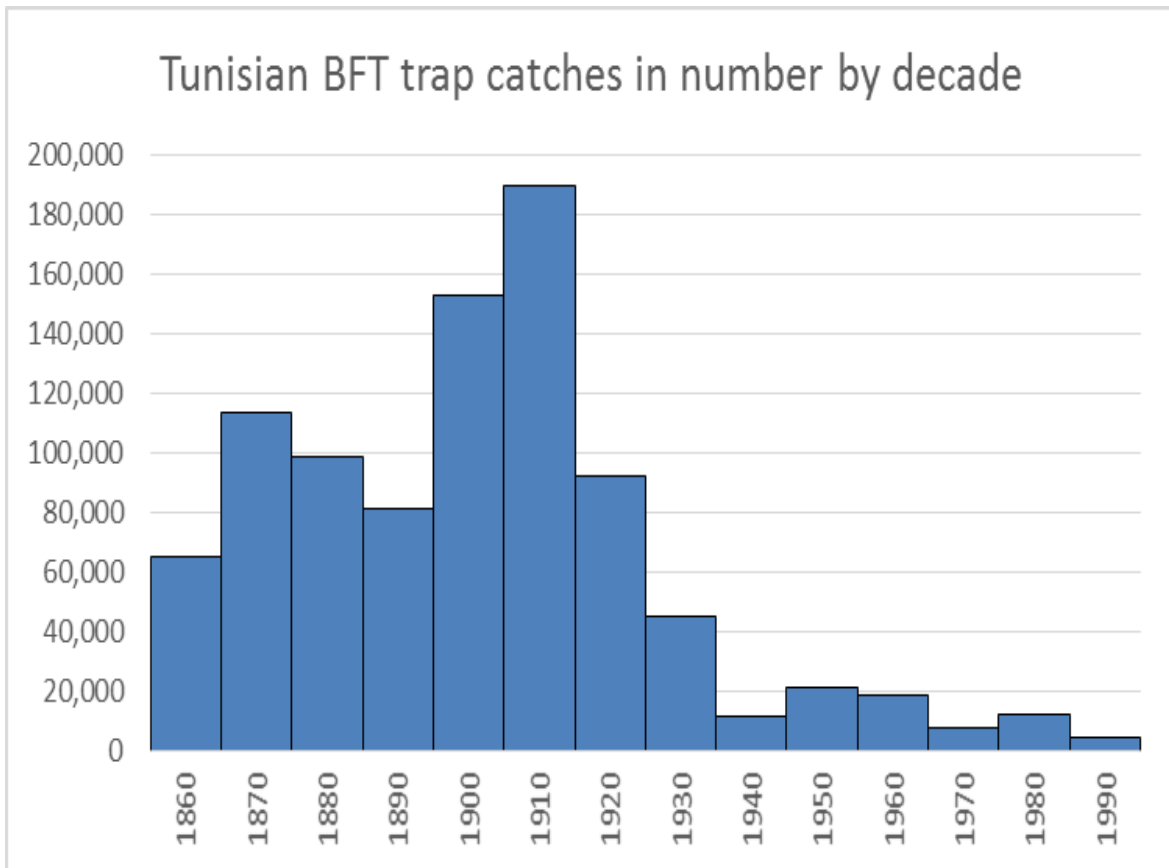


Figure 12. Bluefin tuna catch data by decade, in number of fish (top) and in weight (tons) (bottom) for the Tunisian traps.

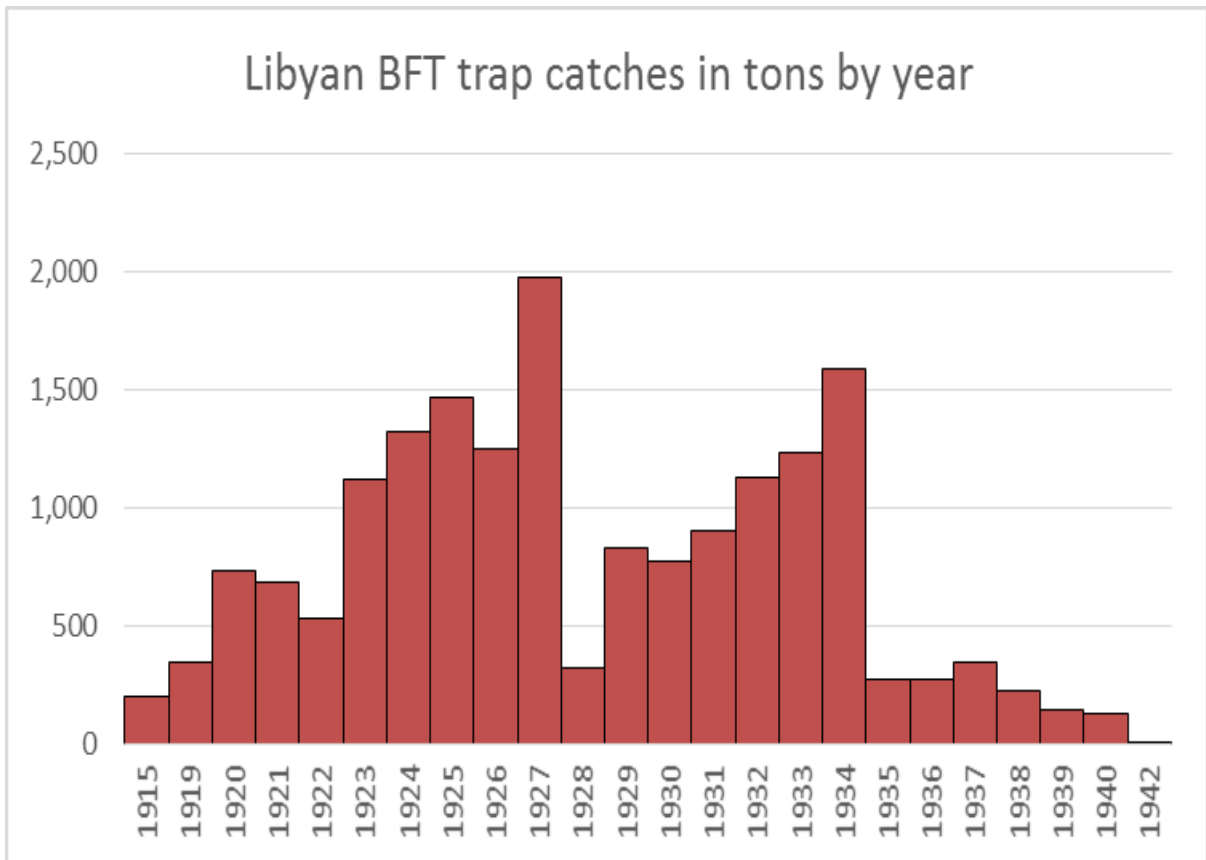
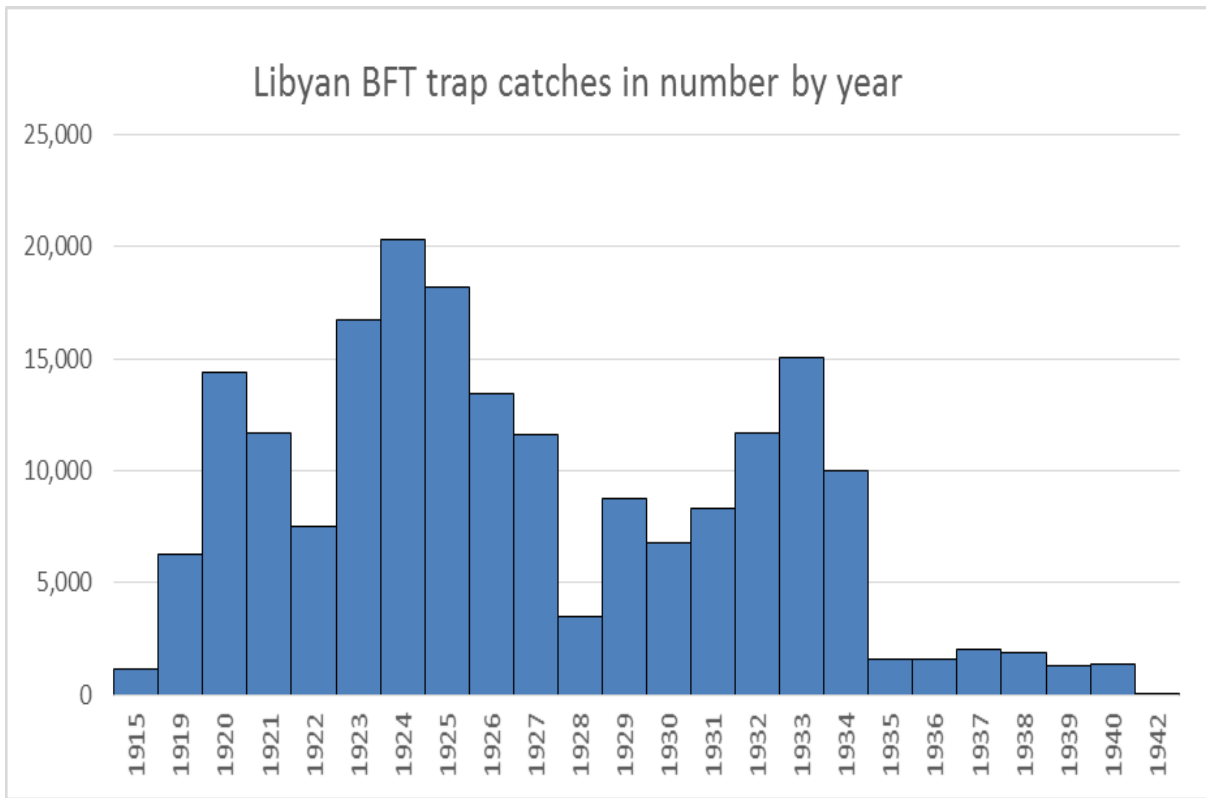


Figure 13. Bluefin tuna catch data by year, in number of fish (top) and in weight (tons) (bottom) for the Libyan traps.

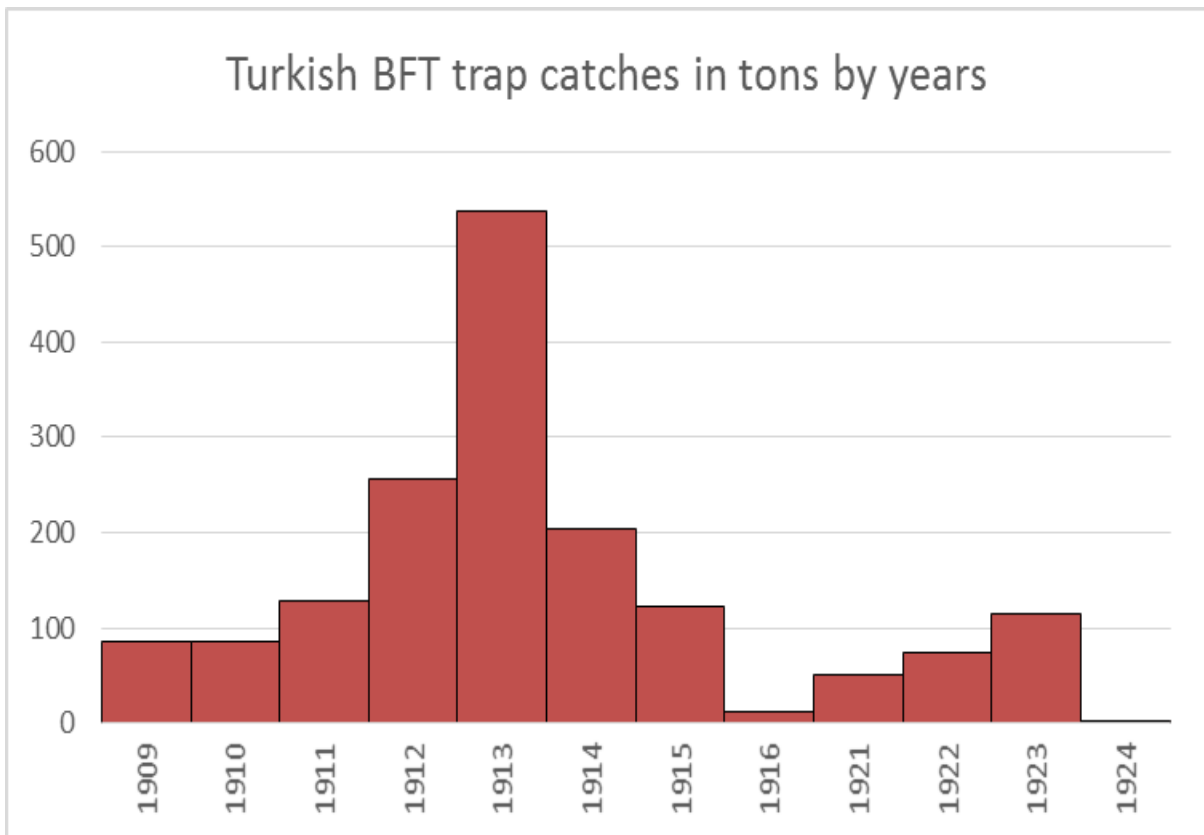
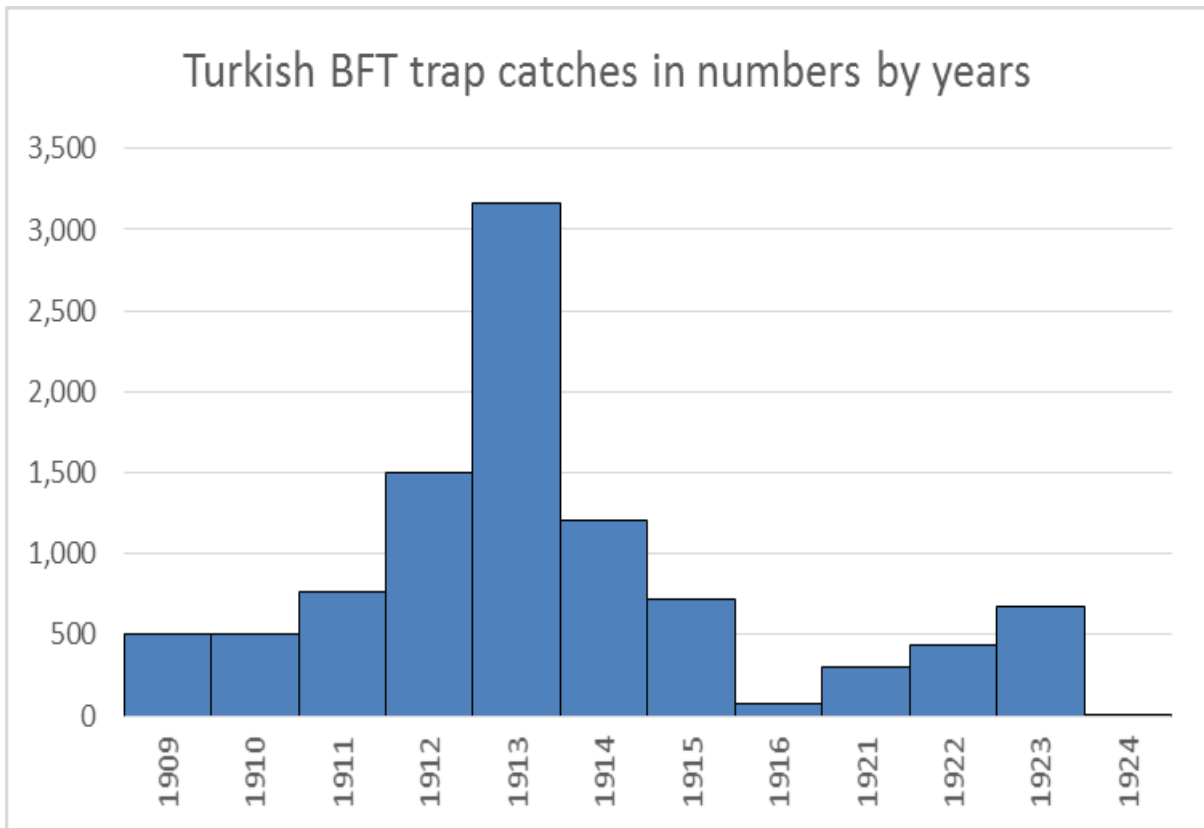


Figure 14. Bluefin tuna catch data by year, in number of fish (top) and in weight (tons) (bottom) for the Turkish traps, according to the statistics from the market in Istanbul.

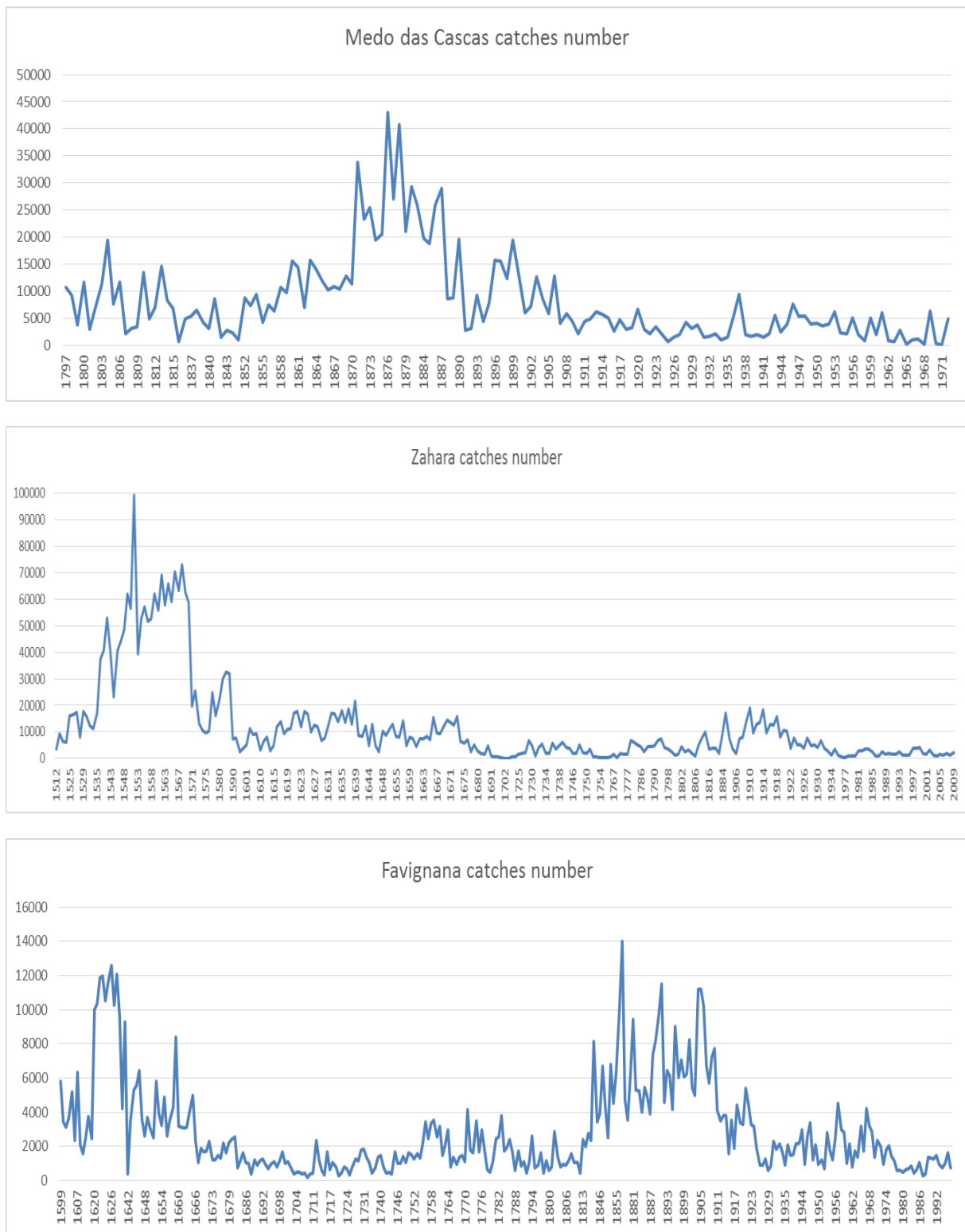


Figure 15. Detailed annual sequence of Bluefin tuna catch data for three tuna traps having a long series: Medo das Cascas, Portugal (top), Zahara de los Atunes, Spain (middle), Favignana, Italy (bottom).

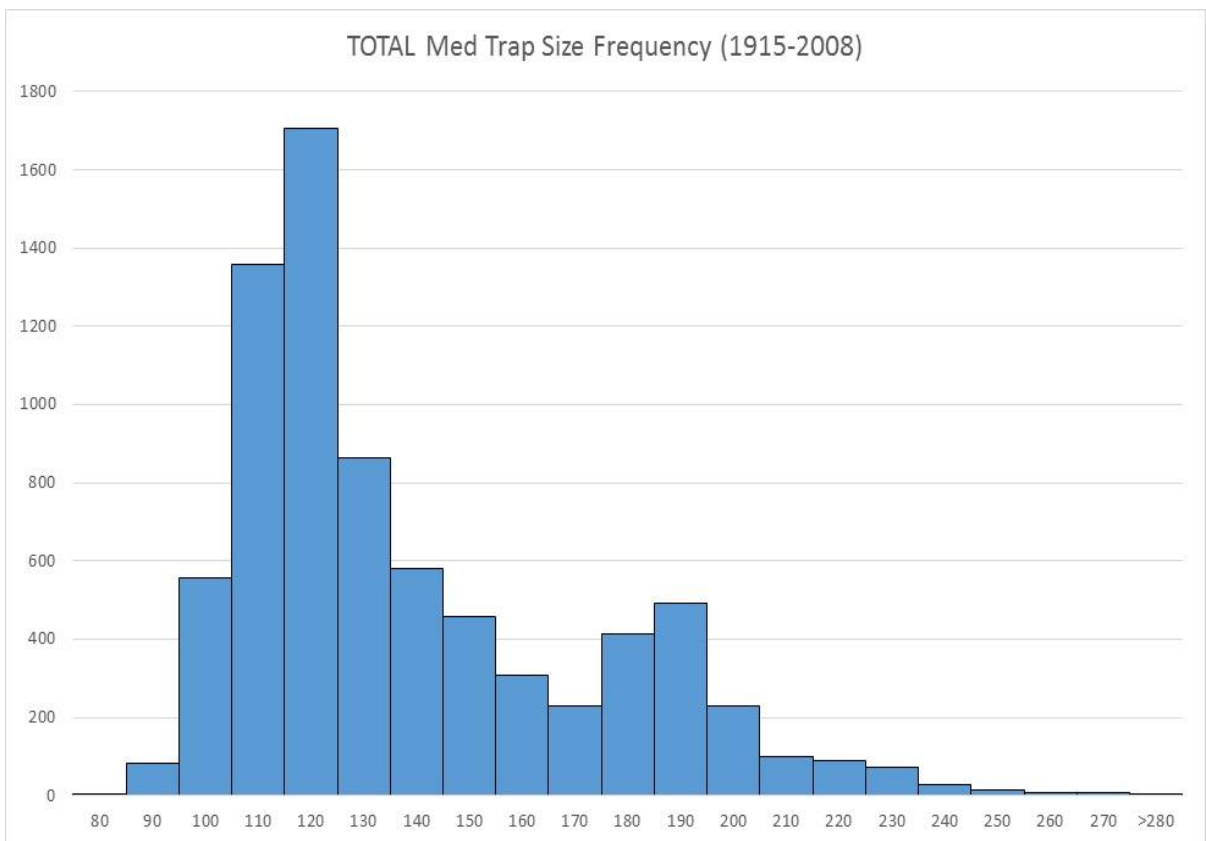
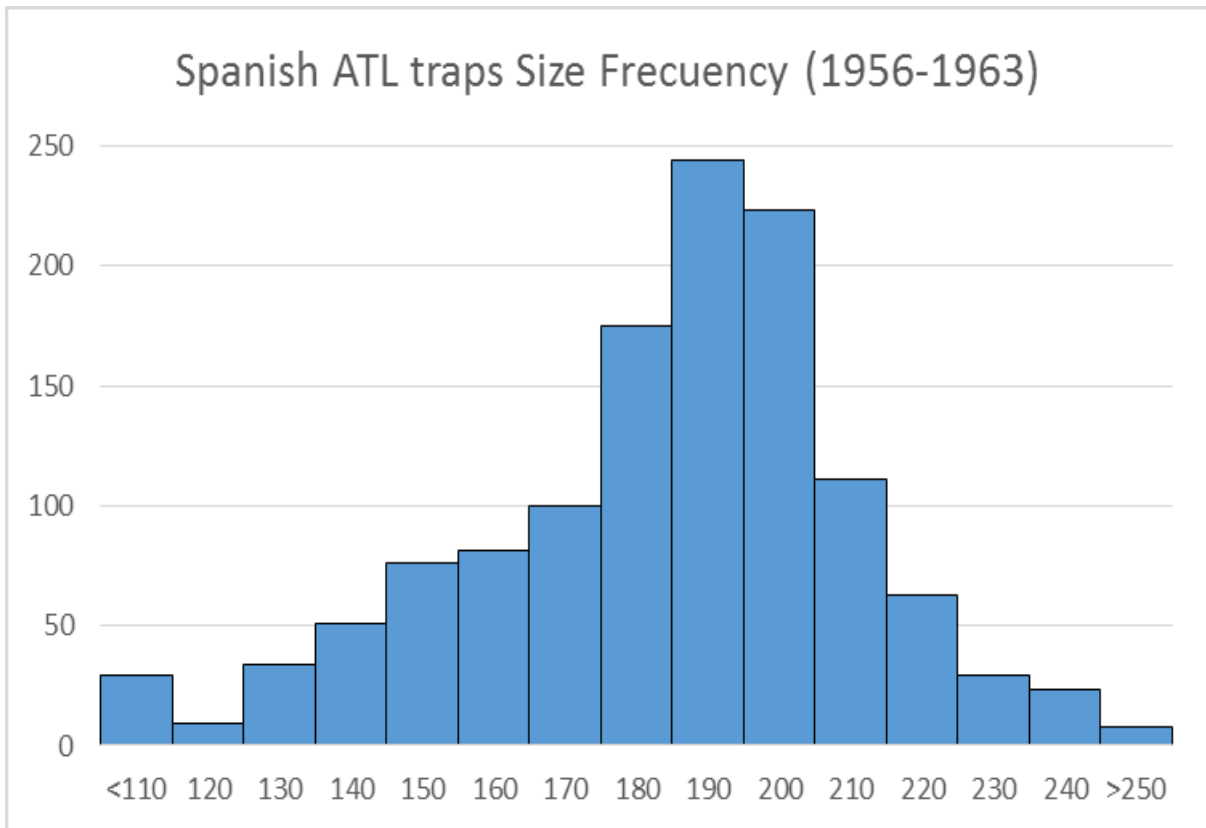


Figure 16. Cumulative bluefin tuna catch data by size class (10 cm) for the Atlantic traps (top) and the Mediterranean traps (bottom).

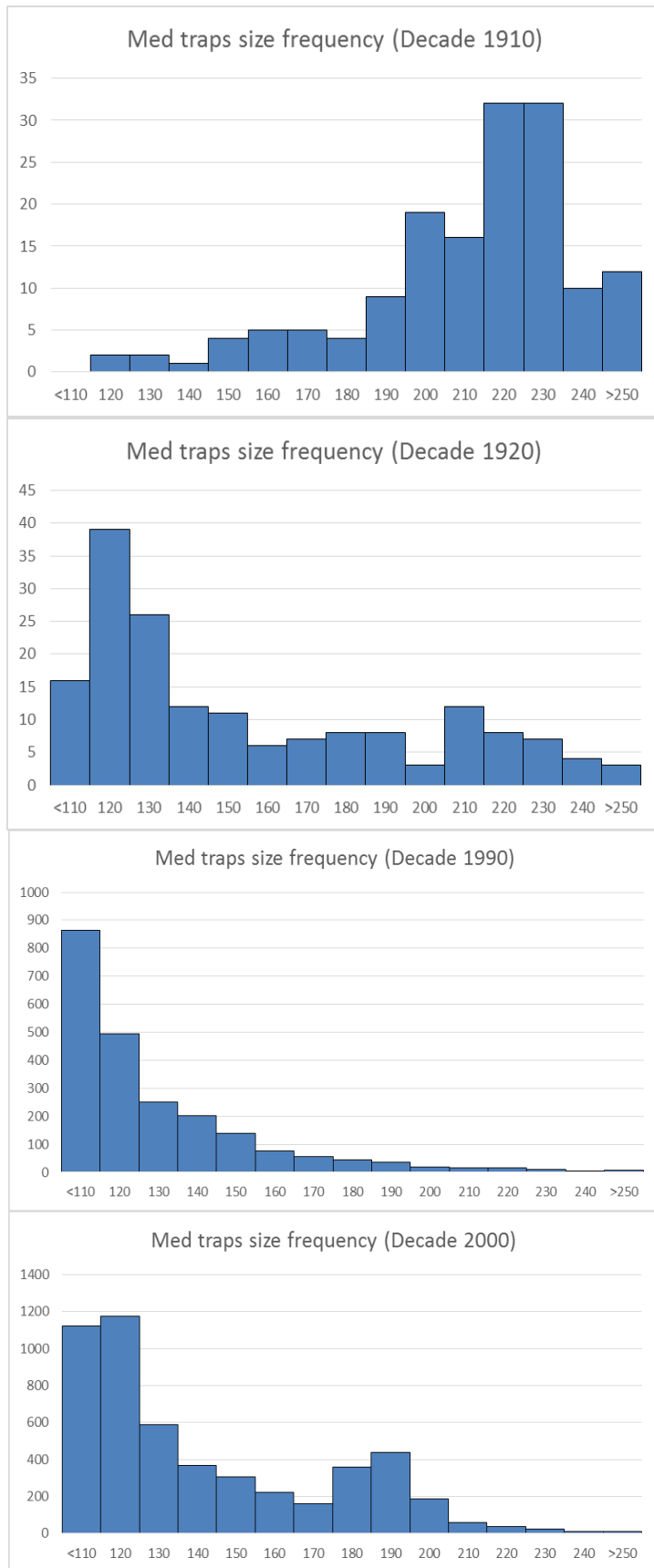


Figure 17. Cumulative Bluefin tuna catch data by size class (10 cm) for the Mediterranean traps by decade (only decades having a representative number of samples have been plotted).