REPORT ON THE REVIEW OF RE-ESTIMATION METHODOLOGY OF INDONESIA'S ANNUAL SHARK CATCH DATA IN IOTC FOR 1950-2023

Muhammad Anas, Riana Handayani

Directorate of Fish Resources Management, DGCF-MMAF, Indonesia

Corresponding author: mykalambe@yahoo.com

Indonesia

Prepared for the Indian Ocean Tuna Commission (IOTC) 22nd Session of Working Party on Data Collection and Statistics (WPDCS22)

November 2026

Contents

Executive Summary……..... 5
1. Purpose of this paper…… 6
2. Background…… 6
3. The process of Re-estimation…….. 8

3.1. Source of catch composition…… 8
3.1.1. Scientific Observer…… 9
3.1.2. Port Landing (PIPP)…….. 9
3.2. Data Processing and Analysis…… 10
3.2.1. Scientific Observer…… 10
3.2.2. Port Landing (PIPP)……... 11
3.3. Re-estimation methodology…… 11
3.3.1. Definition of the fisheries…… 11
3.3.2. Re-estimation methodology…… 12
3.3.3. The final results of re-estimation…… 13

4. Conclusion…….. 26
5. Recommendation……... 26

Tables

1. Summary activities of Indonesian ROS from 2014-2023 (gear: longline)…….. 9

Figures

1. Progressing on the number of fishing ports reporting data in the PIPP……... 10
2. The Flow Chart of Scientific Observer Data Processing and Analysis …… 10
3. PIPP Process Business …….. 11
4. The Flow Chart of The Re-estimation Methodology……... 12

Executive Summary

Catch data is essential in building a robust fisheries management strategy. However, in some Regional Fisheries Management Organization (RFMO) e.g., Indian Ocean Tuna Commission (IOTC), such data needs to be tailored due to several reasons, for example, inter-annual variation in reported catches by species, gear and fleets. As part of the catch data, shark species need also to be properly reported and traced.

Indonesia, as one of the IOTC members, has a commitment to actively participate in all conservation and management measures for fish resources in the Indian Ocean established by the IOTC. Therefore, It deliver its commitment by providing the reliable annual catch data including shark to the IOTC. The 27th Scientific Committee recommended that the Commission note the management advice developed for a subset of shark species commonly caught in IOTC fisheries for tuna and tuna-like species. Indonesia follows up the recommendation by conducting the review on its annual shark catches data for period 1950-2023.

Three-sessions assistance meeting (virtual and physical) with the IOTC staffs were held during 2025. This report provided an in-depth study on how to conduct recalculation on the Indonesian shark datasets with emphasizing on using a reliable data source and minimizing the uncertainties. In the wake that this approach will be approved as the foundation for estimating Indonesian shark catches for the 1950–2023 periods. In 2026, there was an update data and information of pelagic sharks catch in Indonesia, therefore, the recalculation on the update data for the 1950-2023 periods has been conducted.

1. Purpose of this paper

To provide an updated recalculation of Indonesia's shark catch data for the period 1950 – 2023 and to present the re-estimation results.

2. Background

Relevant information related to the background of the development of re-estimation methodology of Indonesia's annual shark catch data for period 1950-2023 quoted from the reports below:

The report of the 20th Session of the IOTC Working Party on Ecosystems and Bycatch (WPEB20)

The WPEB recommended that the Scientific Committee consider management advice provided in the draft resource stock status summary for each of the eight shark species, as well of those for marine turtles and seabirds.

The report of the 27th Session of the IOTC Scientific Committee (SC27)

The SC recommended that the Commission note the management advice developed for a subset of shark species commonly caught in IOTC fisheries for tuna and tuna-like species.

The report of Technical Workshop on Indonesian Catch Data Estimation (22-23 May 2025, Jakarta)

- A potential methodology for shark catches:
    1. Identify the target group (TROP: tropical tunas; NERI: neritic tunas; TEMP = temperate tunas) for each gear and compute the ratio of the sum of catches of IOTC pelagic sharks over the sum of catches of the target group species
    2. Compute an average species composition for the shark species where information is available: (i) from observer data for longline fisheries in coastal areas (NJA; LLCO) and high-sea areas (ABNJ; LLF and LLD) and purse seine fisheries, (ii) from PIPP landings, and (iii) from FRCI longline data if available
    3. For all remaining gears without good information on shark species composition, review literature and data from the IOTC legacy methodology
- Sharks – Finalise methodology and apply to 1950-2023 by 31st October 2025.

The report of Consultation Meeting (24th July 2025, virtual)

By 31st October, to provide re-estimation methodology and apply to 1950-2023, including the information of shark breakdown, step-by-step process document, observer coverage, proportion of aggregated sharks.

The report of 2nd Consultation Meeting (26th September 2025, virtual)

The meeting was reviewing the re-estimation methodology of shark catch data for period 1950-2023 and the result. The IOTC Secretariat gave some feedbacks on the re-estimation which should be followed up by Indonesia and submit the responses by 31st October 2025.

The report of the 21st Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Data Collection and Statistics (WPDCS21)

- The WPDCS NOTED paper IOTC-2025-WPDCS21-23 on A new framework for reconstructing and projecting Indonesia's shark catches: Correcting the past to inform sustainable management.
- The WPDCS NOTED that that the overall approach was to provide a comprehensive review of Indonesia's annual shark catch data by integrating multiple data sources and applying recalculation techniques to minimize uncertainty, with an emphasis on traceability, reliability, and consistency.
- The WPDCS NOTED that the approach involves applying the species composition of pelagic sharks to the reported total pelagic shark catches to derive catch estimates at the species level. This estimation is conducted for different gear types and groups.
- The WPDCS NOTED that regarding catch composition, information is sourced from observer data for main longline gears and from port sampling for purse seine and other semi-industrial and artisanal gears. Since species composition data are only available for recent years (observer data since 2005 and port sampling since 2015), a moving average approach was used to extrapolate species composition to earlier years.
- The WPDCS NOTED that in terms of total shark catch, this was assumed to be known and was based on reported catches. However, reported catch data are only available for 2010–2024. For years prior to 2010, catch estimates were derived using a negative binomial distribution to account for over-dispersion. It was noted that there is very limited information on shark catches before 2010, s sharks were often discarded or not reported, making the situation extremely challenging.
- The WPDCS NOTED that the methodology and results used to re-estimate Indonesia's historical catches for the period 1950–2022 for the 16 IOTC species was endorsed by the SC at its 27th session, RECALLING that this methodology has not been developed nor applied to bycatch species so far.
- The WPDCS NOTED that although the methodology seems to be consistent with the previous catch reviews, the provision of catch compositions and species trends is not clearly detailed. Therefore, the WPDCS REQUESTED more information, especially more detailed results on key shark species, to be presented to the WPEB so that the reliability of the estimates can be better assessed before adoption, and to the Secretariat to work closely with Indonesia to review the shark composition and species trends outcomes obtained.

The report of the 22nd Session of the IOTC Working Party on Ecosystems and Bycatch

- The WPEB NOTED that the data presented reflects the data as reported by CPCs and may include FAO data to supplement the data series where data have not been

provided. The WPEB NOTED that the Secretariat will often revise catches after working with CPCs to review their national data collection and reporting systems.

- The WPEB NOTED small improvements resulting from revisions to historical hammerhead data and ENCOURAGED CPCs to work with the Secretariat to provide additional historical data to further improve the time series.
- The WPEB therefore RECOMMENDED that the SC review the list of species that are mandatory for reporting to species level while considering the feasibility of such data collection in artisanal fisheries, and included the following suggested changes:
    i. Silky sharks to be added also for gillnet fisheries
    ii. Hammerhead sharks to be reported at species level at least for scalloped, smooth and great hammerhead sharks for all gear types (explicitly including purse seine fisheries)
    iii. Mantas and devil rays to be reported at species level differentiating at least between manta rays (giant manta and reef manta) and other devil rays adding them for mandatory reporting at least for purse seine fisheries and for gillnet fisheries instead of optional
    iv. Great white sharks as mandatory for all gear types
    v. Oceanic whitetip sharks as mandatory for all gear types
- The WPEB NOTED that changes in the reported catches of silky shark and oceanic whitetip shark in recent years were influenced by changes in sampling methodologies adopted by some CPCs, as well as data revisions by Indonesia. The WPEB NOTED an increase in species-level reporting for scalloped hammerhead shark, which has contributed to changes in the reported catch series for this species. The WPEB NOTED that coastal longline and gillnet fisheries are primarily responsible for the reported retained catches of these three species while purse seine and trawl fisheries also take these species.
- The WPEB RECOMMENDED that the Scientific Committee consider the management advice provided in the draft resource stock status summary for each of the eight shark species (Blue shark, Oceanic whitetip shark, Scalloped hammerhead shark, Shortfin mako shark, Silky shark, Bigeye thresher shark, Pelagic thresher shark, Porbeagle shark), as well of those for marine turtles, seabirds, cetaceans and mobulids.

3. The Process of Re-estimation

3.1. Source of catch composition

Having had investigated all the data sources (fishing logbook, port landing, observer data), as of the objective of the update re-estimation methodology is to get more accountable data and information of the catch, we use scientific observer and port landing data that provides more appropriate information of catch composition among the data sources. The catch composition of scientific fisheries data is used to re-estimate the catch composition for LL (Drifting longline; over 1800 hooks), LLFR (Drifting longline; up to 1800 hooks), LLCO (Small longline), while the catch composition of port landing is used to re-estimate the catch composition for PS (Tuna purse seine), PSSS (Small purse seines), GI (Gillnet), HL (Handline), HLOF (Offshore handline), DS (Danish seine), LN (Lift net), PL (Pole and line) and TL (Trolling).

3.1.1. Scientific Observer

Indonesia also established a scientific observer program according to IOTC resolution 11/04 related to the Regional Observer Scheme (ROS). Ministerial Regulation No. 33/PERMEN-KP/2021 formally regulates national observers for fishing and carrier vessels, positive progress to secure the government budget for the observer program in the future.

Since 2014 the deployment of observers has been extended to other gears, such as small-scale purse seine, coastal drifting gillnet, and troll line/hand line. However, until this present, longline has better coverage among the gears. Since the scientific observer data provides more detail information in term of fishing activity, especially for longline fisheries, it become one of the data source for the catch composition to be used in the re-estimation. The Summary activities of Indonesian ROS from 2014-2023 for longline is described in table below.

Table 1. Summary activities of Indonesian ROS from 2014-2023 (gear: longline).

Year	No. Of Obs	No. Of Trips	No. Of Company	Total Day at Sea	Days/Trip	Avg (d/trip)
2014	20	28	13	875	29-135	62
2015	4	5	5	241	31-61	48
2016	6	6	6	289	18-86	57
2017	12	15	13	524	15-108	58
2018	10	10	10	322	9-71	33
2019	6	10	5	348	14-104	36
2020	6	6	6	257	22-104	48
2021	16	16	13	796	18-77	44
2022	9	10	9	493	24-97	49
2023	5	7	5	358	17-116	51

3.1.2. Port Landing (PIPP)

For convenience and completeness of presenting data in a certain format and easily accessible to the public as well as the need for policy analysis, it is necessary to digitize the data. For this reason, the Ministry of Marine Affairs and Fisheries encouraged digital-based data collection, one of which is the Fishing Port Information Center (PIPP).

The PIPP is an information system that includes the collection, management, analysis, storage, presentation, and dissemination of fishing port data and information. It was developed in 2019. Data and information on fishing ports are used to support the operations of fishing ports, improve information services to the public, and support the formulation of policies in the fishing port sector.

PIPP covers data and information of fishing port facilities, daily, monthly, and annual operational data of fishing ports, which contain the frequency of vessel's arrival, fish production and prices, fishing gear, logistics, marketing, and labor in the form of daily data that can be accumulated in the form of monthly, quarterly and even yearly.

Based on the Decree of the Minister of Marine Affairs and Fisheries Number 6 of 2018 concerning the National Fishing Port Master Plan, there are 686 fishing ports in Indonesia whose operational data and facilities are expected to be entered in the Fishing Port Information Center (PIPP) digitally that can be easily accessed and processed into the update and valid information for the development of capture fisheries, especially in fishing ports.

The number of fishing ports which actively reporting data in the PIPP at national scale was increasing, from 109 fishing ports in 2019 to 144 fishing ports in 2023 (Figure 1).

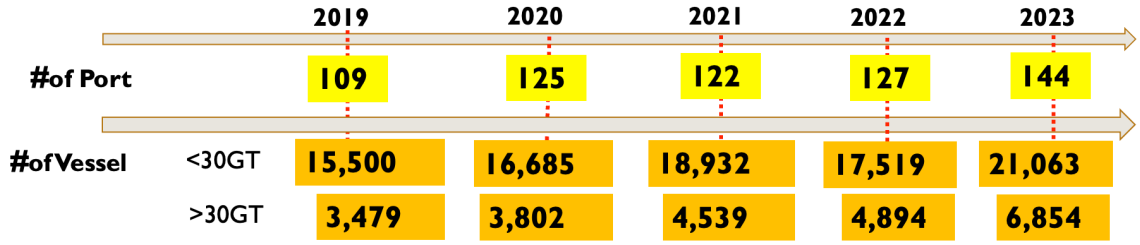


Figure 1. Progressing on the number of fishing ports reporting data in the PIPP

3.2. Data Processing and Analysis

3.2.1. Scientific Observer

No.	Description of Activities	Executor						Standard Quality			Information
		Director	Deputy Director	Head of Section	Officer	Data Processing and Analysis Team	Observer	Completeness	Time	Output	
1	Each observer submits a report on the results of monitoring on fishing vessels and carrier vessels to the Directorate of Fish Resources Management.						Start	Data on Fishing Vessel and Carrier Vessel Forms	5 days	Data documents (Fishing Vessel and Carrier Vessel Form)	
2	Receive documents from Observer to then verify, validate and analyze data on Fishing Vessel and Carrier Vessel Forms and prepare Observer Data Recapitulation to be submitted to Head of Section							Data Documents (Fishing Vessel and Carrier Vessel Form)	3 months	Data documents (Fishing Vessel and Carrier Vessel Form) that have been verified and validated	
3	Receive recapitulation data, check and compile a short report to be submitted to the Deputy Director							Data Recapitulation Document for Fishing Vessel and Carrier Vessel Forms	1 day	Draft Report and Recapitulation Data	
4	Receive recapitulation data, short reports then check and submit to the Director							Data Recapitulation Document for Fishing Vessel and Carrier Vessel Forms	1 day	Draft Report and Recapitulation Data	
5	Receive, check and sign documents and recapitulate data resulting from monitoring on fishing vessels to then be submitted to the Data Processing and Analysis Team.							Data documents (Fishing Vessel and Carrier Vessel Form) that have been verified and validated	3 days	Reports and data documents on Fishing Vessel and Fish Transporting Vessel Forms that have been signed	
6	Receive summary data from the results of monitoring on fishing vessels and carrier vessels to be processed and analyzed.					Selesai		Observer Data Processing and Analysis Results Report	3 days	Report on monitoring results on fishing vessels and carrier vessels	

Page 1

Figure 2. The Flow Chart of Scientific Observer Data Processing and Analysis

3.2.2. Port Landing/PIPP

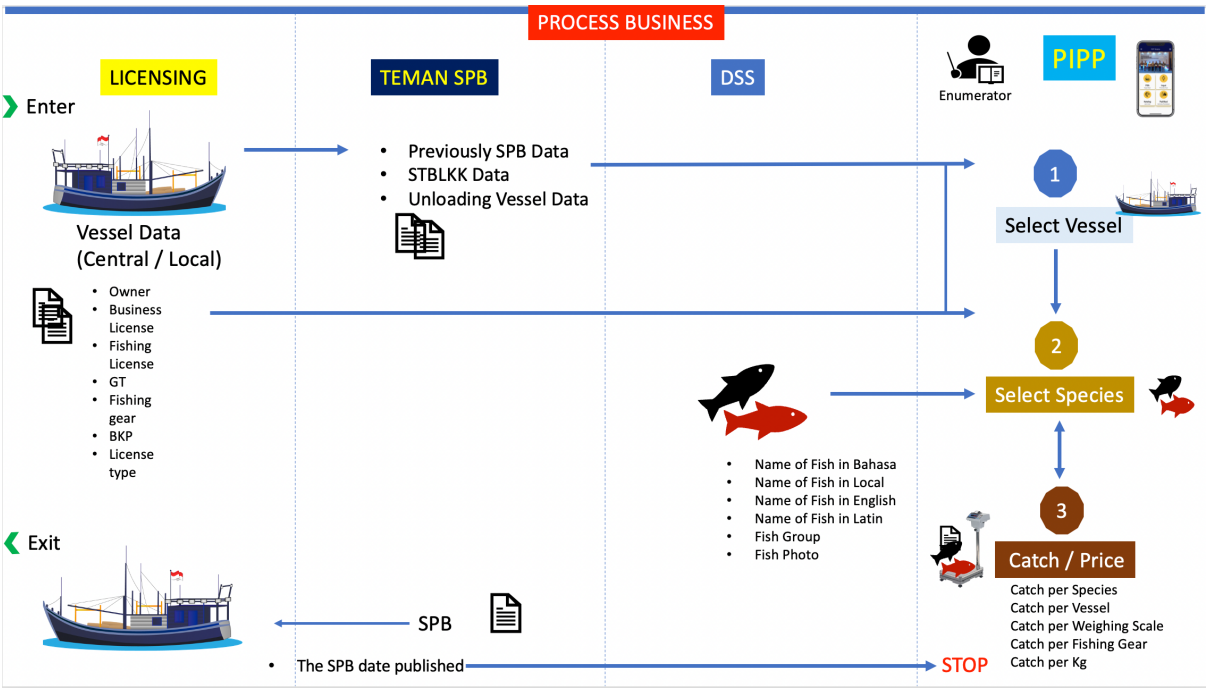


Figure 3. PIPP Process Business

3.3. Re-estimation Methodology

3.3.1. Definition of the fisheries

Based on the recommendation of The IOTC Technical Support Mission in March 2023 that the updated threshold of 115 GT be used from now on to identify purse seine vessels with length overall (LoA) of 24 m and above within all IDN data sets (logbooks, port landing, vessel registries, etc.). That the 85 GT threshold for longline vessels is also used, in lack of any other current evidence, for all other vessel types besides purse seiners. The updated threshold became the basis for determining the fisheries according to types of fisheries for IOTC species.

3.3.2. Re-estimation Methodology

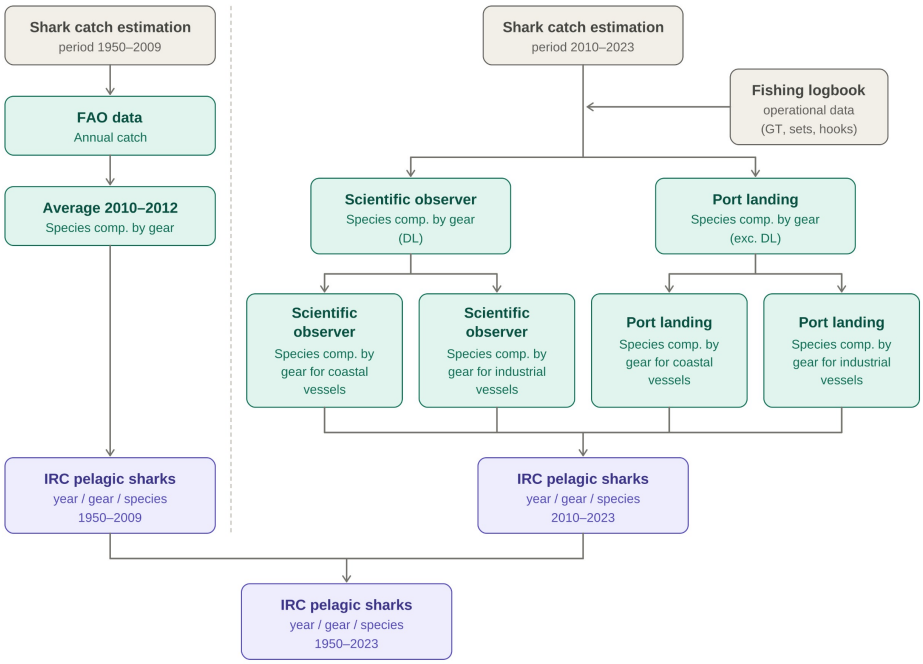


Figure 4. The Flow Chart of The Re-estimation Methodology

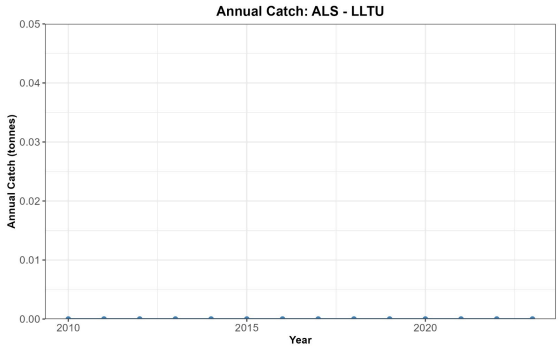
The Indonesia's annual catch recorded in the IOTC datasets, which has been re-estimated for period 1950-2023, is only available for 16 mandatory species, while the shark catch which has been re-estimated previously only for period 2010-2023. Therefore, in order to get proper re-estimation, total catches for the period 1950–2023 are divided into three groups, which are (1) 16 mandatory species, (2) pelagic sharks, (3) non-pelagic sharks and 16 mandatory species.

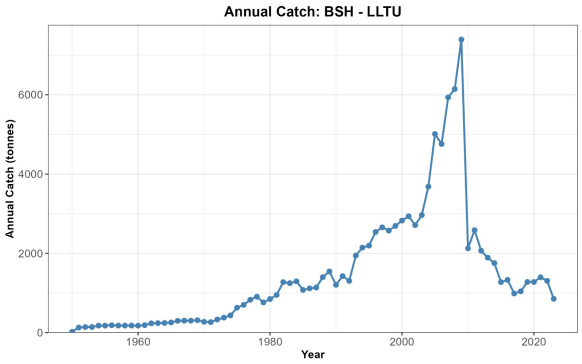
The re-estimation will keep the total annual shark catches (2010-2023) remain the same as recorded in the forms 1RC (available in the IOTC datasets). The re-estimation of catch composition for longline is conducted by multiplying the catch in the 1RC with the catch composition from scientific observer for LLTU, LLCO and multiplying the catch in the 1RC with the catch composition from port landing (PIPP) for DS, LN, PL, TL, HL, HLOF, GI.

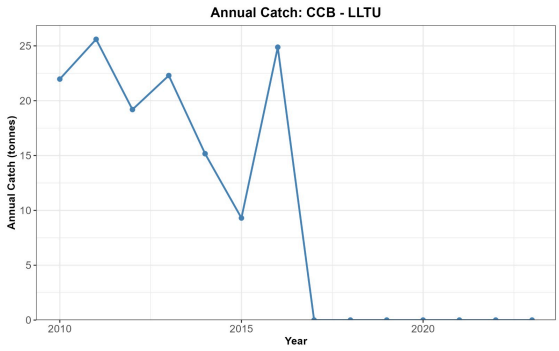
The total annual shark catches for period 1950-2009 refers to the FAO data, while the estimation for the catch composition per fishing gear is using average period 2010-2012.

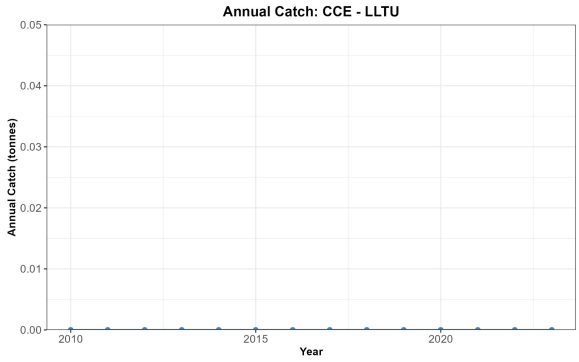
3.3.3. The final results of re-estimation

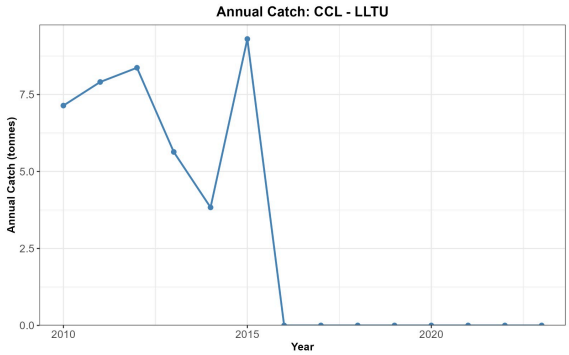
LLTU (Tuna Longline)

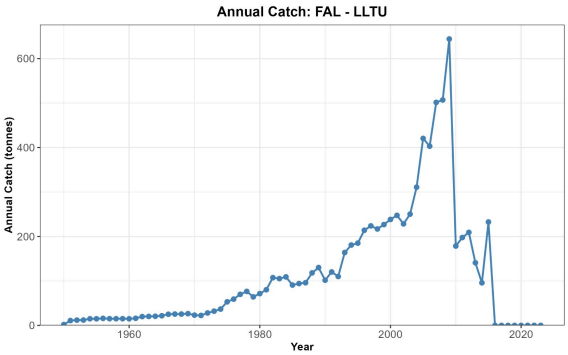


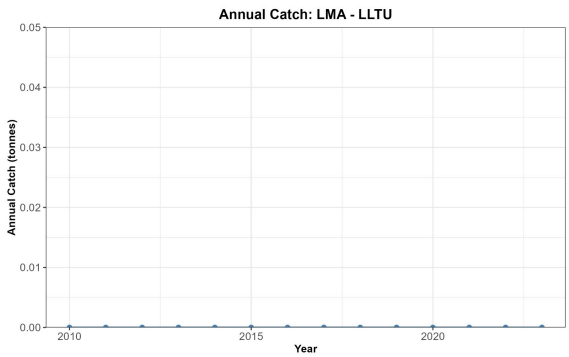


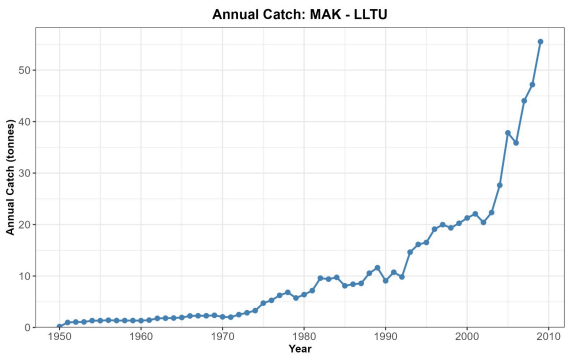


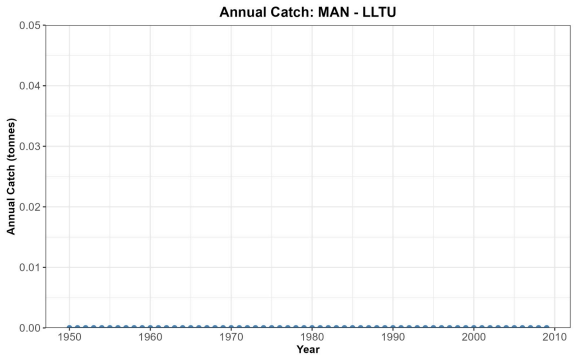




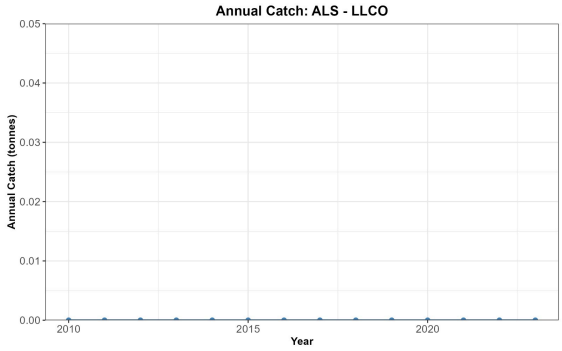


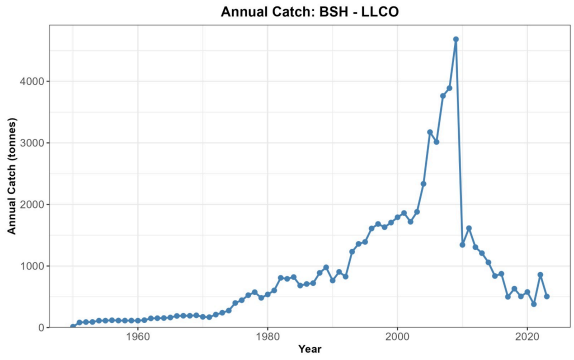


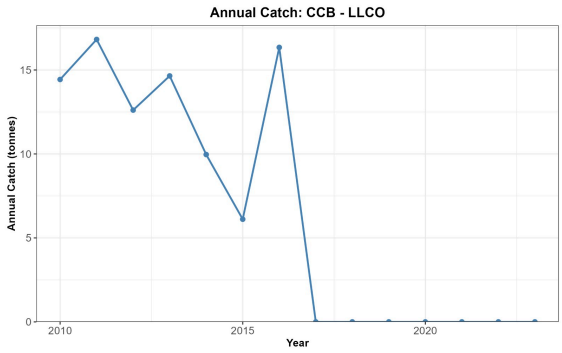


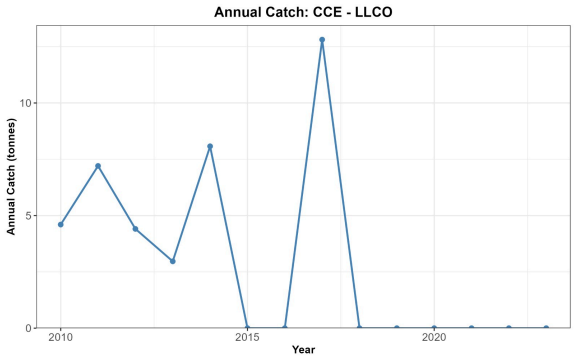


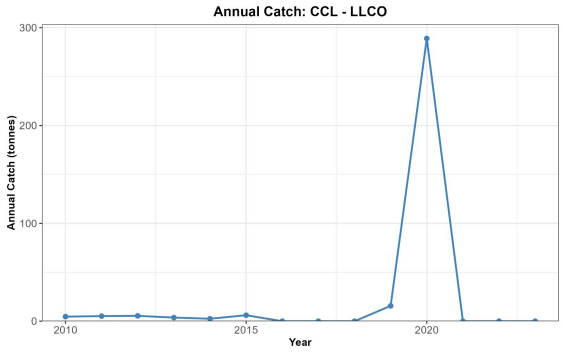
LLCO (Small longline)

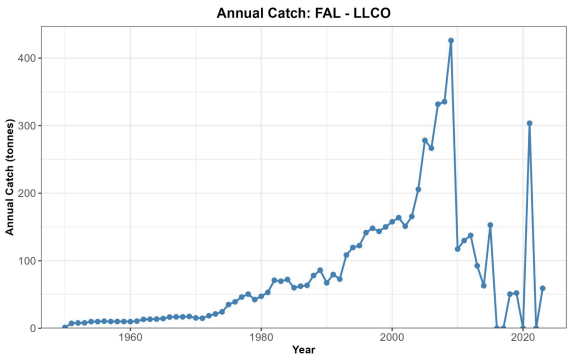


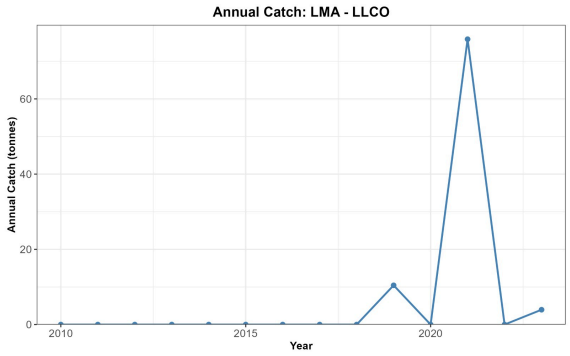


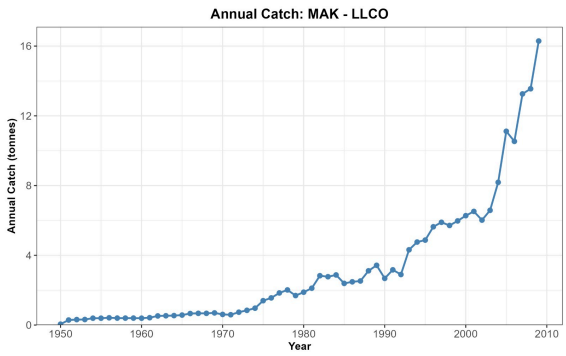


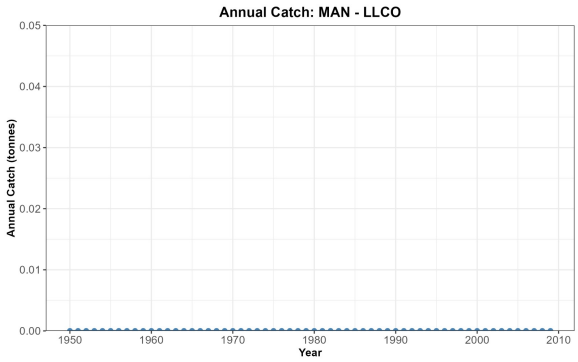




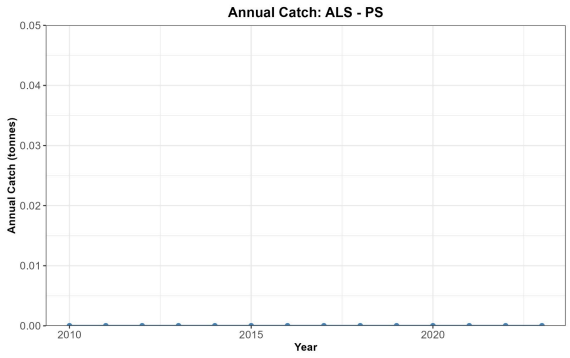


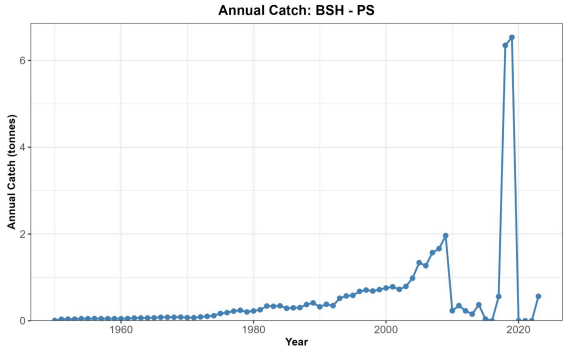


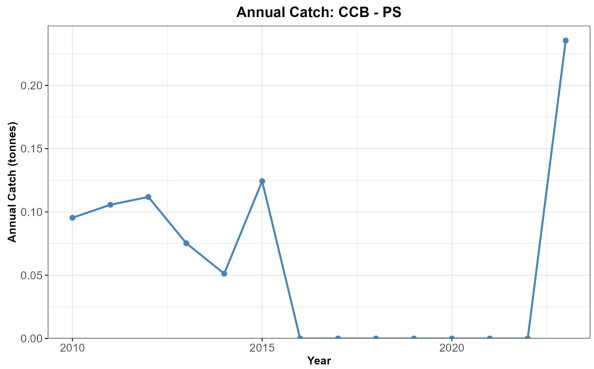


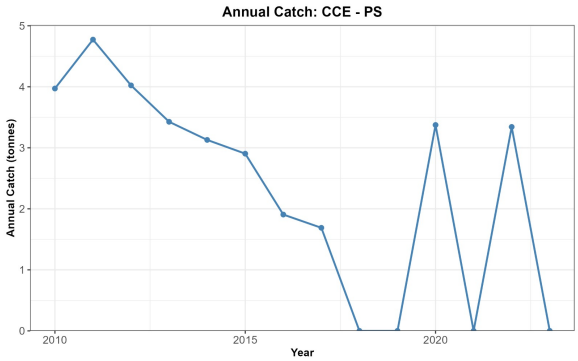


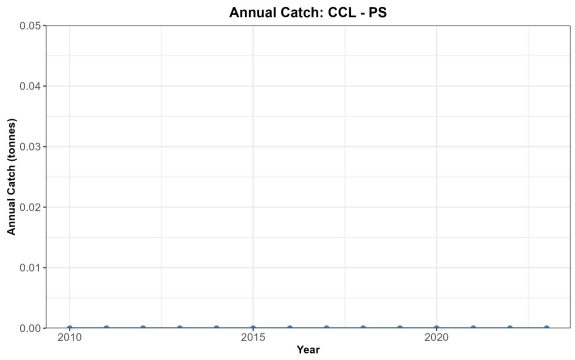
PS (Tuna purse seine)

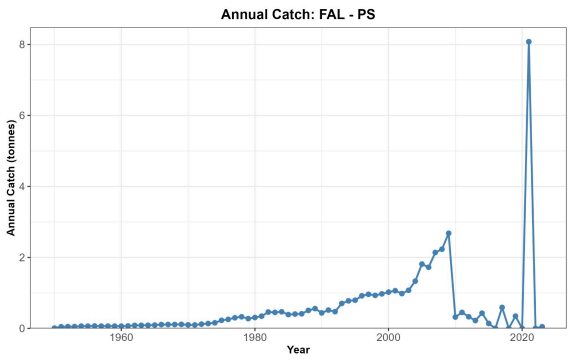


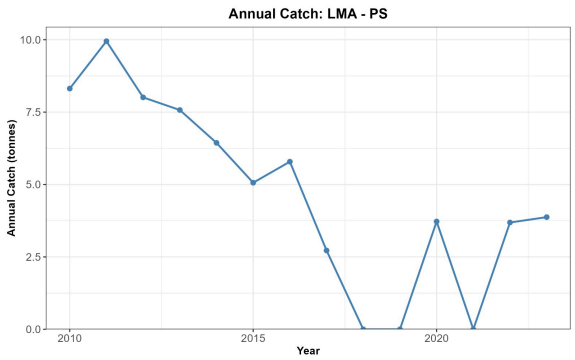


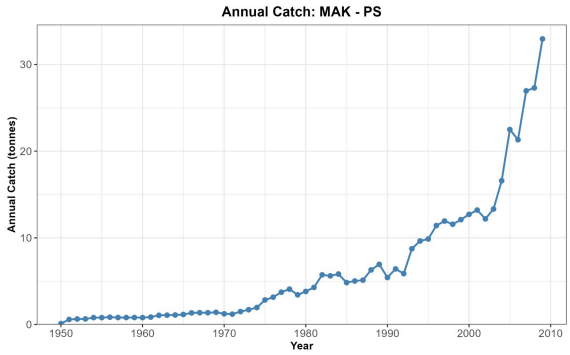


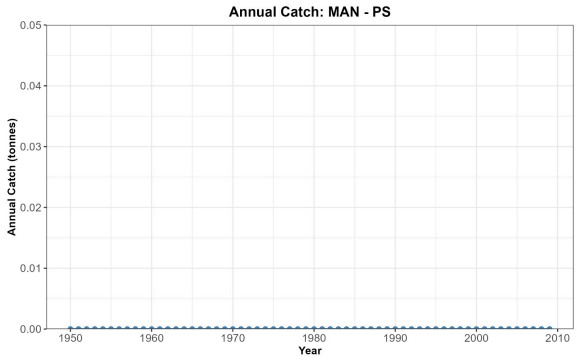




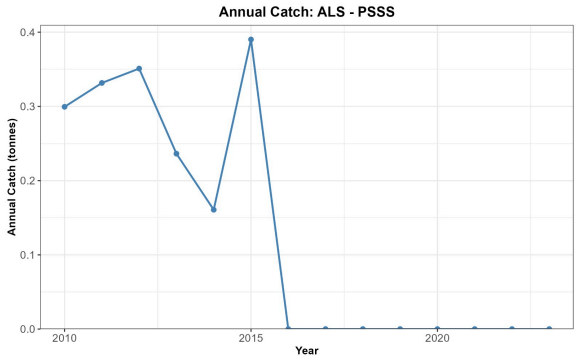


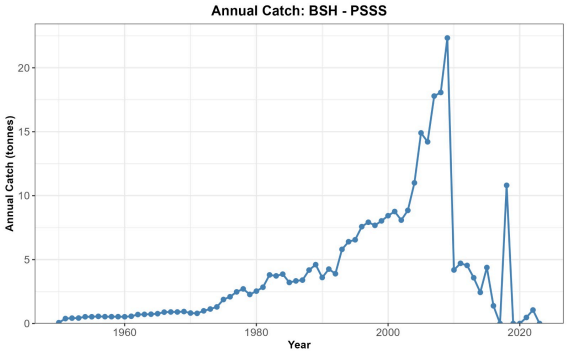


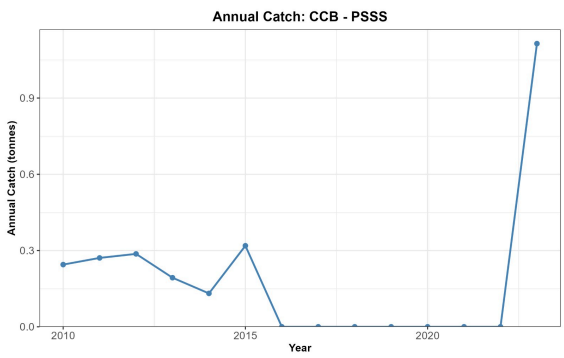


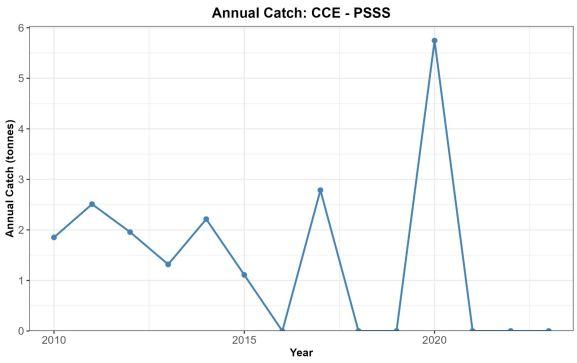


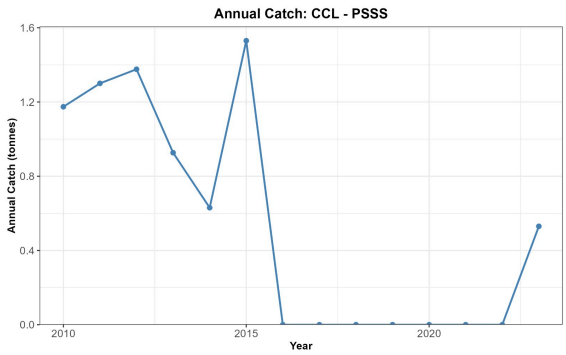
PSSS (Small purse seines)

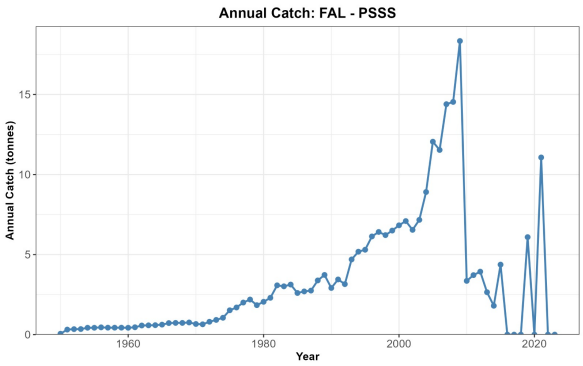


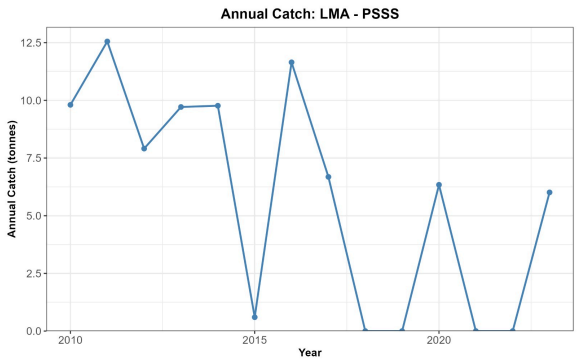


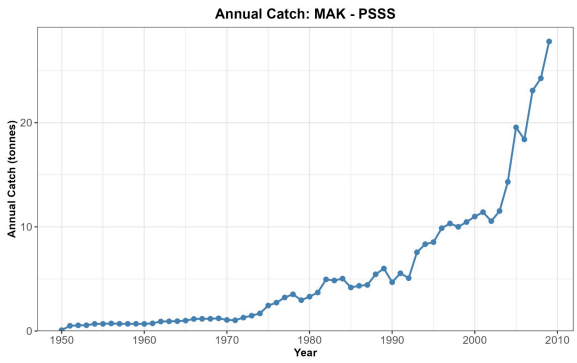

Annual Catch: CCB - PSSS
Annual Catch (tonnes)
0.0
0.3
0.6
0.9
2010
2015
2020
Year


Annual Catch: CCE - PSSS
Annual Catch (tonnes)
0
1
2
3
4
5
6
2010
2015
2020
Year

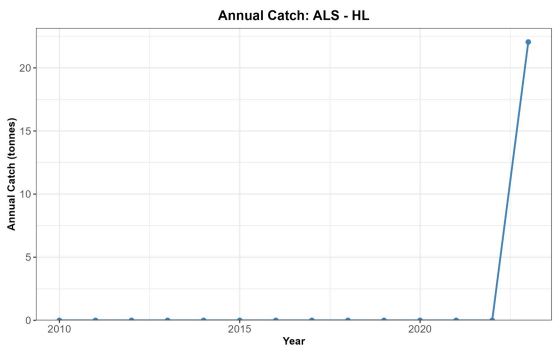

Annual Catch: CCL - PSSS
Annual Catch (tonnes)
0.0
0.4
0.8
1.2
1.6
2010
2015
2020
Year

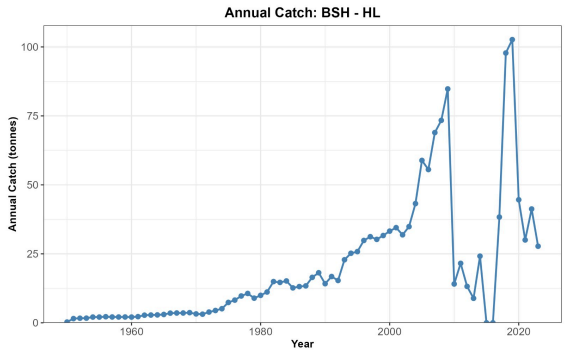

Annual Catch: FAL - PSSS
Annual Catch (tonnes)
0
5
10
15
1960
1980
2000
2020
Year

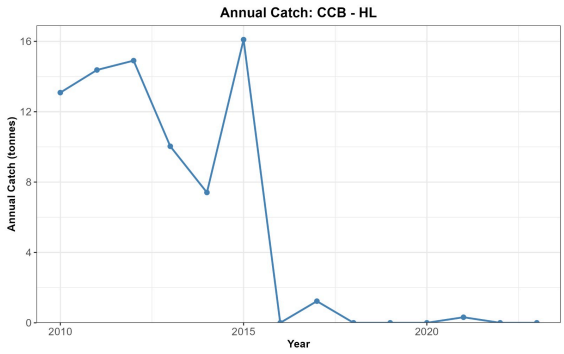

Annual Catch: LMA - PSSS
Annual Catch (tonnes)
0.0
2.5
5.0
7.5
10.0
12.5
2010
2015
2020
Year

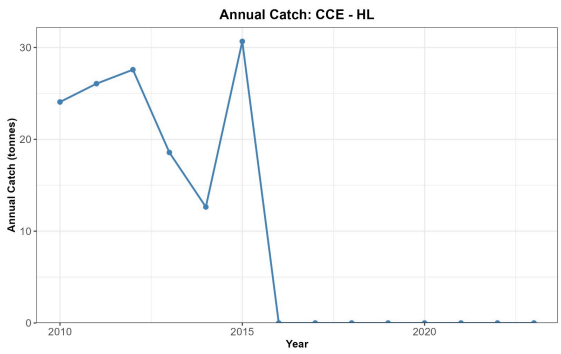

Annual Catch: MAK - PSSS
Annual Catch (tonnes)
0
10
20
1950
1960
1970
1980
1990
2000
2010
Year

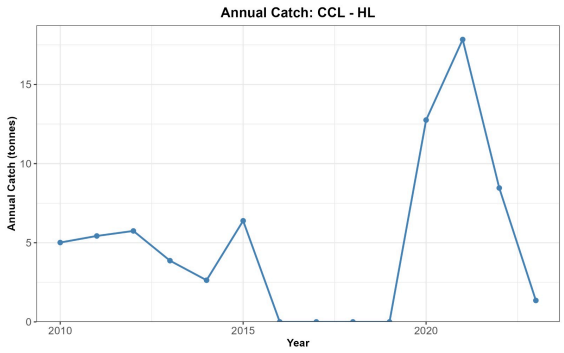
HL (Handline)

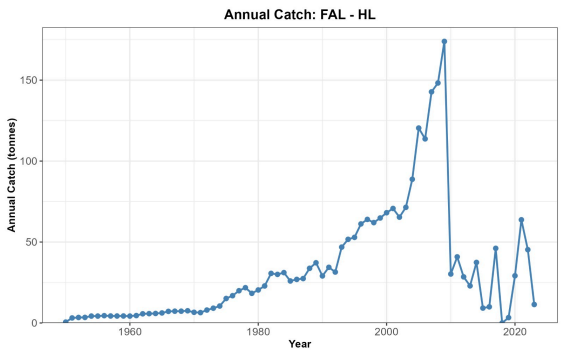

Annual Catch: ALS - HL
Annual Catch (tonnes)
0
5
10
15
20
2010
2015
2020
Year

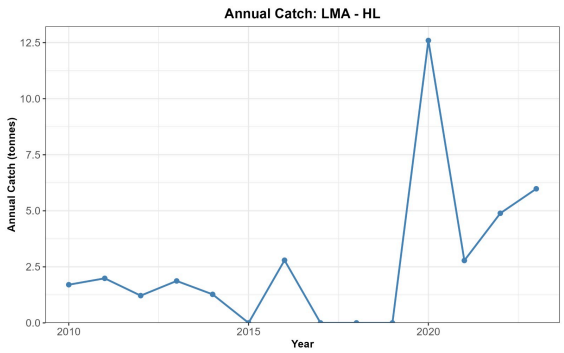

Annual Catch: BSH - HL
Annual Catch (tonnes)
0
25
50
75
100
1960
1980
2000
2020
Year

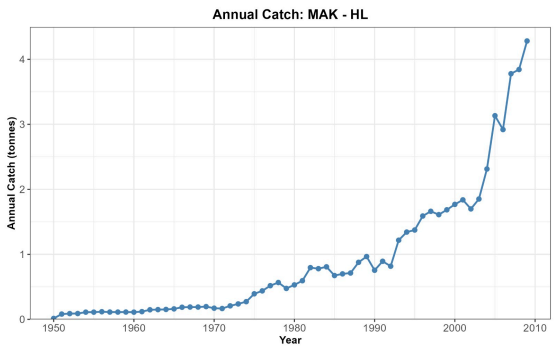

Annual Catch: CCB - HL
Annual Catch (tonnes)
Year

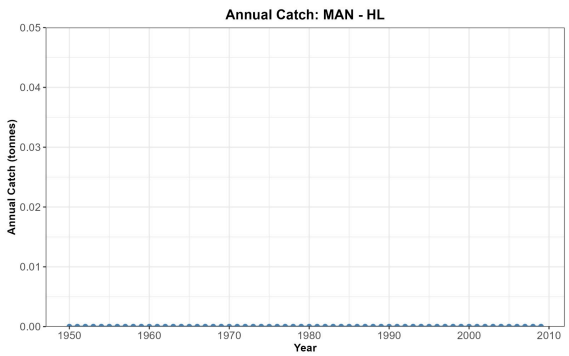

Annual Catch: CCE - HL
Annual Catch (tonnes)
Year


Annual Catch: CCL - HL
Annual Catch (tonnes)
Year

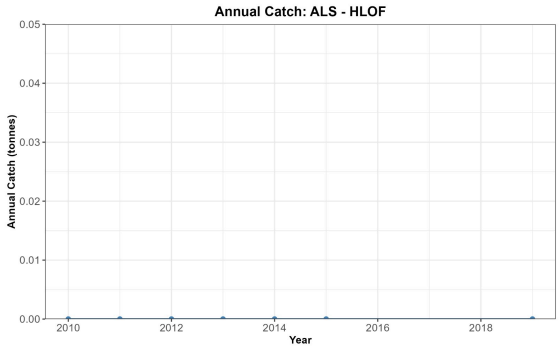

Annual Catch: FAL - HL
Annual Catch (tonnes)
Year

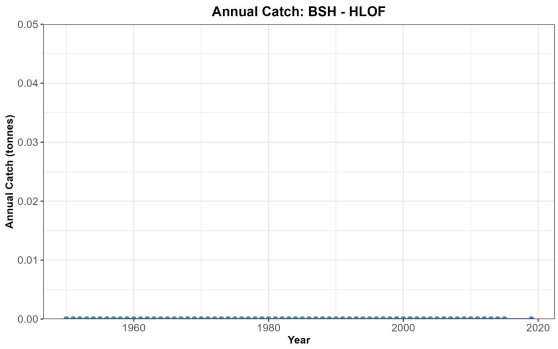

Annual Catch: LMA - HL
Annual Catch (tonnes)
Year

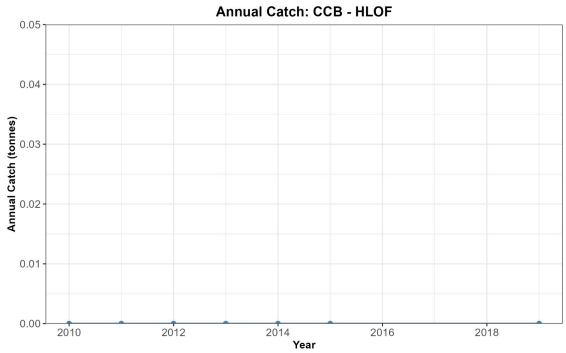

Annual Catch: MAK - HL
Annual Catch (tonnes)
Year

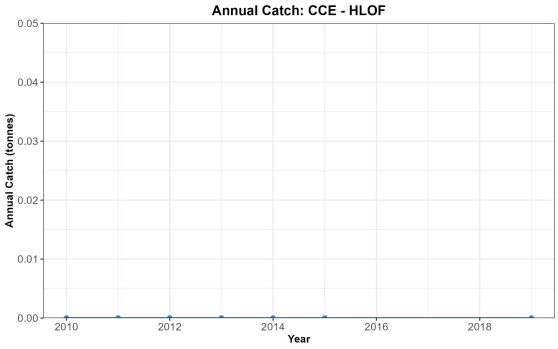

Annual Catch: MAN - HL
Annual Catch (tonnes)
Year

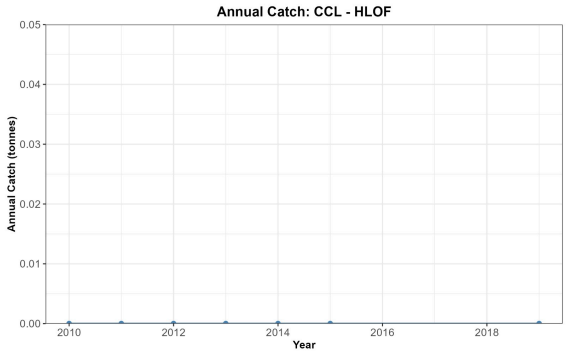
HLOF (Offshore handline)

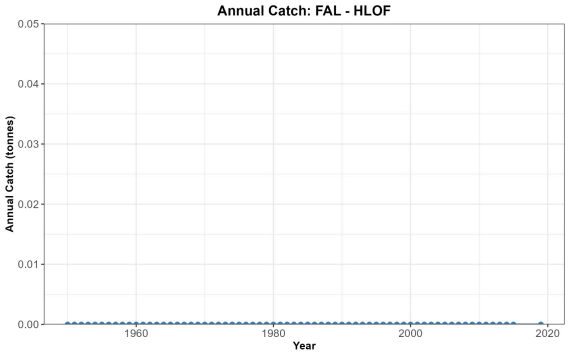


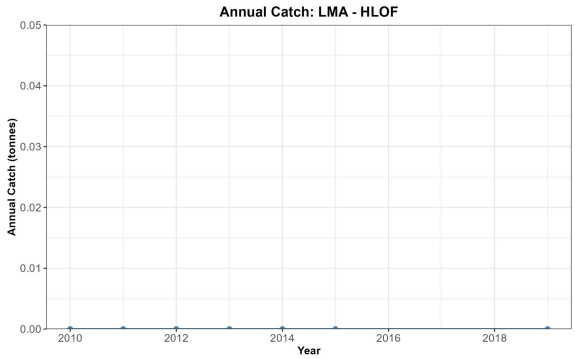


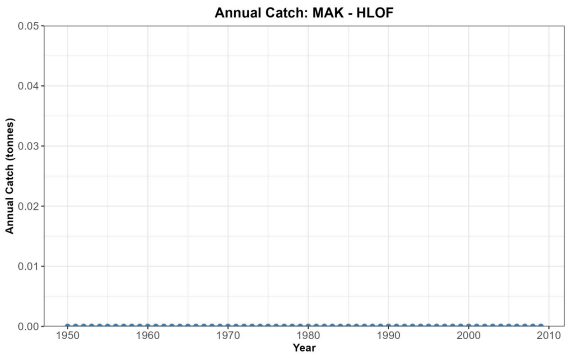


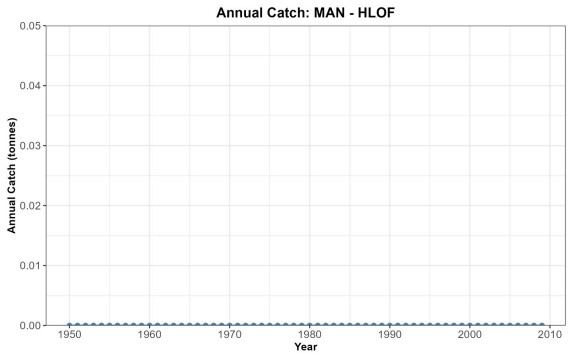




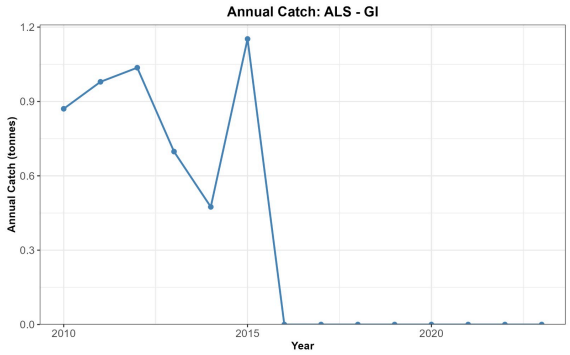


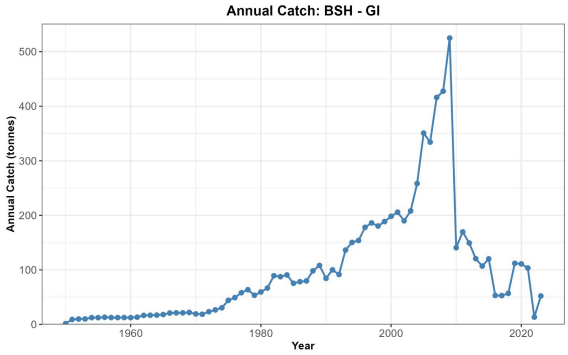


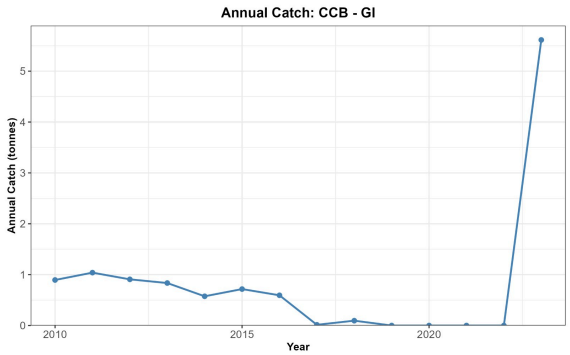


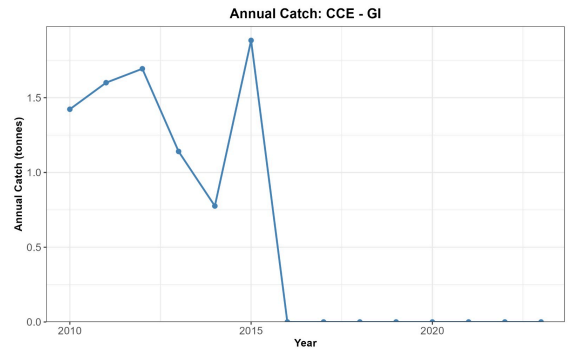

Annual Catch: MAN - HLOF
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
1950
1960
1970
1980
1990
2000
2010
Year

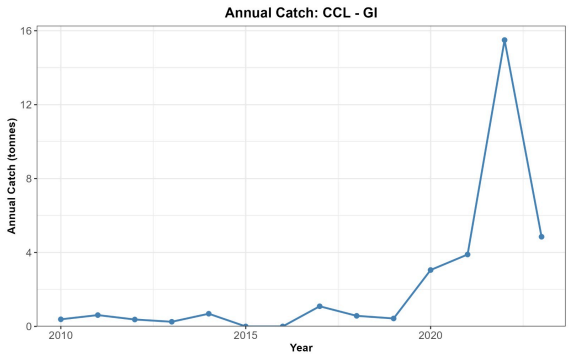
GI (Gillnet)

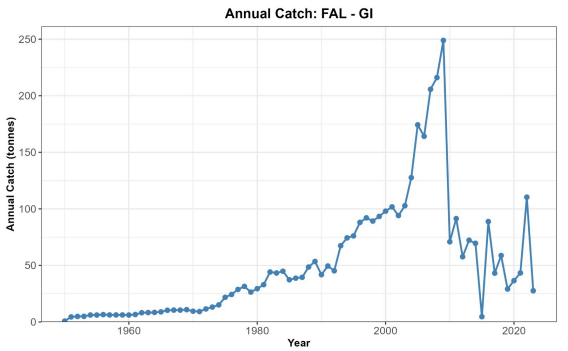

Annual Catch: ALS - GI
Annual Catch (tonnes)
1.2
0.9
0.6
0.3
0.0
2010
2015
2020
Year

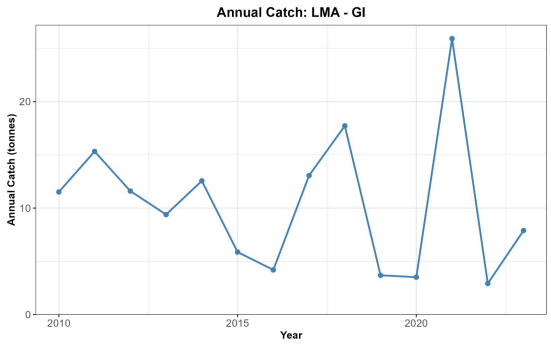

Annual Catch: BSH - GI
Annual Catch (tonnes)
500
400
300
200
100
0
1960
1980
2000
2020
Year

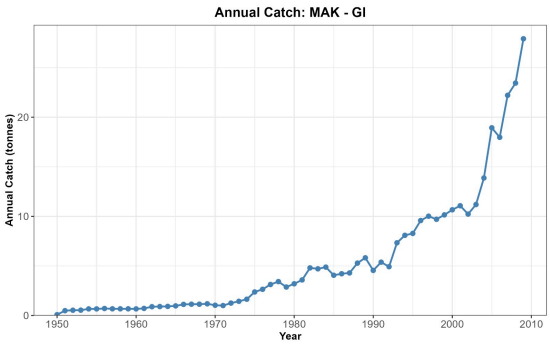

Annual Catch: CCB - GI
Annual Catch (tonnes)
5
4
3
2
1
0
2010
2015
2020
Year

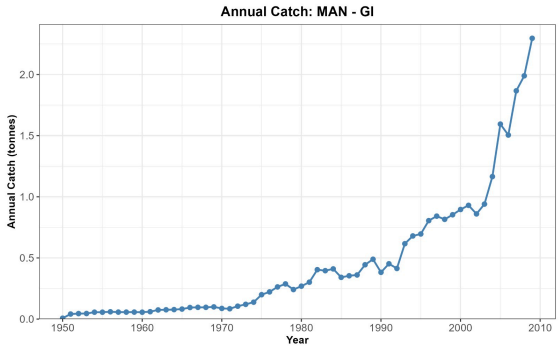

Annual Catch: CCE - GI
Annual Catch (tonnes)
1.5
1.0
0.5
0.0
2010
2015
2020
Year


Annual Catch: CCL - GI
Annual Catch (tonnes)
16
12
8
4
0
2010
2015
2020
Year

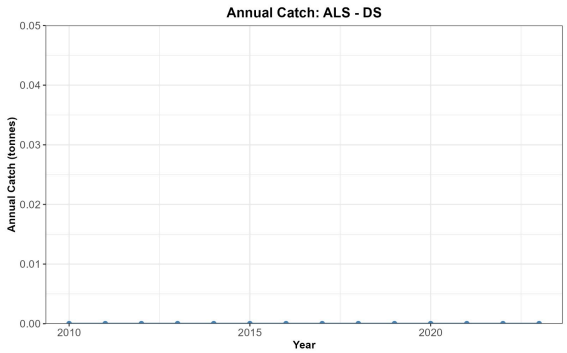

Annual Catch: FAL - GI
Annual Catch (tonnes)
250
200
150
100
50
0
1960
1980
2000
2020
Year

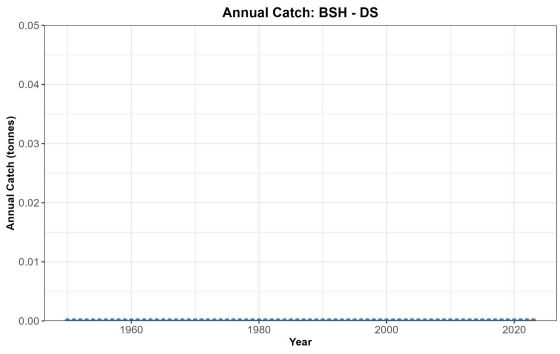


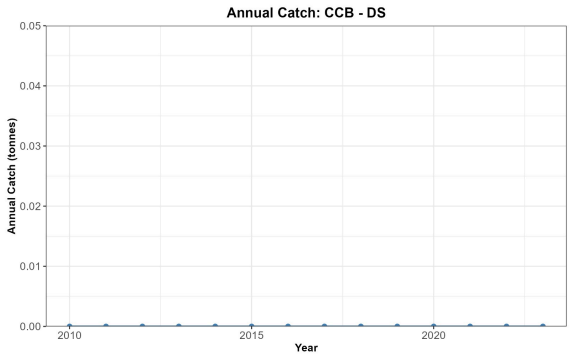


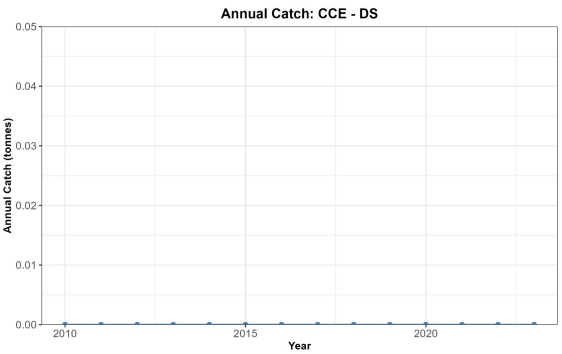


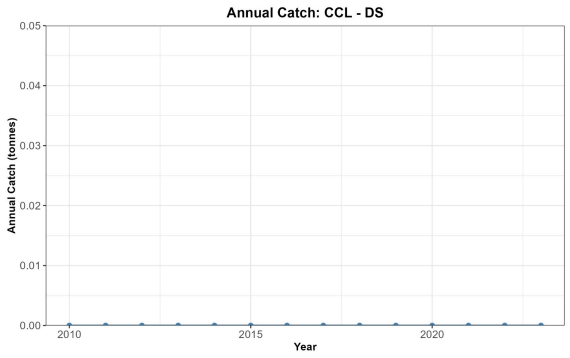
DS (Danish seine)

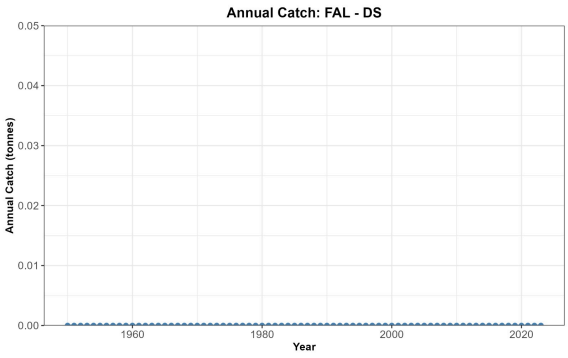


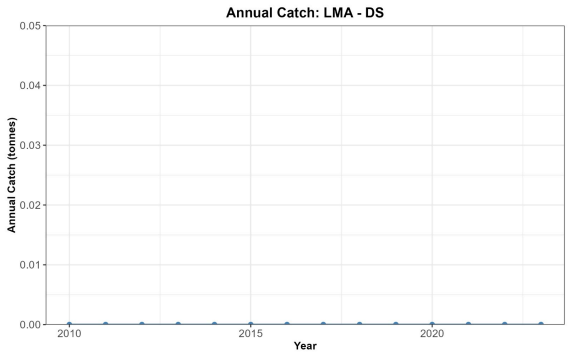


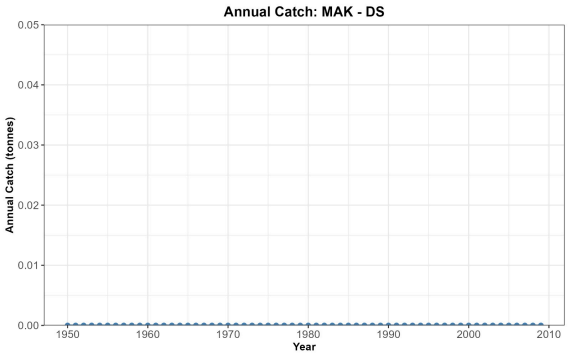


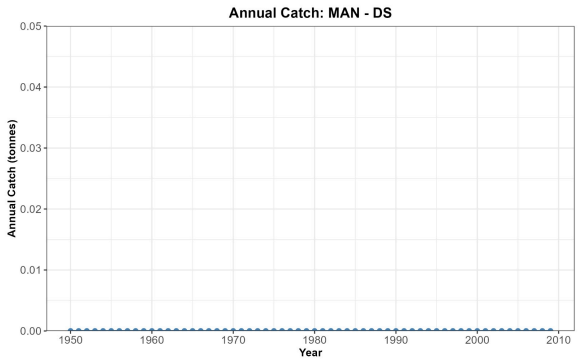




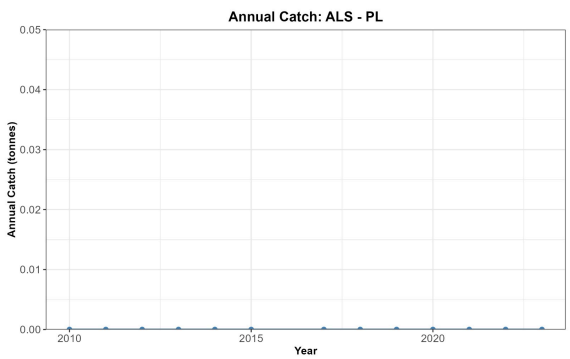


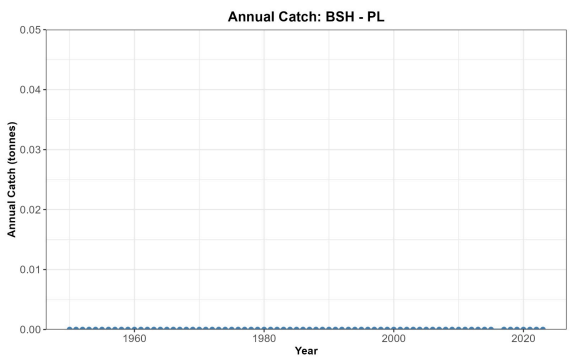


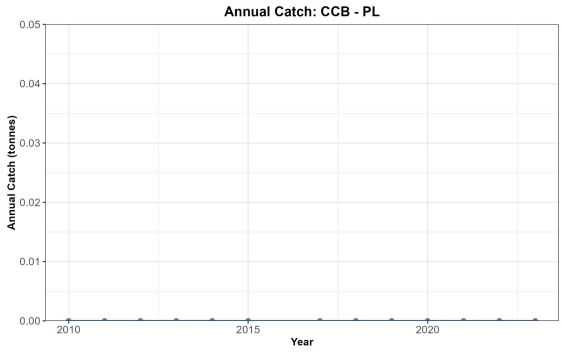


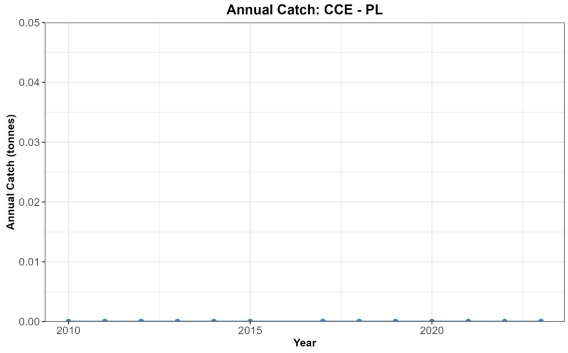


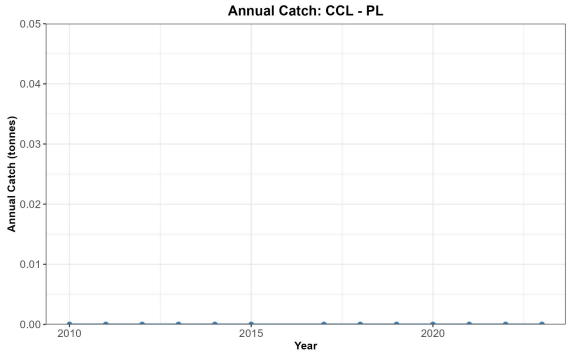
PL (Pole and line)

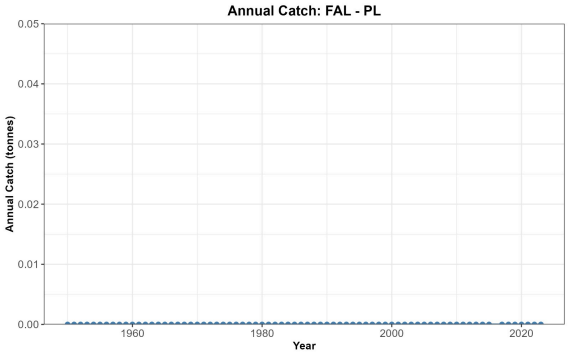


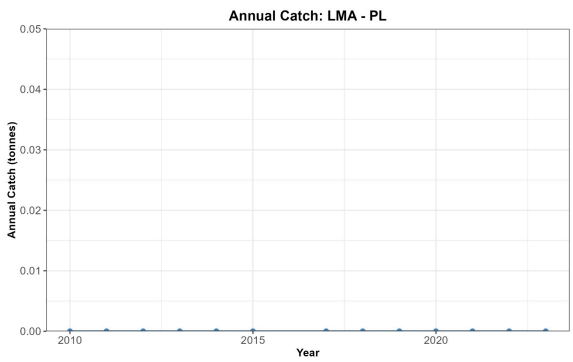


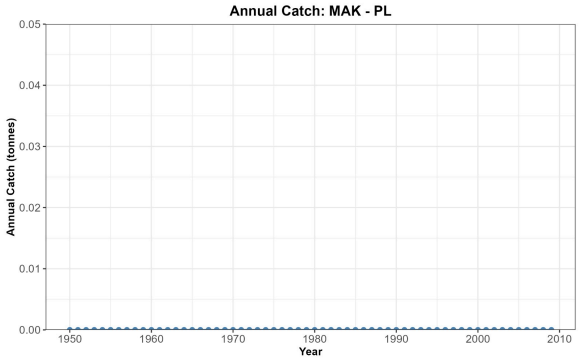

Annual Catch: CCB - PL
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
2010
2015
2020
Year

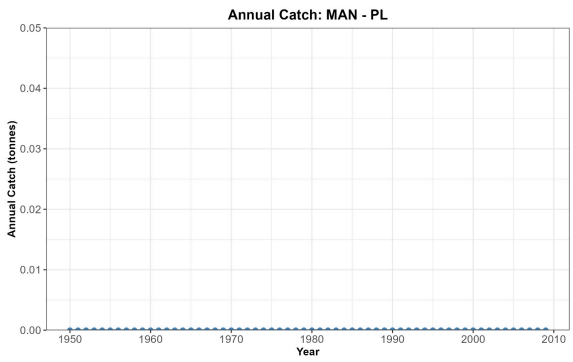

Annual Catch: CCE - PL
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
2010
2015
2020
Year


Annual Catch: CCL - PL
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
2010
2015
2020
Year

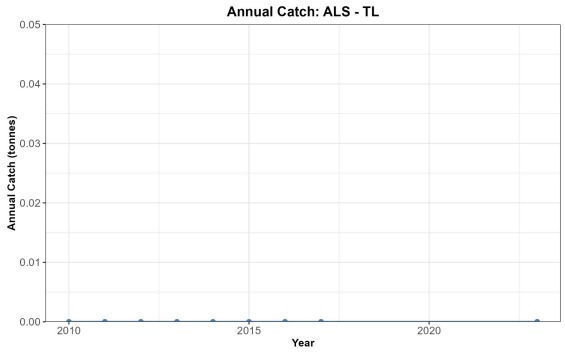

Annual Catch: FAL - PL
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
1960
1980
2000
2020
Year

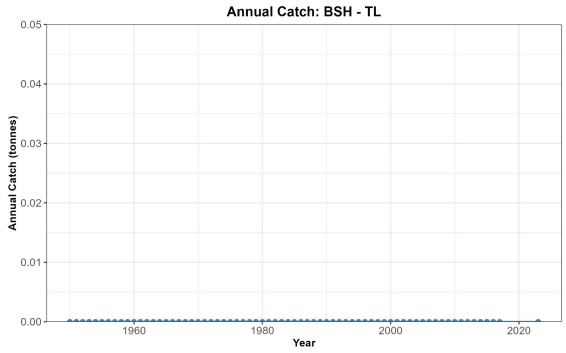

Annual Catch: LMA - PL
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
2010
2015
2020
Year

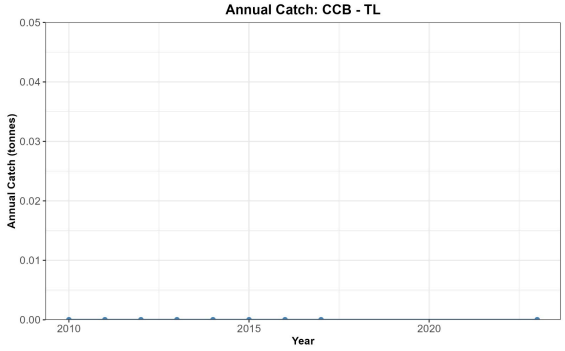

Annual Catch: MAK - PL
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
1950
1960
1970
1980
1990
2000
2010
Year

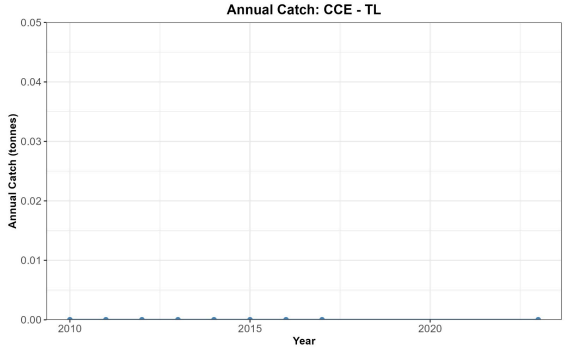

Annual Catch: MAN - PL
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
1950
1960
1970
1980
1990
2000
2010
Year

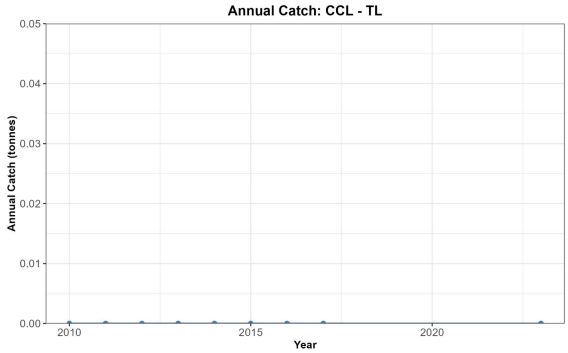
TL (Trolling)

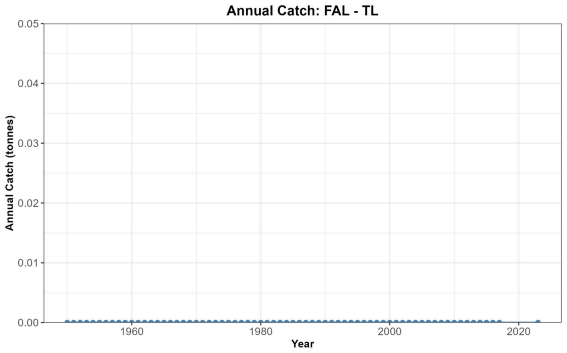

Annual Catch: ALS - TL
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
2010
2015
2020
Year

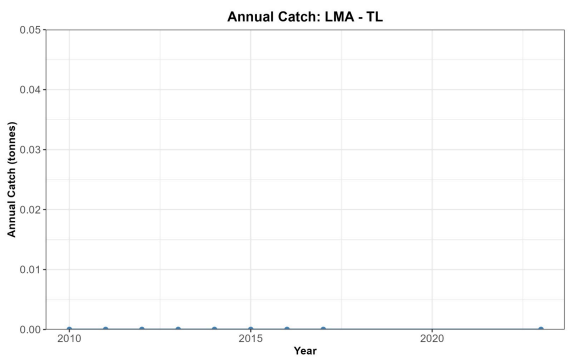

Annual Catch: BSH - TL
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
1960
1980
2000
2020
Year

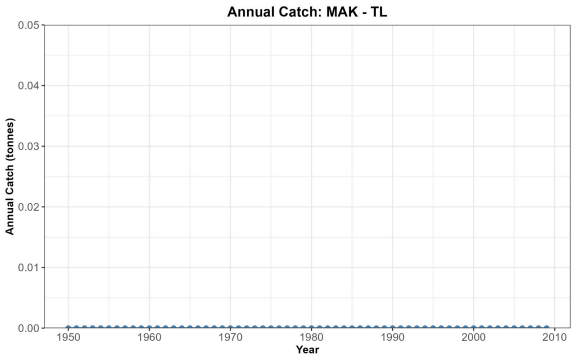

Annual Catch: CCB - TL
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
2010
2015
2020
Year

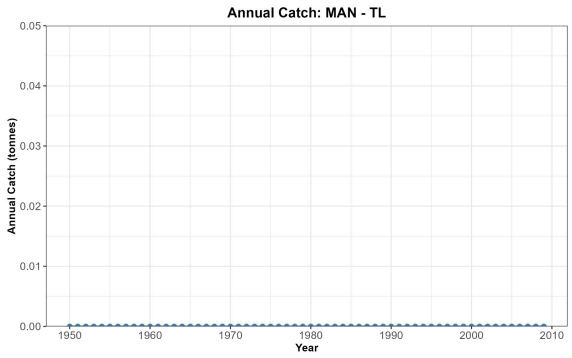

Annual Catch: CCE - TL
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
2010
2015
2020
Year


Annual Catch: CCL - TL
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
2010
2015
2020
Year

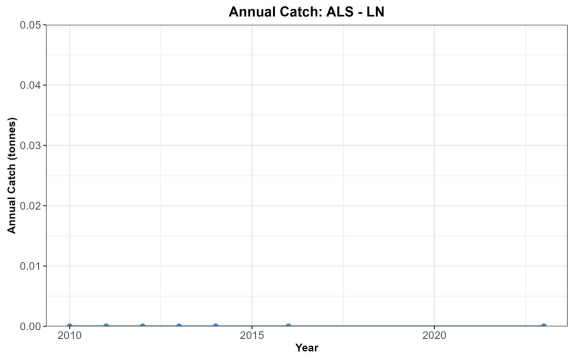

Annual Catch: FAL - TL
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
1960
1980
2000
2020
Year

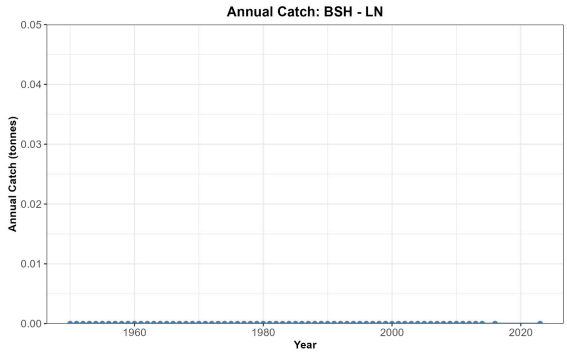

Annual Catch: LMA - TL
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
2010
2015
2020
Year

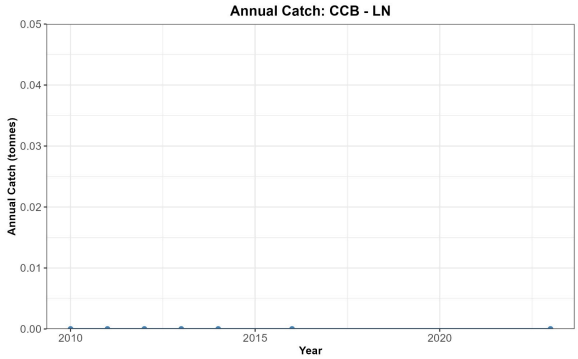

Annual Catch: MAK - TL
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
1950
1960
1970
1980
1990
2000
2010
Year

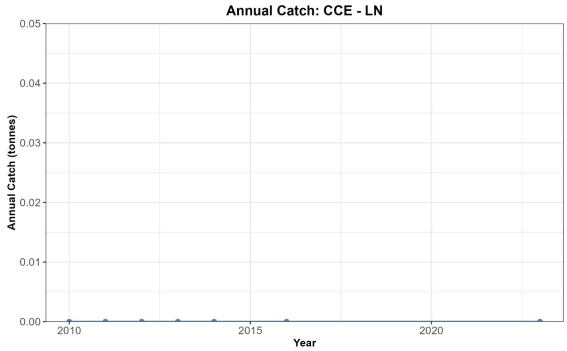

Annual Catch: MAN - TL
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
1950
1960
1970
1980
1990
2000
2010
Year

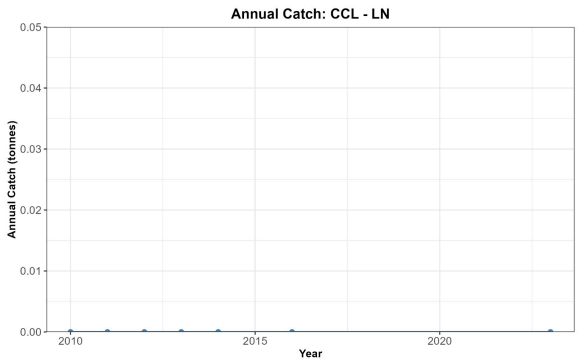
LN (Liftnet)

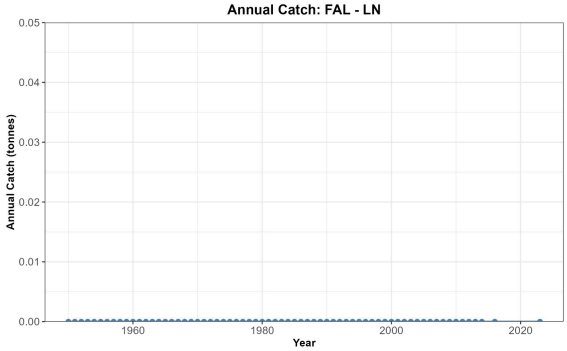

Annual Catch: ALS - LN
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
2010
2015
2020
Year

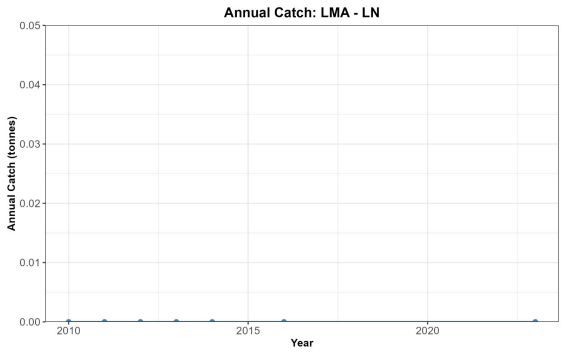

Annual Catch: BSH - LN
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
1960
1980
2000
2020
Year

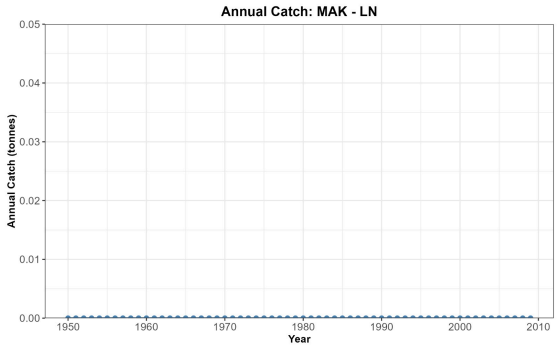

Annual Catch: CCB - LN
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
2010
2015
2020
Year

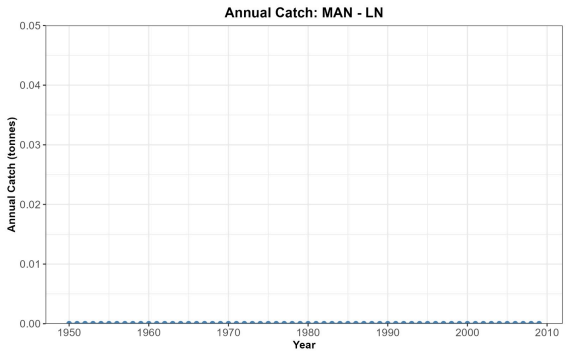

Annual Catch: CCE - LN
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
2010
2015
2020
Year


Annual Catch: CCL - LN
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
2010
2015
2020
Year


Annual Catch: FAL - LN
Annual Catch (tonnes)
0.05
0.04
0.03
0.02
0.01
0.00
1960
1980
2000
2020
Year







4. Conclusion

We have introduced a methodology to re-estimate Indonesian shark catch data for period 1950-2023, incorporating relatively recent information from both scientific observer report and port landing data (PIPP).

The new estimate aligns with more recent reference patterns and shark stock conditions in Indian Ocean and it demonstrates more variative of shark species from year-to-year consistently.

5. Recommendation

The proposed re-estimation method proven to be robust and effective in dealing with consistency across gears and shark species. We are confident that this methodology correctly adjust the Indonesian datasets period 1950-2023.

Therefore, Indonesia recommend that IOTC accept and adopt this methodology to be used in re-estimating Indonesia's historical catch data.

References

IOTC. (2025). IOTC Reference Data Catalogue v1 - Fisheries and Fishing Technologies Domains. Indian Ocean Tuna Commission (IOTC). https://iotc.org/data/datasets.

IOTC. (2025). IOTC Reference Data Catalogue v1 - Biology and Morphometrics Domains. Indian Ocean Tuna Commission (IOTC). https://iotc.org/data/datasets.

IOTC. (2025). IOTC datasets - Best scientific estimates of retained catch data for the 16 species under the IOTC mandate (1950-2024). Indian Ocean Tuna Commission (IOTC). https://iotc.org/data/datasets.

IOTC. (2025). IOTC datasets - Retained catch data covering IOTC species and associated bycatch, reported before being broken down into species- and gear-specific components (1950-2024). Indian Ocean Tuna Commission (IOTC). https://iotc.org/data/datasets.

FAO, 2025. Global Capture Production, Fisheries and Aquaculture. www. fao.org.